Muscle tension dysphonia in the singing voice: The development of resources to connect therapeutic interventions with vocal use in performance.

by

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A thesis submitted in partial fulfilment for the requirements for the degree of Professional Doctorate at the University of Central Lancashire

May 2025

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Type of Award **Professional Doctorate**

School **School of Health, Social Work, and Sport**

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Signature of Candidate Claire Thomas

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To work towards homogenous assessment, and compatible, consistent, charted progress of the singer diagnosed with muscle tension dysphonia (MTD) across the voice care team, there is a need for further research into the treatment of MTD in the singing voice. High quality continued support for the singing voice after an MTD diagnosis requires accessible, practical knowledge to allow a coherent link between initial speech and language therapy (SLT) treatment, ongoing clinical research and the informed singing teachers who continue to support the next stages of treatment and recovery.

While some treatment approaches may initially be based in spoken voice work, with it assumed that singers "would know how their laryngeal mechanisms work" and be able to consciously associate techniques and principles for speaking with those for singing (Stemple & Fry, 2010, p. 311), Leborgne and Rosenberg (2014) continue to highlight the value of input from, and collaboration with, singing teachers during the therapy process. There is inconclusive evidence about how MTD should be best treated in singers as professional voice users and few studies have attempted to measure the success of individual treatments with the singing voice. Furthermore, there is little literature that explores MTD and the musical theatre singing voice, despite earlier recommendations by Scearce (2016) that treatment should be designed with the vocal physiology and multiple vocal approaches required in the musical theatre singing voice in mind. The physical demands, instrumental elements, and additional spoken aspects of musical theatre performance are not routinely considered or evidenced in detail within current literature.

The body of work which makes up this thesis explores MTD in the singing voice, leading to the development of resources to connect therapeutic interventions with vocal use in performance. The thesis begins with the creation of an illustrated guide to The Muscles of Singing Voice Production (Supplementary Resource One) (Thomas, pre-publication), followed by an investigation of current approaches to the measurement of laryngeal tension (Thomas et al., 2023), causes and impacts of MTD, current treatment approaches for MTD in singers, and considers the additional demands on the musical theatre performer and their potential links to laryngeal tension. The thesis then presents chapters which capture a voice practitioner questionnaire and several case study reports to provide data that illustrates current approaches with regards to the treatment of MTD, and additional consideration of the musical theatre singing voice. Collectively the investigations and findings in the current body of work provides the basis for the design of an accessible resource (resource two) of adaptable therapeutic exercises for the singing teacher/vocal coach to ensure a shared knowledge and understanding of the process involved, alongside evidence-based approaches to enable continued progression for the singer.

The thesis concludes that there is still a need for more objective and standardised practical methods to accurately diagnose and monitor the rehabilitation of MTD in the singing voice. Given the person-centred nature of vocal treatment and training, a team-based approach, grounded in shared knowledge and gradual progression, may be the most effective. Further research into the specific

physiological and acoustic effects of MTD on musical theatre singing could help tailor diagnosis and individualise treatment, enabling voice care teams to track recovery more precisely. The final chapter concludes the research, linking to contemporary treatment approaches and recommendations for future research. These elements have informed the development of a supportive resource designed to facilitate a progressive transition from therapeutic intervention to the resumption of performance-level vocal function

Acknowledgements

This thesis is a reflection of the support I received during this gratifying academic endeavour.

I owe an immense debt of gratitude to my parents, who have supported my educational journey from the very beginning.

To my partner, Saul, your endless love, patience, understanding, cups of tea and hoovering, especially during the most demanding phases of this research, have been incredible.

A heartfelt thank you to my director of studies and supervisors, Dr. Jill Alexander and Dr Chris Yiannaki, and to my external supervisor Melanie Mehta, whose support, knowledge and positivity provided reassurance and motivation throughout this process.

I am thankful for my friends and colleagues, particularly Pippa Anderson, who provided both encouragement and perspective when my vision was narrowed. The discussions and unwavering support from my peers in many different pedagogical contexts have enriched my research experience, making this journey thoroughly enjoyable. Their presence and insights have been pivotal in navigating the complexities of my research topic through a multitude of practitioner lenses.

All thanks go to the student who inspired this research and to all those students who continue to engage with the findings and output, your enthusiasm has been inspirational. Your generosity and positivity have reminded me just how important this study is.

A final thank you to our little dogs Loki and Pan who have been a constant comfort and distraction when the writing hours were long.

Publications:

Thomas, C. M., Rhodes, D., Mehta, M., & Alexander, J. (2023). Methods of Measuring Laryngeal Muscle Tension in Patients with Muscle Tension Dysphonia: A Scoping Review. *Journal of voice : official journal of the Voice Foundation*, S0892-1997(23)00106-6. Advance online publication. https://doi.org/10.1016/j.jvoice.2023.03.013

Thomas, C. M. & Alexander, J. (2025). The Additional Demands on the Musical theatre Performer and Potential Links to Increased Laryngeal Tension: A Rapid Review. *International Journal of Music and Performing Arts*, 12. https://doi.org/10.15640/ijmpa.v12p4

Winter, D. & Thomas, C. (2025). Simultaneous Singing and Dancing in Musical Theatre: Assessing Physical and Vocal Demands. *Australian Voice,* 26, 1-17. https://doi.org/10.56307/EMVU8943

Pre-publication:

Thomas, C.M. (2022). The Muscles of Singing Voice Production. Pre-publication. (Resource one)

Thomas, C. M. (2025). Muscle Tension Dysphonia in The Singing Voice: Establishing Links between Therapy and Performing Voice Use. Pre-publication. (Resource two)

Awards:

British Voice Association Finalist for the Van Lawrence Award 2023 & 2026, Online Event

Conference Presentation:

Association Of Teachers of Singing Summer Conference 2024, Yarnfield Conference Centre, Stafford

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AOTOS – Association of Teachers of Singing
AVQI – Acoustic Voice Quality Index
BAPAM – British Association of Performing Arts Medicine
BVA – British Voice Association
CAPE-V – Consensus auditory perceptual evaluation – voice
CCM – Commercial contemporary music
CT - Cricothyroid muscle
DSI – Dysphonia Severity Index
EASE – Evaluation of ability to sing easily
EGG – Electroglottography
ENT – Ear, Nose and Throat consultant
GERD – Gastroesophageal reflux disease
GP – General practitioner
GRBAS – Grade, Roughness, Breathiness, Asthenia and Strain (Assessment)
HADS – Hospital anxiety and depression scale
HPA – Hypothalamic-pituitary-adrenal
HRA – Health Research Authority
LCA – Lateral cricoarytenoid muscle
LMT– Laryngeal manual therapy
LPR – Laryngealpharyngeal reflux
LPRD – Laryngealpharyngeal reflux disease
MDT – Multidisciplinary team
MDVP – Multidimensional voice programme
MPA – Music performance anxiety
MT– Musical theatre
MTD – Primary muscle tension dysphonia
NHS – National Health Service
PA – Performance anxiety
PCA – Posterior cricoarytenoid muscle
PRISMA-ScR – Preferred Reporting Items for Systematic Reviews and Met-Analysis – Scoping Review
PSS-10 – Perceived stress scale – 10
QR – Quick response
RCSLT – Royal College of speech and language therapists
RTE – Real-time electromyography

sEMG – Surface electromyography

SOVTE – Semi-occluded vocal tract exercise

SLT – Speech and language therapist

SNS – Sympathetic nervous system

ST/VC – Singing teacher/Vocal coach

SVRS – Singing voice rehabilitation specialist

TA – Thyroarytenoid muscle

Dysphonia

Difficulty in speaking due to a physical disorder of the vocal folds, tongue or mouth.

Muscle tension dysphonia

A change in the sound or feel of the voice due to excessive muscle tension in and around the larynx.

Ear, nose and throat consultant

Diagnose, evaluate and manage diseases of the head and neck. Further titled as otorhinolaryngologist or otolaryngologist.

Speech and language therapist

Allied health professional who provides treatment, support and care for children and adults who have difficulties with communication, or with eating, drinking and swallowing.

Singing voice rehabilitation specialist

A singing teacher with special training equipping them to practice in a medical environment with patients who have sustained a vocal injury.

Voice practitioner

An educational practitioner working in the field of spoken or sung voice.

CT Visor

The CT Visor refers to the role of the cricothyroid muscle in closing the cricothyroid space and refers to the forward movement of the cricothyroid muscle over the space between the thyroid and cricoid cartilages at the front of the larynx. It is suggested to be an important area to consider within voice disorder rehabilitation.

Thesis Title

Muscle tension dysphonia in the singing voice: The development of resources to connect therapeutic interventions with vocal use in performance.

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1.1 Definition of Muscle Tension Dysphonia

The term muscle tension dysphonia (MTD) for the purpose of the thesis and associated works will be defined under the category of primary muscle tension dysphonia, which is dysphonia without existing pathology. The concept of MTD has been described by Altman et al. (2005) as *"a compensatory adaptation to glottal insufficiency"* and by Koufman and Isaacson (1991) as *"altered laryngeal biomechanics"* caused by *"inappropriate or abnormal muscle tension"*, while Ferrán et al. (2024) add that the *'increase in muscular tension generates an abnormal laryngeal position during phonation: the larynx is elevated, and there is some degree of glottic and/or supraglottic compression.'* The term muscle tension dysphonia may therefore be defined as an imbalance in the coordination of the muscles and breathing patterns needed to create voice, with the imbalance causing functional maladaptation in normal phonatory muscle use and found to have no anatomical abnormality (primary MTD) or be present alongside, or because of, an anatomical abnormality (secondary MTD). In the case of secondary MTD, the muscle tension is thought to be the body's natural compensatory process to adjust for the vocal injury (Khoddami et al., 2013).

Under-diagnosis of MTD may occur when symptoms are incorrectly attributed to functional or psychosomatic causes, or when appropriate assessment tools like videostroboscopy are not used. This can delay the initiation of effective behavioral therapy and allow maladaptive vocal behaviours to become established (Roy et al., 2000). This is particularly detrimental for professional voice users, particularly singers, who are highly dependent on optimal vocal function and are at increased risk of long-term damage without accurate and timely intervention (Sataloff, 2005). Conversely, over-diagnosis of MTD is an additional concern, particularly in settings where non-specialist clinicians may apply the label indiscriminately to cases of nonspecific dysphonia. In the absence of confirmatory assessment, MTD can be misused as a catch-all diagnosis, potentially leading to mismanagement and overlooked organic pathologies (Aronson & Bless, 2009; Dauda & Sridharan, 2023). Both under- and over-diagnosis can significantly impact clinical outcomes, especially in high-stakes populations like professional singers, where career disruptions due to voice loss or misdirected treatment are common and costly. In ideal clinical practice, MTD is diagnosed by a multidisciplinary team consisting of an otolaryngologist or laryngologist working closely with a speech and language therapist who has expertise in voice disorders (Chang et al., 2023; Verdolini et al., 2006). Access to such specialist teams and diagnostic technologies is variable, contributing to inconsistencies in diagnosis and treatment. As a result, many patients undergo prolonged care pathways involving repeated referrals, extended therapy durations, and sometimes unnecessary imaging or medical interventions (Cohen et al., 2012; Martino et al., 2006).

From a health systems perspective, both under- and over-diagnosis have cost implications. The former leads to inefficient use of resources through prolonged therapy and missed treatment windows, while the latter can result in unnecessary therapy sessions and the misdirection of services. The need for standardised diagnostic protocols, including routine access to videostroboscopy and specialist voice teams, is therefore essential to improve outcomes and reduce system-level inefficiencies.

1.2 INTRODUCTION

Similarities in specific muscle use have been suggested between the professional singer and the athlete, with Leborgne and Rosenberg (2014) coining the descriptor 'vocal athlete' to focus the similarities more succinctly. The comparison expects that similar issues impacting those who work specific sets of muscle more often, and with different degrees of effort, will affect singers who use smaller muscles in a more extreme way than those who work with the speaking voice. Issues associated with high demand vocalisation may include fatigue, injury (Zuim, Stewart & Titze, 2023), or increased tension if release is not allowed due to vocal demand or aim (Rubin, Lieberman & Harris, 2000). Dysphonia, or an alteration of the voice during phonation, is a common symptom of vocal fatigue, vocal injury and increased vocal tension (Martinez et al., 2020; Sataloff, Hawkshaw & Spiegel, 1999), and the impact on the singer ranges from the physiological to the psychological, affecting progression, confidence, and employment (Harris & Howard, 2018). It is therefore imperative that a singer experiencing a vocal issue receives the care, education and support required to return to normal, comfortable, confident voicing in a timely manner. Muscle tension dysphonia (MTD) is one of the most common diagnoses within voice clinics (Craig et al., 2015; Mansuri et al., 2019; Van Houtte, Claeys & Van Lierde, 2011) and impacts range, tone, effort, and comfort within the singing voice (Ferrán et al., 2024). To help a singer with an MTD diagnosis, several different practitioner roles may be required to provide input throughout recovery (Flock et al., 2023), with the initial diagnosis potentially being made via laryngoscopic exam with an ear, nose and throat consultant (ENT) and followed by initial therapy from a speech and language therapist (SLT), which may comprise of one-to-one sessions focused on tension release and re-balancing of the respiration, phonation and resonating systems through spoken voice exercises (NHS.uk, 2023).

For many singers who reach this point in voice rehabilitation, the next step is often to find, or return to, a singing teacher to complete the transfer back to confident and healthy singing voice work. Scearce (2016) recommends that singing genre inform treatment design through the rehabilitation process, while Goffi-Fynn and Carroll (2012) go further and suggest that greater progress is noted when speech and language therapists and singing teachers were able to work together for the good of the singer. When narrowing the focus to the musical theatre singer experiencing MTD, the attention is placed on the additional demands of the genre, including diverse vocal requirements and dancing while singing, which may contribute to the likelihood of developing laryngeal tension (Prebil et al., 2020; Kayes, 2015; Stephens & Wyon, 2020). The question of when and how to acknowledge these additional demands during initial treatment or post-therapeutic input as the singer moves back to performing forms part of this overarching body of work which explores the assessment, treatment and considerations of MTD in the singing voice. The lack of resources specific to the transition between SLT and singing teacher, and the mitigation of increased tension because of the additional demands on the musical theatre performer represents the gap which this thesis intends to fill.

1.3 The Researcher Journey

As a singer who was fortunate to be exposed to a great many musical genres during my training, I was aware of additional laryngeal tension when moving from a thinner vocal fold classical cricothyroid dominant laryngeal position to the thicker vocal fold thyroarytenoid dominant musical theatre laryngeal set up early in my vocal performance journey. The result was temporary dysphonia after rehearsal or performance, which I knew was unsustainable. Endeavouring to solve this problem, I investigated several release strategies independently, including body-mapping, Alexander technique, Feldenkrais method, breath work, and use of movement to great effect. Having trained as a singing teacher early in my career, this personal journey led to the awareness of the development of negative laryngeal tension in new and existing singing students.

While working with undergraduate musical theatre students, my pedagogical approach evolved to embed release strategies, and an interest in the more formal study of muscle tension dysphonia was born from the experience of a musical theatre student who developed the condition after suffering from hereditary health conditions. The question of compensatory tension was at the forefront of my attempts to help and understand the cause; however I reflected on a gap in my own knowledge with regards to post-therapeutic progression which needed to be addressed before I could effectively help. Positive communication with the speech and language therapist who provided the initial therapeutic intervention allowed the singer and I to work effectively to design exercises initially based on the SLT input, ensuring they were able to return to performance-level voicing prior to their final show work. The experience led me to identify the gap between SLT intervention and the return to repertoire work with a singing teacher, which relies on the individual knowledge, experience and confidence of the singing teacher to be able to link previous therapeutic exercises to more demanding voicing in a successful and efficient way. Although the role of singing voice rehabilitation specialist (SVRS) undoubtably fills that gap and is an excellent first option, I continue to observe that either many students preferred to work with their existing teacher, or that due to the limited number of clinic-based SVRS practitioners who remain unaccredited as a profession, it is not logistically possible to easily access an SVRS or voice clinic multidisciplinary team when needed.

Although I enjoy the challenge of investigating the physiology of vocal issues, linking practical approaches to evidence-based study, and creating innovative resources, I am aware that this is not the case for all singing teachers, particularly those who are at the start of their career and still developing the fundamentals of their own pedagogy. There is a breadth and depth of knowledge that comes with the opportunity to research and implement evidence-based findings into practice. It is hoped that by creating an accessible, adaptable resource to bridge the identified gap, singing teacher confidence will be increased, and singers can be helped to continue their rehabilitative journey with connected input and the knowledge and understanding required to prevent further vocal issues.

Approaching the end of the current thesis, I had the opportunity to work with a singer who was facing a similar situation to that which first inspired the current body of work. A musical theatre singer, recently diagnosed with MTD who had been allocated 3 sessions with an SLT approached me to re-discover her singing voice. I reflected on the findings within the literature, questionnaire responses and case study reports and realised the value of synthesising real time data with the less personalised format of scholarly articles and publications. Several aspects were noted to be unclear within clinical reporting; the impact of MTD on singer confidence and self-esteem, which approaches are taken by those continuing post-therapeutic progression and why, and how the additional demands the performer may face during rehearsal and performance might impact continued rehabilitation. The need for flexibility in approach, clear, positive communication both with the singer and other practitioners, and above all, the value of shared knowledge, is apparent when working in this and similar contexts. The importance of systematic consultation and input has been highlighted, with the clear need for timely ENT diagnosis, accessible SLT intervention, and the ability to chart progress through the process to allow a positive, measurable progression for the singer. Ultimately, collaborative working seems essential to ensure that shared experience influences the design and creation of resources to help both the singer and each practitioner.

1.4 Problem Statement

Primary MTD remains one of the most frequently diagnosed voice disorders for singing voice users with the evolution of the voice care team model meaning that treatment and care of the singer diagnosed with MTD may be shared amongst several practitioners. Initial treatment is often given by a speech and language therapist before the singer returns to a singing teacher or vocal coach to continue the rehabilitation process and their return to healthy vocal function.

There is currently a gap in evidence-based approach to design at the point of transfer from initial therapeutic intervention to the return to established singing lessons, which this body of work intends to address through the exploration of current treatment practices which will inform the creation of a series of resources designed to allow singing teachers to support initial rehabilitative treatment.

1.5 Research Question

The body of work which makes up this thesis and supplementary resources is an exploration of the physiology and measurement of laryngeal tension and the impact on the singing voice, leading to the development of suitable strategies for use by singing teachers and vocal coaches to bridge the gap between initial SLT treatment and integration into performance level singing voice use. Consequently, the following sub-questions were addressed:

1. What is the physiology, primary and secondary function, and reaction to additional laryngeal tension of the muscles involved in singing voice production?
2. How is tension currently measured in those diagnosed with MTD?
3. What are the main causes of MTD in the singing voice?
4. What are the impacts of MTD on the singing voice, including voice qualities specific to the musical theatre genre?
5. What are the current treatment approaches to MTD in the singing voice?

1.6 Aim and Objectives

Aim

The overarching aim of this body of work is to understand the impact of MTD in the singing voice, current treatment approaches, and more specifically the additional considerations required when rehabilitating the musical theatre singing voice.

Objectives

To fulfil the aim, alongside several literature reviews and an online questionnaire of practitioners, the inclusion of case study data detailing the treatment approaches to MTD in the singing voice intends to derive detailed, contextualised inferences and understand the dynamics that underlie current treatment approaches to MTD in the singing voice.

The final resource produced from the findings of the work is intended to provide those working with the singing voice with both the holistic knowledge of MTD and practical approaches useful in supporting initial therapeutic MTD treatment.

2.1 INTRODUCTION

The following section presents the design process and overview of resource one (see Supplementary PDF 1 – Resource One), which provides an exploration of the anatomy and physiology of the muscles involved in singing voice production. Just as physical athletes must understand their bodies to optimise performance and prevent injury, singers as vocal athletes, require a foundational understanding of the muscular and physiological mechanisms that support healthy vocal function (LeBorgne & Rosenberg, 2014; Narin et al., 2024). Resource one was created to serve as both a visual and literary reference that outlines the roles and functions of key muscles related to phonation and laryngeal tension. As any profession concerned with health relies on basic anatomical and physiological knowledge, this resource supports singers in developing body awareness, vocal efficiency, and injury prevention strategies, thereby reinforcing their identity as skilled practitioners of a physically demanding art form (Namasivayam-MacDonald et al., 2025; Matsuki et al., 2024). It is intended that resource one provide an underpinning of anatomical and physiological education as a foundation for the understanding of clinical literature. The content relates directly to, and is referenced within, the rest of the work presented in this thesis. Additionally, it is intended that resource one be part of the final series of resources which form the innovative output of the body of work.

2.2 Resource One Design Process

2.2.1 Purpose and Intended User of Resource One

As a compendium of the muscles of the singing voice, illustrated, developed and produced by the researcher, resource one was designed to collate the information available from several sources into one reference resource for voice practitioners – particularly the singing teacher. It presents the anatomy of muscles, the primary function of each muscle, the specific function within the production of sound, and the impact of each muscle on surrounding muscles or structures. Of particular importance was the role of each muscle in the creation of different voice qualities, as it is proposed that knowledge of these variations may be useful in the identification of tension within various singing genres and types of MTD. Frustration had previously been experienced by the researcher because a compendium such as this was not easily accessible in a single publication. It seemed apparent that this information would be crucial to allow singing teachers to help singers during training and post-therapeutic progression. The intended audience for resource one is the singing teacher with an interest in vocal anatomy and it may be of use to the singing teacher who requires additional anatomical knowledge linked directly to voice quality production to develop a deeper knowledge of individual muscle function, particularly within a musical theatre singing voice context.

Resource one combines muscle descriptors with their specific function in the creation of sound which is then expanded into five different vocal mechanisms/qualities. The choice of categorisation of voice qualities (M0, M1, M2, M3, Twang and Belt) was intended to include as many of the terms used across singing pedagogy as possible. Common issues relating to the muscle function are highlighted, and useful, generalised solutions are provided and expanded upon in resource two.

2.2.2 Resource One Outcome

Resource one intends to provide a comprehensive overview of the muscles of singing voice production for the singing teacher and underscores the development of resource two alongside the findings of the body of work presented in the thesis.

2.2.3 Resource One Aims and Objectives

Resource one aims to provide comprehensive functional descriptors of the muscles associated with singing voice production, allowing greater depth of clinical comprehension regarding the measurement, causes, impacts and treatment of MTD in the singing voice when reviewing the literature. Resource one will eventually be combined with a final pedagogical resource in order to equip singing teachers with fundamental physiological knowledge of the muscles of phonation upon which to build approaches to post therapeutic work. To provide depth of knowledge appropriate to linking therapeutic intervention to performance voice use, the resource collates individual muscle primary functions, links singing voice production to primary function of muscles, collates possible impacts on phonation in the event of muscle misfunction, and provides descriptions of individual muscle function during the production of voice qualities/mechanisms. The combined content has not previously been produced, ensuring the innovative design and content of resource one addresses a gap in resources supporting singing voice pedagogy.

2.3 METHODOLOGY

The resource was compiled following an investigation of a broad range of anatomical literature during which the researcher identified several muscles relevant to the anatomy and physiology of singing voice production. Throughout the investigation a few discrepancies were noted between functional definitions, leading to a period of cross-referencing and identification of muscle function within the singing voice.

2.3.1 Inclusion/exclusion criteria

Many anatomy sources, including peer-reviewed articles, grey literature, pedagogical literature, and educational literature were included within the search criteria. Websites and online sources were excluded as content could not be verified. After the identification of specific muscle groups, initially focused around three themes of mastication, phonation, and neck and back, the resource design was then refined to reflect more specifically the physiology of muscle tension dysphonia and the impact of additional tension on phonation. Clinical anatomy texts, peer-reviewed articles and pedagogical publications were compared, allowing functional discrepancies to be clarified. The process culminated in description of the role and function of over 70 muscles and structures within the context of singing voice production. Each muscle and structure were then illustrated by the researcher and presented in a reference-style publication. Based on these findings, the physiology of specific vocal qualities/mechanisms were then investigated through both vocal pedagogy sources and peer-reviewed literature in rapid review three (Chapter 3), and each muscle function was subsequently described within the context of each quality/mechanism.

Once muscle function had been established, the researcher initially assessed the content for usefulness to the singing teacher and added vowel and consonant formation and production, visuals of tongue position, and the International Phonetic Alphabet which may be helpful for singing teachers to reference as they design exercises to help post-therapeutic progression after MTD diagnosis.

2.3.2 Expectations of User

Resource one is a starting point for those interested in the anatomical and physiological aspects of voice production and, more specifically, the impact on laryngeal tension. It is expected that resource one be used as a reference alongside resource two (MTD in The Singing Voice – Establishing Links between Initial Therapy and Performing Voice Use) (See Supplementary Resource Two) and to explore specific muscle function further if needed.

2.4 Structure of the Resource

Reflecting the majority of vocal anatomy resource design consulted within the process, it was deemed pertinent to start from the end point of the resonating space and move towards the vocal folds, charting the primary function, physiology and role in voice production, however the referencing nature of resource one design allows the reader to approach the text at any point as required. The illustrations are developed by the researcher and provide rudimentary representations of muscle placement and shape. Revisions to the illustrations are planned and it is hoped that they may inspire the reader to undertake further image searches to create a fully realised concept of function. The full resource is provided in pdf form as Supplementary Resource One.

2.5 Evaluation

During the academic year 2022-2023, an initial feedback process was initiated, during which resource one was distributed to eight final year undergraduate voice students and four voice teacher peers of the researcher to use as they saw fit. Overwhelmingly positive feedback was gathered through discussion with those exploring the resource, alongside several recommendations for future design and refinement. Resource one was thought to be innovative, useful and informative with clear links to the mechanisms of the singing voice. The accessibility was described as good with the illustrations well-received, yet it was thought that the format may lack visual appeal when compared to similar resources. The initial A4 format of the resource was discussed, with the recommendation of an either smaller, more portable book size to allow it to be easily carried or a digital version noted by the researcher. Although a formal evaluation was not undertaken at this stage, the feedback was deemed valuable and integrated with ongoing reflection and refinement by the researcher.

2.6 Resource One Refinement Process

The following refinements and recommendations were applied to the resource following researcher reflection and initial feedback from singing voice practitioners and undergraduate students given access to the resource.

- Additional in-depth examination of intrinsic laryngeal muscles.
- Addition of Buccinator muscle due to links to middle pharyngeal constrictor.
- Reduced to A5 format.
- Addition of further in-depth overviews of abdominal muscles, diaphragm and psoas muscles.

Future refinements will include:

- QR code links to animations of the muscle function.
- Enhanced illustrations.
- Simple visual illustration of vowel formants.
- Further consideration of book size and additional visuals and revised layout to counter amount of text.

2.7 CONCLUSION

Resource one, a book titled ‘The Muscles of Singing Voice Production’, was designed and collated to provide in-depth descriptors of muscle use both in primary function and phonation, with a view to supporting subsequent singing teacher knowledge and understanding of MTD in the singing voice. From the beginning, resource one was designed to be part of a collection of practical approaches to supporting the singer through MTD rehabilitation process. The uniqueness of resource one can be found in the direct links to singing voice mechanisms/qualities, an aspect not previously included in previous anatomical reference sources. Limitations of current resource design include the text-dominant approach which may be off-putting to visual learners, suggesting an increase in visual information, alongside revised layout design may be helpful during the future refining process. As identified, the next steps for resource one design include revised formatting, enhanced visuals, and change of size and or delivery method with regards to a smaller published book size or digital availability. Additional larger-scale evaluation of the final combined resource is planned.

3.1 INTRODUCTION

The following chapter provides, through a mixture of a published scoping review (Thomas et al., 2023) (Appendix A) and a collection of rapid reviews, a current research context for muscle tension dysphonia in the singing voice with additional consideration of the musical theatre voice. The examination of the literature provides an overview of the current methods of measuring laryngeal tension, causes of MTD in the singing voice, the impact of MTD on the singing voice, treatment approaches to MTD in the singing voice, including the role of the multi-disciplinary voice care team, and demands specific to the musical theatre singing voice. Each aspect has a role in the design of resource two which provides practical resources for the singing teacher working with a singer after initial therapeutic intervention for MTD. An overview of MTD types with physiological impact and potential symptoms taken from The Voice Clinic Handbook (Harris & Howard, 2018) are presented in Table 17. A link to copy of the published work titled, Methods of Measuring Laryngeal Tension – A Scoping Review (Thomas et al., 2023) is presented in section 3.2 .

3.2 Study One - Methods of Measuring Laryngeal Tension in Patients with Muscle Tension Dysphonia: A Scoping review

The combined review of the literature regarding MTD in the singing voice begins with a comprehensive overview of measurement methods for use with people with MTD to identify clinical methods measurement and self-reporting approaches which may provide useful information for the singing teacher. Linked is a direct copy of the published paper which can be found in Appendix A.

Methods of Measuring Laryngeal Muscle Tension in Patients with Muscle Tension Dysphonia: A Scoping Review

Claire M. Thomas, David Rhodes, Melanie Mehta, and Jill Alexander, *Preston, UK*

Summary: Background. In clinical practice and research relating to Muscle Tension Dysphonia (MTD), several laryngeal muscle tension measurement methods are used to diagnose, to identify specific muscle strengths and deficits, and to measure therapeutic outcomes. The variety and reliability of available measurement methods presents challenges within diagnosis and treatment. The lack of methodical standardization presents a barrier to homogeneous practice in this area. There is a need for a comprehensive scoping review of laryngeal muscle tension measurement methods.

Study Design. Scoping review.

Objectives. (1) To identify current methods of laryngeal muscle measurement which have been developed or tested with people with MTD; and (2) To identify the construct/s measured, reliability, validity, ability to detect change, efficiency and accessibility of identified methods.

Method. This scoping review was conducted using the Arksey and O'Malley framework. Studies were identified through searches of 4 major databases. The reviewer independently assessed titles, abstracts, and full-text articles.

Results. Twenty seven papers published from 2000 to 2022 that satisfied the inclusion criteria were selected from 194 studies. The papers showed a variety of approaches with regards to the measurement of laryngeal activity and tension in subjects with MTD. Just over a quarter (25.9%) were reviews of the validity of assessment methods of MTD, including surface electromyography (sEMG), while 22.2% discussed surface electromyography as a measurement of muscle activity in subjects with MTD. 96.3% used a published methodological framework.

Conclusions. Assessment methods for Primary MTD are multifaceted, including patient history, laryngoscopic examination, and voice-related musculoskeletal features. Potential use of objective measurement methods, including sEMG, Real Time Elastosonography, Magnetic Resonance Imaging was noted. Due to variability in assessment methods and results, there is a need for greater objective practical methodological standardization to ensure accurate diagnosis, appropriate care, and chart patient progress.

Key Words: Laryngeal—Muscle—Tension—Dysphonia—Measurement.

Practical implications

Study one (scoping review) provides a compendium of available measurement methods, which may be useful in both clinical practice and treatment research, providing a basis for future quality assessment of identified measurement methods and reflects the need for the development of a standardised assessment protocol for MTD treatment research which may improve the quality of research evidence for MTD treatments, assisting clinicians in evidence-based decision making. The establishment of accessible, reliable assessment methods for both singer and singing teacher is recommended.

Having established several potential methods of measuring laryngeal tension, some of which may prove to be accessible to the singing teacher, a rapid review of the causes of MTD in the singing voice was undertaken to address the second research question. The examination may assist in vocal health education and inspire preventative pedagogy alongside approaches to post-therapeutic progression.

3.3 Rapid Review One: Causes of MTD in the singing voice

Rather than a formal literature review the approach for this chapter was taken in the form of a collection of rapid reviews on key topics relevant to the research question. The first rapid review in this section focusses on the ***causes of MTD in the singing voice***. The structure of each rapid review was guided and adapted from the topics outlined in the preferred reporting items for systematic reviews and meta-analyses – scoping reviews (PRISMA-ScR).

ABSTRACT

Excessive muscular tension in the larynx can reduce vocal endurance, vocal power, range access, self-confidence and self-esteem in singers. Currently, there are few studies designed to identify the most common causes of laryngeal tension in singers, relying on theory, self-reporting, and anecdotal evidence to collate possible causes of tension. There is a need to identify existing literature exploring the principal causes of laryngeal tension in singers, both to prevent vocal issues developing, and to support initial ear nose and throat (ENT) clinician and speech and language therapist (SLT) treatment in the singing studio. Rapid review one aimed to identify and discuss existing literature that documented notable causes of laryngeal tension in singers. Literature archived in two databases (PubMed and Wiley Library) were reviewed, and seven key articles met the eligibility criteria for inclusion. The foremost causes of laryngeal tension were excessive voice use, gastroesophageal reflux disorder, allergies, insufficient technical training and an imbalance of laryngeal and para laryngeal muscle use. There is a need for further study specific to primary muscle tension dysphonia in the singing voice, particularly focused on those singing styles which require greater tension at laryngeal level to produce the desired sound.

Keywords: Laryngeal, Singing, Muscle Tension Dysphonia, Voice.

INTRODUCTION

Laryngeal tension has been identified as a primary factor in the development of muscle tension dysphonia (MTD) in singers. The concept of MTD has been described by Altman et al. (2005) as "a compensatory adaptation to glottal insufficiency" and by Koufman and Isaacson (1991) as "altered laryngeal biomechanics" caused by "inappropriate or abnormal muscle tension". The term muscle tension dysphonia is used when the excessive muscle tension leads to a decompensation of the voice and the patient becomes dysphonic (Van Houtte, 2011). Laryngeal tension leading to primary MTD, and possibly subsequent vocal pathologies can have an impact at various points of phonation.

MTD remains a prevalent and often misdiagnosed problem among singers and a variety of voice users (Ferrán et al., 2024). It is often a catch-all term used when no pathology is present, and in the case of association with vocal pathology, may remain due to the chronic muscular compensation used while the pathology existed (Van Houtte, 2011). At the level of the vocal folds, MTD may result in increased tension in the extrinsic laryngeal muscles, which in turn cause an improper position of the larynx, resulting in "tension on the vocal folds" (Tomlinson & Archer, 2014). Excessive tension inhibits free vocal fold oscillation, reduces freedom of range and negatively impacts the movement of the arytenoids (See Supplementary Resource One), therefore reducing the capacity to thin the vocal folds and create higher pitches (Rosen & Murry, 2000). At a resonating level, supraglottal tension may reduce and/or compromise resonating space or shape (Dabirmoghaddam et al., 2019), preventing desired resonance (Roy et al., 1996) and potentially resulting in the recruitment of additional muscle to try to achieve desired sound. At a psychological level, the effects of laryngeal tension on singing voice production may reduce singer confidence, leading to negative perception of voice and self (Goffi-Fynn & Carroll, 2012). Koufman and Isaacson (1991) describe the singer as "the elite vocal performer" for "whom even a slight aberration of voice may have dire consequences".

"Dysphonia is usually caused by a number of factors…sorting out the relative importance of the various factors is the first step towards planning an effective treatment program" (Morrison, 1997).

Although a large body of evidence has been produced in relation to MTD in the speaking voice, there is limited literature on the most common causes of excessive laryngeal tension and MTD within the singing voice. Against this background, a rapid evidence review was proposed. The aim of the review was to add to current understanding of the ways in which laryngeal tension is caused in the singing voice. Rapid review one presents rapid evidence review of a range of sources to identify the nature and scope of the field. Drawing on a range of vocal science-focused bibliographic databases and singing-specific literature, the evidence included has been screened for relevance and quality.

Eligibility Criteria

Included articles are those that discuss MTD in relation to the singing voice. Only articles published from January 1995 to January 2023 were gathered in order to reflect the most contemporary findings in the field.

Search Strategy

An electronic search was undertaken in January 2023. Articles archived in PubMed; Wiley Library Elsevier were reviewed. The following keywords were used for the search: Laryngeal, tension, singing, MTD, voice, causes. Secondary searches including associated peer-reviewed papers via reference searching and chaining were carried out.

Study Selection

A total of 562 results were obtained and screened. A total of seven articles were included in this study (Figure 1). Articles related to the singing voice with full text available, translated to English and published after 1995 were included in the search. After initial screening for duplication, 45 articles were excluded for the following reasons: Not relating to the singing voice, no full text available, not a peer-reviewed journal article and/or a publishing date before 1995.

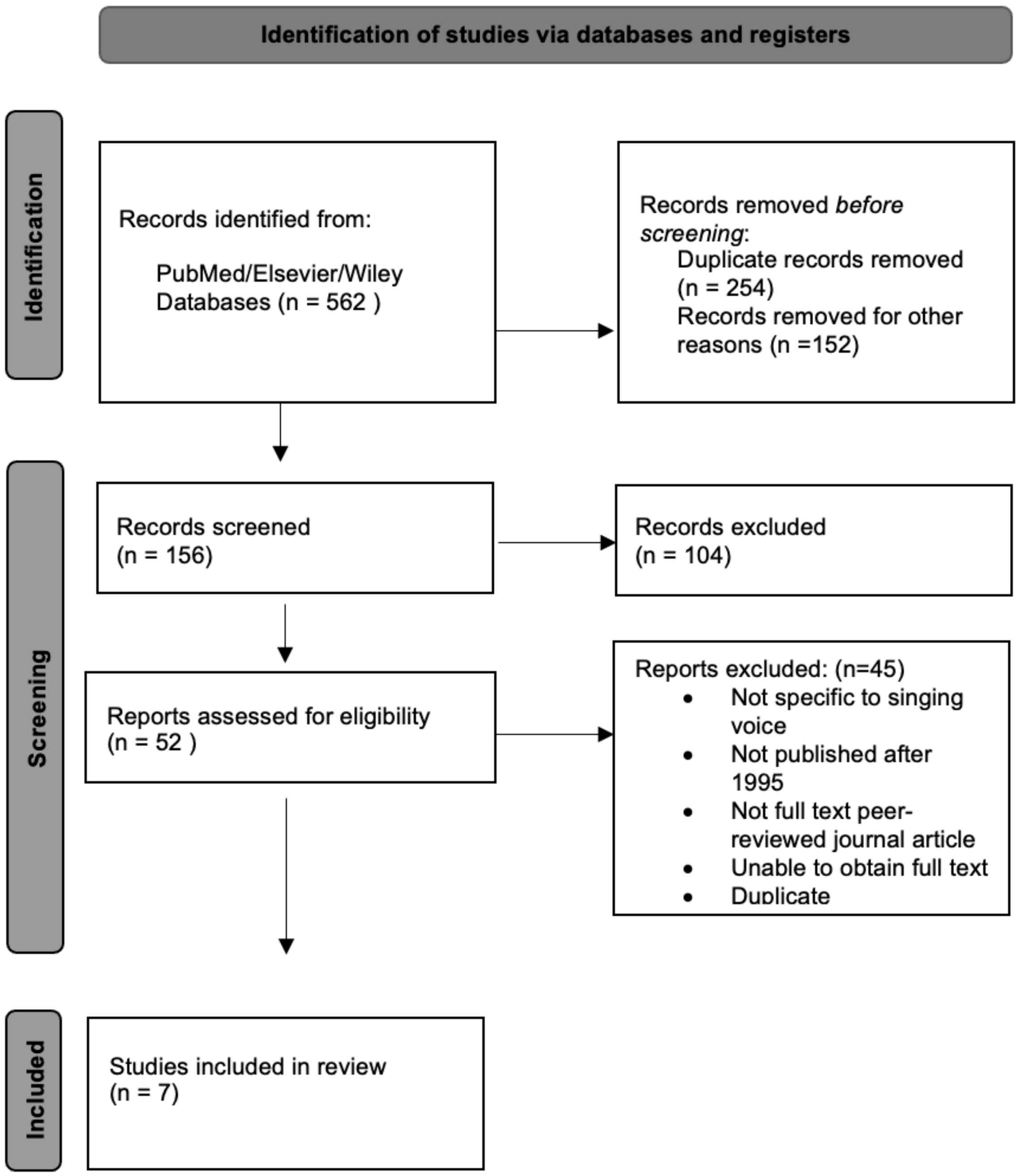

Figure 1

Adapted PRISMA SC-R Study Selection Process.

Data Collection and Synthesis

The following information was extracted and tabulated: title, author(s), year published, country, type of research, and primary causes of laryngeal tension discussed (Table 1). Studies were then summarised and amalgamated in a final overview of the causes, effects, symptoms and potential impacts of laryngeal tension on the singing voice.

RESULTS

In this review, the most common causes of laryngeal tension in the singing voice are discussed. A summary of the included article characteristics and key findings are presented in Table 1.

Table 1

Summary of studies included in rapid review one.

Title	Author	Year Published	Country	Type of research	Causes of laryngeal tension identified
Collaboration and Conquest: MTD as Viewed by Voice Teacher (Singing Voice Specialist) and Speech-Language Pathologist	Goffi-Fynn, J. C. & Carroll, L. M.	2012	USA	Qualitative case study	Vocal fold issues (i.e., gastroesophageal reflux disease or vocal fold trauma), physical state (i.e., medical issues not related to the voice such as injury or surgeries, disease, or allergies), high stress levels, excessive amounts of voice use, and excessive loudness demands. Personality, singing style, technical training, and options of medical care. A mismatch between the balance of breath flow and breath pressure.
Risk factors for voice problems in professional actors and singers.	Prebil, N., Hočevar Boltežar, I. & Šereg Bahar, M.	2020	Slovenia	Case study	The completion of vocal loading tasks while suffering from an upper respiratory tract infection. Gastroesophageal reflux. Loud speech and allergy problems.
Self-reported voice problems among three groups of professional singers	Phyland D. J., Oates, J. & Greenwood, K. M.	1999	Australia	Quantitative study	Voice-use behaviours, vocal backgrounds, amount and nature of training, experience, amount and nature of singing demands, performance environments.
The impact of vocal and laryngeal pathologies among professional singers: A Meta-analysis	Kwok, M. & Eslick, G. D.	2017	Australia	Systematic review and Meta-analysis	Stress and anxiety, frequent travel, venue acoustics and allergens, medication use and abuse, improper vocal technique, performance schedules, GERD.
Combined functional voice therapy in singers with MTD	Sielska-Badurek, E. Osuch-Wójcikiewicz, E. Sobol, M. Kazaneck	1997	Poland	Prospective, randomised study	Excessive tension of laryngeal and para-laryngeal, abnormal coordinative patterns within the whole vocal tract, Inappropriate tension and movement patterns of the muscles within other parts of the vocal tract (abdominal walls,

	a, E., Rzepakowska A., & Niemczyk, K.				chest, jaw, tongue. Higher vocal demands, incorrect body posture, psychological factors.
The effect of breathing exercises combined with manual therapy on muscle tension dysphonia in traditional singers: a blinded randomized controlled trial.	Ahmadi, N. Moein' N. Tarameshlu, M. Ghelich, LKamali, . M. & Jenabi. M. S.	2022	Iran	Blinded randomised controlled trial	Extensive voice use, imbalanced laryngeal and para laryngeal muscle, vocal misuse/abuse, psychological factors.
Laryngeal biomechanics of the singing voice	Koufman J. A. Radomski T., Joharji, G. M., Russell, G. B. & Pillsbury, D. C.	1996	USA	Quantitative study	Supraglottic contraction in an anteroposterior direction. Four muscle tension patterns.

DISCUSSION

Rapid review one sought to identify the most prevalent causes of laryngeal tension in the singing voice. It was identified that limited literature exists in relation to this aspect of the singing voice in either a research or clinical setting, therefore much of the information was found to be anecdotal, self-reported, speculative or based on the spoken voice. Regardless, each analysed study was compared to allow an overview of the most discussed causes of laryngeal tension (Table 2). Identifying these causes can provide a structure in which those working with the singing voice in a variety of capacities may find useful, especially practitioners new to the field. As identified by Morrison (1997) *"Each of these patients has a pattern of causative factors, and many of these "patterns" are typical"*. The author cites as an example the voice user who has long-standing poor postural habits, limited vocal technical skill, suffers from gastroesophageal reflux disease (GERD) often responds to emotional stressors with vocal effort, fatigue, and voice loss. To determine which of the given etiological factors are most important to treat, all aspects of the case must be examined to allow a causational pattern to emerge and support appropriate treatment.

Table 2

Frequency of discussion of cause of laryngeal tension.

Cause of laryngeal tension in singing voice	Frequency of discussion in chosen literature
Excessive voice use	4
Gastroesophageal reflux disease (GERD)	3
Allergies	3
Insufficient technical training	3
An imbalance of laryngeal and para laryngeal muscle use	3
Excessive loudness demand	2
Personality	2
Loud Speech	2
Performance Environments	2
Stress and/or anxiety	2
Vocal fold trauma	1
Singing Style	1
Upper respiratory tract infection	1
Vocal background	1
Frequent travel	1
Medication use and/or abuse	1
Performance schedules	1
Incorrect posture	1
Inappropriate tension and movement patterns in the vocal tract and body	1
Vocal misuse and/or abuse	1

Excessive voice use

Rapid Review one identified that laryngeal tension can been attributed to a variety of factors, including technical misuses of the vocal mechanism in the context of extraordinary voice demands (Roy, 2003). Within the chosen literature, excessive voice use is identified as the most common cause of additional laryngeal tension leading to MTD. A person who talks or sings excessively has previously been termed a 'vocaholic' (Morrison, 1997), suggesting several causes of laryngeal tension may be directly linked to the personality of the voice user.

Professional voice users with higher vocal demands may experience disturbed respiratory, phonatory, and resonatory gestures which lead to improper resonance focus, loss of control of pitch and loudness, and eventually to decompensation of the voice. This may be due to daily prolonged voice use and reliance on their voice to control, entertain, or convince their audience (Van Houtte, 2011). In many instances, including the requirement for excessive voice use, the voice user attempts to increase vocal loudness using excessive effort, which may be termed 'hyperfunctional phonation' (Mathieson et al., 2009) and is characterised by excessive phonatory effort with inappropriate vocal behaviour placing undue physical stresses on the anatomy and physiology of the vocal tract, causing undesirable changes in its function. The articulatory muscles, the extrinsic and intrinsic laryngeal muscles, and the size and shape of the resonators are affected (Mathieson et al., 2009). Inappropriate function of the vocal tract muscles results in loss of voice resonance, loss of control of pitch and loudness, hoarseness, excess vocal effort and vocal fatigue, or neck tightness. These symptoms usually intensify with extended voice use (Ahmadi et al., 2022; Sielska-Badurek, et al., 2017). In a 2004 study into the causes of dysphonia, Altman et al. (2005) found 63% of the 150 participants reported excessive amounts of voice use, making it the most significant factor contributing to dysphonic phonation within the study. Although this result is of note with regards to the identification of common causes of MTD, any study attempting to quantify excessive voice use is problematic due to the lack of standardisation of measurement of appropriate voice use, the reliance on self-reporting, and difference in perception of voice use between study participants.

Gastroesophageal reflux disorder (GERD)

Many clinical and experimental studies reported that GERD and laryngopharyngeal reflux (LPR) (known as 'silent' reflux) can lead to the development of significant macroscopic and microscopic histological changes in the mucosa of the vibratory margin of the vocal folds (Lechien et al., 2019). Additionally, gastroesophageal reflux may produce an increase in pharyngolaryngeal muscle tone through a vagal reflex (Morrison, 1997), resulting in an increase in muscular effort during vocalisation.

Frequent gastroesophageal reflux in singers is regularly discussed in the literature (Cammarota et al., 2003; Hocevar-Boltezar et al., 2012; Sataloff, 1991). The occupation of a professional singer or actor combines a lifestyle with working late, inappropriate nutritional habits, late meals in the evening or even at night and a lot of stress. All these are risk factors that influence GERD and LPR (Phyland et al., 1999; Prebil et al., 2020). Further, Achy et al. (2016) reported heartburn, regurgitation, coughing and hoarseness in opera singers and solo singers more often than the control participants. Marchese et al. (2008) suggest that the higher rate of heartburn among singers may be due to the increased intraabdominal pressure during singing which causes the retrograde flow of gastric content up the oesophagus to the level of the larynx and pharynx. The occurrence of GERD or LPR in professional voice users as singers can have a dramatic impact, including benign lesions, changes in the mucosa of the vocal folds and vocal fatigue (Lechien et al., 2019). In a study by Prebil et al. (2020), the professional singers reported typical symptoms of gastroesophageal reflux more often than the actors. A similar study by Altman et al. (2005) showed a prior history of GERD or LPR present in 49% of the 150 participants in the study with subsequent laryngoscopic examination finding evidence of GERD in 70% of participants, possibly because 'silent' reflux does not present with the most common symptoms of GERD, and consequently initial case history of dysphonic voice users may not identify this aspect without additional laryngoscopic assessment.

Allergies

There is an existing and growing body of evidence that indicates existence of allergic reactions within the larynx (Lauriello et al., 2011; Sala, Hytonen, & Tupasela, 1996; Simberg et al., 2009; Spantideas et al., 2019). It is considered that respiratory allergies are a frequent, although usually hidden, factor in comorbidity of vocal dysfunction (Jokic et al., 2016). The presence of an allergy as a coexisting factor in a hyperkinetic voice disorder contributes to the increase of voice intensity, probably due to the lack of auditory control of voice (Jokic et al, 2016). Simberg (2009) demonstrated that patients with vocal dysfunction have a higher incidence of respiratory allergies and that patients with allergies have a higher incidence of vocal symptoms (Randhawa et al, 2010). Altman et al. (2005) found a history of seasonal/perennial allergy symptoms was present in 37% of the 150 participants included in the study, supported by Prebil et al. (2020) who found significant risk factors for voice disorders in singers to be loud speech and the presence of allergies or asthma with professional singers with frequent voice dysfunction reporting allergy problems more often than the singers without frequent voice problems.

Jackson-Menaldi et al. (1999) and Sala et al. (1996) stated that patients with allergy frequently had thick secretions, hoarseness, and laryngeal oedema/erythema. Spantideas et al. (2019) suggest several mechanisms are responsible for voice problems resulting from allergic rhinitis including the mucus hypersecretion of the nasal glands that causes postnasal drainage and as consequence cough production, throat clearing, and dysphonia. Sympathetic and parasympathetic fibres demonstrated in the vocalis muscle secondary to allergic rhinitis may contribute to the presence of dysphonia via the specific receptors sensitive to negative pressure in the nasal cavity and in the pharynx increasing the muscular activity of the posterior cricoarytenoid muscle. More generalised allergy symptoms may result in irritated and traumatised vocal cords, due to frequent cough and/or clearing of the throat from increased nasal drainage.

Insufficient Technical Training

Primary MTD is sometimes viewed as a reflection of poor speaking or singing technique (Gillespie et al., 2013), a view supported by Zuim et al. (2019) who found in a cross-sectional survey that singers in training reported lower Evaluation of the Ability to Sing Easily (EASE) scores and that vocal health education positively impacted on the self-assessment of their voice. The results of the survey showed increased vocal competence could lead to higher vocal confidence and consequently lower EASE scores, although it should be noted that relying on self-reported EASE scoring without a prior or post-training survey may reduce the validity and value of the results.

Kwok and Eslick (2017) found occupational singers were at higher risk of laryngeal changes and symptoms, attributing the risk to sub-optimal voice technique and overstraining of the voice, while Altman et al. (2005) suggest that common clinical features of MTD are consistent with poor control of the breath system. Results of their study showed a significant portion of participants were compensating for increased vocal limitations because of suboptimal voice production, and/or inability to meet voice use demands due to lack of fundamental singing technique. Within a prospective singing cohort study, Sant Maria et al. (2021) found that the implementation of vocal hygiene education does seem beneficial in improving vocal fold mechanics, such as complete glottic closure and improved mucosal wave, as well as reducing the prevalence of laryngeal inflammatory lesions. The participant group overall performed fewer at-risk behaviours than equivalent ages in the general population, possibly reflecting differences in education and socio-economic status. Moreover, there were fewer than expected laryngeal lesions among the cohort. Study findings across the literature rely upon agreement as to what constitutes fundamental singing technique and consequential reliance on the individual singer understanding and ability to implement agreed technique. The lack of specificity with regards to 'wrong voice technique' and 'suboptimal voice production' presents an obstacle when repeating the study on a larger scale, highlighting a need for standardisation across pedagogy and study design.

Imbalance of laryngeal and para-laryngeal muscles

Muscle tension dysphonia has become the preferred diagnostic label to describe functional voice problems presumably related to dysregulated or imbalanced laryngeal and para laryngeal muscle activity, with a variety of glottic and supraglottic contraction patterns associated with muscle tension dysphonia (Roy, 2003; Van Houtte, 2011). The most common biomechanical alteration found was contraction of the supraglottis in an anteroposterior direction, categorised by Koufman et al. (1996) as type 3 MTD, characterised by partial anteroposterior contraction of the larynx during phonation. Typically, the arytenoids are pulled forward toward the stalk of the epiglottis, obscuring the posterior one half to two thirds of the vocal folds – it is seen in patients who speak with a very low-pitched voice, the so-called 'Bogart-Bacall syndrome' (Koufman et al., 1988), although this posture is routinely seen when singers sing the lowest note of the vocal range.

In patients with MTD, an altered tension of the extrinsic musculature results in a changed position of the larynx in the neck (a mostly higher position) and a disturbed inclination of the cartilaginous structures of the larynx (hyoid, thyroid, cricoid, and arytenoid) that immediately affects the intrinsic musculature. Tension of the vocal folds is altered, and the voice becomes disturbed (Van Houtte, 2011). Studies have shown that there is a measurable increase in the tension of the para-laryngeal musculature between patients with MTD and healthy participants (Hočevar-Boltežar et al., 1998; Redenbaugh & Reich, 1989). Hillman et al. (1989) produced a study with a theoretical framework distinguishing adducted from non-adducted vocal hyperfunction. They proposed that adducted hyperfunction would involve tightly adducted vocal folds, large subglottal pressures, large vocal fold oscillation amplitudes, and large cycle-to-cycle tissue decelerations in phonation. The result would be high inter-vocal fold impact forces during phonation, raising the risk of phono trauma. Non-adducted hyperfunction, which can be considered equivalent to Type 1 MTD, was suggested to involve increased muscle tension (Gillespie et al., 2013). Rubin et al. (2000) suggest that if it is accepted that a failure to relax a muscle following an activity constitutes hyperfunctional muscular behaviour and that voice production (and swallowing) requires repeated complex muscular activity, then it is not surprising that the laryngeal and para-laryngeal musculature is at risk for hyperfunction. In a study to discriminate between healthy patients and those with primary MTD, however, Khoddami et al. (2016) found that although surface electromyography could measure para-laryngeal muscle activity, it was unable to distinguish between patients with MTD and healthy patients. Balata et al. (2015), however, demonstrated that the electrical activity of para-laryngeal muscles (specifically infrahyoid and suprahyoid groups) was lower in dysphonic participants compared to non-dysphonic participants, suggesting further study is required to be able to accurately measure the imbalance of laryngeal and para-laryngeal muscles in MTD patients. As illustrated in Table 3, many individual causes of tension result in similar vocal symptoms and impact on the sound of the singing voice. A compilation of the causes, effects and symptoms of laryngeal tension in the singing voice may form the basis of a useful resource for early diagnosis of MTD.

Table 3

Cause, effect, symptoms and impact on singing voice of laryngeal tension.

Cause of tension	Effect of cause and subsequent impact on function	Vocal symptoms	Impact on singing voice
Vocal fold trauma	Lateral cricoarytenoids close the vocal folds by pulling the back end of the arytenoids apart. This pulls the front together, and subsequently the vocal folds together. The presence of vocal noduli in the larynx leads to increased friction of the vocal cords against each other and prevent vocal folds from vibrating normally. *"…thereby raising the circumscribed hyperplastic changes and/or hyperkeratinisation of the epithelial layer, coupled with secondary hyaline-degeneration in the lamina propria of the vocal cords."* (Colton et al, 2006) If the folds cannot fully close due to trauma (either swelling, or haematoma), additional muscle may be recruited to attempt to close the folds. This may include pharyngeal wall. Excessive air due to incomplete fold closure may dry out the vocal folds, causing further irritation during any phonation. Coughing and throat clearing may occur excessively due to irritation.	Hoarseness, breathiness, lower habitual pitch (Colton et al., 2006.) Reduced vocal range, vocal fatigue, dryness, throat discomfort. (Mansuri et al., 2017)	Difficulty creating higher pitches while singing. Overall reduced range in singing voice. Pressed tone when clarity of tone or higher volume required in song. Breathiness over tone in certain points in the range where VFs are affected by trauma.
Excessive voice use - May link to Personality	Swollen vocal folds Swelling is the result of an increased movement of fluid and white blood cells into the injured area. This process is called oedema and the response is triggered during damage to living tissue. As the vocal folds lack pain receptors, swelling does not usually cause the pain usually associated with swelling in other parts of the body, making it difficult to protect the folds from further injury. It is common for vocal fold swelling to become apparent by symptoms such as hoarseness.	Impact on voice may be fatigue due to increase in muscular effort to adduct vocal folds, hoarseness due to swelling, reduction in upper range due to swelling/mucosal changes, breathy tone due to swelling or subsequent pathologies.	Breathy tone across range, or specifically on higher pitches. Voice fatiguing easily during singing tasks, leading to breaks in tone or further breathiness in spoken voice.

	As thicker folds are not able to vibrate as quickly as thinner folds, higher pitch creation becomes impossible and only 'thick folds' qualities may be heard. Usually at speech level or near to vocal fry due to the inability of the folds to perform a full wave motion from top to bottom.		Reduced range across singing voice.
Excessive loudness demands	Maladaptation and use of additional laryngeal adductor muscles to create volume.	Impact on voice may be fatigue due to increase in muscular effort, hoarseness due to swelling, reduction in upper range due to swelling/mucosal changes, breathy tone due to swelling or subsequent pathologies.	Breathy tone across range, or specifically on higher pitches. Voice fatiguing easily during singing tasks, leading to breaks in tone or further breathiness in spoken voice. Reduced range across singing voice. May lead to pressed tone as the glottal resistance is too high.
Lack of technical training - Leading to: Breath pressure/ flow mismatch	Poor breath management As described by Kenneth Bozeman the 'Phonation Equation', is useful to refer to the balance of airflow versus glottal resistance during the discussion of muscle activity (Bozeman, 2013). It illustrates the most basic requirements for sound production, while helping to identify imbalance where optimum sound production fails. *Breath Pressure ÷ Airflow = Glottal Resistance* 'Breath pressure' as generated below the glottis 'Airflow' through the glottis 'Glottal resistance' as represented by the force of the vocal valve closure. Phonation can be described as 'Breathy', 'Flow' or 'Pressed' depending on the ratios of each aspect of phonation in relation to the other.	May lead to issues as discussed in breath pressure/flow mismatch: Breathy tone = quiet tone, difficulty focusing pitch and little control over dynamic changes. Flow = balanced glottal resistance with appropriate airflow – sound is rounded and contains all partials as required in the context of the sound created. Pressed tone = overworking adduction at vocal fold level combined with high breath pressure. Sound is tight and lacking higher partials.	Either overly breathy or pressed tone at start/ends of sung phrases. If breath support system is not functioning well, the lateral cricoarytenoids may need to increase effort, and recruit the larger intrinsic laryngeal muscles to help close folds, resulting in unwanted tension, pressed tone and lack of space.

	Breathy phonation results from an excess of airflow, combined with little glottal resistance. Flow phonation results from equal ratios of each aspect. Pressed phonation results from excess glottal resistance, combined with high breath pressure.		This may lead to eventual trauma due to too much force combined with too little mucosal lubrication across VFs.
Vocal loading with URT infection	Vocal fold swelling (see: Excessive Voice Use)	May result in excessive throat clearing, changes to mucosa and swollen vocal folds. Impact on voice may be fatigue due to increase in muscular effort, hoarseness due to swelling, reduction in upper range due to swelling/mucosal changes, breathy tone due to swelling or subsequent pathologies resulting	Breathy tone across range, or specifically on higher pitches. Voice fatiguing easily during singing tasks, leading to breaks in tone or further breathiness in spoken voice. Strain in upper register, especially higher speech set up or belt set up. Reduced range across singing voice. May lead to pressed tone as the glottal resistance is too high.
Reflux	Reflux can lead to benign lesions such as polyps, nodules, Reinke's oedema and cysts and may cause contact ulcers (Cipriani et al., 2011). The most frequent symptom of reflux can be Cricopharyngeal muscle spasm which often causes globus sensation before diagnosis (Casado Morente et al., 1998). Gastroesophageal reflux may produce an increase in pharyngolaryngeal muscle tone through a vagal reflex (Morrison, 1997) resulting in an increase in muscular effort during vocalisation. Causes significant macroscopic and microscopic histological changes in the mucosa of the vibratory margin of the vocal folds (Lechien et al, 2019). A combination of these symptoms may encourage increased muscular activity of the posterior cricoarytenoid muscle due to increased adduction through the range.	May result in excessive throat clearing, changes to mucosa and swollen vocal folds. Impact on voice may be fatigue due to increase in muscular effort, hoarseness due to swelling, reduction in upper range due to swelling/mucosal changes, breathy tone due to swelling or subsequent pathologies resulting from untreated GERD.	
Allergies	Blocked sinuses and auditory perception may cause additional vocal intensity. (Jokic et al, 2016). Several mechanisms are responsible for voice problems in allergic rhinitis. These include; the mucus hypersecretion of the nasal glands that causes	Impact on voice may be fatigue due to increase in muscular effort to increase volume, hoarseness due to swelling caused by repeated	

	postnasal drainage and as consequence production of cough, throat clearing, and dysphonia; sympathetic and parasympathetic fibres demonstrated in the vocalis muscle secondary to allergic rhinitis may contribute to the presence of dysphonia; the specific receptors sensitive to negative pressure in the nasal cavity and in the pharynx may increase the muscular activity of the posterior cricoarytenoid muscle; allergies may also result in irritated and traumatized vocal cords, due to frequent cough and/or clearing of the throat from increased nasal drainage (Spantideas, et al. 2019).	coughing or throat clearing, reduction in upper range due to swelling/mucosal changes, breathy tone due to swelling or subsequent pathologies.	
Frequent travel	Dehydration	Thicker mucosal consistency may lead to excessive throat clearing. Dehydration of vocal folds may lead to irritation after phonation, resulting in swelling, hoarseness.	
Medication use	Use of medication may result in changes in hydration, consistency of mucus. Examples of medication which may impact phonation include. • Antidepressants • Muscle relaxants • Diuretics • Antihypertensives (blood pressure medication) • Antihistamines (allergy medications) • Anticholinergics (asthma medications) • High doses of Vitamin C (greater than 5 grams per day) • Angiotensin-converting-enzyme (ACE) inhibitors (blood pressure medication) • Oral contraceptives • Oestrogen replacement therapy post-menopause • An inadequate level of thyroid replacement medication in patients with hypothyroidism • Anticoagulants (blood thinners) • Herbal medications or supplements	Thicker mucosal consistency may lead to excessive throat clearing. Dehydration of vocal folds may lead to irritation after phonation, resulting in swelling, hoarseness and reduced range in singing voice. Thinner mucosal consistency may lead to increased ‘sniffing’, post nasal drip and symptoms similar to those discussed in the allergies section.	
Medication abuse	Recreational drugs such as Cocaine can cause vocal fold swelling, resulting in hoarseness, vocal fatigue,	Impact on voice may be hoarseness due to swelling,	

	loss of vocal range and laryngitis (Agurto et al., 2019).	vocal fatigue due to increased muscle activity to bring folds together, loss of vocal range due to swelling and/or subsequent trauma from irritation.	
Excessive tension of laryngeal and para laryngeal muscles	Tightly adducted vocal folds, large subglottal pressures, large vocal fold oscillation amplitudes, and large cycle-to-cycle tissue decelerations in phonation (Hillman et al, 1989).	The result would be high inter-vocal fold impact forces during phonation, raising the risk of phono trauma. Fatigue due to increased muscular effort and lack of resonating space, which encourages additional effort to create volume. Thyroid may not be moving in a free, flexible motion, leading to strain in upper register.	
Jaw tension	Studies showed hypernasality, hoarseness, roughness, breathiness in patients with TMD (temporomandibular disorders) (Silva et al., 2007). The mandible and the hyoid bone are interconnected by several muscles as well as other soft tissues: the digastric (anterior belly), mylohyoid, and geniohyoid muscles directly, and other extrinsic lingual muscles indirectly. The thyroid cartilage is suspended from the hyoid bone by the thyrohyoid muscle and other membranes or ligaments. These soft tissue connections form the thyrohyomandibular chain and cause a mandible-larynx interaction in speech articulation. When the jaw opens, certain biomechanical effects are expected to occur with respect to the relations among these structures. The jaw opening by rotation alone can cause backward translation of the hyoid bone and consequent rotational separation of the thyroid cartilage from the cricothyroid around their joint because of the passive elasticity of the cricothyroid muscles and other tissues in the anterior portion of the larynx,	Impact on tone may be hypernasality due to increased search for resonance and lack of pharyngeal resonating space, hoarseness due to increased muscle activity to create volume, roughness due to subsequent irritation and swelling caused by increased muscle activity.	Lack of volume across range. Pressed tone in attempt to increase volume – particularly in upper range and/or louder voice qualities. Voice fatiguing easily during singing tasks, leading to breaks in tone or further breathiness in spoken voice. Reduced range across singing voice. May lead to pressed tone as the glottal resistance is too high.

<table>
<tr>
<td></td>
<td>as well as the horizontal friction in the more posterior area around the thyrohyoid muscle and other tissues (Fig. 2).
This change of state of the cricothyroid joint is opposite to the (vocal-fold lengthening) action of the cricothyroid muscle, and results in shortening of the vocal folds, assuming that the cricothyroid is not contracting at the same time.

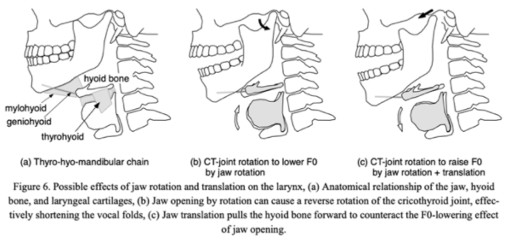

Figure 2. Possible effects of jaw rotation and translation on the larynx. (Erikson et al., 2017)

Laryngeal adduction increases as jaw opening increases and biting pressure increases. This can be translated as a jaw held in a tense biting position may cause vocal hyperfunction as folds are adducted more forcefully while singing. This may lead to pressed tone (Cookman and Verdolini,1999).</td>
<td></td>
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<tr>
<td>Abdominal wall tension</td>
<td>Unable to release abdominal wall on in-breath, therefore using thoracic breath with consequential recruitment of extrinsic laryngeal muscles during phonation. This may occur as a result of reduced trunk stability (Cryns et al., 2021).</td>
<td>Fatigue due to increased muscular effort and lack of resonating space, which encourages additional effort to create volume.
Thyroid may not be moving in a free, flexible motion, leading to strain in upper register.
May lead to pressed tone as the glottal resistance is too high.</td>
<td rowspan="2">Pressed tone in attempt to increase volume – particularly in upper range and/or louder voice qualities.
Voice fatiguing easily during singing tasks, leading to breaks in tone or further breathiness in spoken voice.
Reduced range across singing voice.
May lead to pressed tone as</td>
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<tr>
<td>Chest tension</td>
<td>Activation of sternocleidomastoid and scalene muscles during a chest breath or upper chest holding, may encourage extrinsic laryngeal muscle use, including omohyoid, which may result in lack of freedom of movement at the hyoid and therefore larynx.</td>
<td>Fatigue due to increased muscular effort and lack of resonating space, which encourages additional effort to create volume.
Thyroid may not be moving in a free, flexible motion,</td>
</tr>
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		leading to strain in upper register. May lead to pressed tone as the glottal resistance is too high.	the glottal resistance is too high.
Tongue tension	Inhibits hyoid movement, and therefore laryngeal freedom. Supresses resonating space in pharynx, altering tone.	Fatigue due to increased muscular effort and lack of resonating space, which encourages additional effort to create volume. Larynx may not be moving in a free, flexible motion, leading to strain in upper register. May lead to pressed tone as the glottal resistance is too high.	
Head and neck posture issues - May also be linked to High Stress levels)	Overuse of trapezius and sternocleidomastoid muscles	Fatigue due to increased muscular effort and lack of resonating space, which encourages additional effort to create volume. Thyroid may not be moving in a free, flexible motion, leading to strain in upper register. May lead to pressed tone as the glottal resistance is too high.	
Vocal abuse	Benign masses of the vocal fold related to phono trauma are clinically classified into polyps, nodules, Reinke's oedema, and cysts. (Cipriani et al., 2011)	Hoarseness, breathiness, lower habitual pitch, reduced vocal range, gaps in range.	Difficulty creating higher pitches while singing. Overall reduced range in singing voice. Pressed tone when clarity of tone or higher volume required in song. Breathiness over tone in certain points in the range where VFs are

			affected by trauma.

CONCLUSION

The first rapid review as part of the larger literature review suggests that MTD has multi factorial aetiologies such as higher vocal demands, excessive voice use, gastroesophageal reflux disorder, allergies, insufficient technical training and an imbalance of laryngeal and para laryngeal muscle use. There are, however, many possible causes, specific to the personality, lifestyle and environment of the singer. To determine which of the given etiological factors are most important to treat, the study of the most common causes specific to the individual is necessary. To ensure appropriate prevention and successful treatment of MTD resulting from laryngeal tenson, a wide number of causes must be considered, before a clinical pattern emerges, upon which voice care teams may begin to base the design of appropriate treatment.

Recommendation for Research

As much of the current research available is concerned with classical singing, additional research into the causes of MTD within contemporary commercial music (CCM) singers would ensure parity across singing voice research. It would help to provide further support for singing teachers and voice rehabilitation teams working with these specific styles and vocal approaches.

Key Findings (Rapid Review One)

- MTD has multi factorial aetiologies.
- Causes are specific to the individual singer.
- Broad knowledge of the singer lifestyle allows specific causes to be prioritised during treatment.

Although rapid review one considered the most common causes of MTD in the singing voice, the inspiration for the overarching thesis aim has basis in the musical theatre singing voice and the specific demands of the genre which may increase the risk of MTD in this group of singers. To this end, a subsequent rapid review was undertaken to identify and discuss a number of additional demands placed upon musical theatre singers and the potential impact they may have on laryngeal tension.

3.4 Rapid Review Two: The additional demands on the musical theatre performer and potential links to increased laryngeal tension.

Muscle tension dysphonia (MTD) appears to be disproportionately prevalent in musical theatre professionals, owing to the unique, high-demand vocal and physiological environment in which they perform. For instance, first-year singing students specialising in musical theatre exhibit a substantially higher rate of vocal fold pathology, around 40% compared to 0% among classical singers (Lloyd et al., 2019). The elevated pathology rates point to the persistent laryngeal hyperfunction and elevated intrinsic/extrinsic laryngeal muscle tension inherent to the demands of musical theatre performance. Laryngeal muscles including the cricothyroid, thyrohyoid, and suprahyoid groups are frequently in a state of abnormally high tension in hyperfunctional voice conditions, reflecting how constant performance stress can elevate baseline muscle tension (Cardoso et al., 2021; Kooijman et al., 2005). Concurrently, cardiovascular arousal manifesting as increased heart rate and sympathetic tone during live performance can further amplify neck and laryngeal muscle tension, exacerbating MTD through performance-induced physiological stress which contributes to muscular hyperfunction. Taken together, these performance-driven factors of elevated laryngeal muscular tension and cardiovascular-mediated sympathetic activation offer a compelling explanation for the higher incidence of MTD among musical theatre performers. With this in mind, the next rapid review in this chapter builds upon common aetiologies of MTD and presents further insight into the ***specific demands placed upon the musical theatre performer and their links to increased laryngeal tension***.

ABSTRACT

The musical theatre genre exists in an environment which places a myriad of demands upon the performer. The complex nature of the artform results in additional physiological and psychological demands not found in other aspects of the performing arts. Currently, few studies identify the specific demands and considerations placed upon musical theatre performers and the potential impact these may have on vocal health and function via increased tension. There is a need to identify existing literature exploring these demands with a view to establishing potential causes of laryngeal tension in musical theatre singers. The identification of demands and subsequent potential impacts is required both to potentially mitigate vocal issues developing, and to support initial ear nose and throat (ENT) clinician and speech and language therapist (SLT) diagnosis and treatment in the voice clinic and singing studio when treating musical theatre performers diagnosed with muscle tension dysphonia (MTD). This study aimed to identify and discuss existing literature documenting the current demands placed upon the musical theatre performer. Literature archived in three databases (Pubmed, Elsevier and Wiley Library) were reviewed, and eight articles met the eligibility criteria for inclusion. Further searches were made in grey literature and hand searching took place alongside database searches. The foremost demands examined were the varied and ever-evolving vocal demands, the combination of choreography and

singing, integrating instrument use, the role of the swing, performance anxiety, financial anxiety, and the associated stress.

Rapid review two concludes that individually, each demand has the capacity to increase laryngeal tension, leading to the hypothesis that a combination of demands may compound the potential for detrimental tension further. There is a need for further study specific to the impact of the additional demands of Musical theatre performance on broader vocal function and performer mental and physical health.

Keywords: Musical theatre, vocal, demand, load, anxiety, tension, instrument.

INTRODUCTION

Musical theatre continues to thrive as a prominent cultural force in the UK and globally, attracting diverse audiences and sustaining a vibrant performance industry. In 2024, West End attendance reached over 17.1 million, an 11 percent increase on pre-pandemic levels, and outperformed Broadway by nearly five million spectators, while drawing almost one-quarter of international tourism in London (Financial Times, 2025; Reuters, 2025; Society of London Theatre & UK Theatre, 2025). This success is underpinned by enduring public appeal and substantial economic impact. For every pound spent on a theatre ticket, an additional £1.27 is generated for local businesses, and the national theatre sector produces approximately £4.44 billion in turnover and supports 230,000 full-time-equivalent jobs (Society of London Theatre & UK Theatre, 2025; West End Theatre Guide, 2025). The preservation of Theatre Tax Relief of up to 45 percent on production costs has been instrumental in this resurgence, enabling investment in productions, employment, and regional touring (Reuters, 2025; West End Theatre Guide, 2025).

Beyond its cultural and economic contributions, musical theatre intersects with health and wellbeing. Research commissioned by the UK's Department for Culture, Media and Sport, Frontier Economics, and University College London's WHO Collaborating Centre for Arts and Health estimates that engaging in the arts contributes around £8 billion annually through health improvements, reducing medication use and dependence on health services (Department for Culture, Media and Sport et al., 2024). In the clinical domain, a well-structured bridging resource linking initial speech and language therapy for muscle tension dysphonia (MTD) with subsequent work by an informed singing teacher can substantially improve vocal health outcomes for professional singers. This collaborative model may shorten recovery time, diminish recurrence, and lower long-term clinical costs. It may support the artist's career sustainability and offer a cost-effective benefit to health services by reducing reliance on extended therapy and advanced interventions.

Musical theatre is a rapidly changing art form, continuously including and reflecting a wide range of musical genres and styles (Benson, 2018; Cox, 2020; Hoch, 2018; Kayes, 2015; Melton, 2007). Asare (2022) describes the musical theatre singing voice as *"expansive, reiterated, powerful, nuanced, and commercial, ever in the process of being remade"* (p. 63). As mirrored in the evolution of the musical theatre voice in the West End, Broadway's musical and vocal styles are constantly changing (Freeman et al., 2015), and the basis for aesthetic appraisal or vocal behaviours are indistinct and dynamic (Flynn, 2022b). There is a lack of research specifically analysing the multitude of demands that make up the role of musical theatre performer and their potential impact on vocal function, despite recent studies attempting to measure vocal load in an effort to create a desired baseline for performers in rehearsal, training and performance (Zuim, Stewart & Titze, 2023).

Additional demands of musical theatre performance include although are not limited to; varied and ever-evolving vocal demands, combining choreography and singing, integrating instrument use, role of the swing, logistical considerations, performance anxiety, financial anxiety and associated stress. Little research has attempted to critically assess the possible increase in laryngeal tension related to the demands of performing in musical theatre, either in isolation or in combination. Were individualised, evidence-based studies available to provide a clearer picture of the potential impacts, this may inform preventative behaviour across the industry, influence rehabilitative treatment design and empower the musical theatre performer with regards to voice care in a holistic sense. As this review sits within a broader examination of muscle tension dysphonia (MTD) in the musical theatre singing voice, Morrison's assertion that *"Dysphonia is usually caused by a number of factors…sorting out the relative importance of the various factors is the first step towards planning an effective treatment program"* (1997, p. 108) provides the catalyst to investigate each demand and to measure each with regards to the potential for increased laryngeal tension. The additional demands that the musical theatre genre places on its performers have not been extensively studied in terms of their effects on vocal function and health, particularly laryngeal tension levels. Against this background, a rapid evidence review was proposed. The aim of the review was to explore the potential link between the extra demands of musical theatre performance and increased laryngeal tension in musical theatre singers, presenting a rapid evidence review of a broad range of sources to map out the nature and scope of the field, drawing on a range of voice-focused bibliographic databases and singing-specific literature, the evidence included has been screened for relevance and quality.

Eligibility Criteria

Included articles are those that discuss the demands of musical theatre performing. Due to the nature of the musical theatre genre, international publications are included. Only articles published from January 1995 to March 2024 were gathered in an attempt to maintain relevance to more recent trends within musical theatre.

Search Strategy

An electronic search was undertaken in January 2024. Articles archived in PubMed, Wiley Library and Elsevier were reviewed. The following keywords were used for the search: "Musical theatre, Musical Theater, Vocal demands, Musical theatre performer, musical theatre voice, vocal load, swing, Broadway, performance anxiety, situational anxiety, financial anxiety, tension, instrument, playing". Secondary searches were carried out by the researcher and included associated papers via reference chaining, hand searches of hard copy pedagogical and grey literature.

Study Selection

A total of 58 results were obtained and screened. A total of eight articles were included in rapid review two (Figure 3). Articles were included within the following criteria: Published between January 1995 and March 2024 inclusive, Peer-reviewed, linked directly to the musical theatre genre or the acting voice, full text available, and translated to English where required. Articles were excluded for the following reasons: Not directly relating to the musical theatre industry, no full text available, publishing date before 1995.

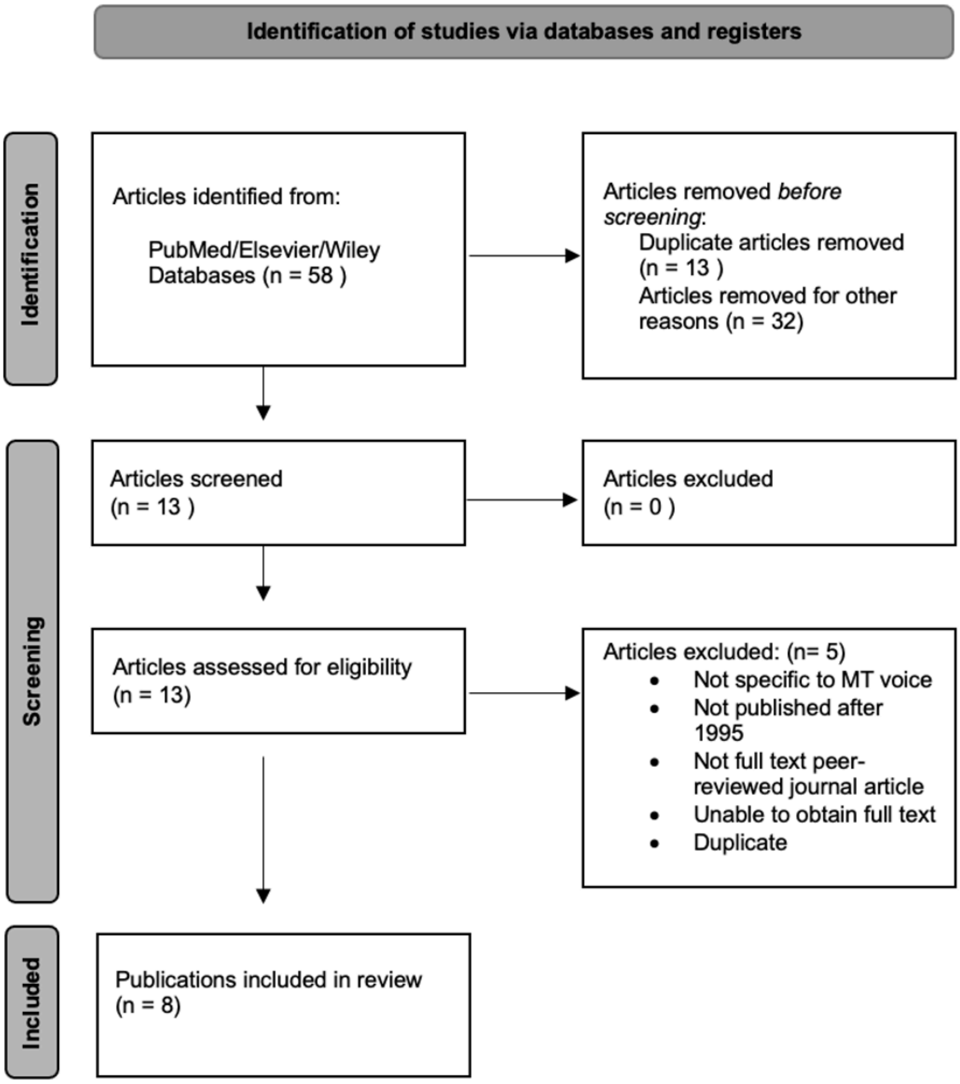

Figure 3

Adapted PRISMA SC-R Study Selection Process.

Data Collection and Synthesis

The following information was extracted and tabulated: title, author(s), year published, country, type of research, and primary musical theatre demands discussed (Table 4). Studies were then amalgamated with supporting sources in a final overview of the physiological and psychological demands and considerations judged to be specific to the musical theatre performer, alongside their links to laryngeal tension.

RESULTS

In rapid review two, the additional demands on the musical theatre performer and potential links to increased laryngeal tension are discussed. A summary of the included article characteristics and key findings are presented in Table 4.

Table 4

Publications included in rapid review two.

Title	**Author/s**	**Year Published**	**Country**	**Type of Research**	**MUSICAL theatre demands Discussed**
Music theater voice: Production, physiology and pedagogy.	Bourne, T., Garnier, M., & Kenny, D. T.	2011	USA	Mixed Methods	Vocal Range Vocal Demand
Act, Sing, Speak: Voice in the World of Theatre	P. Wilson	2013	Australia	Qualitative	Part time jobs Pyrotechnics Make up allergies Heavy costuming and headpieces Vocal loading over loud music Dehydrating theatre conditions
An evaluation of the breathing strategies and maximum phonation time in musical theatre performers during controlled tasks	Sliiden, T, Beck, S & MacDonald, I.	2017	London	Mixed methods	Singing while dancing
Deciphering Vocal demands for today's Broadway leading ladies	Freeman, W, Green, K & Sargent, P	2015	USA	Mixed methods	Vocal and range demands
Perspective on the impact on vocal function of heavy vocal load among working professional musical theatre performers	Phyland et al.	2012	Australia	Qualitative	Vocal loading and impact on voice function
Music Performance Anxiety in Musical theatre Performers: A Pilot Study	James, A and Shipley, M	2022	UK	Mixed methods	Anxiety in musical theatre performers and those currently unemployed
Physiological Characteristics of Musical theatre Performers and the Effect on Cardiorespiratory	Stephens, N., & Wyon, M.	2020	UK	Qualitative	Combined Singing and Dancing Respiration

Demand Whilst Singing and Dancing.					
Vocal demands of musical theatre Rehearsals: A Dosimetry Study	Zuim, A., Stewart, C., Titze, I.	2023	USA	Quantitative	Vocal load of specific musical theatre show and role requirements

DISCUSSION

Voice pedagogue Pat Wilson (2013) refers to Richard Miller's apt comment *"It is difficult to determine where the instrument of the singer leaves off and where the instrument case begin"* (Miller, 1996, p.218) in her examination of the additional demands faced by theatrical performers. She reiterates that the quality of the singing instrument's carrying case is the determining factor in any circumstance. Therefore, in addition to the responsibility to care for the vocal instrument used by the theatre performer, it can be proposed that all of those involved in the teaching, direction and production of voice have a duty to ensure the 'case' remains in good working order.

Few performing employment contexts demand the combination of skills required of the musical theatre performer. The traditionally termed triple threat of acting, singing and dancing has been bolstered by the integration of musical instrument playing within the 'Actor-Muso' show type, the *"demands of the swing"* (Eyer & Smith, 2015, p.5), alongside psychological and emotional stressors, including performance anxiety and financial anxiety, creating an employment context which has the potential to be detrimental to vocal health due to an increase in laryngeal tension caused by a myriad of potential stressors.

Evolution of Musical theatre

Inspired by the European form of comic musical theatre called operetta, developed around 1850 by Herve, and expanded by Offenbach and Strauss II, Gilbert & Sullivan designed their comic operas to attract family audiences. Combined with improved street lighting and transportation options, these popular shows brought a theatre building boom to London's West End in the late Victorian and Edwardian periods (McWilliam, 2020). Edwardian musical comedy dominated the stage by the late 1800's, followed by the light comic repertoire of Ivor Novello and Noel Coward in the early 1900's.

"*The musical has been changing ever since Offenbach did his first rewrite in the 1850s. And change is the clearest sign that the musical is still a living, growing genre. Public taste has undergone fundamental changes..."* (Kenrick, 2024).

In recent years, the musical has evolved from classic book format to concept and genre-specific shows and the regular production of a varied range; including 'Jukebox' musicals which use existing pop or contemporary songs, revivals of the classics, musical adaptations of films, regional writing and long-running shows. Musical theatre composers continue to draw from many different influences and styles which include, although not limited to; Opera, Operetta, Art Song**,** Jazz Standards**,** Pop/Rock (usually reflecting the time period in which the musical was composed unless it is a biographical or period piece), Folk, Country, Bluegrass, R&B, Motown, Rap, Gospel, Latin and Disco.

Furthermore, there are an increasing number of crossover opportunities for vocal performers from different genres. As contemporary commercial music (CCM) artists may be featured in shows such as Chicago (Kander & Ebb, 1975), Ghost (Rubin & Stewart, 2011), Jesus Christ Superstar (Lloyd Webber, 1970) which have reduced range or pop-specific vocal approaches, musical theatre performers must master a range of styles to compete for the roles available.

Evolving Vocal Demands

The complex processes involved in singing include neurological, physiological, respiratory and psychological activity. Callaghan and Wilson describe singing as *"a form of sport, within which neuromuscular training is essential"* (2002, p.112), confirmed by evolution of the genre of musical theatre through, and inspired by, mainstream musical trends, both past and present. The variety of musical and vocal styles contained within the genre continues to evolve.

"Everybody needs to sing everything"

(LoVetri et al., 2014, p. 65).

With regards to the creative and physiological aspects of singing, the ever-expanding range of musical and vocal aesthetics within the musical theatre genre have not led to an increase in vocal specialism, rather to the expectation that the individual musical theatre performer should master a broad range of singing and musical styles (Bourne et al., 2011; Cox, 2020; Flynn, 2022).

From pop/rock belt to relaxed folk styles, the multitude of different musical theatre composition styles and genres require that same multiplicity of different vocal approaches. Contemporary research into the physiological, anatomical and acoustic properties of the voice has allowed a greater understanding with regards to the difference in activity between vocal mechanisms and qualities (Echternach et al., 2014; Flynn et al., 2018; Kayes, 2015, 2019; McGlashan et al., 2017). These insights can ensure both singing teachers and performers are equipped with more evidence-based resources than ever before, allowing the exploration and skill acquisition required to master a greater number of vocal styles. This does not negate the fact that due to the variety of style demands, greater pressure is placed on the singer to master the sustainable production of each vocal quality, requiring high levels of vocal flexibility and agility between the many approaches.

"…having multiple voices is not the exception in musical theatre, it is the norm." (Johnson et al., 2019, p. 41).

When examining audition requirements for female musical theatre performers on Broadway, Freeman et al. (2015) found that 84% of the musical theatre productions required belting and over half of the belted notes were spent on E5. Whereas previously within the musical theatre canon, notes within the range of C5 and above were traditionally sung in M2/Head voice, many shows now require that these be performed in a belt set up (Figure 4) (Freeman et al., 2015).

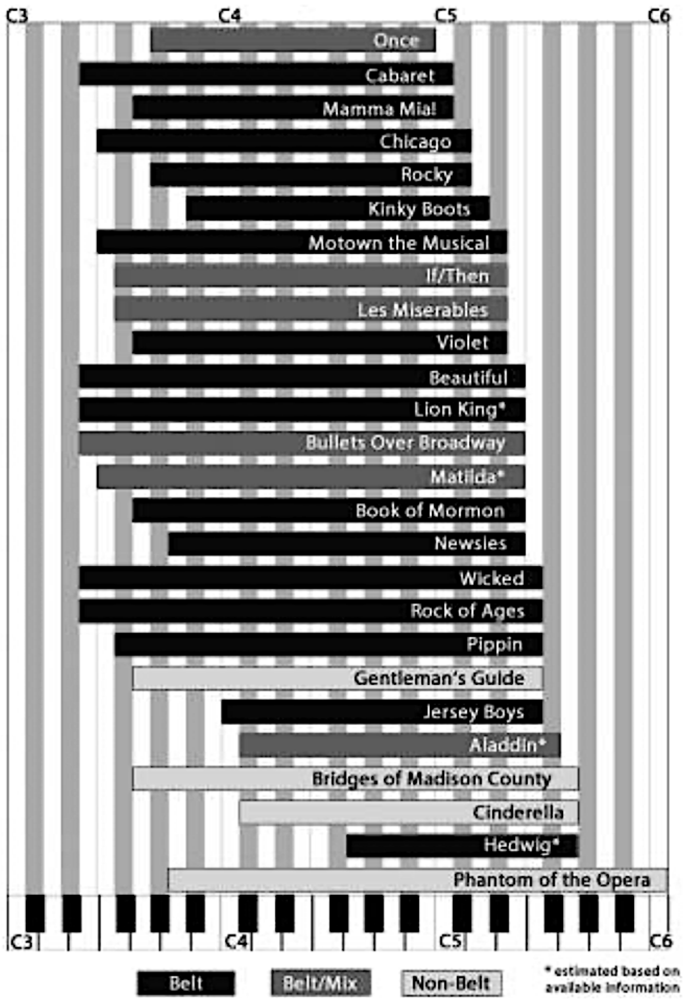

Figure 4

Vocal ranges for Broadway leading female roles as of 2014 (Freeman et al., 2015).

Link between evolving vocal demands, increased laryngeal tension and MTD

Sustained heavy vocal loading, such as those found in the Belt demands of many musical theatre shows, increases the potential for vocal fatigue leading to or as a result of compensatory tension. The requirement to sing higher in the upper range in a belt set up which in previous years have been performed in a lighter vocal set up (Freeman et al., 2015) may cause tension for those whose natural vocal tendency is lighter in that range. As musical theatre writing often reflects the trends of contemporary music, there are additional challenges associated with integrating CCM styles which may not allow the supported, stamina-reliant vocalisation found in more traditional musical theatre voice qualities.

The Demands of Score and Rehearsal: Vocal Loading and Vocal Dose

The vocal requirements of a musical theatre rehearsal demand unpredictable amounts of singing and speaking. As regular voice use continues during rehearsals, singers' additional vocal demands include conversation, an aspect which is often overlooked. Beyond the rehearsal additional commitments such as interviews, media work and socialising may increase demand without clear acknowledgement.

Many contemporary musical scores require heavy mix and belting strategies that may overload the vocal instrument (Freeman et al., 2015) due to the concentration of mechanical stress confined to the middle third of the vocal folds, which can lead to tissue reactions and phono trauma. As the rehearsal process often involves multiple repetitions of specific sections of the score, this focused production and repetition of a limited frequency range can overburden the vocal mechanism of soloists and ensemble cast members, and potentially lead to vocal trauma (Zuim et al., 2023). In recent research this concept has been referred to as vocal loading (Phyland et al., 2012). To define the concept of vocal loading, Hunter et al. (2019) examined the current use of the term within the literature, finding it described as perception or phonatory effort, which is described as heavy, moderate or light. Solomon (2008) described vocal load as phonating at higher-than-normal frequency and intensity, with Titze et al. (2007) describing it as the accumulated voicing within a set duration. Vocal loading capacity is defined by Echternach et al. (2014) as the amount of load that a voice user can handle before experiencing negative vocal impact. Both the Vocal Loading Test (Richter et al., 2016) and the Vocal Loading Index (Svec et al. 2003) are used to quantify vocal load through perceptual questionnaire and survey. Hunter et al. proposed a new definition of 'Vocal demand' and 'vocal demand response' (2019) to clarify the areas between vocal load, vocal loading, vocal effort and vocal fatigue, however this review will use the term vocal loading as proposed by Solomon (2008), with the additional consideration of Titze et al.'s definition of accumulated voicing within a set timeframe (2007). This definition is applicable to the musical theatre performer and allows for specific discussion. The exposure of vocal fold tissue to vibration is referred to as the vocal dose. Previous research has identified changes in the vocal folds and voice production over time, as well as the prevalence of voice disorders in vocalists because of the contact stress brought on by each collision of the membranous portion of the vocal folds, the impact of repeated stress on vocal tissue due to intraglottal pressure, and fatigue brought on by repeated vibration (Assad et al., 2017). A baseline of vocal dosing which can be assessed as safe for singers has yet to be established (Zuim, Stewart & Titze, 2023). The vocal dose is impacted by many elements, such as duration of vocalisation, sound pressure level, range of frequency used, and styles of singing required by the score. Louder and fuller phonation results in 'larger distance doses, representing the cumulative load placed on vibrating tissue' (Zuim, Stewart & Titze, 2023).

The measurement of vocal fold exposure to vibration is measured through a vocal dosimeter (Assad, et al, 2017), which is attached to an accelerometer to the sternal notch and measures the vocal load without recording background noise or the content of the vocal sound produced. Zuim et al. (2023) found in a recent study of vocal demands in the rehearsal period for the musical 'Nine' (Yeston, 1982) that due to the vocal demands of a specific musical score, particular aspects of a singer's vocal dose usually increased during rehearsals. The increase was thought to be in response to the focus on specific types of vocal quality and desired vocal sound, especially when the range in which most of the notes fall within the musical focuses on a belting or high-intensity vocal quality area. The variability and unpredictability of the vocal demands for individual performers through the rehearsal process were highlighted. The study noted that even if the pace of the rehearsal was not deemed too great, the specific demands of the score alone may prove to be much larger than the vocal dose reported through the rehearsal. Zuim et al. (2023) concluded that further studies are needed to establish the overall dose of each musical theatre role to serve as considerations for vocal pacing and voice care during rehearsal and performance.

Link between vocal demands, increased laryngeal tension and MTD

The concentrated production and repetition of a small frequency range can tax the vocal mechanism of soloists and ensemble cast members, leading to vocal trauma (Roll, 2016; dos Santos et al., 2019). Previous investigators have identified changes in the vocal folds and voice production across time (Jiang, Lin & Hanson, 2000) and the prevalence of voice disorders in singers (Pestana, Vaz-Freitas & Manso, 2017) due to the contact stress that results from each collision of the membranous portion of the vocal folds (Mehta et al., 2021) the intraglottal pressure and impact of repetitive stress on vocal tissue (Chan & Titze, 1998; Titze, 1994), and the resulting fatigue from repetitive vibration (Palaparthi et al., 2019; Svec, Popolo & Titze, 2003).

If the vocal dose of each role and the potential impact was made apparent, musical theatre singers may be better equipped to manage their voices during rehearsals and performances using appropriate strategies. Furthermore, directors, teachers and performers would be equipped to develop strategies to establish and maintain the vocal stamina required throughout rehearsals and eight performances per week.

Combining Singing and Choreography

The combined skill of singing and dancing is one of the fundamental aspects of musical theatre performance (Sliiden, Beck & MacDonald, 2017). Gates et al. (2013) highlight the potential impact of movement on the musical theatre voice, raising the possibility that in some performers the demands of movement may contribute to the development of MTD.

Breathing for singing

Controlled breathing is necessary for singing, with an emphasis on low, controlled airflow through partially adducted vocal folds during expiration. Breath control is introduced early in singing pedagogy as constant fluctuations in pressure are required in response to the musical demands. Depending on the prosody of the piece, frequent, varied changes to air volume, flow and rate are required. In a study comparing particle emissions in both spoken and sung voice use, Alsved, et al. (2020) found singing to require sustained voicing, a greater range of frequencies, increased sound pressure, an increase in articulated consonants, and higher peak airflows than the spoken voice. As these combined aspects contribute to increased exhaled emissions, the findings that the professional singer produced more than double the level of particle emissions (1480) compared to loud talking (570). These results are supported by Barbosa and Madureira (2020), who found notable differences in their study concerning professional singers, including longer breath cycle duration and increased volume of inhalation in song when compared to speech.

Control of rib cage movements is of great relevance in singing technique. Studies by Binazzi et al. (2006) and Thorpe et al. (2001) found that breathing when singing resembles breathing at rest more than breathing during athletic activity, with less differentiation between rib cage and abdominal wall excursion, with the rib cage and abdominal muscles jointly activated so that the respiratory system acts as a single compartment. Neither study considered the integration of aerobic activity with phonation. Thomasson and Sundberg (1999) and Watson, Willams and James (2012) found that within singing (opera) there are many individual variations in muscle recruitment patterns from the rib cage, abdominal wall, and accessory respiratory muscles, suggesting that professional opera singing does not require strictly uniform breathing strategies, suggesting that variety of approach may be useful when seeking to develop the optimum approach to breath control during dance.

Breathing for dancing

Open airways and a glottis with the vocal folds abducted, a regular breathing rate and tidal volumes (the volume of air that enters or exits the lungs with each respiratory cycle), are all necessary for spontaneous breathing during cardiovascular work, including dance. Being able to regulate airflow is essential when singing or playing wind instruments, particularly when trying to play extended, continuous phrases. When singing and dancing at the same time, this skill becomes more difficult to perform (Sliiden, Beck & Macdonald, 2017).

Integration of Singing and Choreography

While discussing body movement in performers, Gates et al. (2013) highlight that some performers may run out of breath during choreographed movement due to the difficulties in maintaining volume when you are running out of breath and may have to induce muscular tension in the larynx to maintain enough subglottic pressure while singing. Over time such vocal tension can become habitual and problematic. Furthermore, the impact of dance on cardiorespiratory demands within a musical theatre performance, explored by Stephens and Wyon (2020) found that although musical theatre performers have a greater maximal aerobic capacity than dancers from other genres, the singing component reduces breathing frequency, leading to a negative effect on the physiological recovery from the dance sections and increase lactate levels, leading to supressed cardiac output. Musical theatre dancers may need to either compromise the singing component to improve breathing frequency or decrease the intensity of the dance sequences to ensure singing is not affected by the breathing frequency required by the movement demands.

Maximum Phonation Time

In a 2016 study, Sliiden, Beck and Macdonald found that Maximum Phonation Time (MPT) has been demonstrated to correlate with several different voice disorders and is a useful tool for monitoring the effectiveness of voice therapy, surgery, or other forms of treatment. While respiratory muscle dysfunction is not unheard of, singers are more likely to experience imbalances in their musculature, or even hyperfunction, which can result in irregularities at vocal fold level including inadequate approximation leading to reduced breath efficiency and increased airflow as a result (Sliiden, Beck & Macdonald, 2017). In a 1988 study, Schmidt, Klingholtz, and Martin found the maximum phonation time to be higher in classically trained female singers than in non-trained women. To measure respiratory or sound control the Maximum Phonation Time test measures an individual’s ability to sustain a sung tone, after filling their lungs to maximum capacity (Maslan, 2011). The decline in MPT was an increase in sound pressure of three seconds per10dB observed in the results.

In a mixed-method study conducted in 2016, Sliiden, Beck and MacDonald discovered a 65.2% decrease in MPT between singing while dancing (7.1 seconds) and singing at rest (20.4 seconds). The study revealed that participants were in agreement that dancing had the greatest potential to negatively affect singing phraseology and prosody because dancing rapidly reduced the control of the breathing apparatus. The ability to even support and sustain notes was found to be the group’s largest challenge when singing while dancing. By opening night, only 45% of the participants thought they could fully execute the combined singing and dancing. Sliiden, Beck and MacDonald (2017) concluded that to better prepare performers who must sing while dancing, as well as those who instruct aerobic circuit training classes, more research is needed.

Link between simultaneously singing and dancing, increased laryngeal tension and MTD

While discussing body movement in performers, Gates et al. (2013) highlight that some performers may run out of breath during choreographed movement due to the difficulties in maintaining volume and may have to induce muscular tension in the larynx to maintain enough subglottic pressure while singing. Over time such vocal tension can become habitual and problematic. Gates et al. (2013) highlight the potential impact of movement on the musical theatre voice, raising the possibility that in some performers the demands of movement may contribute directly to the development of MTD.

The Logistics of Performing

Stage Effects

Stage effects that impact the performance environment are commonly encountered by vocalists in MT. The ability to prevent or minimise negative effects on the voice depends on an understanding of the special effects, the chemicals used to create them and their possible impacts on voice quality (Rossol, 2021).

A short medical study of 25 pit orchestra musicians at Beauty and the Beast on Broadway, was undertaken by Dr Jacqueline M. Moline (Moline & Golden, 2000). Medical tests clearly showed signs of ill health in each pit musician. Dr Moline stated that

"The conditions for the musicians in the music pit at Beauty and the Beast are unhealthy. A large percentage of the musicians are suffering from symptoms related to the irritative effects of the work environment. Several musicians now require medical care and medication to treat their symptoms which have developed or worsened since taking part in this production."

The data from the Beauty and the Beast study may not be generalisable to other Broadway shows, due to the use of pyrotechnic effects that created an additional type of smoke alongside the fog and haze used. A 2003 report to SHAPE (Safety and Health in Arts, Production, and Entertainment) by the University of British Columbia School of Occupational and Environmental Hygiene which studies the effects of theatrical fog on 100 stage workers found that: *"Overall, the health study results suggest that exposure to theatrical smokes and fogs is provoking non-specific respiratory irritation and increasing the risk for chronic airflow obstruction among BC theatrical industry employees."* Another significant finding of this study was that a *"measurable drop in lung function (over the testing period of about four hours on average) was more often seen when mineral oil fog was used."* There is a lack of contemporary research on this aspect of musical theatre performance. On the recommendation of Dr Moline, clear guidelines have been put in place by the actor's union Equity regarding the duration and proximity of haze and fog within the theatrical setting. Yet, the evaluation of the health effects of theatrical smoke, haze and pyrotechnics was last updated in 2000 by Moline et al., leaving room for more current research. The dry and dusty air during rehearsals and performances is another common complaint from performers. The findings of Richter et al. (2000) supported the complaints of performers; they consistently discovered that the heat and dryness in theatres lacking compensatory humidification were generally too high for healthy voice performance. The performer may be expected to use extreme vocal ranges, such as screaming, crying, or sobbing within this potentially irritant environment (Wilson, 2013).

Link between stage effects, increased laryngeal tension and MTD

The performance of singers, actors, and musicians can be adversely affected by a decrease in pulmonary function and it is unknown whether this change in lung capacity occurring repeatedly could develop into a chronic condition (Rossol, 2021). In a link to restricted breath use previously identified, a lack of breath capacity may encourage tension in the larynx, as the performer recruits muscle to maintain subglottic pressure while singing which, combined with the potential irritant impact of haze, fog, dust, and dry conditions, may lead to coughing and additional habitual tension in the larynx.

Costuming

Wilson (2013) states that some costumes in the more fanciful areas of theatre, opera, and music theatre are windfalls for local physiotherapists, stating *"Music theatre pieces beloved of health practitioners for their kinky costuming include The Lion King and Beauty and the Beast".* A lack of research into the impact of additional weight, the need to balance and compensate for uneven weight distribution and the potential for neck strain while wearing heavy headpieces, masks or bulky costuming makes this aspect difficult to examine. Shoe design for women in musical theatre is typically based on the style period or stylistic decisions made by the director. Differing heel heights might be required to change the appearance of a character on stage. Additionally, the production may employ the use of a raked stage, which may affect the posture of the performer in a similar way to wearing high heels. The requirement to wear heels within a production may directly impact phonation. Data from a 2018 study by Rollings into the impact of heel wearing on head position, long-term average spectra, and perceptions of singers, found that for most participants, heel height encouraged a significant lowering of head position, and notable changes in vocal timbre and resonance. An investigation into optimum singing posture by Luck and Toiviainen (2007) found that *"a lowered head position could produce spectral irregularity and an elevated head position could increase perceived loudness in singers".* Although a lowered head position may produce a useful vocal timbre within a genre requiring lowered laryngeal position and lengthened vocal tract, this position may not be effective when producing the musical theatre belt sound, which typically needs the first formant frequency to be raised and a slightly higher laryngeal position (Echternach et al., 2014; Sundberg, Thalen & Popeil, 2012). With regards to the impact on respiration, a historical study by Mathews and Wooten (1963) observed participants used significantly more oxygen while moving in high-heeled shoes compared with non-heeled shoes. These findings are supported by Lee et al. (2001) who found an increase in the height of the mean centre of gravity and subsequently increased activity in the erector spinae muscle group when wearing high heels. As erector spinae muscle contribute to postural stability and flexibility, the impact on accessory muscles of respiration may prove detrimental to phonation.

Link between costuming, increased laryngeal tension and MTD

It may be hypothesised that the impact of additional extrinsic neck tension may lead to maladaptation of the laryngeal mechanism resulting in MTD as a by-product of compensatory postural alignment strategies. Additionally, the impact of carrying additional weight while dancing may lead to compromised breath control, overheating, dehydration and the associated increased muscle use, irritation at vocal fold level, and increased cardiac function. All of which may increase stress on the body, leading to a rise in maladaptive approaches throughout the system.

Raked Stage

In a 1998 survey which remains the only one compiled to date, Neurologist Randolph Evans found raked stages, inclined platforms at various angles, to be a risk factor on Broadway and in the West End. He argued that raked stages cause the performer to *"put your weight back, making you reset the centre of your balance [...]It's like standing on a ski slope or an inclined highway. It's not your natural position"* (Evans, Evens & Carajal, 1998, p585). Studies by Cielo, et al. (2014), Lagier et al. (2010), Grini, Ouaknine and Gionvanni (1998) and Gilman and Johns (2017) had reported that sub-optimal posture or tension produced compensation in muscles at both respiratory and phonatory levels, attributed to an increase in muscle activity and tension which negatively affected inspiratory volume by placing the respiratory muscles in a shortened position, alongside head and neck level muscle tension at laryngeal muscles, which had the potential to translate to dysphonia.

Link between raked stage, increased laryngeal tension and MTD

Although the survey targeted the collection of data regarding bodily injuries, the findings suggest that the impact on posture may have an associated impact on voice production due to the compensatory muscle use in the larynx, upper back, and neck while performing on an incline. A study into muscle activity and aerodynamic changes in voice within different body postures by Castillo-Allendes et al. (2022) hypothesised in their limited study that if allowed the appropriate amount of time to practice on the incline or unstable surface, singer may be able to adapt to the impact.

Integrating Instrumental Performance

In the only known study of its kind, Longo et al. (2020) believed that the postural changes involved in playing an instrument while singing may increase muscular resistance in the tracts of the phono-articulatory apparatus and lead to voice disorders. They undertook a study to track changes in vocal parameters in pianists and guitarists playing while they sang. Results showed that playing an instrument while singing led to an impairment of the singer's formant and a decrease in jitter, fundamental voice frequency, shimmer, soft phonation index and maximum phonation time; Shoulder and back position affected voice features, and playing the guitar decreased the amplitude of the singer's formant and increased noise, causing a typical raucous rock voice.

Professional music players frequently develop musculoskeletal disorders (Rotter et al., 2020). According to Zaza et al. (1998), the definition of playing-related musculoskeletal disorders (PRMDs) is "pain, weakness, numbness, tingling, or other symptoms that interfere with their ability to play their instruments at the level they are accustomed to".

These PRMDs are regarded as multifactorial health issues, with several risk factors including sudden increase in playing load, repetitive motions, posture, mental health conditions and number of hours played (Baadjou et al., 2016; Kenny & Ackermann, 2015; Kok et al., 2016; Rousseau et al., 2021).

The practice of playing an instrument requires repetitive movements, sometimes in an awkward posture (violin, trumpet, and accordion) which can result in significant musculoskeletal strain. Postural impairments are often regarded in the literature as one of the main injury risk factors among musicians (Blanco-Pineiro et al., 2017; Chan & Ackermann, 2014; Ranelli et al., 2011; Watson, 2009). Considering the variations between musical instruments, Ramella et al. (2014) demonstrated how playing an asymmetrical instrument, coupled with the influence of years of practice raises the possibility of assuming "non-optimal" posture. Additionally, studies have examined and contrasted standing and various sitting positions by examining factors such as the recruitment of abdominal muscles or spirometry parameters in woodwind players (Ackermann et al., 2014; Price et al., 2014). Researchers in the field of musical health have found that posture is a significant risk factor that should be considered when evaluating, treating and preventing PMDs in musicians (Longo et al., 2020). Various techniques have been used to assess and rate musician's posture (Blanco-Pineiro et al., 2015; Chan et al., 2013; Valenzuela-Gomez et al., 2020). Chan et al., 2013 used photographs to describe changes in posture before and after an intervention, while Valenzuela-Gomez et al. (2020) used the Rapid Entire Body Assessment (REBA) to analyse posture. In 2015, Blanco-Pineiro et al. created the Postural Observation Instrument (POI) as a tool to systematically examine students' posture in music classes. Due to a lack of specific studies into the potential impacts of combined instrumental playing with singing, it may be prudent to examine the physiological impacts of instrumental playing on the body, and how they may potentially impact voice use. A recent study by El-Demerdash et al. (2024) to examine voice and vocal tract changes in professional wind instrumentalists found dysphonia in almost a third of the participants screened, along with signs of *"hyperadduction, arytenoid edema and phonatory waste"*.

Link between instrumental playing, increased laryngeal tension and MTD

Voice production has been observed to be influenced by variations in craniocervical posture (Scotto Di Carlo, 1998). Consequently, posture has been recognised as a significant aspect of voice quality, particularly from research on functional dysphonia and, more specifically since the classification of muscle tension dysphonia (Van Houtte, Van Lierde & Claeys, 2009). An ideal alignment of the body is said to be achieved by optimum posture which requires less energy from the neuromuscular system and does not put undue pressure on the different tissue (Dutton, 2008; Marques, Hallal & Gonçalves, 2010). Anywhere along the kinetic chain a change in one joint can have an impact. Gait, joint load, brain function, endurance, strength, balance, respiration, muscle coordination and phonation are among the areas where these alterations may show themselves (Arboleda & Frederick, 2008; Dutton, 2008).

Stress and the role of the swing

At the time of rapid review two, only grey literature was available regarding the role and demands of the musical theatre swing. A swing is so-called as they can move easily and quickly between two or more parts in the same show (Elster, 2023). Eyer & Smith (2015) provide an in-depth examination of the pros and cons, using recollections from those who have worked extensively as swings contain a common theme of stress, uncertainty and anxiety. Where the role of an understudy is to be able to fill in for a lead role, a swing may cover the parts usually played by an understudy, or additional roles within the ensemble. A super swing, or universal swing, is a performer who commutes around the country as required to perform in various productions of a widespread show. Massazza et al. (2022) found a positive association between uncertainty and metal health problems, including anxiety, depression and stress.

Link between stress, increased laryngeal tension and MTD

Several studies have demonstrated a correlation between increased muscle tension and general anxiety or tension (Dahlstrom et al., 1985; Flor et al., 1991; Vanltallie, 2002). Unlike physical stress or exercise, emotional stress can continue even when there is no stressor present as it can maintain increased muscle tension (Lundberg, 2002). Hagg (1991) suggests that stress may maintain low-threshold motor unit activity. The continuous activation of the motor units may have physiological and motoric effects on the laryngeal structures. The main function of the larynx is to prevent foreign substances from entering the airway. Form a neuromuscular standpoint, the larynx predates the neocortex's neuromuscular system for language and articulation, and its function in producing speech is incidental (Aronson, 1990). Primitive neural mechanisms take precedence over higher cortical functions in the brain when the stress reaction is triggered, leading to inadequate and imbalanced muscular behaviour during voice production. Stress and psychological variables are linked to muscle tension dysphonia or muscle tension in the larynx (Altman et al., 2005; Dietrich et al., 2008). According to Dietrich et al. (2005), stress may increase laryngeal muscle tension in correlation with cardiovascular and emotional arousal. According to Holmqvist et al. (2013), the body's reaction to stress causes metabolic, immunological, neuroendocrine and autonomic changes in addition to changes in the psychoneuroimmunologic system, and vocal function may be impacted by both the primary and secondary effects of stress reaction, a finding supported by McEwen (2000), who describes the initial reactions to acute stress as defensive and intended to continue with increased activity. As a result of this reaction, the body becomes overstretched when the protective stress system is overworked, which increases susceptibility to disease (Toppinen-Tanner et al., 2005). The reciprocal relationship between the immune system and the central nervous system (Shanks et al., 1998) and as a result, the bloodstream is filled with cortisol during a stress response, which has the effect of boosting immunity, however if the stressor is not eliminated and the sympathetic nervous system (SNS) is activated for an extended length of time, cortisol has a detrimental effect on the immune system (Iverson, Iverson & Saper, 2000). Stress directly affects health and the ability to recover from illness (Cohen, 2005). It is therefore conceivable that long-term stress and fatigue that weakens the immune system may lengthen the course of a viral or LPRD-induced laryngitis.

Irregular or late-night eating

Musical theatre show performance times necessitate irregular and/or late-night eating schedules. Late-night or rapid eating may lead to gastroesophageal reflux disease, leading to increased acid around the hypopharynx and vocal folds. In contrast to an acute stress reaction, the two stress-related symptoms of heartburn and GERD may suggest prolonged exposure to stressors. Those who have experienced long-term stressors in their lives are more likely to report having GERD symptoms (Mizyed, Fass & Fass, 2009). Numerous mucosal alterations may result from acid in the larynx and pharynx (Khan et al., 2006). Laryngeal symptoms, including sore throat, persistent hoarseness, persistent coughing and clearing of the throat, and feeling of a lump or foreign body in the throat, are caused by the lesions and mucosal alterations (Hamdan et al., 2001; Koufman, 1991). The findings of a research by Tokashiki et al. (2010) demonstrate that increased pressure or globus sensation in the upper oesophageal sphincter is a side-effect of gastroesophageal reflux.

Link between irregular eating, increased laryngeal tension and MTD

Laryngeal muscular tension and GERD were found to be strongly correlated ($P < 0.001$) by Angsuwarangsee and Morrison (2002). Although muscle tension may be a secondary symptom of the disease, the results of this study may indicate that treating GERD or LPRD does not focus largely on treating this symptom. Reduction of stomach acid reflux on the upper respiratory tract may lead to a decrease in compensatory harmful functions in the larynx, including muscle tension. Muscle tension could persist even after treatment for GERD or LPRD if it is a secondary sign of stress. Stress can directly produce an increase in muscle tension, or it can occur indirectly as a result of mucous membrane stiffness brought on by inflammation of the mucous membranes caused by LPRD, or laryngitis. According to the findings of a study conducted in 1986 by Morrison et al, LPRD alone predisposes MTD. Additionally, Morrison et al. (1986) noted that MTD typically occurs in individuals who use their voices a lot during stressful situations.

Stress and Anxiety

Performance Anxiety

According to Beilock et al. (2017), performance anxiety (PA) is “apprehension and fear related to completing a specific task or even engaging with a specific domain.” Sweating, palpitations, lack of focus, and forgetfulness are just a few of the symptoms that performance anxiety can cause. Numerous factors have been linked to PA, including genetics, experiences, cognitions and environment (Kenny et al., 2014). Several domains including singing, public speaking, sport, and music have been studied for performance anxiety (Niering et al., 2023). Musical theatre performers, however, have not been the focus of specific research. Most performers in musical theatre are required to be ‘triple threats’, meaning they must be able to sing, act and dance to a high standard. More recently, the introduction of the ‘actor-muso’ performance requires musical theatre performers to play instruments alongside the existing three disciplines. Higher levels of PA could result from performers having more of an obligation to live up to expectations in all three or four domains.

Although Kenny et al. (2014) defines the cause of PA as “pressure placed on oneself, excessive arousal and inadequate preparation for the performance,” it is accepted that musical theatre performances are subject to suitable rehearsal period and repetition of content, suggesting that musical theatre performers might have lower levels or instances of PA, however the multifaceted nature of musical theatre performance may make it difficult to feel adequately competent in all aspects of the performance, which may expose musical theatre performers to PA to the same extent as many other performers. In a recent study into music performance anxiety (MPA) in musical theatre performers by James and Shipley (2022), performance anxiety was a shown to be a significant issue, which is in line with findings specific to musicians. The authors concluded that more research is required to suggest treatments designed specifically for musical theatre performers. Some performers claim that the worst PA is not always the performance, rather the audition process or what comes after the final show and as performers are evaluated during auditions with the possibility of employment at the conclusion of the process, this increases the pressure experienced. Comparably, as a run of a show is coming to an end, concern will increase with regards to subsequent employment, causing financial anxiety and the need to audition in tandem with final show performances. Naturally the two situations have the most profound effects on the performer’s livelihood and, therefore cause the most anxiety.

Financial Anxiety

Sociologists studying the effects of low wages and uncertain income have documented the negative consequences of financial hardship. Simmons and Swanberg's (2009) study comparing the prevalence of depressive symptoms in workers with lower versus higher wages discovered that a higher percentage of lower wage workers reported having depressive symptoms.

Lund et al. (2010) conducted a meta-analytic study and found a positive correlation between common mental health disorders like anxiety and depression, and perceived poverty. They found that the lower the income level, the more common these disorders became. Research indicates that having a particular objective financial situation has an impact on mental health (Lund et al., 2010; Simmons & Swanberg, 2009) and may lead to negative outcomes.

When compared to an objective financial state, financial anxiety is subjective and is defined as worrying or feeling anxious about personal financial status due to an assessment that present and future financial resources will not be sufficient to pay for the "basic necessities of life" (Lim & Sng, 2006). It is noteworthy to mention in this definition that financial anxiety, which has been termed financial worry (Meuris & Leana, 2018), is an emotional evaluation of personal financial circumstances. It must be acknowledged that different individuals may have different interpretations and responses to the same objective situation. Some may experience anxiety from living within an uncertain or low-income setting, even though their personal finances may be sufficient to meet their needs in an objective sense. According to Gasiorowska (2014), financial anxiety is a more proximal determinant than objective financial condition because of its subjective nature, making it a better predictor of relevant outcomes.

In their ground-breaking study, Meuris and Leana (2018) discovered that cognitive resources were depleted by financial worries to the point where people began to experience cognitive issues that interfered with their ability to perform tasks. Jawahar, Mohammed and Schreurs (2022) went on to research whether financial anxiety may contribute to emotional exhaustion due to the depletion of emotional resources in the same way. Support for a conditional indirect effect was found using data gathered in three waves from 434 respondents. Perceived internal employability acted as a moderator of the indirect relationship between financial anxiety and performance through emotional exhaustion (Figure 5). If the level of perceived employability increased, anxiety decreased, along with symptoms of emotional exhaustion.

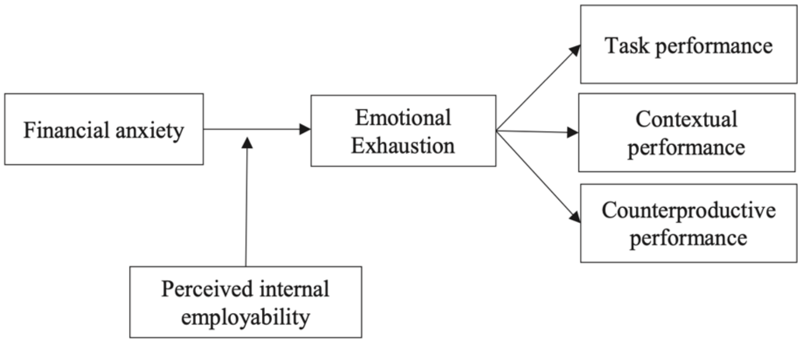

Figure 5

Research model visualising the indirect effect of financial anxiety on job performance via emotional exhaustion moderated by perceived internal employability (Jawahar, Mohammed & Schreurs, 2022).

Although most of the research is based within the business sector and not the performing arts, the parallels can be noted. Within the musical theatre profession, the continued lack of job security and pressure to compete for employment may lead directly to financial anxiety, which in turn may lead to cognitive issues and emotional exhaustion. These psychological and physiological impacts would be disastrous for the musical theatre performer and can be judged as a threat to livelihood.

Exhaustion and Stress Physiology

Exhaustion reflects the body's physiological response to prolonged stress exposure. Tache and Selye (1985) described it as a stage marked by cardiovascular, hormonal, and neuroimmunologic alterations, which weaken the immune system and increase vulnerability to illness. McEwen's (1998) concept of allostatic load captures the cumulative physiological toll of chronic stress, including dysregulation of the neural, endocrine, and immune systems. This dysregulation may lead to delayed recovery, heightened reactivity, or inadequate adaptation to repeated stressors. Importantly, such physiological disruptions can manifest somatically, potentially influencing voice production, particularly under fatigue or psychological strain.

Stress and Vocal Function

The body's stress response is regulated primarily by the sympathetic nervous system (SNS) and the hypothalamic-pituitary-adrenal (HPA) axis. The SNS is activated during stressors perceived as manageable, while the HPA axis is triggered by events seen as uncontrollable and threatening to personal goals (Dickerson & Kemeny, 2004; Kudielka, Hellhammer, & Kirschbaum, 2007). Social-evaluative threats, such as public performances, are particularly potent HPA activators. Holmqvist et al. (2013) found that vocalising under such conditions is associated with elevated cortisol levels, which may adversely affect vocal quality.

Elevated cortisol has been linked to self-reported voice complaints (Holmqvist et al., 2017), and increased cortisol reactivity is associated with higher fundamental frequency post-stressor (Pisanski, Nowak, & Sorokowski, 2016), suggesting a physiological pathway by which stress may impact voice.

Functional Voice Disorders and Stress

Psychosocial stress has been implicated in the onset and maintenance of functional voice disorders (FVDs), which arise without organic pathology and are thought to result from psychogenic factors or maladaptive laryngeal muscle use (Roy & Bless, 2000; Roy, 2003). These disorders often involve abnormal glottal configurations (e.g., hyper- or hypoadduction) and may be influenced by unresolved psychological stressors.

Life Stress and Voice Disorders

Individuals with hyperfunctional voice disorders report higher levels of perceived stress despite no significant increase in voice use, suggesting that subjective stress experience may play a critical role (Cohen, Kamarck, & Mermelstein, 1983). The Perceived Stress Scale (PSS-10) offers a more contemporary assessment of stress compared to earlier instruments. Dietrich et al. (2008) found that among patients with various voice disorders, 25% reported high stress, 36.9% high anxiety, and 31.2% high depression. Notably, patients with muscle tension dysphonia were more likely to report psychological distress than those with vocal fold lesions.

Anxiety and Voice Disorders

The relationship between anxiety and voice disorders is bidirectional and complex. Brodnitz (1962) suggested that vocal problems can contribute to broader psychological dysfunctions, although it remains unclear whether anxiety and vocal disorders co-develop or influence each other over time (Mirza et al., 2003). Teachers with voice complaints report higher psychological distress than their peers without such complaints (Nerrière et al., 2009), further supporting the link between mental health and vocal function.

Stress Reactivity and Vulnerability to Voice Disorders

There is limited research on individual differences in biological stress reactivity and their role in voice disorder vulnerability. Gassull et al. (2010) found a positive association between heightened stress reactivity and self-perceived vocal handicap, particularly among those scoring nine or higher on the Voice Handicap Index. Holmqvist et al. (2015) reported elevated salivary cortisol levels in women with voice complaints, suggesting gender differences in stress-related vocal pathology.

Increased autonomic activity, especially in highly anxious individuals, may lead to excessive laryngeal tension, contributing to the development of functional voice disorders (Morrison, Rammage & Nichol, 1994). This is supported by findings linking sympathetic nervous system overactivity to changes in voice quality (Holmqvist et al., 2013; Morrison et al., 1994).

CONCLUSION

By collating and presenting information on the different demands within musical theatre performance, and their possible impacts with regards to laryngeal tension and muscle tension dysphonia, rapid review two highlights the multifaceted nature of the profession. Awareness of additional stressors may impact treatment design of MTD in musical theatre singers. Each physiological and psychological aspect may impact tension levels differently, depending on the reaction in the singer. Due to time and resource constraints, only three databases were searched by a single researcher. Broadening the search to additional databases and broadening the search terms, as well as considering more informal collaboration done with other health professionals, may yield more results. It is hoped that further research into the specific physiological and psychological demands on the musical theatre performer may help to tailor diagnosis and treatment and subsequently allow voice care teams and performers to act to prevent additional tension where possible.

Having discussed the potential links between additional demands on the musical theatre performer and increased laryngeal tension, a wider exploration is required to assess the impact of this tension on the singing voice, specifically the many voice qualities required within the musical theatre genre. Due to the lack of specific literature, a small study was undertaken to ascertain the physical impacts of MTD in these qualities. To the best of the researcher's knowledge, this has not previously been completed.

Recommendation for Research

Qualitative study of the perceived impact individual demands and the combination of demands have on laryngeal tension levels would be valuable to ensure these factors are considered during therapeutic intervention for functional voice disorders which may help to provide further support for singing teachers and voice rehabilitation teams working with these specific musical theatre parameters.

Key Findings (Rapid Review Two)

- MTD has multi factorial aetiologies which are increased when present in musical theatre voice use.

- Awareness of additional stressors may impact treatment design of MTD in musical theatre singers.
- Further research into the specific physiological and psychological impacts of MTD on the musical theatre voice may allow specific causes to be prioritised during treatment.

Rapid review two explores the impact of the additional demands of musical theatre on the development of MTD in the musical theatre singing voice. A major aspect of increased demand concerns the ever-evolving vocal demands and varied voice qualities the musical theatre performer is required to produce. To this end, a subsequent rapid review was undertaken to identify and discuss the physiological impact of laryngeal tension on voice qualities specific to musical theatre performance voice use.

3.5 Rapid Review Three: Impact of MTD on the singing voice with a focus on mechanisms and musical theatre voice qualities

The third rapid review in this chapter seeks to synthesise existing literature to provide an ***overview of the impact of MTD on the singing voice***, including specific outcomes by mechanism/voice quality.

ABSTRACT

There is a need to identify existing literature exploring the impact of excessive laryngeal tension in singing voice mechanisms and specific musical theatre voice qualities to allow singing teachers to prevent vocal issues from developing and extend initial treatment provided by speech and language therapists into the musical theatre singing studio after a diagnosis has been made. The original approach to the question aimed to review within the existing literature the impact of muscle tension dysphonia (MTD) in musical theatre singing. The structure of the review was initially guided and adapted from the topics outlined in the preferred reporting items for systematic reviews and meta-analyses (PRISMA). Literature archived in two databases (PubMed and Wiley Library) were extracted. From these initial searches no articles matched the inclusion criteria. Due to the lack of available literature focused on those voice qualities which physiologically and perceptually require greater levels of laryngeal tension to create, the author decided to synthesise information from several other sources including linguistic and pedagogical literature to add a much-needed overview to the existing knowledge. By collating information on the different causes and effects of MTD on several musical theatre voice qualities, rapid review three highlights the multifaceted nature of diagnosis and treatment of MTD in musical theatre singers, concluding that the production of each musical theatre voice quality may be impacted differently, depending on the cause of MTD in the singer. Further structured exploration is required to ensure treatment approaches are designed with each singing style in mind.

Keywords: Musical, Theatre, Voice, Qualities, Muscle, Tension, Dysphonia.

INTRODUCTION

Excessive muscular tension in the larynx can impact the production, sound and stamina of the musical theatre singing voice. Where laryngeal tension is found to negatively impact desired phonation, it is termed muscle tension dysphonia (MTD) (Morrison & Rammage, 1986). In a study to determine whether singing style influenced laryngeal muscle tension, Koufman et al. (1996) found musical theatre in the top three musical styles requiring high laryngeal muscle tension (74%), after Bluegrass/Country and Western singers (86%) and Rock/Gospel singers (94%). Although a large body of evidence has been produced in relation to the speaking voice and the classical singing voice, in an initial structured search no literature on the physiological and perceptual impact of MTD on specific vocal qualities used in the musical theatre singing voice were identified, leading to a wider and less structured process of locating credible and relevant literature to explore the topic. The aim of the piece therefore was to add to the understanding of the ways in which excessive laryngeal tension impacts specific musical theatre voice qualities, the author decided to synthesise a wide range of literature to suggest what the impact of MTD may be on the physiological and perceptual acoustic qualities of several musical theatre voice qualities. A broad range of sources were explored to determine the nature and scope of the field. Using a range of vocal science-focused bibliographic databases and singing-specific literature, the evidence included has been screened for relevance and quality and collated to create a useful addition to the existing body of work available.

Eligibility Criteria

Included articles are those that discuss individual vocal qualities relating to the musical theatre voice. Only articles published from January 2000 to the present day were searched to avoid repetitive reviewing. To ensure relevance, only contemporary research published after 2000 was considered due to the changing nature of vocal demands within the musical theatre genre.

Search Strategy

An electronic search was done in March 2023. Articles archived in PubMed and Wiley Library database were reviewed. The following keywords were used for the search:
String 1: Musical, theatre, voice, qualities, MTD.
String 2: “MTD” “Musical theatre”
Secondary searches to include other associated papers via reference chaining were carried out by the researcher.

Study Selection

A total of 87 results were obtained and screened. No articles were deemed eligible to be included in review three (Figure 6). The articles were excluded for the following reasons: Not relating to muscle tension dysphonia, not related to musical theatre voice qualities, no full text available, not a peer-reviewed journal article and/or a publishing date before January 2000.

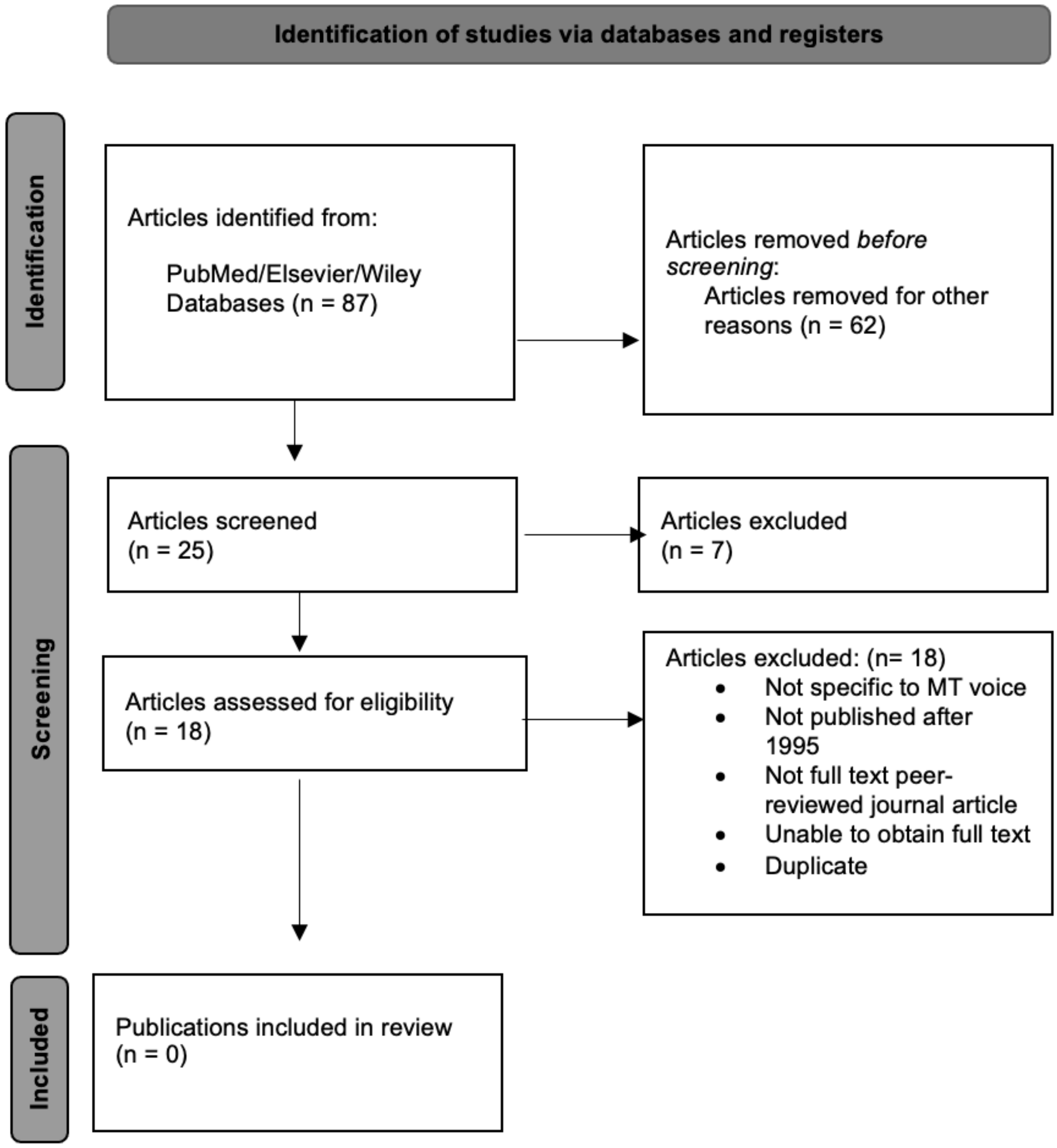

Figure 6

Adapted PRISMA SC-R Study Selection Process.

RESULTS

As no studies were deemed eligible to be included in review three, the impact of excessive laryngeal tension on several musical theatre voice qualities was investigated by the author synthesising literature which discussed musical theatre vocal qualities alongside wider studies on the physiological and acoustic impacts of MTD in the singing voice.

DISCUSSION

Further supporting the notion of the musical theatre performer as a vocal athlete (Leborgne & Rosenberg, 2019), today's performer is expected to sing in a great many vocal styles incorporating, most notably, the voice qualities known as Belt, Mix and Legit (Bourne & Kenny, 2015; Edwin, 2009, Green et al., 2013, LoVetri 2002). The performance requirements of music theatre singing can be highly taxing, both physically and vocally. Rapid review three initially sought to identify the physiological and perceptual acoustic impact of MTD on singing voice mechanisms and musical theatre voice qualities, however limited literature exists in relation to this aspect of the singing voice in either a research or clinical setting. It was therefore decided that available information would be synthesised to address this lack of literature. It is hoped that review three may help to highlight the demands on musical theatre singers, and their vocal health practitioners (Green et al., 2013; Roll, 2015) and provide the basis for future research to develop our understanding of voice care in the field of musical theatre. Identifying these potential physiological and perceptual changes in each voice quality may help to highlight early indications of MTD which those working with the singing voice in a variety of capacities may find useful. It is hoped that review three may act as a catalyst for a comprehensive system by which to help diagnose, treat and chart progress of MTD specifically in the musical theatre singing voice.

Vocal Registers

Within the pedagogy and training of musical theatre, there remains a lack of standardisation with regards to voice quality and/or register classification. Vocal registers are underlined by different mechanisms of vocal fold vibration and vocal tract adjustments. Titze (1988) found that singing registers appear to be based on timbre transitions resulting from subglottal resonances that interfere with the vocal fold driving pressure, and that the registers of pulse, chest, head and falsetto were predicted based on the first subglottal formant. The four laryngeal mechanisms have been defined physiologically and have been labelled M0-M3 (Table 5).

Table 5

Physiological characteristics of laryngeal mechanisms.

Mechanism 0 (M0)	Mechanism 1 (M1)	Mechanism 2 (M2)	Mechanism 3 (M3)
is also called 'creak' or 'vocal fry'.	is usually associated with what has been termed 'chest' register.	is associated with what has previously been termed 'head' register in women and the 'falsetto' register in men.	is sometimes used to describe the production of the highest range of pitches, known as the 'whistle' or 'flageolet' register (Miller and Shutte, 1993).
Here the tension of the folds is so low that the vibration is not periodic (meaning that successive vibrations have substantially different lengths).	This is used to produce low and medium pitches. In M1, virtually all the mass and length of the vocal folds vibrates (Behnke, 1880) and frequency is regulated by muscular tension (Hirano et al.,1970) and affected by air pressure.	It is used to produce medium and high pitches for women, and high frequencies for men. In M2, a reduced fraction of the vocal fold mass vibrates. The moving section involves about two thirds of their length, but less of the breadth.	Little has been published on this mechanism, although studies by Bourne and Garnier (2012) and Garnier et al. (2010) investigating the physiological and acoustic characteristics of the female voice discuss 'legit' quality, which may have some overlap.
M0 sounds low however has no clear pitch (Hollien and Michel, 1968).	The glottis opens for a relatively short fraction of a vibration period (Henrich et al., 2005).	The glottis is open for a longer fraction of the vibration period (Henrich et al., 2005).	

The mechanism classification system is used in voice research (Henrich et al., 2005) and clinical settings with reference to the physiology of the vocal folds, rather than being fully integrated into musical theatre pedagogy (Bourne & Kenny, 2016). Issues in cross-study understanding arise as the qualities have been assigned different numbers in different countries, indicating a lack of standardisation across the classification. An earlier study by Titze (1988) concludes that whenever possible, scientists and pedagogues should aim to clarify their labels in terms of supplementary acoustic and physiologic information.

Defining Musical theatre Singing Voice Qualities

While the spoken voice community largely agree on the existence of three registers (pulse or vocal fry, modal or chest, and falsetto) the singing community, on the other hand, is still very much divided on the number of registers, their names, and how they should be defined (Henrich, 2006). To provide an overview of the most prominent pedagogical models and approaches using varied terminology, each will be discussed briefly here.

Estill Voice Model:

Between 1972 and 1979 Estill et al. (1990) undertook physiological study of the singing voice and categorised the acoustic properties and laryngeal positions of six specific sounds, many of which are still used within musical theatre pedagogy today. Estill hypothesised that in studying qualities that were so different from each other in sound, differences in the physiology relative to differences in voice production would be found (Steinhauer et al., 2017). Initially four qualities were chosen for study by Estill et al. : Speech quality (known as modal quality), Sob quality, Twang quality and Opera quality. Further study led to the classification of six main voice qualities: Speech, Sob/Cry, Twang, Falsetto, Belt, Opera. The Estill classification of voice qualities as their accompanying physiological descriptors are used widely within musical theatre pedagogy (Supplementary Resource One). The voice quality known as 'Mix' is described by Estill as either a mixture of voice qualities, such as cry + twang, or the creation of a quality designed to minimise any obvious shift between vocal registers (Estill et al., 1990).

Contemporary Commercial Music

The term contemporary commercial music (CCM) has recently been coined in the United States by pedagogue and researcher Jeanette LoVetri to describe musical theatre, pop and commercial styles of music as opposed to classical singing styles (Bartlett & Naismith, 2020). Several vocal qualities, including Belt, chest and mix, are referenced without being specific to any single contemporary style. The term "mix" in this context came from Broadway and was referring to CCM styles that were coordinated or blended across the range. Mix can be head dominant with some chest involved passively, or chest dominant with some head involved passively. This has various pedagogical terms and is simultaneously called "Blended, Coordinated, Middle, Balanced". Jeanette LoVetri describes her definition of head mix and chest mix as "*A lighter speech-oriented sound deliberately incorporating head register with a smooth transition to pure head register possible on higher pitches. Chest mix is a generic description for anything that isn't head register or operatic sound or an obvious loud, pure chest register*" (Clarkia, 2022).

Vocal Process:

The UK based educational company 'Vocal Process' run by teachers Gillyanne Kayes and Jeremy Fisher (Fisher & Kayes, 2016), has applied alternative terminology to the voice qualities defined by Jo Estill. Table 6 provides a comparative table detailing the different terms used for each voice quality across clinical and pedagogical methodology.

Complete Vocal technique:

Within the 'Complete Vocal Technique' CCM pedagogy model, authored 30 years ago in Denmark, Cathrine Sadolin chooses to define vocal qualities by the perceptual amount of 'metallic' sound in each.

Table 6

Terminology applied to different voice qualities by method.

The Estill Method	Spoken Voice	Vocal Process	CCM (Contemporary Commercial Music)	Complete Vocal Technique
Creak	M0		Vocal Fry	
Speech	M1	Strong-clear	Chest	
Cry	M2	Whinge	Head	Neutral
Twang		Edgy bright		Edge
Falsetto	M3	Breathy light		
Belt			Belt	Overdrive
Mix			Mix	Curbing

To examine the impact of muscle tension dysphonia (MTD) on specific voice qualities in this report, three commonly used musical theatre voice qualities have been identified for analysis: M1 (associated with Speech and Chest qualities), M2 (associated with Cry, Legit, and Head qualities), and Belt (characterized by both Chest and Twang qualities). The following section explores the physiological and acoustic changes in these voice qualities as influenced by MTD.

Physiological and Acoustic changes in voice quality due to MTD

M1

In M1 the vocal folds are thick, resulting in a higher vibrating mass of folds than in M2 (Harris & Howard, 2018), with the vocal folds vibrating over their whole length with vertical phase difference. Increased vibration mass is due to the coupling of the vocalis within the vocal fold, allowing dominance over the cricothyroid muscle. The amplitude of phonation is greater as the closed phase of vibration is longer than the open phase, generally in the range of 30%-80% of the vibratory cycle (Henrich et al., 2005). M1 phonation is defined as phonation in which a mostly full glottal closure occurs during the closed phase of a phonatory cycle (Titze, 1995). An overview of M1 physiology and the suggested impact of tension/MTD is provided in Table 7.

Table 7

Overview of M1 physiology and the impact of tension/MTD (Estill et al., 1990; Thomas, pre-publication; Calais-Germain & Germain, 2013; Dimon, 2018; Harris & Howard, 2018; Spencer & Bell, 2021).

Vocal Quality	Physiology	Muscle action during phonation	Impact of Tension/MTD
Speech or M1 or Modal Voice or Thick Folds or Heavy or Chest Voice	Glottal onset	Transverse arytenoid/interarytenoid contract to pull vocal folds together Thyroarytenoid contract to pull vocal folds together. Lateral cricoarytenoid contract to pull vocal folds together and shorten vocal folds. Arytenoids tense and relax vocal folds during phonation. Posterior cricoarytenoid opens vocal folds during phonation.	Insufficient closure of folds results in overly aspirate quality to tone which may inhibit control and pitch of tone. Too much activity in lateral cricoarytenoids and surrounding muscles may lead to constricted tone after onset.
	Released false vocal folds	Relaxed aryepiglottic folds.	Aryepiglottic folds may contract to cover the glottis & vocal folds, resulting in a pressed tone without full resonance
	Horizontal vocal fold plane	Arytenoids relaxed, holding vocal folds horizontal, rather than pulling backwards and upwards during phonation.	If arytenoids pull vocal folds backwards and upwards, vocal folds will be thinner, and sound will be lighter
	Thick vocal fold mass	Arytenoids relaxed. Thyroarytenoid relaxed vocal ligament to allow lower sounds. Lateral cricoarytenoid shortens vocal folds, making them thicker	If vocal folds are held thinner, the sound will lack volume. Thinner vocal folds have a shorter closed quotient which results in a smaller build-up of pressure behind the folds and therefore less active adduction during phonation.
	Vertical larynx (not tilted)	Thyroid remains in neutral position, without tilting forward.	If thyroid cartilage tilts, sound will become sweeter and of a lighter quality
	Closed soft palate (oral sound)	Palatine aponeurosis gives strength to palate muscles. Levator palati elevates the soft palate which is then held in place by palatopharyngeus which tenses the soft palate. Tensor palati also tenses soft palate in closed position.	If tensor palati does not activate enough, soft palate may be held in a slightly open position, resulting in a nasal sound which lacks volume and resonance

		Musculus uvulae elevates the uvula and ensures soft palate closely fits against the pharyngeal wall.	
	Relaxed anchoring	No extrinsic neck/back muscles are working	If additional neck and back muscles are activated, laryngeal flexibility may be compromised
	Released pharynx	Palatopharyngeus is only tensing palate, NOT pulling walls of pharynx inward/upwards/forwards. Relaxed pharyngeal constrictors	If pharyngeal walls are constricted the available resonating space will be compromised. The resulting tone will lack resonance, sound pressed and constricted. Full resonance/ potential harmonics of tone will not be achieved.
	Neutral pharyngeal length	Larynx held neither high nor low, it is in a neutral position. Suprahyoid and infrahyoid muscles activity is balanced.	If larynx is held low, sound will comprise of additional lower harmonics, creating a 'classical sound'. If larynx is held low, supra hyoid muscles may activate to bring larynx up, creating negative tension around hyoid bone, and therefore muscles of phonation If larynx is held high, sound will be comprised of fewer low harmonics and more high harmonics, creating an imbalance in tone If the larynx is held high, the infra hyoid muscles may activate to lower the larynx, creating negative tension around the hyoid bone and tongue, which may impact further by reducing pharyngeal resonating space
	Low tongue	Genioglossus holds tongue low Hyoglossus holds tongue low Superior longitudinal muscle lowers upper part of the tongue Inferior longitudinal lowers tongue	If any muscle holds the tongue high, the larynx may subsequently be pulled upwards and out of neutral laryngeal position
	Open aryepiglottic sphincter	Oblique arytenoid (AES) relaxed	If oblique arytenoid muscles are contracted, twang is created and space above vocal folds is constricted, impacting open tone, and released set up of vocal quality
	The body and cover of vocal folds both vibrate.	Modal refers to the resonant mode of the vocal folds (optimal combination	Overuse of glottal tension (overuse of transverse arytenoids, thyroarytenoids and lateral cricoarytenoids) is a danger

	Balanced glottal closure	of airflow and glottal tension = maximum vibration) For the lowest tones, only the thyroarytenoid muscles are active. As the pitch rises, the cricothyroids enter the action, which begins to lengthen the vocal folds. As longitudinal tension increases, the glottis develops a gap in the middle. To counteract this, the lateral cricoarytenoids are brought into action, pulling forward on the muscular process of the arytenoids.	with M1 – this may result in additional muscle use/involvement and lead to maladaptation in voicing process. This may include habitual pharyngeal, tongue, jaw tension, use of throat for power rather than breath.

The Impact of MTD on M1

As MTD is classified as a hyper functional voice disorder, the main impact in each voice quality can be assessed as overuse of phonatory and/or non-phonatory muscles leading to disordered sound. Overuse of glottal tension (involving transverse arytenoids, thyroarytenoids and lateral cricoarytenoids) is a danger with M1, resulting in additional muscle use/involvement and leading to maladaptation in voicing process (See Table 8 for different causes of MTD and their potential effect on M1) which may include habitual pharyngeal, tongue, jaw tension, use of throat for power rather than breath (Stepp et al., 2010).

Excessive activity in lateral cricoarytenoids and surrounding muscles may lead to constricted tone after onset as the aryepiglottic folds contract to cover the glottis & vocal folds, resulting in a pressed tone without full resonance (Bozeman, 2013). Pressed phonation arises when a high subglottal pressure is accompanied by a low glottal flow and restricts various resonances of the vocal tract and sound level compared to flow phonation. Pressed phonation displays a long-closed vibratory function phase of the vocal folds, with reduced airflow during the opening phase (Proutskova et al., 2013). In addition, increased intrinsic laryngeal muscle use, if pharyngeal walls are overly constricted the available resonating space will be compromised (Lemon-McMahon & Hughes, 2017). The resulting tone will lack resonance, sound pressed and constricted, therefore full resonance and/or potential harmonics of tone will not be achieved (Callagan, 2000, Sundberg, 1987). With regards to laryngeal height, if the larynx is held too low, supra hyoid muscles may activate to bring larynx up, creating negative tension around hyoid bone, and therefore muscles of phonation, which may lead to the fundamental frequency being lowered by MTD in sung pitches (Nguyen & Kenny, 2009). Conversely, if the larynx is held high, sound will be comprised of fewer low harmonics and more high harmonics, creating an imbalance in tone (Bozeman, 2013). If the larynx is held too high, the infrahyoid muscles may activate to lower the larynx, creating negative tension around the hyoid bone and tongue, which may impact further by reducing pharyngeal resonating space. Heightened levels of laryngeal tension may inhibit cricothyroid movement, and thus vocal folds may not thin and/or vibrate as required. If any muscle holds the tongue high, the larynx may subsequently be pulled upwards and out of neutral laryngeal position (Seikel et al., 2000).

Table 8

Different causes of MTD and their potential effect on M1 (Goffi-Fynn & Carroll, 2013; Prebil et al., 2020; Kwok & Eslick, 2017; Sielska-Badurek et al., 1997; Ahmadi et al., 2022; Koufman et al., 1996).

Cause of MTD	**Effect on M1**
MTD due to vocal fold trauma	Lowered overall fundamental pitch. Possible hoarseness across upper speech range, depending on severity of trauma. Pressed tone in upper speech quality range.
MTD due to excessive voice use	Fry or hoarseness in parts of speech quality range. Additional work required to close folds fully. Breathiness of tone in upper speech quality range. Lowered fundamental frequency.
MTD due to excessive voice demands:	Pressed tone, strain in upper speech quality range. Constriction of resonant tone, lack of upper partials in pitch – may sound 'flat'.
MTD due to lack of technical training/poor breath control	Pressed tone across upper speech quality range.
MTD due to vocal loading with URT infection	Fry or hoarseness in parts of speech quality range. Additional work required to close folds fully. Breathiness of tone in upper speech quality range. Lowered fundamental frequency.
MTD due to reflux/GERD	Lowered overall fundamental pitch. Possible hoarseness across upper speech range, depending on severity of trauma. Pressed tone in upper speech quality range.
MTD due to allergies	Increased muscular effort to close folds may lead to pressed or strained tone. Lowered overall fundamental pitch. Possible hoarseness across upper speech range, depending on area of allergic reaction.
MTD due to Frequent travel/medication use or misuse	Thicker mucosa: Excessive throat clearing may lead to irritation, swelling and/or hoarseness. Fry or hoarseness in parts of speech quality range. Additional work required to close folds fully. Breathiness of tone in upper speech quality range. Lowered fundamental frequency. Thinner mucosa: Thinner mucosal consistency may lead to increased 'sniffing', post nasal drip and symptoms similar to those discussed in the allergies section. Increased muscular effort to close folds may lead to pressed or strained tone. Lowered overall fundamental pitch. Possible hoarseness across upper speech range, depending on area of allergic reaction.
MTD due to excessive tension of the laryngeal muscles, jaw tension, abdominal tension, chest tension, tongue tension, head and neck posture issues	Pressed tone, strain in upper speech quality range. Constriction of resonant tone, lack of upper partials in pitch – may sound 'flat'.
MTD due to vocal misuse	Lowered overall fundamental pitch. Possible hoarseness across upper speech range, depending on severity of trauma. Pressed tone in upper speech quality range.

M2

In M2 the vocal folds are thinner with less vibrating mass than M1, due to the decoupling of the vocalis within the vocal fold (Henrich et al., 2005). The folds are stretched, due to the dominance of the cricothyroid muscle activity over thyroarytenoid muscle. The vocal folds vibrate with lower amplitude and no vertical phase difference. The open phase is always longer than the closed phase, and greater than 50% of the vibratory cycle. Table 9 provides an overview of M2 physiology and impact of tension/MTD on sound production in M2. In a study to assess the differences in laryngeal behaviour, glottal behaviour, vocal tract resonance tuning and source-filter interaction between belt and legit qualities, Bourne and Garnier (2012) found that legit quality (M2) remained lower in frequency of first and second vocal tract resonance. The closed quotient, degree of symmetry of the electroglottography (EGG) waveform, sound pressure level and the energy of the spectrum above 1kHz was lower than in belt quality.

Table 9

Overview of M2 physiology and the impact of tension/MTD (Estill et al., 1990; Thomas, pre-publication; Calais-Germain & Germain, 2013; Dimon, 2018; Harris & Howard, 2018; Spencer & Bell, 2021).

Vocal Quality	Physiology	Muscle actions during phonation	Impact of Tension/MTD
Cry M2 Thin Folds or Cry or Light or Loft or Head voice or Falsetto or Mix or Middle.	Simultaneous onset	Transverse arytenoid/interarytenoid contraction to pull vocal folds together and hold Thyroarytenoid contraction to pull vocal folds together Lateral cricoarytenoid contraction to pull vocal folds together Arytenoids tense and relax vocal folds during phonation Posterior cricoarytenoid opens vocal folds during phonation and lengthens vocal folds to create higher pitches	If vocal folds are not fully adducted, additional air may pass over folds during phonation, causing an aspirate onset and subsequently breathy tone. If vocal folds are strongly adducted and held too tightly by the lateral cricoarytenoid muscles during the onset, the result will be a glottal onset, possibly followed by a pressed tone.
	Released false vocal folds	Relaxed aryepiglottic folds.	Aryepiglottic folds may contract to cover the glottis & vocal folds, resulting in a pressed tone without full resonance
	Horizontal vocal fold plane	Arytenoids relaxed, holding vocal folds horizontal, rather than pulling backwards and upwards during phonation.	If arytenoids pull vocal folds backwards and upwards, vocal folds will be thinner, and sound will be lighter
	Thin vocal fold mass	Arytenoid cartilages pull vocal folds backwards to tense for higher pitches. Cricothyroid pulls the thyroid cartilage forwards and downwards to lengthen and tense the vocal folds to create higher pitches and thinner vocal folds.	If vocal folds are held thicker, the sound will have increased volume and potentially greater risk of additional muscle work around the vocal folds. Thicker vocal folds have a longer closed quotient which results in a larger build-up of pressure behind the folds and therefore more active adduction during phonation.
	Thyroid tilt	Cricothyroid pulls the thyroid cartilage forwards and downwards	If thyroid is not fully tilted, vocal folds may not be stretched thin enough to allow vibration at desired high frequency. If thyroid is not fully tilted by cricothyroid, arytenoids may attempt to pull the vocal folds upwards and backwards, creating a posteriorly higher vocal fold plane – resulting in a thinner, falsetto quality. If Infrahyoid muscles are activated, cricothyroid may be unable to pull the

			thyroid forwards and downwards, maintaining thicker vocal folds which are not conducive to a higher pitch.
	Closed soft palate (oral sound)	Palatine aponeurosis gives strength to palate muscles. Levator palati elevates the soft palate which is then held in place by the palatopharyngeus which tenses soft palate. Tensor palati tenses soft palate in closed position. Musculus uvulae elevates the uvula and ensures soft palate closely fits against the pharyngeal wall.	If tensor palati does not activate enough, soft palate may be held in a slightly open position, resulting in a nasal sound which lacks volume and resonance.
	Active anchoring	Extrinsic neck muscles and upper back muscles are active to hold larynx in place during phonation in a flexible way	During activation of extrinsic head, neck and back muscles, negative additional muscle contraction may occur in muscles attached to the hyoid. This may impact vocal quality and tone by compressing sound, inhibiting the flexibility of the larynx, and creating tension in the respiratory system.
	Expanded pharyngeal width	Stylopharyngeus dilates the pharynx Pharyngeal constrictor muscles are released	If pharyngeal walls are constricted the available resonating space will be compromised. The resulting tone will lack resonance, sound pressed and constricted. Full resonance/ potential harmonics of tone will not be achieved.
	Short pharyngeal length	Digastric raises the hyoid bone, making a shorter pharyngeal space Stylohyoid raises the hyoid bone, making a shorter pharyngeal space Geniohyoid raises the hyoid bone, making a shorter pharyngeal space Mylohyoid raises the hyoid bone, making a shorter pharyngeal space Palatopharyngeus pulls the walls of the pharynx upwards, forwards and inwards, reducing pharyngeal space Stylopharyngeus elevates the pharynx and larynx. Salpingopharyngeus raises the pharynx and larynx	If larynx is held low, sound will comprise of additional lower harmonics, creating a ‘classical sound’. If larynx is held low, supra hyoid muscles may activate to bring larynx up, creating negative tension around hyoid bone, and therefore muscles of phonation

	Neutral/high tongue	Styloglossus raises body of the tongue. Palatoglossus raises the back of the tongue.	If any muscle lowers the tongue back, the pharynx may subsequently be constricted, and tone compromised If the tongue is retracted into the pharyngeal space, resonating tone is inhibited. If tongue is in a lowered position, this may create tongue root tension and subsequently jaw tension during phonation.
	Open aryepiglottic sphincter	Oblique arytenoid (AES) relaxed	If oblique arytenoid muscles are contracted, twang is created and space above vocal folds is constricted, impacting open tone, and released set up of vocal quality
	The body no longer vibrates Balanced glottal closure, may allow more air the pass through than M1	Mode 2 refers to a lighter quality using thinner vocal folds and balanced airflow vs glottal tension/resistance. Transverse arytenoid/interarytenoid contract to pull vocal folds together and hold Thyroarytenoid contraction to pull vocal folds together Lateral cricoarytenoid contraction to pull vocal folds together Arytenoids tense and relax vocal folds during phonation Posterior cricoarytenoid opens vocal folds during phonation and lengthens vocal folds to create higher pitches Arytenoid cartilages pull vocal folds backwards to tense for higher pitches Cricothyroid pulls the thyroid cartilage forwards and downwards to lengthen and tense the vocal folds to create higher pitches and thinner vocal folds Palatine aponeurosis give strength to palate muscles. Levator palati elevates the soft palate which is then held in place by palatopharyngeus which tenses soft palate.	If the Vocal folds move towards the M1 state (with both body and cover vibrating), they will not be able to adequately vibrate fast enough to produce the required pitch, resulting in additional work by the LCA, thyroarytenoids, arytenoids and cricothyroid muscles. This may result in negative tension and maladaptation in voicing process.

		Tensor palati tenses soft palate in closed position Musculus uvulae elevates the uvula and ensures soft palate closely fits against the pharyngeal wall Digastric raises the hyoid bone, making a shorter pharyngeal space Stylohyoid raises the hyoid bone, making a shorter pharyngeal space Geniohyoid raises the hyoid bone, making a shorter pharyngeal space Mylohyoid raises the hyoid bone, making a shorter pharyngeal space Palatopharyngeus pulls the walls of the pharynx upwards, forwards and inwards, reducing pharyngeal space Stylopharyngeus elevates the pharynx and larynx Salpingopharyngeus raises the pharynx and larynx Twang is used when required to create the 'mix' setting as appropriate to the style sung.	

The Impact of MTD on M2

If vocal folds are strongly adducted and held too tightly by the lateral cricoarytenoid muscles during the onset, the result will be a glottal onset, possibly followed by a pressed tone as vocal folds may be too thick to stretch sufficiently as required for desired pitch in cry quality (Bozeman, 2013). If vocal folds are held thicker, the sound will have increased volume and potentially greater risk of additional muscle work around the vocal folds. Thicker vocal folds have a longer closed quotient which results in a larger build-up of pressure behind the folds and therefore more active adduction during phonation (Harris & Howard, 2018). Aryepiglottic folds may contract to cover the glottis & vocal folds, resulting in a pressed tone without full resonance. If thyroid is not fully tilted due to additional suprahyoid muscle tension, vocal folds may not be stretched thin enough to allow vibration at desired high frequency (Nguyen & Kenny, 2009). In addition, if infrahyoid muscles are activated, cricothyroid may be unable to pull the thyroid forwards and downwards, maintaining thicker vocal folds which are not conducive to a higher pitch. During activation of extrinsic head, neck and back muscles, negative additional muscle contraction may occur in muscles attached to the hyoid (Angsuwarangsee & Morrison, 2002), impacting vocal quality and tone by compressing sound, inhibiting the flexibility of the larynx, and creating tension in the respiratory system. If pharyngeal walls are overly constricted the available resonating space will be compromised (Bozeman, 2013) and the resulting tone will lack resonance, sound pressed and constricted. In addition to pharyngeal constriction, if the larynx is held too low due to maladaptive tension of the infrahyoid muscles, supra hyoid muscles may activate to bring larynx up, creating negative tension and 'holding' around hyoid bone, and therefore muscles of phonation (Calais-Germain & Germain, 2013; Hong et al., 1997). If any muscle lowers the tongue back unnecessarily, the pharynx may subsequently be constricted in size and shape, and therefore tone compromised which may create tongue root tension and subsequently jaw tension during phonation. If the tongue is retracted too far back into the pharyngeal space, resonating tone is inhibited (Luxgrant, 2020). Table 10 provides an overview of MTD types and the impact of on sound production in M2.

If the vocal folds move towards the M1 state (with both vocal fold body and cover vibrating), they will not be able to adequately vibrate fast enough to produce the required pitch, resulting in additional work by the lateral cricoarytenoids (LCA), thyroarytenoids (TA), arytenoids and cricothyroid (CT) muscles (Spencer & Bell, 2021). Consequently, negative tension and maladaptation in voicing process, causing pressed phonation may occur (Bozeman, 2013).

Table 10

Different causes of MTD and their potential effect on M2 (Goffi-Fynn & Carroll, 2013; Prebil et al., 2020; Kwok & Eslick, 2017; Sielska-Badurek et al., 1997; Ahmadi et al., 2022; Koufman et al., 1996).

Cause of MTD	**Effect on M2**
MTD due to vocal fold trauma	Strain when attempting higher pitches. Breathiness of tone across cry quality range due to difficulty in achieving fold closure. Possibly tone cuts out at specific point in upper range relating to location of trauma.
MTD due to excessive voice use	Very breathy or missing tone in upper range. Reduced range, strain when attempting to fully close folds in upper cry quality range.
MTD due to excessive voice demands:	Pressed tone across cry quality range. Minimal resonance in cry quality range. Possible attempt to use twang to create volume in upper range. Possible pharyngeal constriction in quality (Kermit)
MTD due to lack of technical training/poor breath control	If adduction is too forceful, folds may become too thick to achieve desired pitches in cry quality, resulting in strain, pressed tone, lack of upper partials in frequency – may sound 'flat'.
MTD due to vocal loading with URT infection	Very breathy or missing tone in upper range. Reduced range, strain when attempting to fully close folds in upper cry quality range.
MTD due to reflux/GERD	Strain when attempting higher pitches. Breathiness of tone across cry quality range due to difficulty in achieving fold closure. Possibly tone cuts out at specific point in upper range relating to location of trauma.
MTD due to allergies	Very breathy or missing tone in upper range. Reduced range, strain when attempting to fully close folds in upper cry quality range. Lack of resonance may encourage additional laryngeal/paralaryngeal effort to achieve perceived required volume.
MTD due to Frequent travel/medication use or misuse	Thicker mucosa: Excessive throat clearing may lead to irritation, swelling and/or hoarseness. Very breathy or missing tone in upper range. Additional work required to close folds fully. Breathiness of tone in cry quality range. Lowered fundamental frequency. Thinner mucosa: Thinner mucosal consistency may lead to increased 'sniffing', post nasal drip and symptoms similar to those discussed in the allergies section. Increased muscular effort to close folds may lead to pressed or strained tone. Reduced range, strain when attempting to fully close folds in upper cry quality range. Possible hoarseness across range, depending on area of allergic reaction.
MTD due to excessive tension of the laryngeal muscles, jaw tension, abdominal tension, chest tension, tongue tension, head and neck posture issues	Pressed tone across cry quality range. Minimal resonance in cry quality range. Possible attempt to use twang to create volume in upper range. Possible pharyngeal constriction heard in voice quality.

MTD due to vocal misuse	Strain when attempting higher pitches. Breathiness of tone across cry quality range due to difficulty in achieving fold closure. Possibly tone cuts out at specific point in upper range relating to location of trauma.

Belt Quality

Belting has been shown to be produced using a vocal tract that is "megaphone" shaped, with a high larynx, narrow aryepiglottic space, pharyngeal constriction, a high and forward-placed tongue position, and a widened jaw opening (Bestebreurtje & Schutte, 1999; Bourne & Garnier, 2012; DeLeo, et al., 2009; Echternach et al., 2008; Lebowitz & Baken, 2009; Schutte & Miller, 1991; Sundberg et al., 1992). Belt quality has a high degree of activity in the Thyroarytenoid (Vocalis) muscles within the vocal folds themselves, leading to a longer closed quotient (>50% as observed by Schutte & Miller, 1991) of the vocal folds and higher subglottic pressures than would be expected for classical styles of singing (Björkner, 2006; Bourne & Garnier, 2012; Bourne & Kenny 2012; Echternach et al., 2014; Edwin, 2008; Estill, 1988; Kayes & Welch, 2016; Kochis-Jennings et al., 2014, Titze, 2009).

In almost every available study on belt quality, it is noted that the unique shape of the vocal tract produces the effect of tuning the first formant to the second harmonic in any given tone, leading to a weaker fundamental frequency than would be seen in classical voice production (Bestebreurtje & Schutte, 1999; Bourne & Garnier, 2012; Estill, 1988; Sundberg, 2010; Sundberg, 2014; Sundberg & Thalén, 2014; Titze, 2016), a resonance strategy which has been described as producing a brassy quality which has similar acoustic properties to a trumpet having a similar shape, with a narrow input (pharynx) and a wide output (mouth) shape (Titze, 2016). Hein, (2010) suggests that due to the longer closed quotient of the vocal folds in Belt quality when compared to M2, it is reasonable to assume that less air would be used.

In a study comparing vocal tract settings in hyper functional dysphonia and belting male participants, Saldias et al. (2021) proposed that it would be possible to produce stronger constrictions in the epilarynx and hypopharynx while using only moderate adduction, which would diminish vocal loading and increase loudness of phonation. In the same study, various similarities were found between belting and hyperfunction: high vertical larynx position, small hypopharyngeal width, and epilaryngeal outlet shape. Belting however, relied on a wider lip and jaw opening and large volumes of the oral cavity. In addition, Bourne & Garnier (2011) found no difference in the closed quotient of the vocal folds or power ratio between 'twangy' and 'chesty' belting and suggest that they are not fundamentally different modes of productions, rather variations of one another. Table 11 provides an overview of Belt Quality Physiology and Impact of Tension/MTD.

Table 11

Overview of Belt Quality Physiology and Impact of Tension/MTD (Estill et al., 1990; Thomas, 2022; Calais-Germain & Germain, 2013; Dimon, 2018; Harris & Howard, 2018; Spencer & Bell, 2021).

Vocal Quality	Physiology	Muscle actions during phonation	Impact of Tension/MTD
Belt (Chesty)	Glottal onset	Transverse arytenoid/interarytenoid contraction to pull vocal folds together Thyroarytenoid contraction to pull vocal folds together. Lateral cricoarytenoid contraction to pull together and shorten vocal folds. Arytenoids tense and relax vocal folds during phonation Posterior cricoarytenoid opens vocal folds during phonation	Insufficient closure of folds results in overly aspirate quality to tone which may inhibit control and pitch of tone Too much activity in LCA and surrounding muscles may lead to constricted tone after onset
	Released false vocal folds	Relaxed aryepiglottic folds.	Aryepiglottic folds may contract to cover the glottis & vocal folds, resulting in a pressed tone without full resonance
	Horizontal vocal fold plane	Arytenoids relaxed, holding VFs horizontal, rather than pulling backwards and upwards during phonation.	If arytenoids pull vocal folds backwards and upwards, vocal folds will be thinner, and sound will be lighter
	Thick vocal fold mass	Arytenoids relaxed. Thyroarytenoid relaxed vocal ligament to allow lower sounds Lateral cricoarytenoid shortens vocal folds, making them thicker	If vocal folds are held thinner, the sound will lack volume Thinner vocal folds have a shorter closed quotient which results in a smaller build-up of pressure behind the folds and therefore less active adduction during phonation.
	Cricoid tilt	Thyroid cartilage is held in vertical position, while Splenius capitis, semispinalis capitis, rectus capitis posterior minor and oblique capitis superior muscles flex the head backwards to also tilt cricoid cartilage back. Trapezius may also pull the head back if forced.	If thyroid tilts during belt set up, the sound is sweeter and without the edge created by only cricoid tilt. If thyroid tilts too much, folds become too thin to be able to create the volume associated with belt quality. If folds are too thin, quality can result in vocal fatigue and potential damage to vocal folds.
	Closed soft palate (oral sound)	Palatine aponeurosis give strength to palate muscles. Levator palati elevates the soft palate which is then held in place by palatopharyngeus which tenses soft palate.	If tensor palati does not activate enough, soft palate may be held in a slightly open position, resulting in a

		Tensor palati tenses soft palate in closed position Musculus uvulae elevates the uvula and ensures soft palate closely fits against the pharyngeal wall	nasal sound which lacks volume and resonance
	Active anchoring	Extrinsic neck muscles and upper back muscles are active to hold larynx in place during phonation in a flexible way	During activation of extrinsic head, neck and back muscles, negative additional muscle contraction may occur in muscles attached to the hyoid. This may impact vocal quality and tone by compressing sound, inhibiting the flexibility of the larynx, and creating tension in the respiratory system.
	Expanded pharyngeal width	Stylopharyngeus dilates the pharynx Pharyngeal constrictor muscles are released	If pharyngeal walls are constricted the available resonating space will be compromised. The resulting tone will lack resonance, sound pressed and constricted. Full resonance/ potential harmonics of tone will not be achieved.
	Short pharyngeal length	Digastric raises the hyoid bone, making a shorter pharyngeal space Stylohyoid, Geniohyoid and Mylohyoid raises the hyoid bone, making a shorter pharyngeal space Palatopharyngeus pulls the walls of the pharynx upwards, forwards and inwards, reducing pharyngeal space Stylopharyngeus elevates the pharynx and larynx Salpingopharyngeus raises the pharynx and larynx	If larynx is held low, sound will comprise of additional lower harmonics, creating a ‘classical sound’. If larynx is held low, supra hyoid muscles may activate to bring larynx up, creating negative tension around hyoid bone, and therefore muscles of phonation
	High tongue	Styloglossus raises body of the tongue Palatoglossus raises the back of the tongue	If any muscle lowers the tongue back, the pharynx may subsequently be constricted, and tone compromised If the tongue is retracted into the pharyngeal space, resonating tone is inhibited. If tongue is in a lowered position, this may create tongue root tension and subsequently jaw tension during phonation.
	Constricted aryepiglottic sphincter	Oblique arytenoid (AES) pulls arytenoid cartilages together, and therefore the vocal folds together, while constricting the space above the vocal folds. This creates twang and a louder sound.	If Oblique arytenoid/AES is not constricted/active enough, the result will be a tone without ‘twang’/’singer’s formant’. This

			may result in simple constriction of tone, rather than enhanced harmonics and stronger adduction of vocal folds.

The Impact of MTD on Belt Quality

Too much activity in lateral cricoarytenoids and surrounding muscles may lead to constricted tone after onset (Spencer & Bell, 2021). Aryepiglottic folds may contract to cover the glottis & vocal folds, resulting in a pressed tone without full resonance. If pharyngeal walls are constricted the available resonating space will be compromised (Sakamoto, 2013). The resulting tone will lack resonance, sound pressed and constricted. Full resonance/ potential harmonics of tone will not be achieved. If larynx is held low, supra hyoid muscles may activate to bring larynx up, creating negative tension around hyoid bone, and therefore muscles of phonation (Hong, et al, 1997). Alternatively, if larynx is held too high, the infrahyoid muscles may activate to lower the larynx, creating negative tension around the hyoid bone and tongue, which may impact further by reducing pharyngeal resonating space (DeLeo et al., 2010). If any muscle holds the tongue too low, the larynx may subsequently be pulled downwards and out of high laryngeal position required for Belt (Bourne & Garnier, 2012). Table 12 summarises the different causes of MTD and their potential effect on Belt quality.

Overuse of glottal tension (categorised as overuse of transverse arytenoids, thyroarytenoids and lateral cricoarytenoids) which may result in additional muscle use/involvement and lead to maladaptation in voicing process, which may include habitual pharyngeal, tongue, jaw tension, use of throat for power rather than breath (Stepp et al., 2010). Fundamental frequency may be lowered by MTD in sung pitches (Nguyen & Kenny, 2009) as heightened levels of laryngeal tension may inhibit cricothyroid movement and thus vocal folds may not thin and/or vibrate as rapidly as required in belt quality.

Table 12

Different causes of MTD and their potential effect on Belt Quality (Goffi-Fynn & Carroll, 2013; Prebil et al., 2020; Kwok & Eslick, 2017; Sielska-Badurek et al., 1997; Ahmadi et al., 2022; Koufman et al., 1996).

Cause of MTD	Effect on Belt Quality
MTD due to vocal fold trauma	Lowered overall fundamental pitch. Possible hoarseness across upper speech range, depending on severity of trauma. Pressed tone in upper belt quality range.
MTD due to excessive voice use	Hoarseness in parts of belt quality range. Additional work required to close folds fully. Pressed tone in upper belt quality range. Lowered fundamental frequency.
MTD due to excessive loudness demands	Pressed tone, strain in belt quality range. Constriction of resonant tone, lack of upper partials in pitch – may sound 'flat'
MTD due to lack of technical training/poor breath control	Pressed tone across belt quality range.
MTD due to vocal loading with URT infection	Hoarseness in parts of belt quality range. Additional work required to close folds fully. Pressed tone in belt quality range. Lowered fundamental frequency.
MTD due to Reflux/GERD	Lowered overall fundamental pitch. Possible hoarseness across range, depending on severity of trauma. Pressed tone or inability to create desired pitch in belt quality range.
MTD due to Allergies	Increased muscular effort to close folds may lead to pressed or strained tone. Lowered overall fundamental pitch. Possible hoarseness across belt range, depending on area of allergic reaction.
MTD due to Frequent travel/medication use or misuse	Thicker mucosa: Excessive throat clearing may lead to irritation, swelling and/or hoarseness. Hoarseness in parts of belt quality range. Additional work required to close folds fully. Pressed tone in upper speech quality range. Lowered fundamental frequency. Thinner mucosa: Thinner mucosal consistency may lead to increased 'sniffing', postnasal drip and symptoms similar to those discussed in the allergies section. Increased muscular effort to close folds may lead to pressed or strained tone. Lowered overall fundamental pitch. Possible hoarseness across belt range, depending on area of allergic reaction.
MTD due to excessive laryngeal muscle tension/jaw tension/abdominal wall tension/chest tension/tongue tension/head and neck posture issues	Pressed tone, strain in belt quality range. Constriction of resonant tone, lack of upper partials in pitch – may sound 'flat'
MTD due to vocal misuse	Lowered overall fundamental pitch. Possible hoarseness across range, depending on severity of trauma. Pressed tone in belt quality range.

Limitations

Due to the limited availability of peer-reviewed research specifically examining voice qualities that physiologically and perceptually require increased laryngeal tension, such as those used in certain styles of musical theatre, this report draws on a synthesis of literature from adjacent fields. These include clinical voice science, linguistics, and vocal pedagogy, which provide valuable insights despite not always adhering to rigorous empirical or peer-reviewed standards (e.g., Estill, 2005; Titze, 2000; Kayes, 2014). While such sources may lack the methodological robustness of experimental studies, they offer practical and experiential knowledge that is widely referenced in voice training and therapeutic contexts.

CONCLUSION

By collating information on the different impacts of MTD on several musical theatre voice qualities, rapid review three continues to highlight the multifaceted nature of diagnosis and treatment of MTD in musical theatre singers. The production of each musical theatre voice quality may be impacted differently, depending on the cause of MTD in the singer. Although this subject has not been addressed in depth within the clinical literature, it is acknowledged that broadening the search to other databases and search terms in addition to considering more informal collaboration done with other singing voice professionals, may have yielded more results. It is hoped that further research into the specific physiological and acoustic effects of MTD on the singing voice qualities required by the musical theatre performer may help to tailor diagnosis and treatment and subsequently allow voice care teams to track recovery more accurately.

Recommendation for Research and Practice

Further research depends somewhat on a standardisation of terminology and understanding of the vernacular applied to musical theatre voice qualities. It is recommended that further measurement of MTD within specific voice qualities relating to the musical theatre voice be undertaken. As the genre has been reported to require higher laryngeal tension than other singing styles to create the various voice qualities needed (Koufman et al., 1996), it would seem vital that ENT specialists, singing voice rehabilitation specialists and musical theatre voice teachers should have the knowledge to identify issues early and work collaboratively to ensure recovery is swift and measurable.

Key Findings (Rapid Review Three)

- The production of each musical theatre voice quality may be impacted differently, depending on the cause of MTD in the singer.
- Awareness of specific impacts on musical theatre voice qualities may impact treatment design of MTD in musical theatre singers.
- Further research into the specific physiological and acoustic effects of MTD on the musical theatre voice may allow diagnosis and treatment to be tailored more directly to voice types and usage.

By creating a clear picture of MTD, its causes, impacts on the singing voice, and methods of measuring tension during assessment, a foundation has been developed to allow greater understanding of the features and aetiologies involved in this voice disorder. To assess real-time approaches to the clinical treatment of MTD, the rapid review which follows was undertaken to assess treatment as it is represented in the available literature. Rapid review four considers the limitations of the literature and the clinical viewpoint of the findings, the results of which will be synthesised with real-life practical investigation to form a clear picture of current treatment approaches upon which a bridging resource for singing teachers will be designed.

3.6 Rapid Review Four: Treatment approaches to MTD in the singing voice.

A final rapid review sought to provide an overview from the current evidence base on contemporary ***treatment approaches to Muscle Tension Dysphonia in the singing voice***. The additional question as to whether there is a need for differentiated therapeutic approaches for musical theatre singers based on the previous findings within the literature regarding additional demands and their potential to increase laryngeal tension was considered.

ABSTRACT

Voice therapy for the spoken voice has been well-documented within the literature and forms the basis of the majority of initial SLT intervention when treating MTD in the singing voice. Increasingly, initial therapeutic interventions may consider the need for tailored therapy for the singing voice. Currently, few studies identify the specific treatment approaches used with the singing voice, and the potential value these may have on rates of progression as singers return to performance voice use, justifying the need to identify existing literature exploring current treatment approaches to MTD in the singing voice with a view to designing a resource which will allow singing teachers to create a link between therapeutic intervention and a return to singing voice use. The identification of possible treatment approaches and delivery is required both to ensure awareness of intervention types is heightened across singing teacher population, and to support initial ear nose and throat (ENT) clinician and speech and language therapist (SLT) treatment in the voice clinic and singing studio when treating musical theatre performers diagnosed with muscle tension dysphonia (MTD). Rapid review 4 aimed to identify and discuss existing literature documenting the current treatment approaches to MTD in the singing voice. Literature archived in three databases (PubMed, Elsevier and Wiley Library) were reviewed, and six articles met the eligibility criteria for inclusion. Further searches were made in grey literature and hand searching took place alongside database searches. Two supporting clinical reference publications were included to enable cross-referencing of MTD types and treatments. Combined indirect and direct therapeutic approaches were found to be the optimal approach, with a gap in the research pertaining to the most effective individual approaches.

Rapid Review four concludes that there are multiple factors involved in the treatment design of MTD in the singing voice including MTD type, singer voice use and demand, singer lifestyle, and clinician knowledge of the singing voice. Collaboration between therapist and singing teacher was recommended and supports the previous findings that shared knowledge, and input can lead to successful outcomes for the singer with regards to a return to performance voice use.

Keywords

Muscle tension dysphonia, treatment, singing voice.

INTRODUCTION

Although a great deal of literature exists with regards to the release of laryngeal tension in the spoken voice (Behrman & Haskell, 2013; Dehqan & Scherer, 2019; Rangarathnam et al., 2022; Stemple & Fry, 2010; Van Houtte et al., 2011) and there are several studies regarding the classical singing voice (Kaneko et al., 2019; Shabani et al., 2023; Sielska-Badurek et al., 2017), no research has yet been centred on whether differentiated approaches to tension release may be more suitable with regards to the musical theatre voice. It is hoped that subsequent studies may make use of the information collated here to highlight the need for differentiated therapeutic approaches for musical theatre singers.

Eligibility Criteria

Included articles are those that discuss the treatment of MTD in the singing voice. Only articles published from January 1995 to October 2023 were gathered to reflect the most contemporary treatment options currently available.

Search Strategy

An electronic search was done in October 2023. Articles archived in PubMed, Wiley Library and Elsevier were reviewed. The following keywords were used for the search: Muscle tension dysphonia, treatment, singing voice. Secondary searches to include foundational clinical reference publications and other associated papers via reference chaining were carried out by the researcher.

Study Selection

A total of 6450 results were obtained and screened. A total of 6 articles were included in rapid review four. A further two clinical reference resource publications were deemed to be required to support article findings (Table 14). Articles related to the singing voice with full text available, translated to English and published after 1995 were included in the search. After initial screening for duplication, 6446 articles were excluded for the following reasons: Not relating to the singing voice, no full text available, not a peer-reviewed journal article and/or a publishing date before 1995 (Figure 7).

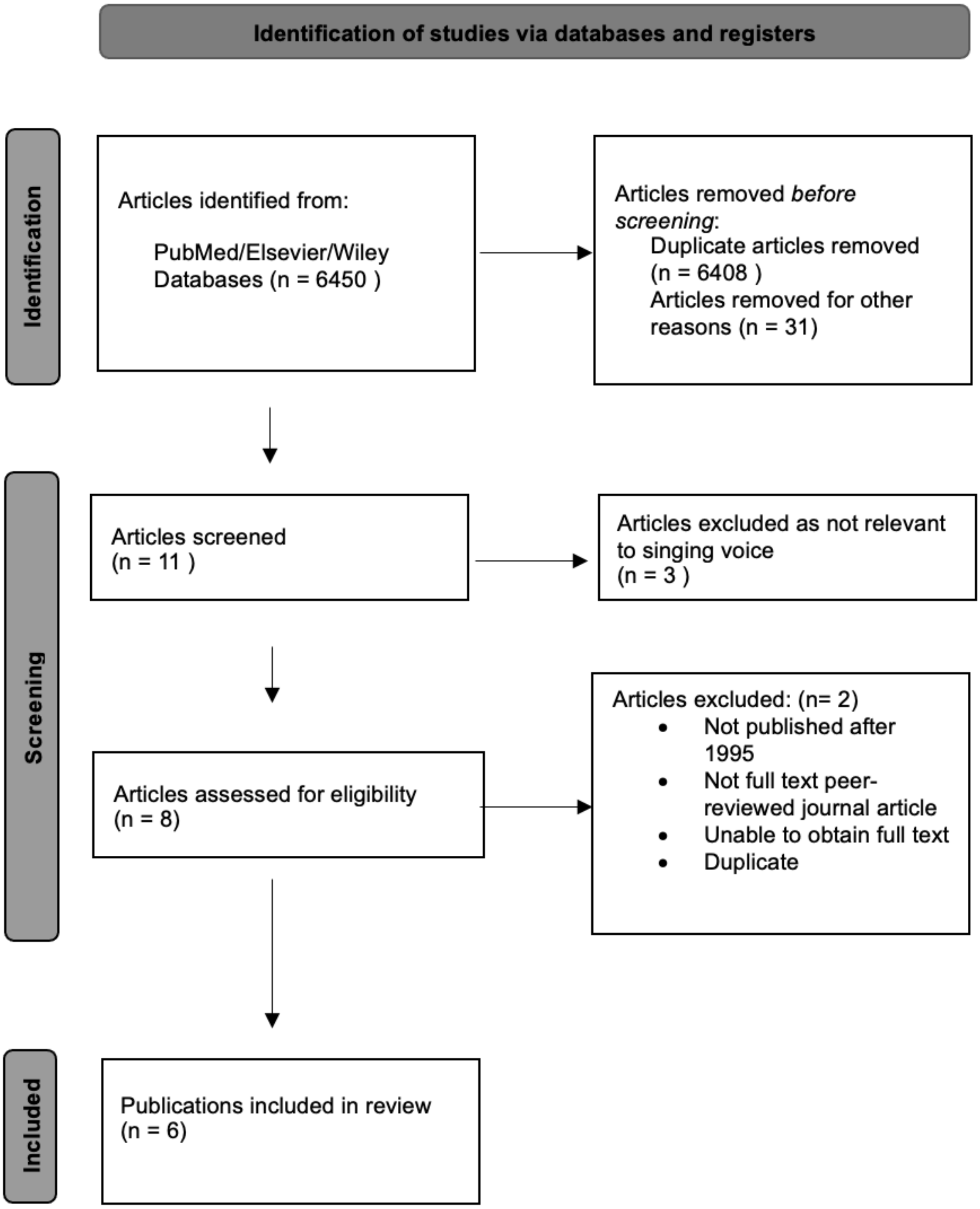

Figure 7

Study Selection Process (Adapted from PRISMA SC-R).

Data Collection & Synthesis

The following information was extracted and tabulated: title, author(s), year published, country, type of research, and treatment discussed (Table 13). Studies were then amalgamated with supporting sources in a final overview of the current approaches to treatment of MTD by type.

RESULTS

In review four, the treatment approaches to MTD in the singing voice are discussed. A summary of the included article characteristics and key findings are presented in Table 13.

Table 13

Publications included in rapid review four.

Title	Author/s	Year Published	Country	Type of Research	MTD Treatment Discussed
Effects of Laryngeal Manual Therapy on Primary Muscle Tension Dysphonia (MTD-1): Implications for MTD-1 Type.	Ahmadi, N., Abbott, K. V., Rajati, F., Khoddami, S. M., Torabinezhad, F., Takamjani, I. E. & Vasaghi-Gharamaleki, B.	2022	Iran	Quantitative	Laryngeal Manual Therapy
Active Ingredients of Voice Therapy for Muscle Tension Voice Disorders: A Retrospective Data Audit.	Madill, C., Chacon, A., Kirby, E., Novakovic, D. & Duong Nguyen, D.	2021	Australia		Combined
Taxonomy of Voice Therapy	Van Stam, J. H., Roy, N., Awan, S., Stemple, J. & Hillman, R.	2015	USA	Qualitative resource	Indirect, Direct & Combined
Combined Functional Voice Therapy in Singers with Muscle Tension Dysphonia in Singing.	Sielska-Badurek, E., Osuch-Wojcikiewicz, E., Sobol, M., Kazanecka, E., Rzepakowska, A. & Niemczyk, K.	2017	Poland	Mixed methods	Combined
Quantifying Component parts of Indirect and Direct Voice Therapy Related to Different Voice Disorders	Gartner-Schmidt, J. L., Roth, D. F., Zullo T. G., & Rosen, C. A.	2013	USA	Quantitative	Indirect and Direct
Effects of voice therapy: a systematic review.	Speyer, R.	2008	The Netherlands	Qualitative review	Combined

Table 14

Reference Publications included in cross-referencing of rapid review four.

Title	Author/s	Year Published	Country	Type of Research	MTD Treatment Discussed
Voice Therapy case studies	Stemple, J.C. & Thomas Fry, L.	2010	USA	Reference resource	Combined & Individual methods
The Voice Clinic Handbook	Harris, T. & Howard, D., eds.	2018	London	Reference Source	Combined & Individual methods

DISCUSSION

Treatment Types

Most therapeutic treatments for muscle tension dysphonia in singers are a combination of several practical tasks (Ahmadi, 2022b; Gates et al., 2013; Harris, 2018a; Harris, 2018b; Madil et al., 2021; Scearce, 2016, Sielska-Badurek et al. 2017; Stemple & Fry, 2010; Van Stam et al., 2015). They are divided into direct and indirect interventions which are combined (Gartner-Schmidt et al., 2013). Combined therapy draws from the categories of direct therapeutic interventions as collated by Van Stam et al. (2015) in the 'Taxonomy of Voice Therapy', as well as indirect interventions including behavioural modification. Table 15 provides the categories and sub-categories of tools of direct therapeutic intervention.

Table 15

Categories of Tools of Direct Intervention (Van Stam et al., 2015).

Main category	Sub-categories
Auditory	Conduction
	Sensorineural
Vocal Function	Glottal Contact
	Pitch Modification
	Vegetative Vocalisation
Somatosensory	Nociception
	Discrimination
	Visual Processing
Musculoskeletal	Neck Modification
	Orofacial Modification
Respiratory	Loudness Modification
	Respiratory Coordination
	Respiratory Support

Indirect Voice Therapy

Indirect interventions use behavioural modifications which include understanding and compliance with vocal health and hygiene recommendations, elimination of phono traumatic behaviours, conservative voice use, and adequate oral hygiene (Leborgne & Rosenberg, 2014; Scearce, 2016). Table 16 provides an overview of the component parts of indirect therapy.

Table 16

Definitions for Indirect Component Parts of Voice Therapy (Gartner-Schmidt et al., 2013).

Anatomy and physiology education	Explanation of current laryngeal mechanism
	Explanation of elimination of phono trauma
Hydration	Explanation of the benefits of internal and external hydration
	Explanation of how hydration affects the voice
LPR diet modification	Diet modification
	Medical explanation of drugs
	Food diaries
	Explanation of how LPR affects the voice
Environmental modification	Counsel concerning amplification
	Room organisation
Stretches and relaxation	Breathing related to voice
	Posture
	Body awareness exercises
	Deactivating muscle tensions
Motivational issues	Compliance to homework checks
	Regular attendance counsel
	Taking responsibility for voice production
	Empowering the patient
Psychosocial counsel	Counselling
	Reassurance
	Stress/anxiety/depression counsel and the effects on voice
	Family dynamics
Homework preparation	Importance of homework from a motor learning perspective
	Varied and random practice

Direct Voice Therapy

In addition to identifying and modifying phono traumatic behaviours, a primary goal in voice therapy for the singer to return from injury to full performance standard, is to identify, modify and replace abnormal voice production patterns with efficient, effective alternatives (Scearce, 2016). Leborgne and Rosenberg (2014) discuss that although targeted vocal goals are initially established by the speech pathologist, if the patient has an established singing teacher it is helpful for the speech pathologist and voice teacher to be in close communication regarding treatment goals. These goals are typically focused on re-coordination, strengthening and balancing of the respiratory, phonatory and resonating subsystems used for voice (Stemple & Fry, 2010).

In a summary of the literature regarding the effects of voice therapy, Speyer (2002) concludes that direct voice therapies appear more effective than indirect voice therapies (Carding et al., 1999, Bassiouny, 1998, Behrman et al., 2008). Direct voice therapy concentrates on modifying aspects of faulty voice production to promote appropriate and efficient voice production (Carding et al., 1999). In contrast, indirect voice therapy does not involve any direct work on correcting sub-optimal voice production, rather it includes anything that contributes to and/or maintains a voice problem such as dehydration, stress reactivity and laryngopharyngeal reflux, aiming to enable the patient to modify these factors and decrease or eliminate their effects on the voice (Gartner-Schmidt et al., 2013).

Morrison et al. (1994) suggest that different MTD gesture types develop because of different muscle interaction. This classification can be linked to specific singing voice postures, which may prove useful when designing a treatment plan for MTD in the singing voice. Sara Harris (Harris & Howard, 2018) outlines the four most common types of MTD as categorised by Morrison et al. (1994) (Table 17) and proposes the most effective treatment options (Table 18), which include established singing voice methodology (Harris & Howard, 2018).

Table 17

Overview of MTD types with physiological impact and potential symptoms (Harris & Howard, 2018, p.130).

Type of MTD	Physiological descriptor	Symptoms	Aims of Voice Therapy
Type 1 MTD – Laryngeal isometric disorder	MTD gesture develops as a result of a persistent forced inspiratory activity in the posterior cricoarytenoid muscles (PCA) during phonation. The back of the vocal folds are held open while the front of the vocal folds are closed by the vocalis and epilaryngeal muscular activity, causing a posterior gap at the glottis.	Low, breathy harsh voice quality, restricted upper range, frequent pitch and voice breaks.	1. Open the cricothyroid visor 2. Establish full vocal fold closure reducing/eliminating the interarytenoid gap 3. Reduce suprahyoid and pharyngeal muscle tension 4. Eliminate any habitual laryngeal raising during speech
Type 2 MTD – Lateral contraction	Vocalis muscle fatigue due to persistent, inappropriate cricothyroid activity.	Breathy vocal quality, diplophonia, pitch and voice breaks, rough gravelly quality and harshness and strain.	1. Open the CT visor and reduce vocal fold stretching 2. Establish modal voice with increased vocal fold mass and medial compression 3. Reduce the supraglottic lateral compression to release jaw, tongue and pharyngeal tension and eliminate any habitual laryngeal raising.
Postero-Anterior supraglottic contraction	The front of the vocal folds are obscured by the epiglottis while the arytenoids tilt forwards. Vocalis activity is reduced, and false folds are often recruited to support the failing vocalis.	Discomfort, fatigue and restriction in range.	1. Open the CT visor (where closed), relaxing the vocal folds and reducing strain on the PCA 2. Activate PCA to oppose vocalis and stabilise the arytenoids posteriorly. 3. Reduce false fold activity, epilaryngeal constriction and any tongue movement. 4. Restore flexibility and freedom of vocal range and laryngeal movement.
Antero-Posterior Constriction	The muscles of the epilarynx are contracted so that the supraglottis appears thickened and pinched medially and anteriorly.	Vocal fatigue, difficulty with pitch changes, a feeling the voice is inflexible and ‘not quite in the right place’.	1. Release excessive media land anterior compression 2. Reduce tongue backing 3. Reduce laryngeal raising

Treatment for MTD in the singing voice may include aspects of, or a combination of the following evidence-based voice therapy systems (Table 18).

Table 18

Effective voice therapy systems for four types of MTD (Harris & Howard, 2018).

Voice Therapy System	**Type of Muscle Tension Dysphonia**			
	Type 1 MTD	**Type 2 MTD**	**Postero-Anterior supraglottic contraction (Koufman's Bogart-Bacall syndrome)**	**Antero-posterior Constriction**
Laryngeal Manual Therapy		Palpatory monitoring may allow the patient to monitor CT visor activity, laryngeal position and unwanted tension in the jaw and floor of the mouth.		Releases tight epilaryngeal muscles and restores neutral laryngeal position.
Lax Vox (Designed by Finnish Speech Pathologist Marketta Sihvo in 1991)			Adjusts breath-voice coordination, re-setting the vocal tract to neutral, re-sets the PCA arytenoid stabilisation, reduces glottal hyperadduction, improves CT visor control and flexibility of laryngeal movement.	Reduces medial compression and increases airflow. Releases epilaryngeal muscle tension and establishes a neutral laryngeal position.
The Accent Method (Devised by Danish Phonetician Svend Smith)	Opens the cricothyroid visor, establishes modal/thick fold phonation, establish es full vocal fold closure eliminating the interarytenoid gap, releases suprahyoid, strap muscle and pharyngeal tension, allowing the larynx to return to its vertical and horizontal position. The graded exercises help condition in the	Opens the CT visor, establishes modal voicing, releases lateral compression restoring a neutral arched laryngeal configuration, resets the vertical laryngeal position to its neutral setting for breathing, releases pharyngeal and supraglottic constriction, restoring resonance.	Opens the CT visor, reduces glottal constriction, helps to resolve habitual laryngeal raising or lowering, can be adapted to resolve tongue backing.	Reduces medial compression and increases airflow. Releases epilaryngeal muscle tension and establishes a neutral laryngeal position.

	more relaxed muscle set, supporting successful carryover into spontaneous speech.			
Estill Voice Training Sob, Twang, 'ng' sirening, retraction & Onset Work (Devised by singing teacher and researcher Jo Estill)	**Sob:** Effective at producing full vocal fold closure, releases supraglottic tension, low larynx position counteracts laryngeal raising. **Gentle Glottal Onset:** Achieves full vocal fold closure and eliminates interarytenoid gap, establishes modal voicing, opens CT visor. **Simultaneous onset:** Releases suprahyoid and pharyngeal tension.	**Glottal onset:** Usually opens the CT visor, establishes modal voice, improves vocal fold closure, increases mass and medial compression. **Twang:** Increases medial compression and the closed phase. Counteracts lateral compression yet introduces antero-posterior compression.	**Sob & 'ng' sirening**: Activates PCA to oppose vocalis, decreases glottal hyperadduction and medial compression. Laryngeal lowering in sob releases unnecessary pharyngeal constriction. Helps counteract tongue backing. Sirening frees laryngeal movement and encourages smoot visor control, also helps control over changes in vocal fold mass. **Aspirate & simultaneous onset:** Reduces glottal hyperadduction, reduces likelihood of false vocal fold involvement. **Retraction:** Reduces hyperadduction and restores laryngeal symmetry, releases false fold adduction, secondary release of pharyngeal constriction due to the slight lowering of the larynx.	**Sob and Sirening:** release medial compression, stretch and thin the vocal folds, release tight epilaryngeal muscles, restores flexible pitch change.
Humming	Releases suprahyoid and pharyngeal tension.	Opens the CT visor, establishes modal voice, restores a more neutral tract and resolves lateral	Releases or increases glottal closure (depending on whether placed front or back), releases vocal tract constriction and resets the	

		compression, produces good vocal fold alignment.	laryngeal position in the neck, opens the CT visor and increases vocal fold mass to establish modal voice.	
Stemple's Vocal Function Exercises (Joseph Stemple)	Closing interarytenoid gap through range, establishes CT visor control and establishes awareness of the appropriate vocal fold mass re-distribution throughout the pitch range.	Establishes full vocal fold closure, modal voicing and stronger medial compression. CT visor work develops pitch control the allows release of the visor in the lower range. Breath control is extended as the vocal fold closure is improved.		
Pahn's nasalisation (Dr Johannes Pahn)	Releases suprahyoid and pharyngeal tension.			
Froeschels chewing technique	Releases the jaw, suprahyoid and thyrohyoid muscle tension. Closes interarytenoid gap. Releases CT visor so that modal voice can be established.			
Creaky voice/Vocal fry		Opens CT visor increases vocalis mass, medial compression and lengthens closed phase. Counteracts lateral compression.		

Babbling bilabial plosive consonants		Opens the CT visor, establishes modal voice, increases mass and closed phase, restores neutral laryngeal position and resonance settings.		
Yawn-Sigh		Introduces laryngeal lowering, opens CT visor. Laryngeal lowering counteracts habitual laryngeal raising and can help eliminate it. Laryngeal lowering will release the pharyngeal musculature, restoring the normal resonating space.	Lowers the larynx for patients with habitual laryngeal raising, opens the CT visor where this is closed, releases glottal hyperadduction, releases pharyngeal constriction.	Reduces medial compression and increases airflow. Releases epilaryngeal muscle tension and establishes a neutral laryngeal position.

The delivery of voice therapy for singers may be limited to as few as three or four sessions, depending on the provider and need (Dastolfo-Hromack et al., 2016), although Stemple and Fry (2010) propose that a higher number of sessions may allow more singing-voice specific treatment. Some treatment approaches are initially based in spoken voice work and singers are then asked to *"consciously associate techniques and principles for speaking with those for singing"* (Stemple & Fry, 2010), however Leborgne and Rosenberg (2014) continue to highlight the value of input from and collaboration with voice teachers during the therapy process. A qualitative case study by Goffi-Fynn & Carroll (2012) found that collaborative treatment from both a speech and language therapist and singing teacher produced the most successful results in rehabilitating a singer with MTD. As the majority of treatment approaches for MTD in singers will be a combination of direct and indirect therapies, Sielska-Badurek (2017) examined combined voice therapy, consisting of various direct and indirect techniques of voice rehabilitation including Feldenkrais method, manual techniques, alternate stretching and relaxing of the muscles, Lax Vox therapy, techniques related to the singer's imagination, the accent method and increasing sensorimotor self-awareness of the vocal tract. The study found that combined therapy may be concluded to be successful, however individual components were difficult to measure, with the objective measurement of acoustic analysis on overall voice quality being the main quantitative element. Madill et al. (2021) agreed with the findings and asserted that it is therefore difficult to pinpoint the 'active ingredient' with regards to treating individual aspects of MTD. That said, Ahmadi et al

(2022a) found that there is still inconclusive evidence as to how MTD should be treated in singers as professional voice users, and to date very few studies have attempted to measure the success of individual treatments with the singing voice, although recent attempts to do so by Ahmadi et al. (2022a, 2022b) reported the findings of two randomised, controlled trials to first assess the effects of laryngeal manual therapy (LMT) alone and then assess the success of a combination of breathing exercises combined with LMT on muscle tension dysphonia in traditional singers. Prior to exploring individual treatment effects, Ahmadi et al. (2022a) explored LMT treatment by MTD types 1-5 as classified by Morrison and Rammage (1994). These are (1) Laryngeal isometry, (2) Medial hyperadduction, (3) Anteroposterior constriction of the supraglottic larynx (4) Hypo adducted folds, and (5) Bowed glottal appearance. Results charted a decrease in MTD type 3-5 with LMT however noted an increase in type 1 & 2 across the group. Ahmadi et al. (2022a) hypothesised that many participants may have had weak glottal closure at baseline, leading to compensatory hyperfunction. It was concluded that an additional treatment approach to help fold closure may be required after LMT, an observation supported by the results of a second study which concluded that a combination of breathing exercises and LMT provided better results than with either method alone.

Within the context of the literary findings, it is useful to note that the evaluation of interventions for MTD requires a multifaceted approach due to the complexity and heterogeneity of the condition (Tanner, Milstein & Smith, 2018). Consequently, research designs must integrate both objective and subjective outcome measures to capture the multidimensional nature of vocal function. Given the individual variability in presentation and response to treatment, single-case experimental designs and mixed-methods approaches are frequently employed to allow for personalised analysis while still ensuring methodological rigour (Behrman et al., 2008). Randomised controlled trials remain the gold standard, however they are often limited by the small, heterogeneous populations and ethical considerations associated with withholding treatment. Incorporating standardised yet flexible vocal tasks and including follow-up assessments to evaluate the durability of treatment effects further strengthens study design. Ultimately, research into MTD interventions benefits from interdisciplinary collaboration and methodological diversity to address the condition’s physical, functional, and experiential dimensions.

Treatment of the musical theatre voice

The physical demands of the modern musical theatre performer include movement, spoken voice work, use of instruments and a variety of different singing qualities, all of which may be required within the same song or performance. As a singing genre, it contains a number of sub-styles which must be perfected in order to have the skillset required to perform professionally (Read, 2021). Rapid review two concluded that due to these high demands, instances of additional laryngeal muscle tension leading to dysphonia can be commonplace (Thomas & Alexander, 2025), and if untreated may lead to additional pathologies and further maladaptation of the vocal mechanism (Van Houtte, 2011).

Rather than simply following the speaking voice therapy into singing voice approach, singing voice rehabilitation specialist Leda Scearce highlights the need for in-depth knowledge of the singer and singing voice. As with the rehabilitation process in general, *"one size definitely does not fit all when it comes to singing voice rehabilitation"* (Scearce, 2016, p157). Scearce advocates therapeutic approaches and exercises specific to the type of singer, with the view that rehabilitation for commercial contemporary music (CCM) singers must be customised to meet the individual stylistic characteristics of the singer. As musical theatre singers often must master several different styles of singing, alongside potentially having to impersonate existing singing voice styles in biographical musicals, (Read, 2021) this approach seems essential for the treatment of MTD within the genre.

Stemple and Fry (2010) include a case study describing the use of Estill Voice Training methodology in the rehabilitation of a singing voice with hyperfunction and subsequent pathologies. Treatment included aspects included in combined voice therapy alongside specific Estill exercises (Table 19). Improvement, however, was described as 'subtle', with a slightly higher pitch of speaking voice, reduced jitter and shimmer, with the voice remaining mildly breathy and strained with intermittent vocal fry. Results were non-generalisable due to the nature of a single case study.

Table 19

Overview of vocal hyperfunction in the singing voice using Estill Voice Training exercises (Stemple & Fry, 2010).

	Aspect of Voice Production	**Exercises prescribed**
1	Hygiene	
2	Reduce Musculoskeletal tension	McClosky Six massages and stretch/releases for face, jaw, tongue, geniohyoid, infrahyoid strap muscles and muscles to side and back of neck.
		Laryngeal Manipulation
		Laugh posture – descends larynx and enlarges thyroid space
		Neck, shoulder and torso stretches
3	More efficient speaking voice production	Inhaling and exhaling to and from different lung volumes
		Effort monitoring
		Abdominal release, tidal breathing, freeing up the breath
		Speaking range pitch glides
		CVCVCVs (i.e.. Potato, lemony)
		Carrier phrase practice drills
		Use of twang to increase volume in spoken voice
4	More efficient singing voice production	'ng' siren across range
		Adding twang to siren
5	Patient Education	Independent work/approach

A case study of the treatment of a dysphonic 31-year-old female (Patient 00) who was performing on a Broadway tour in the musical theatre genre was provided by Stemple and Fry (2010) who describe the use of vocal function exercises (VFE) and resonant voice therapy (RVT). The treatment followed the previously established VFEs and RVT exercises (See Supplementary Resource

Two for overview) with no additional differentiation regarding the vocal style or qualities used by the singer. The therapy was delivered over four sessions and resulted in an increased maximum phonation time, a 'lighter and easier feel to the voice', improvement in airflow rates at low pitches and an increase in dynamic range at the first passaggio. Unfortunately, continued progress and the ability of the singer to embed therapeutic approaches during subsequent Broadway tours was not reported in the case study, illustrating the need for longitudinal research in this area.

Scearce (2016) argues that vocal technique and exercise design should align with the physiological demands of the specific style. For example, applying strategies like Yawn-Sigh or Sob, typically aimed at lowering laryngeal tension, may conflict with the belting technique and potentially increase muscle tension instead of relieving it. While discussing the specific requirements of the musical theatre voice, Gates et al. (2013) reiterate the concept of singing genre specificity and additionally highlight the potential impact of movement on the musical theatre voice, they raise the possibility that in some performers the demands of movement may contribute to the development of MTD. While discussing body movement in performers, Gates et al. (2013) highlight that due to the difficulty in maintaining volume when running out of breath, some performers may run out of breath during choreographed movement and must induce muscular tension in the larynx to maintain enough subglottic pressure while singing. Over time such vocal tension can become habitual and problematic. In addition to these findings, the impact of dance on cardiorespiratory demands within a musical theatre performance, explored by Stephens and Wyon (2020), found that although musical theatre performers have a greater maximal aerobic capacity than dancers form other genres, the singing component reduces breathing frequency. Consequently, this may have a negative effect on the physiological recovery from the dance sections and increased lactate levels. Musical theatre dancers may need to either compromise the singing component to improve breathing frequency or decrease the intensity of the dance sequences to ensure singing is not affected by the breathing frequency.

As part of the behavioural modification aspect of indirect therapy for MTD, Scearce (2016) advocates that musical theatre performers use staging and choreography rehearsals to vocally pace themselves, 'marking through' or even lip-synching rather than singing with full voice. Aside from this concession, no mention is made of choreography and movement being considered during therapeutic treatment for MTD in the literature available. In addition to the demands of the choreographed element to musical theatre performance, the genre of musical theatre now includes a greater use of the role of performer as actor-musician. For some performers, the impact of playing and performing may prove to be a contributing factor to the development of MTD, however there are limited studies around this supposition. As described in rapid review two, Longo et al (2019) found that voice features may be affected using the instrument played while singing with shoulder and back position affecting voice features as measured by Multi-dimensional Voice Programme (MDVP) and playing the guitar leading to a decreased amplitude of the singer's formant and increased noise. Postural changes may increase muscular resistance in tracts of the phono-articulatory apparatus and lead to voice disorders, MTD. The acknowledgement of increased aetiologies of MTD for musical theatre singers suggests a network of practitioners, referred to as voice care services, or multidisciplinary voice care teams (Flock et al., 2023), providing targeted intervention within an environment of shared knowledge may be the optimum way to help the singer return to performance voicing.

The Multi-Disciplinary Voice Care Team

The goal of voice care services is to give people with voice problems specialised assistance. Issues related to voice quality, pitch, loudness, and flexibility can fall under functional and organic diagnostic categories. Voice services in the UK offer professional voice assessment and treatment and are located within tertiary care. They are frequently referred to by other healthcare providers and/or voice professionals (RCSLT.org, 2024).

A multidisciplinary team (MDT) is composed of a group of healthcare workers who are members of different medical disciplines (Slavova-Azmanova et al., 2015). MDT voice clinics aim to provide individualised yet integrated services to patients with complex voice disorders and often include input from speech and language therapists, laryngologists, voice coaches, and general medical practitioners (GPs), with consultation from other disciplines (psychology, occupational therapy, social work) if required and/or requested by the client (Flock et al., 2023).

Experts with experience and practitioners dealing with voice disorders were consulted by Flock et al. (2023), who discovered that specialised voice care services address a significant clinical need. According to prevalence estimates, 1.7% of the general population experiences clinically significant voice symptoms, and the number of people referred for specialised assistance is constantly rising. The COVID-19 pandemic has likely contributed to the rise in voice-related symptoms (Lechien et al., 2022; Tohidast et al., 2021), higher service demands, and stretched resources, which in turn have increased demand for specialised voice care. Additionally, as the population ages and voice problems which commonly affect the older voice user increase, service demands are predicted to rise (Bertleson et al., 2018). These clinical need indicators show how important it is for voice care services to be ready to offer precise and efficient multidisciplinary voice assessment and treatment. Alternatively, lengthy wait times, convoluted routes to voice care, and conflicting data and viewpoints about the effectiveness of treatments can occasionally make it challenging for services to deliver timely, relevant, and meaningful care.

CONCLUSION

Rapid review four concludes the review of literature for the thesis, exploring direct and indirect approaches to voice therapy, types of MTD and the consequences for treatment design in the general singing population and, more specifically the musical theatre singer. Both direct voice therapy, to modify aspects of faulty voice production and promote appropriate, efficient voice production, and indirect voice therapy, to encourage behavioural change, were explored.

A combination of direct and indirect therapeutic approaches was found to be the optimal approach, linking to the concept of the voice user at the centre of treatment design and efficacy. Literature suggests that there are multiple factors involved in the treatment design of MTD in the singing voice including MTD type, singer voice use and demand, singer lifestyle and clinician knowledge of the singing voice. Collaboration between therapist and singing teacher, potentially under the voice care team umbrella, was recommended and supports the previous findings that shared knowledge, and input can lead to successful outcomes for the singer with regards to a return to performance voice use.

Key Findings (Rapid Review Four)

- MTD has multi factorial aetiologies which support the use of combined therapeutic approaches.
- Awareness of additional demands may impact treatment design of MTD in musical theatre singers.
- Collaborative working and shared practitioner knowledge may help to improve outcomes and efficacy of treatment.

3.7 CONCLUSION (of Rapid Reviews)

The causes of MTD are multi-factorial and linked directly to the personality, vocal demands lifestyle, and environment of the singer. In assessing and measuring laryngeal tension in the singing voice, clinical approaches are most likely to involve laryngoscopy and palpation, while ongoing assessment by the singing teacher or singer themself is most feasibly undertaken through a combination of singer history and perceptual/acoustic assessment. The findings point towards the importance of communication between the singer and those involved in supporting rehabilitation of the voice, to develop a holistic picture of the nature of the potential causes. The nature of demand on the musical theatre voice increases the difficulty in establishing direct cause, which supports the use of combined therapeutic approaches within treatment design.

Within the available literature with respect to generalised treatment of singers with MTD the approaches follow the established SLT spoken voice methodology, using several generalised exercises aimed at targeting as many possible causes at the same time. As most treatments consist of combined therapy, it is difficult to determine which exercises may be most effective if treating a specific genre of singing. Due to the evolving and varied demands of musical theatre singing voice qualities, the physiological requirements of specific qualities may be pertinent to treatment design and the prevention of MTD re-occurrence. Scearce (2016) supports this hypothesis, suggesting that treatment should be designed with the vocal physiology and number of voice qualities required in the musical theatre singing voice in mind in the absence of specific literature discussing how MTD affects the musical theatre voice.

There is some recognition of the multi-faceted nature of musical theatre performance and the myriads of demands which may cause or exacerbate MTD, however little or no provision for exercises designed specifically for MTD in musical theatre voices. The physical demands, instrumental elements and additional spoken aspects of musical theatre performance are not routinely considered or evidenced in the literature. Scearce (2016) appears at the forefront of the singing voice rehabilitation literature, however explorations and a robust evidence base is still lacking for differentiated therapeutic work in the musical theatre genre. The numerous demands on the musical theatre singing voice support the concept of combined therapeutic approaches. Much like the interdisciplinary care model used for sports athletes, elevating such approaches in the context of the vocal athlete can enhance support for the musical theatre performer (LeBorgne & Rosenberg, 2014; Namasivayam-MacDonald et al., 2025). Shared knowledge and collaboration between practitioner roles, such as vocal coaches, speech-language pathologists, physiotherapists, and medical professionals, may improve both the experience and the outcome for the singer (Narin et al., 2024; Matsuki et al., 2024). This aligns with contemporary models of performance health, where cross-disciplinary strategies are used not only for rehabilitation, but for vocal efficiency, endurance, and injury prevention in high-demand performance settings.

For the musical theatre singer seeking genre-specific treatment for MTD, until treatment is developed that considers the additional demands on the musical theatre singer, input may not be able to allow sustained and long-term recovery and progress. It may only provide rehabilitation of symptoms, which may then be exacerbated after treatment by a return to tension-provoking habits. Further research into the additional demands placed on the musical theatre performer and their role in the development of MTD is recommended below.

- There is a need to assess individual components within combined therapy for MTD in singers.
- The musical theatre voice contains several different qualities along with additional physical demands on the performer.
- Further study on the treatment of MTD in the musical theatre voice is required to assess the value of differentiated therapeutic work within the vocal genre.

Designed with the context of the findings within the initial review of the literature, this body of work aims to explore the assessment and treatment of MTD in the singing voice. The data collected will inform an innovative pedagogical resource for singing teachers who are working with singers diagnosed with MTD who have received therapeutic input from an SLT. The body of work will collect assessment and treatment data from voice practitioners via questionnaire and case study reports to triangulate findings and provide an evidence-based foundation for the design of a final resource.

4.1 Research Plan and Methodology

The overarching research plan for the body of work presented in this thesis was designed to conduct predominantly qualitative, exploratory sequential studies that explored the physiology, aetiology and impacts of muscle tension dysphonia in the singing voice, before examining current treatment approaches to MTD in the singing voice by speech and language therapists and singing voice rehabilitation specialists with the additional generation of minimal quantitative descriptive data. Triangulation of data between literature reviews, practitioner questionnaires, and treatment case studies was designed to form the basis of the design of evidence-based supporting resources to allow singing teachers to continue the rehabilitation process beyond initial speech and language therapist therapeutic intervention.

4.2 Research Design

Designed within an interpretivist paradigm, placing the emphasis on context, a mixed methods approach, more heavily weighted towards the generation of qualitative data, was deemed most suitable for the research. Due to the examination of an array of viewpoints, experiences and methods contextualised by statistically significant information, the acceptance that reality is subjective and multiple, and that constructs are interpreted by individuals based on their experiences underpins the research design. Ideas are allowed to emerge as the data is collected and subsequently be used to produce a practical resource designed to support practitioners.

The current body of work develops an understanding of the phenomena regarding MTD from the perspective of those involved in the delivery of treatment, not to predict or control it, therefore each of four studies contained within the project attempted to make sense of reality rather than testing hypotheses. Consequently, Chapter 2 provides a grounded foundation of anatomical and physiological understanding of the muscles of the singing voice (Supplementary Resource One), Chapter 3 is made up of several rapid reviews, followed by a primary research study representing an online questionnaire of practitioners (Chapter 4). Practitioner case studies follow (Chapter 5), and the combined results intend to derive detailed, contextualised inferences and understanding of the dynamics that underlie current treatment approaches to MTD in the singing voice. A final pilot evaluation of the pedagogical resource presented in Chapter 8 seeks to inform preliminary refinement prior to larger scale development. The research design requires the synthesis of quantitative and qualitative methods and the means to appropriately combine the data (Wasti et al., 2022). As the goal of mixed methods research design is to produce results which facilitate greater understanding (Creswell & Creswell, 2018), it is intended to provide a holistic view of the meaning of the data which is significant for the studies which make up the thesis due to the multidisciplinary nature of therapeutic input. In the overarching research design, although actively invested in the topic and aware that their subsequent practice will be impacted by the findings, the researcher aims to remain an observer, rather than an active participant. The ongoing use of Schon's reflective model will guide the application of the analysis and evaluation of data collected (Schön, 1983).

Literature for Chapter 2 and rapid reviews (Chapter 3) was searched through several different databases, using specific inclusion and exclusion criteria detailed in each review. Primary and secondary searches were made and included pedagogical literature, grey literature and hand searching with details provided within each review. Participants for studies two and three were selected from a purposeful sample of speech and language therapists, singing voice rehabilitation specialists, singing teachers, and vocal coaches. The research in studies two and three took place with practitioners who were affiliated with The British Voice Association, The British Association of Performing Arts Medicine, and The Association of Teachers of Singing, with a practitioner questionnaire and transcribed case studies serving as the main sources of primary data collection. Triangulation was achieved through thematic analysis of the data and examined within the broader context of the reviewed literature. The methodology implemented is described in detail in Chapter 3

4.3 Conceptual Framework

The conceptual framework underpinning this research was designed using a combination of literature synthesis, practitioner experience, and iterative engagement with research aims. Consistent with Bloomberg and Volpe (2008), the framework evolved throughout the project and provided a structure to guide the selection of methods and the development of the final resource.

It comprises five interconnected research sub-questions, each aligned with specific outputs and methods. These address the anatomy of voice production, the clinical assessment of MTD, its causes, subtypes, and impacts, and the treatment needs of the musical theatre performer. Together, they form the foundation for a pedagogical resource bridging speech and language therapy and singing practice.

The five categories of the conceptual framework (Figure 8) were directly derived from the overarching project aim and contemporary literature available with regards to the various facets of muscle tension dysphonia and the singing voice, resulting in related research sub-questions which directed the body of work presented in this thesis.

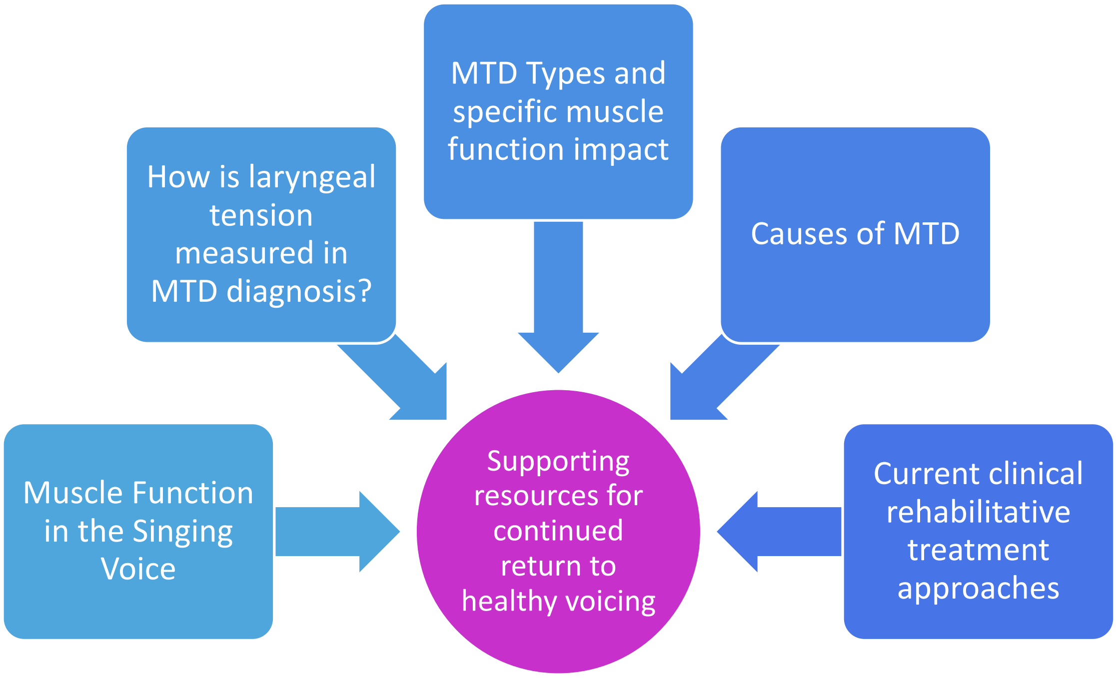

Figure 8

Conceptual framework for the body of work which makes up the thesis.

The five sub-questions allowed the development of an exploratory sequential approach to the overarching thesis question and are aligned with specific methods and outputs. These are summarised below.

What is the physiology, primary and secondary function, and reaction to additional laryngeal tension of the muscles involved in singing voice production?

The first research question led to the definition, illustration and collation of the individual muscles of the singing voice, their primary function, their secondary function in the context of singing voice production, and the impact of additional tension in each muscle on voice production, categorised as 'The Muscles of Singing Voice Production', a reference resource in book format which will form part of the final practical resource (Chapter 2).

How is laryngeal tension measured in MTD diagnosis?

The second research question aimed to determine how laryngeal tension is clinically measured in those diagnosed with MTD. Taking the form of a scoping review, examining 12 methods of measurement and their relevance to MTD in the singing voice with regards to accessibility and reliability (Chapter 3), and questionnaire and case study responses will be triangulated with the scoping review findings to allow an overview of current approaches (Chapter 7).

What are the causes of MTD?

The third research question aimed to examine available literature to establish the breadth of potential causes of MTD in the speaking and singing voice. Two rapid reviews explored the (1) causes of MTD in the singing voice (Chapter 3) and (2) the additional demands on the musical theatre performer and potential links to increased laryngeal tension (Chapter 3). The examination of additional demands was included to link findings of data gathered in an online questionnaire and case study reports regarding the treatment of the musical theatre performer and subsequently influence MT-specific resource two content.

What are the different types of MTD and their impact on vocal function in the singing voice?

The fourth research question aimed to determine the classifications of MTD and the impacts each may have on the singing voice. Two rapid reviews explored the (1) impact of MTD on the singing voice by voice quality (Chapter 3) and (2) current treatment approaches to MTD in the singing voice (Chapter 3). In addition, the fourth research question aimed to define and highlight the voice qualities required by singers and more specifically musical theatre performers and the impacts MTD may have upon each, allowing discussion of impacts in alignment with, although not specific to, the musical theatre voice. A rapid review explored the impacts through existing literature (Chapter 3), while questionnaire responses and case study data will subsequently triangulate to allow a clear picture to emerge (Chapter 7).

What are the current rehabilitative treatments for MTD in the singing voice, including additional considerations for the musical theatre singing voice?

The final research question seeks to establish current rehabilitative treatment approaches to MTD in the singing voice, with particular attention to the musical theatre voice, through literature review (Chapter 3), online questionnaire (Chapter 5) and individual case study reports (Chapter 6). The final question considers the additional demands upon the musical theatre performer through a rapid review, the results of which may impact treatment design. In addressing this question, the basis of a pedagogical resource for singing teachers will be established. The practical pedagogical resource will be titled 'Muscle Tension Dysphonia in the Singing Voice: Establishing Links between Therapy and Performing Voice Use'.

4.4 Methodological Overviews of Individual Studies

4.4.1 Study One – Scoping Review

The aim of study one was to identify and map existing methods of laryngeal muscle measurement developed or tested with individuals diagnosed with muscle tension dysphonia. Specifically, the study sought to examine the constructs measured, and the reported reliability, validity, sensitivity to change, efficiency, and accessibility of each method. A scoping review methodology was selected because it is particularly suited to areas in which the evidence base is heterogeneous or not yet systematically synthesised. As Arksey and O'Malley (2005) and later Munn et al. (2018) argue, scoping reviews are appropriate when the purpose is to explore the breadth of existing literature, clarify conceptual boundaries, and identify gaps in knowledge rather than to evaluate the quality of evidence or generate a meta-analytic synthesis. Given the evolving and multidisciplinary nature of laryngeal measurement approaches, a systematic review, with its narrower focus and stringent requirements for methodological homogeneity, would have been premature and unnecessarily restrictive (Peters et al., 2020).

Therefore, a scoping review allowed for a comprehensive mapping of available evidence across clinical, pedagogical, and research contexts. Inclusion criteria focused on studies reporting physical measurement outcomes involving participants with confirmed MTD, published in English or translated form from 2000 onward in order to reflect contemporary diagnostic criteria and assessment technologies. Studies involving populations without MTD or non-translated articles were excluded to maintain conceptual coherence. Further methodological detail is presented in Chapter 3.

4.4.2 Study Two – Practitioner Questionnaire

Study two aimed to explore practitioner perspectives on delivering therapeutic treatment for MTD in singers. An online questionnaire was selected to collect both qualitative and quantitative data from a purposive sample of practitioners, including speech and language therapists (SLTs) working with singers, singing teachers (ST/VCs), and singing voice rehabilitation specialists (SVRSs). The use of a questionnaire was theoretically justified by the need for breadth rather than depth at this stage of the research. As Rowley (2014) notes, questionnaires are effective for capturing a wide range of views and identifying preliminary patterns in practitioner behaviour and beliefs, particularly when participants are geographically dispersed.

Alternative qualitative approaches, such as focus groups or in-person interviews, were considered but deemed impractical and potentially restrictive. Focus groups risked power imbalances between different practitioner roles and could have inhibited open discussion (Kitzinger, 1995). Individual interviews, while capable of generating richer data, would have limited the range of perspectives and been less efficient for mapping early-stage themes across professions (Brinkmann & Kvale, 2018). The use of thematic analysis enabled the identification of recurring patterns within the qualitative responses while still allowing for unexpected viewpoints to surface (Braun & Clarke, 2006). Inclusion criteria comprised practitioners listed on the British Voice Association practitioner list who worked regularly with professional singers. Practitioners working mainly in classical voice or unaffiliated SVRSs were excluded to maintain alignment with the contemporary, musical-theatre–focused scope of the research. Further methodological detail is presented in Chapter 5.

4.4.3 Study Three – Case Study Reports

The aim of study three was to explore the therapeutic processes of treating MTD in singers in more detail by inviting practitioners to submit written case study reports. A case study approach was selected because it allows for the close examination of practice in real-world contexts, capturing depth and complexity that are not accessible through questionnaires alone (Yin, 2018). This method aligns with the need to understand clinical and pedagogical decision-making in situ, including practitioner reasoning, contextual considerations, and the unfolding of treatment pathways over time.

Case study methodology was preferred over approaches such as ethnography or phenomenology. Ethnography, which requires prolonged immersion in a field setting, was unsuitable due to the clinical nature of the work and associated confidentiality constraints (Hammersley & Atkinson, 2019). Phenomenology would have focused on practitioners' subjective experience rather than the practical, procedural dimensions of treatment delivery that were central to the study aims (Smith et al., 2009). Written case reports instead allowed practitioners to present detailed accounts while maintaining participant and patient confidentiality. The data was analysed using thematic analysis (Saldaña, 2013), which enabled systematic comparison across varied practitioner accounts while retaining sensitivity to contextual nuance. Inclusion criteria limited participation to SLTs, SVRSs affiliated with a voice clinic, and singing teachers actively working with professional musical theatre singers diagnosed with primary MTD. Further methodological detail is presented in Chapter 6.

4.4.4 Study Four – Pilot Evaluation of Resource Two

Study four aimed to gather practitioner feedback on the design and content of the pedagogical resource that emerged from studies one to three. Given the evaluative nature of this stage, semi-structured interviews were chosen as the primary method of data collection. Semi-structured interviews offer a balance between consistency across participants and flexibility to explore emerging ideas in depth (Brinkmann & Kvale, 2018). This was important for ensuring that all participants responded to the core components of the resource while still allowing them to expand on their professional insights and offer targeted suggestions for improvement.

Alternative methods such as surveys or focus groups were considered and found unsuitable. Surveys would have restricted the depth of feedback required for resource refinement, while focus groups carried the risk of hierarchical dynamics between clinical roles, potentially limiting the openness of critique (Morgan, 1997). Content analysis (Saldaña, 2013) was applied to examine both explicit recommendations and underlying practitioner concerns, aligning with the study's practical aim of refining the pedagogical tool. Participants included SLTs, SVRSs, and other voice clinic practitioners working in private practice or the NHS. Practitioners without voice clinic affiliation were excluded to ensure that the evaluation reflected the perspectives of those regularly involved in clinical decision-making for singers with voice difficulties. Further methodological detail is presented in Chapter 9.

4.4.5 Participant engagement overview

Responses were carefully aligned with individual participants throughout data collection and analysis to maintain coherence across the different stages of the research programme. This allowed the researcher to track emerging insights from each practitioner. In the case of the singing voice rehabilitation specialist (SVRS#2), participation in both the questionnaire study (study two) and the pilot evaluation (study four) offered the opportunity to compare responses across different methodological contexts, providing additional depth and insight into how the practitioner interpreted and engaged with both the research questions and the emerging pedagogical resource.

The involvement of a participant in multiple studies presented several strengths. Longitudinal or cross-contextual insight may be facilitated, supporting the identification of patterns or consistencies in professional reasoning that might not be observable in single-stage participation (Sandelowski, 1995). Repeated participation may enhance the richness of the dataset, as participants who are already familiar with the research aims and procedures may provide more detailed, reflective, or nuanced responses. It must be acknowledged that repeated participation introduces potential limitations. Familiarity with the research process or prior engagement may lead to response bias, including social desirability or over-elaboration in ways that reflect perceived researcher expectations (King & Horrocks, 2010). Additionally, the presence of a single participant across multiple studies may disproportionately influence thematic development, particularly if their perspectives differ from the broader participant group, which could impact the generalisability of findings. In this research, the anonymity of the questionnaire meant that it was not possible to track repetition of engagement beyond SVRS#2, limiting the ability to systematically explore potential effects of repeated participation on data integrity or comparative analyses across participants.

Overall, while repeated participation provides opportunities for richer, triangulated insights, it must be interpreted cautiously within the context of qualitative research. The design and analytic approach aimed to balance the benefits of cross-study continuity with careful attention to maintaining transparency, reflexivity, and awareness of potential bias introduced through repeated engagement. Figure 9 provides an illustration of engagement in study by participant number.

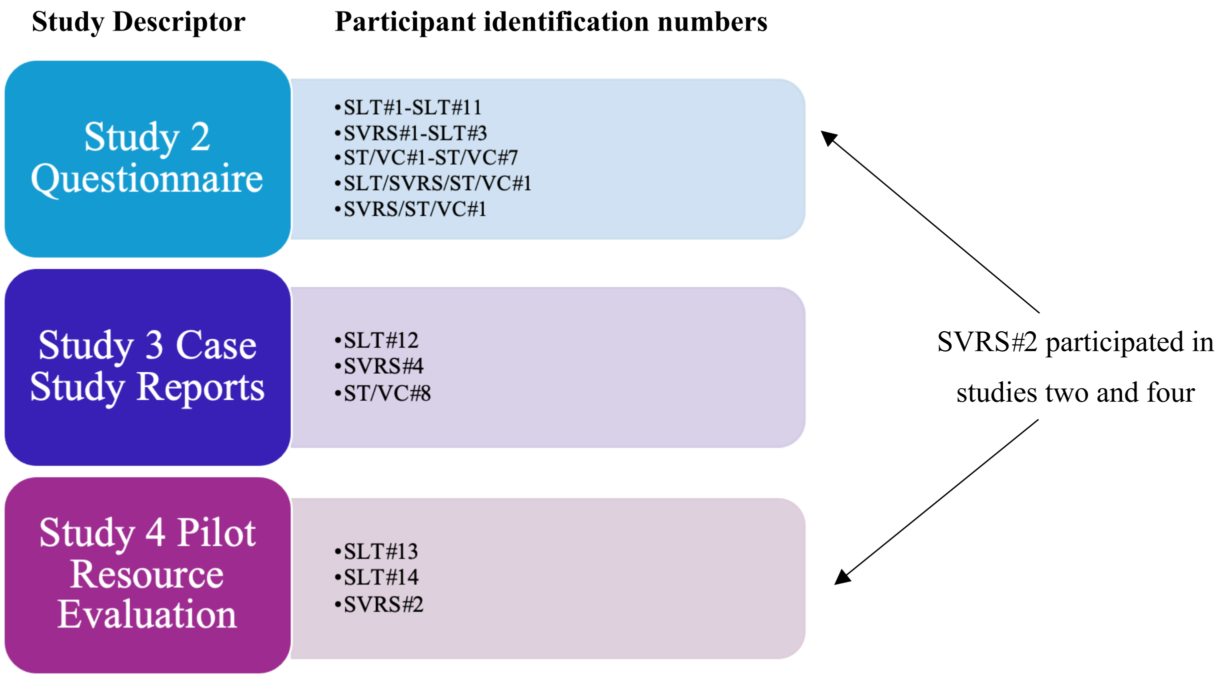

Figure 9

Engagement in study by participant number.

4.5 Thematic Analysis: Application and Justification

Thematic analysis was selected as the primary analytical method due to its theoretical flexibility and its capacity to identify meaningful patterns across a range of qualitative materials, including written responses and semi-structured interviews. As outlined by Braun and Clarke (2006), thematic analysis does not require adherence to a single epistemological position, making it well suited to research that spans multiple practitioner groups and incorporates both exploratory and evaluative components. This flexibility was particularly valuable in a programme of work where the focus, participants, and research questions developed across successive studies.

In the earlier exploratory stages of the research (studies two and three), thematic analysis was applied inductively. This allowed themes to emerge directly from participant accounts without being constrained by pre-existing frameworks. Inductive analysis supported a grounded understanding of practitioners' perspectives, revealed unexpected areas of concern or interest, and provided a rich foundation for refining subsequent research tools. As the research progressed, these inductively generated insights informed the structure of the semi-structured interview schedule used in study four. In study four, the analytic approach shifted toward a more deductive form of analysis. Here, the aim was not to generate novel thematic categories but to examine how participant responses aligned with or diverged from themes already suggested by the interview questions. The deductive approach was appropriate because study four sought to evaluate a developing resource, meaning that some thematic categories, such as usability, clarity, and professional relevance, were already conceptually defined. Deductive analysis allowed for systematic testing of these categories while still remaining open to nuanced or contradictory participant perspectives.

Alternative qualitative approaches were considered and ultimately deemed unsuitable for the aims and structure of the research. Interpretative phenomenological analysis (IPA), for example, demands an intensive, idiographic focus on lived experience and typically requires a small, homogenous participant group. Although IPA is widely used in health and psychology research (Smith, Larkin & Flowers, 2023), critics note that its deeply personal nature can limit its suitability for practitioner-oriented studies that aim to explore shared patterns across professional groups rather than deeply individual experiences (McCammon et al., 2024; Darley et al., 2025). Moreover, some scholars argue that IPA's double-hermeneutic interpretive process introduces subjectivity and a lack of standardisation when applied in contexts beyond tightly defined experiential enquiry (Lawrence, 2023; Smith et al., 2023).

Similarly, grounded theory (GT), originally conceived to generate theory inductively through iterative data collection and constant comparison, was judged misaligned with this project's practice-driven aims. While GT remains a powerful methodology for theory-building, recent methodological reflections caution that employing classic or constructivist GT in research that is not explicitly theory-generating can impose substantial methodological burdens (Andrews, 2024; Elliott & Higgins, 2023). A recent critique highlights common misunderstandings around core GT practices (Andrews, 2024), and reflections from applied GT users argue that combining GT with other approaches without clear philosophical alignment may lead to confusion or methodological "slurring" (Yarwood-Ross & Jack, 2023). In contrast, the present research is applied and practice-driven, aiming to use existing practitioner insight to inform resource development rather than to build new theory. The goal was to draw on existing knowledge through practitioner perspectives and evaluate the relevance of proposed resources, rather than to conduct theoretical sampling and saturation in pursuit of emergent theory. A full GT methodology would have introduced unnecessary procedural complexity without substantially advancing the project's applied objectives.

Taken together, these considerations highlighted thematic analysis as the most suitable and pragmatic choice. Its flexibility allowed the analytic approach to adapt across the different stages of the research programme, while still offering a coherent framework for identifying, organising, and interpreting patterns within the data.

4.6 Methodological Rationale

The selection of questionnaires, semi-structured interviews, and document analysis as primary data collection methods was informed by both ethical considerations and practical constraints inherent in clinical voice research. Direct observation of therapy sessions or video recording was deliberately avoided to protect client confidentiality and minimise disruption to routine clinical practice. This approach is consistent with contemporary guidance advocating for research designs that are low-burden, ethically sensitive, and inclusive of diverse practitioner populations (McGrath et al., 2023). In the context of working with professional singers, such methods are particularly important because participants often operate under time pressures and confidentiality obligations that could be compromised by intrusive data collection methods. Self-reported methods, while recognised as subject to potential bias, offer significant advantages in capturing practitioner knowledge, reasoning, and decision-making processes that are otherwise inaccessible through observational means (Creswell & Poth, 2018). Questionnaires enabled the collection of broad, generalisable insights across a geographically and professionally diverse sample, allowing patterns in practice to emerge at an early, exploratory stage. Semi-structured interviews, in contrast, facilitated deeper engagement with individual practitioner perspectives, enabling exploration of nuances, contextual factors, and rationales behind clinical decision-making (Brinkmann & Kvale, 2018). Document analysis of case study reports complemented these methods by providing artefactual evidence of clinical reasoning and practice decisions, serving as a bridge between self-reported data and observable outcomes (Bowen, 2009).

The methodological choice reflects a balance between data richness and feasibility. While direct observation or video-recorded sessions could provide highly detailed behavioural data, such approaches were deemed impractical given the sensitive clinical environment, ethical constraints, and potential impact on therapeutic interactions. Instead, self-reported and document-based methods were combined with triangulation and iterative validation processes to enhance credibility and trustworthiness of the findings (Flick, 2018; Patton, 2015). Triangulation across questionnaires, interviews, and case study reports allowed cross-verification of emerging themes, while iterative validation mitigated concerns regarding interpretive bias.

Overall, these methodological choices reflect a theoretically informed compromise: they prioritise ethical responsibility, accessibility, and participant inclusion while ensuring the collection of rich, context-specific data capable of informing both research and applied practice.

4.7 Issues of Trustworthiness

Within each study presented in the body of work making up the thesis, issues of trustworthiness with regards to credibility (or validity), dependability (or reliability), and transferability were considered. To increase the study's credibility, thorough checks of the questionnaire response transcriptions and case study reports were completed. Dependability of the study was strengthened by presenting both data sets in a thorough, systematic manner through descriptive statistics, thematic analysis and synthesis of findings.

While study three provides details of the experiences of three practitioners and their clients, the participant size does not represent the SLT, SVRS or ST/VC population. Transferability may be shown, however, if the reader determines that the findings are relevant to their own context through the thorough accounts of the strategies, approaches, and views of the participants in study three (Bloomberg & Volpe, 2008). To ensure trustworthiness, evidence of the four primary criteria; credibility, transferability, dependability, and confirmability is included with reference to the study design and process in studies two and three.

Credibility

The credibility of qualitative data has been assured through multiple perspectives throughout data collection to ensure data collected is appropriate to the collected studies presented within this thesis. This has been achieved through mixed methods data collection, qualitative and quantitative analysis, and theoretical triangulation.

Transferability

The simplicity of the research design within this body of work results in a good level of transferability. The applicability of both the methodology and findings to similar contexts such as vocal injury or pathology is clear. Transferability may further be achieved by a "thick description" (Leeds-Hurwitz, 2015) of the findings from multiple data collection methods.

Dependability

Dependability can be ensured through rigorous data collection techniques and procedures, and well documented analysis. By thoroughly documenting each step of the research process transparency has been promoted and duplication of the study or assessment of the reliability of the findings allowed by following the same processes. Record of decisions made during the research process, sampling methods, research materials adopted, emergence of the findings, and information about the data management, including changes in techniques or analysis were maintained to improve transparency and accountability, helping to establish the reliability of the study and providing insights into potential biases (Korstjens & Moser, 2018). Embedding the process of interpretation within the process of analysis further ensured that interpretation is grounded in the data rather than researcher preferences and viewpoints (Lincoln & Guba, 1985).

Confirmability

Confirmability of the results of the body of work will be assured when data is checked and rechecked throughout data collection and analysis to ensure findings would likely be repeatable by others. Confirmability will be documented by a clear coding schema that identifies the codes and patterns identified in analyses, and through triangulation and checking of the data as well as practicing reflexivity to confront potential personal bias.

4.8 Philosophical Underpinning of the Research Design

This study adopts an interpretivist paradigm that gradually develops into a pragmatic orientation, aligning with the applied, practice-focused aims of exploring MTD in the singing voice. Interpretivism assumes that reality is socially and individually constructed (Schwandt, 2000) and therefore seeks to understand how practitioners perceive, experience, and articulate their therapeutic engagement with MTD within the context of their professional identities (Creswell & Poth, 2018). Rather than pursuing universal or generalisable claims, the intention is to develop rich, contextualised understanding (Denzin & Lincoln, 2018). The use of questionnaires and case studies supports this aim by enabling exploration of lived experience and the personal, psychological, and situational factors that shape practitioners' responses to MTD (Roy et al., 2005; Van Mersbergen, 2011). Reflexivity is acknowledged as central, recognising the researcher's active interpretive role in making sense of the data (Finlay, 2002; Berger, 2015).

As the research progressed, a pragmatic orientation became increasingly important. Pragmatism prioritises the practical value of findings and encourages methodological flexibility across qualitative, quantitative, and mixed methods approaches (Morgan, 2014; Tashakkori & Teddlie, 1998). This evolving stance supported iterative movement between inductive exploration in the early studies and more deductive content analysis in later stages (Feilzer, 2010). Ontologically, the design is rooted in relativism, recognising multiple, context-dependent realities (Poucher et al., 2019). Epistemologically, the interpretivist–pragmatic position views knowledge as co-constructed through researcher–participant interaction and interpreted within the context of practice.

The exploratory sequential structure of the thesis reflects this worldview, aiming to understand practitioner perspectives on MTD rather than predict or control the phenomenon. While some quantitative data contributes to the overall findings, the predominantly qualitative emphasis aligns with the interpretivist focus on meaning-making and the pragmatic aim of generating useful, practice-relevant insights. The role of the researcher as observer–interpreter requires careful reflexive awareness to ensure that emerging interpretations remain grounded in participants' accounts while acknowledging the researcher's disciplinary commitments (Schwartz-Shea & Yanow, 2013). Ultimately, thematic and content analysis were used to construct explanatory representations of practitioner experience (Creswell & Creswell, 2018), informing the development and evaluation of a practical resource for professional use (Supplementary Resource Two). This methodological orientation leads into a consideration of the researcher's positionality within the research process.

Positionality

Research is always situated within a shared social space shaped by interactions, identities, and power relations (England, 1994). Positionality refers to the stance a researcher occupies within that space and highlights how personal histories, disciplinary perspectives, and worldviews shape the conduct and interpretation of research (Savin-Baden & Major, 2013). As individuals draw meaning from multiple overlapping identities, positionality is dynamic and context dependent (Kezar, 2002).

Acknowledging positionality involves recognising the inevitability of bias and the impossibility of complete separation between researcher and knowledge (Hanly & Fitzpatrick Hanly, 2001). Rather than undermining qualitative work, this integration is part of how researchers interpret meaning (Bourke, 2014). In this thesis, the researcher's background as a vocal coach and voice researcher influenced both interactions with participants and the interpretation of data. Transparency regarding this influence is therefore essential to methodological rigour.

Insider and outsider positions exist along a continuum rather than as fixed categories (Huberman & Miles, 2002; Yip, 2023). Researchers move along this continuum depending on context, a process described by Thomson and Gunter (2010) as "liquid identity." Across the studies, the researcher's position shifted in relation to each professional group. When engaging with the data collected from singing teachers, a clear insider stance facilitated shared language and instinctive understanding but required careful reflexivity to avoid unexamined assumptions. In contrast, interactions with speech and language therapists and singing voice rehabilitation specialists positioned the researcher as a partial outsider. Differences in clinical training and regulatory frameworks necessitated attentiveness to terminology, boundaries, and the limitations of the researcher's non-clinical role. This outsider perspective was also generative, enabling the researcher to ask questions that might be less visible to those within the clinical community.

Working with highly specialised practitioners, particularly singing voice rehabilitation specialists, required even greater reflexive monitoring. Schön's (1983) notion of reflection-in-action helped the researcher recognise moments where pedagogical experience could unintentionally shape interpretation. Brookfield's (1995) Four Lenses- self-reflection, participant perspectives, colleague viewpoints, and theoretical literature - supported systematic examination of emerging assumptions. Cooper et al.'s (2024) Positionality Tool further enabled structured mapping of identity, power dynamics, and knowledge assumptions across the research. Reflexive journaling and memo-writing documented the researcher's shifting positionality over time (Woodley & Mazzoli Smith, 2020), informing both analytic interpretation and the development of study materials. Together, these strategies reinforced the need for reflexive practice throughout the research process, forming a natural progression into the reflexive framework underpinning the study.

Reflexivity

Reflexivity is widely recognised as a foundational element of qualitative research, though researchers conceptualise and apply it in different ways. Some emphasise self-disclosure to establish positional validity (Macbeth, 2001), while others draw on personal experience during fieldwork (Williams, 1990). Pillow (2003) argues that reflexivity must extend beyond acknowledging subjectivity to include critical interrogation of truth claims, positionality, and the relational dimensions of research. This deeper reflexivity helps prevent misrepresentation and supports ethical, transparent interpretation.

Several reflexive models were considered, including Finlay's (2002) typology of descriptive, methodological, and epistemological reflection, and Pillow's (2003) model of transformative, critical reflexivity. While these approaches offer valuable theoretical tools, the decision to apply Cooper et al.'s Positionality Tool alongside Schön's reflective practitioner model and Brookfield's Four Lenses was guided by their alignment with the iterative, applied, practitioner-focused orientation of this research. Cooper et al. provided a systematic way to map identity and power; Schön supported real-time reflection during participant engagement; and Brookfield ensured a balanced critique across personal, social, and theoretical dimensions.

Reflexivity was therefore enacted as an ongoing epistemic stance rather than an isolated stage of the research. This approach enabled the researcher to continually question where pedagogical or clinical assumptions could restrict interpretive openness, and to remain attentive to alternative perspectives that might deepen understanding. Integrating complementary reflexive models strengthened methodological transparency, enhanced credibility, and highlighted the complex interplay between researcher identity, methodological decision-making, and knowledge production.

This ongoing reflexive engagement ensured that the interpretations generated were both robust and contextually grounded.

Shared Knowledge

"Research-based evidence alone is unlikely to be sufficiently influential to determine […] practice, nor should it do so. There is a need to involve a wide range of actors and ways of knowing if relevant knowledge is to be created and used in the pursuance of better policy." (Nutley et al., 2019, p. 313).

An SLT can provide a critical link to other health care professionals. Several studies have found treatment attendance for voice therapy for dysphonia improved when patients were treated by a multidisciplinary team (Litts & Abaza, 2017; Starmer et al., 2014; Vamosi et al., 2020), possibly due to easy access to diverse medical input and improved medical and emotional support throughout the voice care team. Ward (2012) asserts that when groups of people are trying to work out how to work together, their knowledge sharing typically falls into five main areas; the problem that they are trying to address, the knowledge that is available or needed to address the problem, the context in which they are working and in which knowledge is to be found and used, the ways in which they identify, share and access knowledge and the ways in which they use knowledge.

It is proposed that the innovative output of the thesis aims to address these areas through the lens of the singing teacher/vocal coach rather than the clinical lens of the speech and language therapist. Positionality such as this aims to ensure practitioner boundaries and roles are upheld, while seeking to provide a link between practitioner input for the benefit of the singer. Furthermore, ongoing use of Brookfield's reflective model requiring examination of the process and findings through both the colleague and theoretical lenses during data collection and analysis ensures the acknowledgement of differing viewpoints and validity in variety of response (Brookfield, 1995).

4.9 Statement of Ethics

When undertaking an overarching research design containing several linked practical studies, it is the sole responsibility of the investigator to be concerned with producing an ethical research design. Due to the nature of the data gathered via questionnaire, case study report, and interview, the researcher acknowledged the ethical considerations required (Bloomberg & Volpe, 2008). Ethical approval for the online questionnaire data gathering (HEALTH01062), case study report collection (HEALTH01087), and pilot evaluation discussion (HEALTH01087-Phase 2) was sought and gained individually from The University of Central Lancashire (UCLan) Ethics board (Appendices B, E & H).

Chapter V – STUDY TWO PRACTITIONER QUESTIONNAIRE: Investigating existing approaches to the release of laryngeal tension in singers diagnosed with Muscle Tension Dysphonia (MTD)

5.1 INTRODUCTION

The purpose of study two in the body of work presented in this thesis was to explore with a sample of participants their perceptions of the process of delivering therapeutic treatment of muscle tension dysphonia in singers. The researcher believed that a better understanding of the subject matter would allow singing teachers and vocal coaches to proceed from a more informed perspective in terms of designing exercises to enable continued progression to performance-level voice use and build on to the literature already published. In seeking to understand the area of focus, study two addressed three of the five research questions:

1. How is tension currently measured in those diagnosed with MTD?
2. What are the impacts of MTD on the singing voice, including voice qualities specific to the musical theatre genre?
3. What are the main treatment approaches to MTD in the singing voice?

As demonstrated within the collection of rapid reviews a considerable amount of literature is available with regards to the measurement of laryngeal tension in a clinical setting (Thomas et al., 2023), the causes of MTD (rapid review one), the impacts of MTD on the singing voice (rapid review three) and general treatment approaches to MTD in the singing voice (rapid review four) (Chapter 3). Less specific information can be found on how speech and language therapists (SLT), singing voice rehabilitation specialists (SVRS) and singing teachers/vocal coaches (ST/VC) assess progress, design treatment, consider the additional demands of the musical theatre singer, and work towards producing what they consider a healthy singing voice. To determine how SLTs, SVRSs and ST/VCs assess and treat MTD in the singing voice, a qualitative research approach was used as it is suited to promoting a deep understanding of a social setting or activity as viewed from the perspective of the research participants (Bloomberg & Volpe, 2008).

Chapter 5 describes the research methodology for study two. As part of an exploration of the treatment of MTD in the singing voice, leading to the development of suitable strategies for use by singing teachers and vocal coaches to bridge the gap between initial SLT treatment and integration into performance level singing voice use, a purposive sample of SLTs, SVRSs and ST/VCs were invited to complete an anonymous online questionnaire. The questionnaire title was 'Current approaches to treatment of MTD in the singing voice'. The questionnaire was sent via email to members of the British Association of Performing Medicine (BAPAM), The British Voice Association (BVA) and The Association of Teachers of Singing (AOTOS) based on their work in vocal rehabilitation and MT/CCM singing styles.

Questions were designed to provide contemporary responses to the following research questions:

1. How is tension currently measured in those diagnosed with MTD?
2. What are the impacts of MTD on the singing voice?
3. What are the main treatment approaches to MTD in the singing voice?

13 questions were asked, with three closed multiple choice options and the remainder designed to be open, requiring written input from the respondents. Three questions were specific to individual practitioner roles and two were specific to the musical theatre singing voice (See Appendix D for study two questionnaire).

5.2 METHODOLOGY

5.2.1 Participants and Setting

According to Brinkmann and Kvale (2015), qualitative data gathering allows the researcher to: 1) understand the meaning of the central themes of the participants' lived world; 2) seek knowledge as expressed in participant language; 3) exhibit openness to new and unexpected phenomena; and 4) focus on themes (Brinkmann & Kvale, 2015). Participants for study two were therefore deemed eligible if selected from a purposeful sample of speech and language therapists, singing voice rehabilitation specialists and singing teachers/vocal coaches who were currently actively practicing in the field of rehabilitation of the singing voice, with specific expertise in musical theatre and CCM genres.

5.2.2 Inclusion/exclusion criteria

To approach the question from the perspective of practitioners involved in the voice rehabilitation process, it was expected that participants meet the following criteria: Registered with one or all the following bodies: BVA, BAPAM, AOTOS, and considered as recognised in their field. BVA, BAPAM, AOTOS and Vocal Health Education (VHE) (vocalhealth.co.uk, 2025) practitioner databases were searched by the researcher and information was cross-referenced with individual practitioner websites where possible to identify those who may meet the inclusion criteria. 75 participants were invited to take part in the questionnaire via direct email. They consisted of 25 speech and language therapists, 25 voice practitioners who identified as working specifically to rehabilitate the singing voice and 25 singing teachers who advertised a willingness to work within a rehabilitative approach. 23 final respondents took part in the questionnaire. Participants were asked to self-identify with the inclusion criteria.

SLT participants were considered eligible to be included if they self-reported an interest in working with or regularly work with professional singers as listed on the BVA

(Britishvoiceassociation.org, 2025) and BAPAM list of practitioners. SLT participants were required be part of an established voice clinic, either NHS or private practice. Singing teacher participants were invited to take part if they were working with contemporary commercial music (CCM) or musical theatre singers using information as listed on personal biographies or institution biographies in targeted recruitment. Singing voice rehabilitation specialists had to self-identify as such and have formal affiliations with an established voice clinic either in the UK or internationally as listed at the time by VHE and BVA databases.

5.2.3 Research Plan and Implementation

Based on findings from the literature review regarding the measurement, types, impacts, and treatment approaches for muscle tension dysphonia (MTD) in the singing voice, a questionnaire was developed as the primary data collection method. The study was designed as primarily qualitative, with a minimal quantitative component, to capture rich, context-specific insights from practitioners while still allowing some descriptive analysis across participant responses. The choice of a qualitative questionnaire was informed by the need to reach a geographically dispersed and professionally diverse participant group, including speech and language therapists (SLTs), singing voice rehabilitation specialists (SVRSs), and singing teachers/vocal coaches (ST/VC), while minimising the burden and ethical risks associated with direct observation or video recording of therapy sessions. This approach aligns with best practice in clinical voice research, where low-burden, inclusive, and ethically sensitive data collection methods are encouraged (McGrath et al., 2023).

Potential participants were contacted via email and invited to participate using an anonymous link embedded in the recruitment email (see Appendix C for recruitment email, consent form and participant information sheet). The questionnaire included an explicit informed consent requirement prior to completion, ensuring that ethical standards for voluntary participation were upheld. Data collection focused on multiple aspects of clinical practice, including assessment strategies, client considerations, treatment design, and professional communication during the rehabilitation of singers with MTD. This design enabled the researcher to gather practitioner knowledge and reasoning that would not be accessible through observation alone (Creswell & Poth, 2018).

A pilot consultation was conducted with established SLTs and SVRSs to refine the questionnaire design, ensuring that questions were clear, relevant, and capable of eliciting data suitable to inform subsequent resource development. Pilot feedback supported adjustments to question wording, format, and sequencing, enhancing both the face and content validity of the instrument (Bryman, 2016). This iterative approach served as a form of reflexive methodological evaluation, allowing the researcher to reflect on potential sources of bias, clarify ambiguities, and optimise the questionnaire for practical deployment. Following minor revisions, the questionnaire was judged fit for purpose, capable of generating data that would provide meaningful insight into practitioner perspectives while remaining ethically sound, minimally intrusive, and aligned with the overarching applied goals of the research.

5.2.4 Data Collection

The data was collected over a period of three months from November 2023 to February 2024. These took the form of anonymous questionnaire responses which provided both qualitative and quantitative data. The questionnaire content related to the assessment and treatment process involved in the rehabilitation of MTD in singers, with the aim of allowing comparison and extending the breadth of knowledge to inform the final resource design. All participants provided responses to all questions, and questionnaire data was then thematically analysed using in vivo coding to preserve participants' own language and perspectives.

The response rate must be acknowledged as a limitation in terms of representativeness. Of the 75 individuals invited to participate, only 23 completed the questionnaire, resulting in a response rate of approximately 31%. This relatively low rate introduces the possibility of volunteer bias, wherein those who chose to respond may differ in meaningful ways from those who did not. For example, participants may have had a stronger interest in MTD, more positive or negative experiences with the rehabilitation process, or a greater willingness to engage in reflective practice. As a result, the data may disproportionately reflect the views and experiences of a self-selecting subgroup, limiting the generalisability of the findings.

This potential bias should be considered when interpreting the thematic outcomes and drawing conclusions for broader application. While the data gathered is rich and informative, it may not capture the full diversity of perspectives within the target population. Therefore, findings should be viewed as indicative rather than definitive, and further research with a larger and more representative sample would be valuable to validate and expand upon the themes identified.

Participant responses have been aligned to individuals throughout the analysis and discussion to allow for the tracking of evolving viewpoints and comparison where required. The participant identifiers used are:

11 speech and language therapist participants have been identified as SLT#1 – SLT#11

7 singing teach/vocal coach participants have been identified as ST/VC#1-ST/VC#7

3 singing voice rehabilitation specialist participants have been identified as SVRS#1-SVRS#3

1 combined speech and language therapist/singing voice rehabilitation specialist/singing teacher/vocal coach participant has been identified as SLT/SVRS/ST/VC#1

1 combined singing voice rehabilitation specialist/singing teacher/vocal coach participant has been identified as SVRS/ST/VC#1

5.3 Thematic Analysis

Analysis initially used Patton's (1987) content analysis techniques, followed by an adapted in vivo coding approach to phase two and three of Clarke and Braun's framework by Saldaña (2013) (Table 20), both of which were woven throughout the process, to identify themes and patterns that were both coherent and prominent within the data.

Codes for the qualitative data were created through a line-by-line analysis of the comments and based on the research questions, literature review, and theoretical perspective of the study. The coding process ensured that all data was considered equally and any bias that might be introduced was limited. Codes were listed and grouped by similarity. The categories were then reviewed to determine the themes that emerged. Five themes (Figure 10) emerged from the synthesis of the 22 initial codes via in vivo inductive coding (Table 21).

Table 20

Questionnaire Data Coding Process (Adapted contextualised In Vivo Coding and Saldaña (2013)).

Cycle No.	Description	Form	Optimum amount: Narrowing Process	
1.	The collected qualitative raw data	RAW DATA – Survey responses	23 full responses Transferred to table form by question and respondent	
2.	Response count by subject	One or two words	By % of responses By % of respondents By type of respondent	Descriptive Stats produced
3.	First Order Codes development	One/two-word codes	Search for patterns Repetitive meaning	Responses coded and grouped into broad category
4.	First output major categories	One/two-words	Search for patterns Repetitive meaning	Narrowing of concepts 5 categories
5.	Refinement into themes	One/two-word themes	Refinement into themes	5 themes – refine labels

Table 21

22 initial questionnaire data codes.

Client commitments	Direct therapy
Client circumstances	Indirect therapy
Additional demands on client	Education
Client driven	Liaison
Client preference	Communication
Client demands/needs	Interaction with others
Body	Self-assessment
Breath	Visual assessment
Resonance	Audio-perceptual assessment
Phonation	Assessment by communication
SOVT	Assessment by palpation

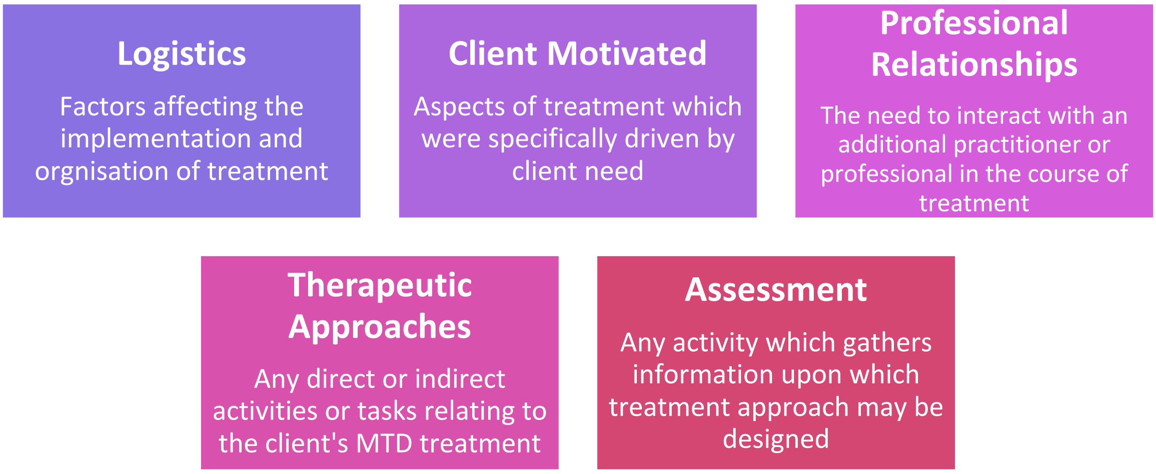

Figure 10

Study two themes from coding process.

Patterns of response were identified and sorted into frequency of mentions by practitioner role within responses which, combined with the analysis of closed question response allows additional quantitative demographic data within each question response which will be used to support qualitative discussion where appropriate.

5.3.1 Theme descriptors and areas of convergence

Logistics (Links noted to client motivated)

The content in the theme of logistics focuses on the logistical, organisational and management-based aspects of treating a singer with MTD. It reflects the following considerations made by those working with MTD in the singing voice; client circumstances, time constraints, modalities of support and the need to proactively contact others.

Client motivated (Links noted to logistics)

Most considerations prior to treatment design are client-driven, as would be expected in a client-centred practice. Although the theme primarily of client motivation converges with logistics, it extends across each role and each stage of client/singer treatment process and progress.

Professional relationships (Links noted to logistics)

Liaison between practitioners via email, calls, video call, or letter are evident across several questions, despite there being no direct enquiry within the wording. Additional relationships with multidisciplinary teams, choreographers and singing teachers were discussed, allowing examination of existing and potential collaboration and shared experience for the benefit of the client/singer.

Therapeutic interventions (Links noted to client-motivated and assessment)

Within the theme of therapeutic interventions, a wide variety of approaches were discussed and suggested. SLTs work with spoken voice first in the main, while the response from SVRS/ST/VC show a difference in approach – tending to reflect singer style and voice use. Exercises are broadly similar, with a weight on semi-occluded vocal tract exercises (SOVTEs), although additional exercises were identified as based on the therapeutic programmes identified by the SLTs.

Assessment (Links noted to Logistics, Client-motivated, therapeutic approaches, professional relationships)

The assessment process covers the breadth of all aspects involving the client. From circumstances to attitude to availability – they feed into the design of treatment which is based then on the assessment of MTD diagnosis. Varied assessment methods, therapeutic approaches, communication levels were noted within responses, while similarities within the client-centred nature of approaches and treatment design was evident.

5.4 RESULTS

5.4.1 Quantitative Data Findings

The online questionnaire attracted 23 participants in total. Each participant provided responses to all questions. Descriptive statistics from closed questions were generated using EXCEL. Responses showed several combined roles within participant group (Figure 11), including one respondent who identified as a combined speech and language therapist, singing voice rehabilitations specialist and singing teacher/vocal coach, and another respondent who identified as a combined singing voice rehabilitations specialist and a singing teacher/vocal coach. These combined roles may support the view that bringing together the knowledge and expertise required in distinct practitioner roles in a single voice care worker may better serve the singer.

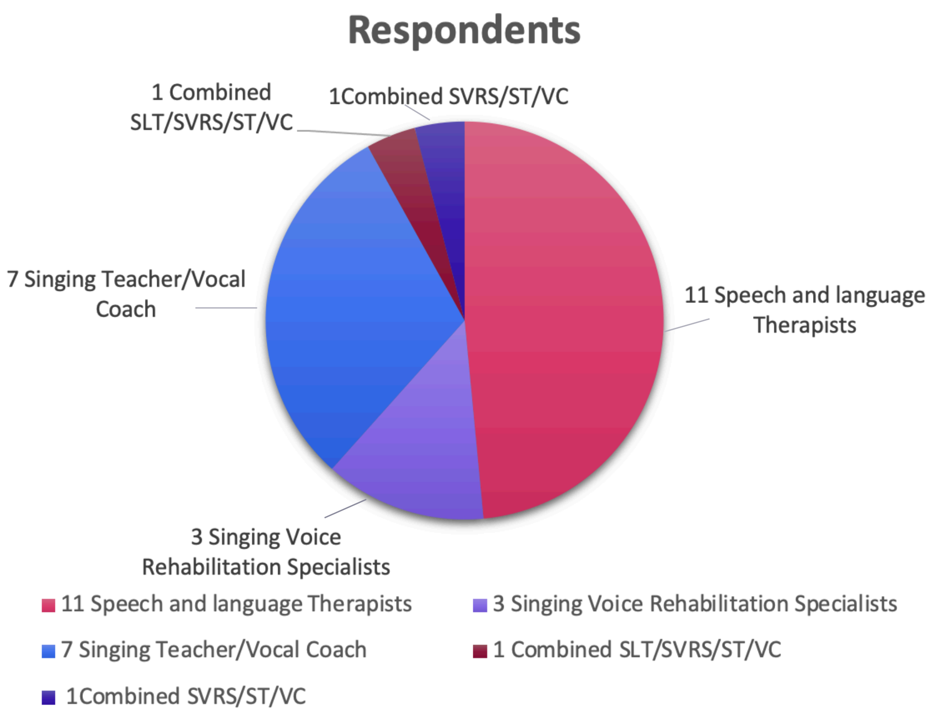

Figure 11

Respondents single and combined role types.

Data gathered illustrated the maximum number of SLT sessions undertaken when working with MTD in the singing voice was nine, although most responses identified between three and six sessions.

5.4.2 Key Findings

The key findings generated by study two through practitioner questionnaire suggest variation in approach to treatment although the use of core therapeutic approaches was found to be a common factor across practitioner groups. The impact of findings suggest singers can expect treatment designed around their own needs and linked to practitioner position, interest, and knowledge. Results were inconclusive with regards to awareness, interest, or knowledge with regards to the musical theatre singer and their additional demands/requirements. It is recommended that future research considering the efficacy of individual treatment approaches, the role of the multidisciplinary team, and the specific needs of the musical theatre performer with regards to the increased risk of additional laryngeal tension and efficacy of treatment design may be valuable.

5.5 DISCUSSION

Study two used an online largely qualitative questionnaire to gather practitioner data with a view to answering three research questions and inform the design of resource two. Contemporary therapeutic practice was the focus of data collection, to place existing knowledge gathered through review of the literature in practical context.

The value of qualitative questionnaire use can be high, as participants are able to answer open-ended questions in their own words and own time. *"Qualitative surveys can produce the rich and complex accounts of the type of sense-making typically of interest to qualitative researchers – such as participants' subjective experiences, narratives, practices, positionings and discourse"* (Braun et al., 2020). It was with this hope that an overview of practitioner assessment and treatment processes was collected to build deeper understanding of subsequent study findings, their application in a practical setting, and relevance to the design of resource two.

From the five original sub-questions which make up the overarching research question, the following were investigated through the practitioner lens within questionnaire data collection:

- How is tension currently measured?
- What is the impact of MTD on the singing voice?
- What are the main treatment approaches to MTD?

To address these questions, draw meaningful inferences from questionnaire data, and use the findings to influence resource design, participants were encouraged to submit answers in their own words to a series of open questions. The results are subsequently examined by theme.

Theme 1: Logistics

Responses which included logistical considerations were noted in six of the 13 questions. The emphasis upon accommodating client practicalities, considering potential barriers to treatment and liaison patterns with either ENT, SLT, multi-disciplinary team or creatives in contact with the client/singer. Almost three quarters of SLT respondents reported that they would normally have three to six sessions allocated to the treatment of a singer with MTD. When asked about the main considerations contemplated before designing treatment, responses were varied, although over a quarter of SLT respondents identified the client's lifestyle as preferred considerations, while modalities of support were identified as the main considerations by the combined SLT/SVRS/ST/VC and SVRS/ST/VC respondents (Scearce, 2016; Stemple & Fry, 2010). With regards to the communication of diagnosis and treatment between practitioners, 82% of SLT respondents agreed that they receive a client report from the initial ENT consultant, while there was no clear pattern of information sharing between ST/VCs or SVRS and SLTs, with one singing teacher identifying that they often find out information of previous treatment from the singers themselves and two who regularly independently contacted the SLT to find out information.

Information sharing

Q3 - If you are a Speech and language therapist (SLT), do you liaise directly with the Ear, Nose and Throat (ENT) clinic who provided the initial diagnosis of MTD to the singer? If so, please give details of this handover.

Q5 - If you are a Singing voice rehabilitation specialist or Singing teacher, do you liaise directly with the Speech and language therapist who provided initial therapeutic intervention? If so, please give details of the handover.

"Yes, I will receive a letter/report from them with info of laryngoscopy findings, hx and whether any medical or surgical intervention is required." (SLT#5)

"Yes – I would usually email the SLT or ask the singer to get in touch with them and ask if they can send an overview of the previous therapy. They will send an outline of the diagnosis and the approaches used – this is usually brief." (ST/VC#3)

"On occasion I have been able to contact the SLT and have discussed treatment and the types of exercises recommended by the specialist. In other instances, this was not possible/not welcomed by the SLT, and I have worked with the patient to support them in the exercises and recommendations given to them by the SLT." (ST/VC#1)

"Not always, sometimes it is a direct referral from the ENT consultant. The nature of the handover can be varied, from the detailed sharing of all session notes, to just 'see what you can do'." (SVRS#2)

Throughout the responses and across practitioner groups, there is a focus on currency and considering the nature of the situation in real time. Harris (2018) states *"in an ideal world, the SLT and singing/spoken voice teacher will work collaboratively together with the patient, particularly during the generalisation period"* (p.149). Reflecting this connectivity, the verbs call, ask, liaise, and observe were frequently noted in response language across practitioner groups. Each of these verbs, however, places the responsibility upon the practitioner to reach out, move towards, and action change personally (Flock et al., 2023). When describing the liaison process between SLT and ENT to gather diagnostic information to aid treatment design, all SLTs had some contact with the ENT, although some stated they did not have routine contact, raising the question regarding the network between ENT and SLT practitioners and whether some may only have a basic handover. The link to the logistics of contact between practitioner groups may be useful to investigate further with regards to SLT to ST/VC connection which was addressed by question six. Responses from ST/VCs around the level of liaison between ST/VCs and SLTs were mixed and suggest that some ST/VCs must reach out to SLTs for information or simply ask the singer for prior treatment details. The established sharing of confidential information between clinical practitioners does not extend to the ST/VC due to the ethical considerations around health information (Eastwood & Maitland-Scott, 2020), leaving ST/VCs reliant on the singer and their memory or understanding of assessment details.

The description of barriers to treatment and treatment being dependent on specific factors suggests the need for flexibility around treatment design and delivery, clearly supporting the client-centred pattern running through the questionnaire responses. It may be concluded that constant flexibility and the ability to adapt to the needs of others may impact treatment programme design and delivery. With regards to modalities of support, SVRS responses showed a greater degree of flexibility than that reported by SLTs which may be due to the focus of SLT delivery being centred around specific speech-based outcomes (Stemple & Fry, 2010), while SVRSs may have a wider application of treatment approaches which can be more flexibly delivered, reinforcing the assertion that SVRS input may be the most beneficial option for the singer with MTD, yet may not be the most accessible.

As expected, there were differing approaches with regards to the progression towards more demanding voice use for the singer with primary MTD which could be expected due to the varied practitioner respondents, however there was a logistical difference shown within the responses. These ranged from directly asking a singing teacher for input (SLT response), to conducting in-person observations during performance or rehearsal (SVRS response), and the design of progression being dependent on the date of the singer's performance (ST/VC response). In responses to the additional question regarding the influence of musical theatre demands on treatment design, widely different logistical considerations were reported. SVRS responses included liaising directly with choreographers, while both SVRSs and ST/VCs mentioned 'taking into account' physical factors within the rehearsal and performances. The lack of detail within the comments made it difficult to establish what 'taking into account' or 'physical factors' mean within this context.

Theme 2: Client-motivated

Responses with a focus on aspects of treatment driven by the various needs of the client/singer were noted in five out of the 13 questions. Treatment design, reflection of style of singing within therapeutic exercises, guiding to more demanding repertoire and consideration of the additional demands of the musical theatre singing voice were linked directly to client-driven characteristics. When discussing the main considerations before treatment design, singer goals were identified by each respondent group. Singer temperament was identified by two SVRSs as a factor influencing treatment design, linking to the client influence upon a variety of treatment aspects.

Main consideration before treatment

Q2 - What are the main considerations before designing treatment?

"Client motivation, attention, and availability. Barriers to therapy (e.g. travel/ support required/ technical literacy and access to any required resources/ time and availability of both client and therapist). Modalities of support preferred (e.g. in independent practice there are more options for wider use of support modalities than in NHS- e.g. motivational WhatsApp messages/ videos/ audio guides/ printed resources/online or in-person sessions." (SVRS#2)

"The severity and nature of symptoms, lifestyle and circumstances, current vocal roles and requirements." (SLT#1)

"What the singer would like/needs to be able to achieve and the timeframe usually. This depends if they are aiming to go back into a specific performance." (ST/VC#4)

"Ensuring awareness of client goal/s for activity and participation. What will 'success' or a positive outcome look/feel/sound like? Client expectations. Client motivation, attention, and availability." (Combined SLT/SVRS/ST/VC#1)

"In no particular order, what are the vocal demands (i.e. what does the client need their voice for), how long has the potential MTD been going on for, perceptual assessment results, client report, urgency around voice rehab." (SLT#7)

The breadth of considerations made it impossible to generalise; however client/singer goals emerged as a repeated answer throughout. Singer repertoire was used within exercise design by SVRSs and ST/VCs, however genre was not specified by respondents. It is notable that all SLTs answered 'sometimes' to the question 'When working with Musical theatre singers, do the demands of specific musical theatre voice qualities influence treatment design?", while all SVRSs and ST/VCs answered 'yes'. Most considerations prior to treatment design are client-driven, as would be expected in a client-centred approach, however only a small number of responses showed initial therapeutic approaches took the singer's most used singing style into account.

Directly linked to this, consideration of the additional demands of musical theatre were mentioned as part of an ongoing conversation/discussion and usually by the SVRS and ST/VC rather than SLT, with SLTs only 'sometimes' considering the demands of musical theatre when designing treatment, most ST/VCs and SVRS did.

Overall, responses suggested the successful treatment is dependent on multiple factors, many of which are outside of practitioner control. It was clear that treatment design is client-driven to an extent, although as singing style was generally not considered, nor the additional demands of musical theatre which may have a large impact on vocal health/approach, there seems to be an area of consideration which may benefit from further research. The need for overall flexibility in design and delivery of core therapeutic approaches was reiterated in a high number of responses, although SLT responses generally indicted that the initial vocal therapy exercises do not reflect the singing style of the singer, while SVRS and ST/VC responses showed a clear and client-driven adaptation of exercises to reflect the singing style of the singer. Although it may be assumed that singers would have a long-term goal of returning to pre-MTD singing, SLT practitioners responded minimally to the question of how they might guide singers to bring results from their therapeutic work into a wider more demanding vocalising context. These findings link to the initial treatment of the spoken voice within SLT treatment design; therefore, it is to be expected that the movement into more demanding sung vocalisation would not be undertaken by the SLT practitioner and greater responsibility placed onto the SVRS and/or ST/VC at that stage. SVRS and ST/VC responses universally consider the singing aims and accommodate them with regards to progression to more demanding repertoire.

In contrast to the responses around moving into more demanding vocal work, all SLTs agreed that the demands of musical theatre 'sometimes' influence treatment design, and although not providing enough detail to hypothesise upon how this might manifest within the practical elements of treatment design, it suggests a level of awareness from the initial treatment process of the individual nature of the musical theatre voice. In contrast to the SLT responses, the majority of ST/VC and SVRS reported that the demands of musical theatre do influence treatment design. In addition to the acknowledgement of musical theatre demands within treatment design, the majority response from SVRS and ST/VC confirmed that navigating the additional demands of musical theatre was an ongoing discussion with the singer, linking to the client-driven nature of the responses in general.

Theme 3: Professional relationships

Liaison or communication between practitioners or creative professionals was described briefly in five of the 13 questions. Although there is the expectation of communication between SLTs and ENTs, there is no clearly established method or expectation of information sharing between SLT and ST/VCs. With regards to progression from initial treatment to more demanding sung repertoire, 55% of SLT respondents would liaise with a singing teacher to guide singers into repertoire from initial therapeutic intervention.

Liaising with SLT as an SVRS or ST/VC

Q4 - If you are a Singing voice rehabilitation specialist or Singing teacher, do you liaise directly with the Speech and language therapist who provided initial therapeutic intervention? If so, please give details of the handover.

"I work directly with the SLT in the same space. I would be present at the moment of diagnosis. I would be involved in the design of the treatment plan. I would then implement treatment after the SLT has worked on the spoken voice, this might be the same day or after one to six sessions with the SLT depending on the severity of the issue." (Combined SVRS/ST/VC#1)

A combined SVRS/ST/VC respondent identified that they work directly with the SLT which ensured a detailed handover and progression onto singing voice work, however, it was unclear as to whether this was by email, mail or via the singer themselves. When discussing approaches to moving the singer on to sung aspects, the responses were varied across the different practitioner roles as you would expect. A notable difference was within the SLT responses which had little similarity and ranged from working from the start of treatment with the singing voice and style in mind, to no approach at all, only the advice to find a singing teacher.

A limited number of responses identified a willingness to reach out to creative professionals who were working with the client/singer in a performance setting. These included liaising with choreographers to identify appropriate voice use for the singer recovery stage. Within the responses, the role of the SVRS is highlighted as being pivotal as they can be present at diagnosis and work directly with the SLT to facilitate a smooth transition to the singing voice from initial spoken work.

Minimal additional relationships were discussed, suggesting an element of isolation within each role, and a clear focus on the client which forms the main described relationship. Responses suggest that the establishment of relationships within a larger multidisciplinary team for each practitioner type may provide an elevated level of care for the singer, while regular interactions with choreographers and singing teachers may encourage shared practice and be beneficial for those singers based in the musical theatre genre.

An SVRS response mentioned considering the need for multidisciplinary team input before treatment design, however ST/VCs did not mention reaching out to additional practitioners within responses around exercises/treatment design, showing a clear difference within practitioner attitudes towards collaboration which may be based on a lack of awareness of the potential for team input, or a lack of connection within a network of practitioners. Following on from the lack of multidisciplinary team input, some SVRSs and ST/VCs call or email SLTs to discuss previous diagnoses and treatment inputs, while one of the SVRSs is usually present at diagnosis and able to work directly with the SLT, which seems to be the ideal situation, yet it is unclear from the questionnaire responses how prevalent the practice is, or how logistically possible this would be for each client/singer.

Guiding the singer to more demanding sung repertoire

Q10 - How do you guide singers to bring results from their therapeutic work into wider vocalising?

"Carry over starts from the very beginning. I introduce voice exercises as the training tool to feel and elicit easy full voice and move between them and that same easy voice feeling in connected speech." (SLT#1)

"I don't, I advise them to get a singing teacher once they understand their voice and have normal speaking voice." (SLT#9)

When asked how they would work with a singer to move into singing voice work and embed practices, over half of all SLT respondents would liaise with an ST/VC. It is interesting to note that there is no mention of this type of relationship or referral within the responses from ST/VCs or SVRS questionnaire participants.

Additional demands of MT

Q12 - How are considerations of movement, choreography and/or instrumental playing demands built into treatment?

"Working to release the breath without feeling like the student is compromising dance, considering options that may be more suitable vocally for particular movements, but also speaking to the choreographer about what is reasonable given the needs of the singer." (ST/VC#7)

Within open comments regarding the integration of musical theatre demands into singing voice work, several SVRSs and ST/VCs mentioned that they would liaise directly with choreographer to attempt to mitigate the impact of movement on the rehabilitating voice. There was no mention of that type of interaction from SLT respondents.

Theme 4: Therapeutic approaches

Specific therapeutic demands were discussed in six of the 13 questions. The content depended greatly on the practitioner role, although demonstrated a pattern of speech work by SLTs, combined speech and sung work by SVRSs and exclusively sung work by ST/VCs. Breath work, considering release throughout the body was a common sub-theme, especially from SLT and SVRS respondents, with 82% of SLTs and 86% of ST/VCs identifying it as a first area of treatment. The term 'release' was used throughout all practitioner type responses, although not specifically linked to laryngeal de-constriction, with body release identified by 57% of ST/VCs as being an effective approach to MTD in the singing voice. Overall, individual therapeutic approaches in general were extremely varied. It was possible, however, to identify two elements of Stemple's resonant voice therapy model – respiration and phonation - across the responses.

Initial Approaches

Q8 - What are the initial approaches and/or exercises used when rehabilitating a singer with primary MTD?

"I usually work with release first – this may be whole body work, breath and relaxation exercises, neck and shoulder release. It is holistic to start and then moves to more specific areas if needed." (ST/VC#1)

"Understanding where the tensions stem from in the body is generally the first port of call." (ST/VC#5)

"All of the above plus SOVT exercises and a lot of breath and de-constriction work." (SLT#5)

The responses confirm that SLTs work with spoken voice first in the main. The response from the combined SVRS/ST/VC practitioner showed a difference in approach, with exercises and approaches tending to reflect singer style and voice use. Within each practitioner group exercises and approaches are generally similar, with SOVTEs featuring frequently across the responses from each practitioner group. The prevalence of the use of SOVTEs was notable across all practitioners, with 73% of SLTs using them within initial therapeutic approaches (Figure 12).

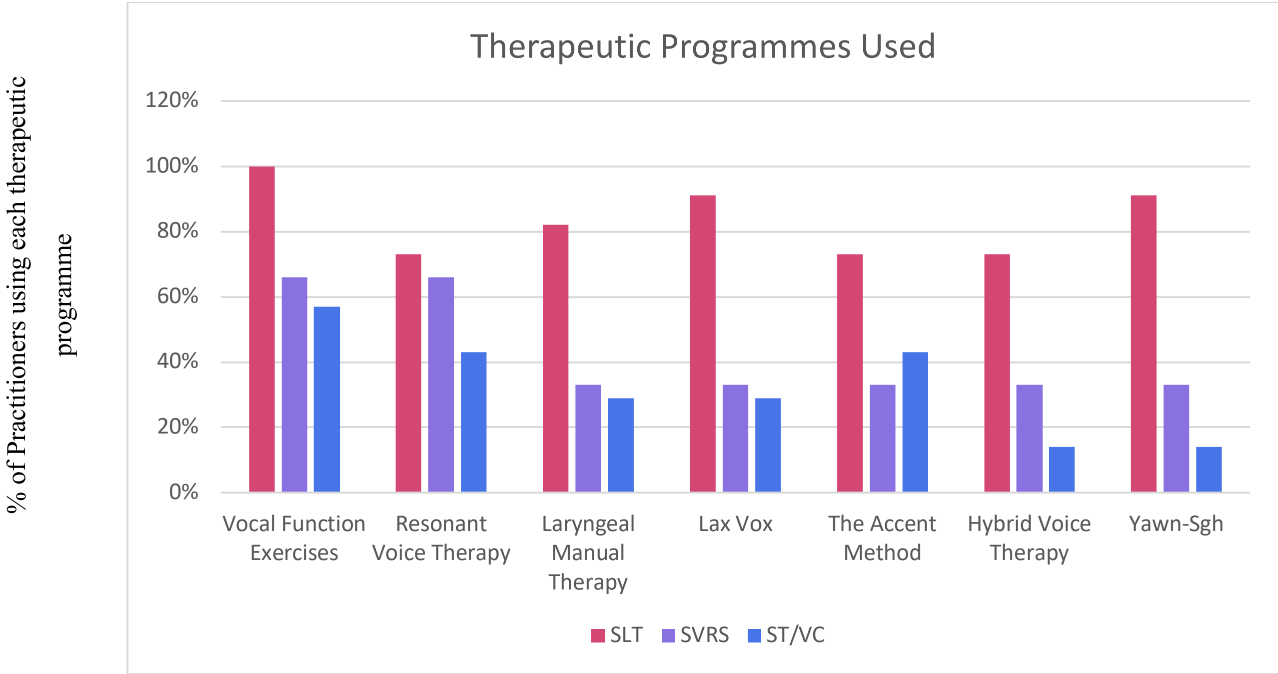

Figure 12

Specific therapeutic programmes used by practitioners when treating MTD.

Vocal function exercises, resonant voice exercises and the accent method were identified as the three most reported therapeutic programmes used by all practitioners. See resource two (Supplementary Resource Two) for an overview of therapeutic programmes. Additional exercises featured within SVRS and ST/VC responses, are linked to, or variations of the therapeutic programmes identified by the SLT responses in question eight.

The descriptions of practitioner approaches to different aspects of treatment design provide an overview of preferred individual practitioner process, a factor which should be considered in resource design. Due to the wide range of treatment approaches found within responses, it is difficult to isolate and assess the effectiveness of individual strategies (Madill et al., 2021). Differing approaches to initial interventions include a wide range from semi-occluded vocal tract exercises (SOVTEs) to body mapping and psychological support, although there is no clear pattern or number of aspects included within the responses. These findings link to the variety of combined therapeutic approaches found previously in the literature (Sielska-Badurek, 2017).

The variety of approaches from SLT and SVTRS practitioner responses provide no clear or specific strategies for ST/VCs to base post-therapeutic progression exercises on, although responses indicated that all ST/VCs agree on the use of breath work, release, and the incorporation of SOVTE-based exercises, while both SVRSs and ST/VC groups agreed on the slow or gradual incorporation of more demanding repertoire into treatment (Scearce, 2016; Stemple & Fry, 2010).

Despite the development of creative approaches, the lack of a clear practical or ideological links between initial therapeutic intervention and those working post-therapeutically suggest that channels of communication between ST/VCs and those providing previous therapeutic intervention should be established and maintained to ensure the singer receives the most comprehensive support (Goffi-Fynn & Carroll, 2013).

Types of MTD

Despite clear categorisation and discussion within clinical and SLT supportive literature (Harris & Howard, 2018), no mention was noted in responses with regards to taking the different types/categorisations of MTD into account in therapeutic approach design for the singing voice.

Manual Therapy

Although nine of the 11 SLT respondents stated they would use laryngeal manual therapy (LMT) within therapeutic design, the use of LMT was mentioned by only one ST/VC, raising the question as to where physical therapy is placed within the expectations of ST/VC input, and whether it begins to blur the line between SVRS and ST/VC. The ethical and professional questions surrounding the level of training required to deliver laryngeal massage is ongoing.

Additional demands of Musical theatre

Within the discussion of whether the individual demands of musical theatre are considered by each practitioner group, some did not consider the additional demands at all, while others factored them into treatment design. It is unclear as to how treatment was adapted to consider movement, choreography, and/or instrumental playing, apart from the SVRS and ST/VC mentions of liaising directly with the choreographer. Overall, there is a clear difference in approach between SLT and SVRS or ST/VCs, with the latter group raising the possibility of direct communication to facilitate post-therapeutic progression when navigating specific physical demands of musical theatre.

Theme 5: Assessment

Questions two and three focused on the assessment process. Responses indicate that the assessment process essentially covers all aspects involving the client. From circumstances to attitude to availability – they feed into the design of treatment which is based then on the assessment of MTD diagnosis. Practitioners assess to evaluate the logistic impact, therapeutic approach and need for inter-relationships throughout the process. A wide breadth of assessment approaches which concern measuring MTD to chart progress and the considerations undertaken before treatment design were noted. The significant observation within this theme is the lack of standardisation and diversity of combination of assessment methods. Self-reporting, palpation and observation were the most common sub-themes throughout this theme.

Types of assessment:

All practitioners assessed clients to determine logistical needs, appropriate therapeutic approaches, and, in the case of SLTs and SVRSs, the potential need for interdisciplinary collaboration. Assessments vary widely and are influenced by individual client factors such as personal circumstances, attitude, and availability. Common assessment components include reports, proformas, perceptual analysis, case histories, discussions, findings, recordings, observations, rating scales, and client feedback. Key words included report, proforma, perceptual analysis, history, discussion, findings, recordings, observation, scale, felt, elimination, listening, guidance, test, look, listen, ask.

Measuring MTD to chart progress

Q2 - How do you initially measure Primary Muscle Tension Dysphonia (MTD) to chart progress?

"Client self-report (VHI/ SVHI -10), Peri laryngeal palpation using proforma, Auditory perceptual analysis (GRBAS/ CAPE-V), Case History Discussion (context, exacerbating & relieving factors, consistency, severity, description of symptoms), endoscopic footage, audio recordings (speech and singing), observations of speaking and singing using a model such as Christina Shewell's Voice Skills Perceptual Profile." (SLT#7)

"GRBAS scale, Vocal Tract Discomfort Scale, Vocal Handicap Index." (SLT#1)

"As a singing teacher/voice coach, I don't measure MTD because it's not my job to diagnose. However, I do keep an eye/ear out for tensions including pressed vocalisation, visible straining, muffling of the voice, singer discomfort, holding patterns in the body etc." (ST/VC#3)

"I listen and observe, singer self-perception." (SVRS#3)

While SLTs and SVRSs combine both subjective and objective measures, ST/VCs rely primarily on observation and client feedback. Each approach contributes to tailoring treatment plans based on the assessment of MTD symptoms.

Main considerations

Q3 - What are the main considerations before designing treatment?

"Primary and secondary causes, occupational use, main area of identified tension." (SLT#11)

"...pathology, Patient concern/motivation, extent of DY and impact on life." (SLT#2)

"Diagnosis, MTD type, client goals, client motivation, time available for therapeutic work." (SLT#1)

Responses indicate that each practitioner can form a detailed picture of the client, adapt approaches to suit, design treatment around client goals, and potentially ensure appropriate differentiation of intervention between individuals. The volume of response linked to the theme of assessment highlights the importance of and continued need for varied approaches to assessment throughout the treatment process. Responses indicate a reflective practice which allows flexibility and adaptive approaches to treatment. SLT responses focus on primary and secondary MTD causes, while SVRS responses emphasise the need to assess barriers to therapy, preferred modalities of support, and the potential for multidisciplinary team input. The key concept of empathy for the client which features within many responses emphasise the importance of client-practitioner relationship building to ensure optimum outcomes.

5.6 Strengths and Limitations of Study Two

Qualitative research allows the researcher to present a deeper understanding of a social setting or activity as viewed from the perspective of the research participant while emphasizing exploration, discovery, and description (Bloomberg & Volpe, 2008). By using a survey method with open question format, the reader is provided with a detailed description of a setting and its participants, created by an analysis of the data for themes, patterns, and issues (Merriam, 1998; Stake, 1995). The qualitative data is strengthened by the addition of quantitative analysis of distribution and closed question responses, providing useful descriptive statistics within which to contextualise the findings further.

Although practitioners who were associated with BVA, BAPAM and AOTOS were approached to participate, study two did not provide an opportunity for the inclusion of different types of voice rehabilitation specialists and practitioners who may practice independently of these bodies. Data for study two was collected during a fixed time, allowing the researcher to obtain a brief account of practitioner viewpoints and approaches used in the treatment of MTD in the singing voice. While the viewpoints and approaches may be appropriate for the period of the study observed, it may not represent the breadth of practitioner knowledge or creativity. While the data collected may be transferable, study two alone does not provide a complete evaluation of the treatment approaches to MTD for all singers. Finally, while the researcher intends to portray the current approaches to MTD treatment in the singing voice, the researcher acknowledges their own bias and interest in treatment development. While the questionnaire respondents are used to help gain a deeper understanding of the participant's approach to the MTD treatment process, the researcher acknowledges that the data gathered may be influenced by the practitioner reporting.

5.7 CONCLUSION

The questionnaire findings outline a client-centred, client-driven practice that calls for all practitioners to oversee organisational issues, respond to clients' needs, evaluate to track development, and provide suitable treatment methods with a degree of flexibility. Responses to the theme of logistics and professional relationships revealed an uneven set of expectations, with communication being a vital aspect of treatment design, yet highlighting a lack of direct or established avenues to the information required. As expected, direct links between therapeutic approaches and assessment were evident, demonstrating the extensive range of assessments necessary for every role alongside the balance required between client-specific requirements and practitioner delivery. The analysis of these responses confirms the wide variety of assessment methods used and supports the previous scoping review conclusion that an easily replicable method of assessment among practitioners would allow reliable progress tracking when working in an interdisciplinary team context. The impact of this consistency may be increased singer confidence in treatment approaches, resulting in greater independent application of both direct and indirect therapeutic practices, continued progression and awareness, and increased possibility of the singer avoiding muscle tension dysphonia in the future. Within each identified theme, there are clear differences in approach between practitioner respondents. The variety may be attributed to the diversity of approaches and treatment aims used by each practitioner role and is to be expected. Within the theme of therapeutic approaches however agreement is found with regards to the incorporation of breath work, release strategies and semi-occluded vocal tract exercises across all practitioner groups. More notable are the variety of approaches and attitudes reported towards assessment, communication and professional relationships within practitioner groups themselves. The wide range of potential client experience makes it difficult to ensure that singing teachers can be equipped with the breadth of knowledge required to build upon initial therapeutic treatment and support the singer in their return to performance level voice use.

It is proposed that the expectation of clear lines of communication between singing teachers, singers, and those providing initial therapeutic intervention, alongside accessible and established methods of assessment which can be easily replicated may help to ensure those working with the MTD-impacted voice can provide synchronised and progressive treatment which allows a return to performance-level voice use.

6.1 INTRODUCTION

After completing an initial questionnaire to establish practitioner views and approaches with regards to the assessment and treatment of MTD in the singing voice (Chapter 5), a series of case studies were conducted from individual practitioner treatment sessions to provide additional insight into current real-time approaches to working with singers with MTD.

"Bridges can be built through the process of case study inquiry itself, when complex, dynamic processes are investigated within authentic settings," as noted by Butler (2011) in reference to the alignment of practice and theory (p. 358). Merriam (2009), Stake (1995), and Yin (2014) describe case studies as an empirical interactive inquiry approach which have the capacity to yield a variety of evidence sources that support rich and in-depth descriptions of the finite settings. Moreover, Duran et al. (2006) agrees, stating that case studies as sources of evidence which include evidence for the process of the selection of therapeutic approaches, judgements made, and descriptions of the pertinent features of both approaches and participants. It was with this in mind that a 'snapshot' of the treatment process was collected from therapeutic and singing lesson-based sessions with singing performers who had been diagnosed with MTD with the aim of building deeper understanding of the questionnaire responses, their application in a practical setting, and relevance to the design of resource two.

The aim of the analysis of the case study reports was to provide an overview of how current treatment modalities for MTD in the singing voice are being used in real time, with a view to identifying common approaches to charting progress, treatment and interaction. Four of the five sub-categories within the research question were provided as prompts to practitioners gathering session data, these included:

- How is tension currently measured?
- What are the main/potential causes of MTD?
- What is the impact of MTD on the singing voice?
- What are the main treatment approaches to MTD?

6.2 METHODOLOGY

6.2.1 Participants and Setting

To explore therapeutic responses to MTD in this specialist population, a qualitative case study approach was employed with a purposive sample of speech and language therapists (SLTs), singing voice rehabilitation specialists (SVRSs), and singing teachers/vocal coaches (ST/VCs). Participants were recruited via email through professional bodies including BAPAM, BVA, and AOTOS, targeting practitioners with experience in vocal rehabilitation for musical theatre singers. Priority was given to individuals who had previously engaged with the research during the practitioner questionnaire phase, reflecting both willingness to participate and prior familiarity with the research context.

The case study format was selected for several theoretical and practical reasons. It allowed practitioners to provide detailed, contextually rich accounts of clinical reasoning, treatment planning, and observed outcomes in a manner that prioritised ecological validity and professional autonomy (Yin, 2018). This method enabled exploration of nuanced, idiographic insights that are often not captured through structured questionnaires or purely quantitative measures. The approach accommodated ethical and practical constraints associated with working in clinical settings. Direct observation or videorecording of therapy sessions was considered and rejected due to client confidentiality concerns, potential disruption to therapy, and time/resource limitations, consistent with recommendations for low-burden and ethically sensitive designs in clinical voice research (McGrath et al., 2023).

Self-reported case study reports, although subject to limitations such as recall bias, selective reporting, and inter-practitioner variability (Althubaiti, 2016), offered a pragmatic means of accessing professional knowledge across multiple settings. The flexibility in submission modalities, including typed reports, audio recordings, or voice notes with accompanying transcripts, was designed to support practitioner preferences, enhance participation, and reduce barriers associated with time pressures or transcription demands. In practice, all participants opted for typed reports, which may reflect a preference for greater control, clarity, and the ability to anonymise sensitive client information prior to submission.

6.2.2 Inclusion and exclusion criteria

To explore treatment approaches from the perspective of practitioners involved in the voice rehabilitation process, it was expected that participants for the series of case study reports met the following criteria: Registered with one or all the following bodies: BVA, Royal College of Speech and language therapists (RCSLT), BAPAM, AOTOS. Participants were asked to self-identify with the inclusion criteria. SLT participants were invited to take part if they self-reported an interest in working with or regularly work with professional singers as listed on the BVA list of practitioners (Britishvoiceassociation.org, 2025). SLT participants were required to be part of an established voice clinic, either via NHS or private practice. ST/VC participants were included if they identified as working with Contemporary Commercial Music (CCM) or musical theatre singers (information as listed on personal biographies or institution biographies was used in targeted recruitment). SVRSs were required to self-identify as such and have formal affiliations with an established voice clinic either in the UK or internationally (as listed by BVA and/or Vocal Health Education (Vocalhealth.co.uk, 2025)).

These criteria ensured that participants had the expertise and clinical context relevant to the research questions. Exclusion criteria omitted practitioners without these qualifications or affiliations, ensuring that the data reflected credible professional perspectives.

6.2.3 Research Plan and Implementation

Three practitioners were able to match participation criteria required during the data collection timeframe. The data collection timeframe was a period of five months from February to May 2024 and consisted of written case study reports. The collected data related to the assessment and treatment process involved in the rehabilitation of MTD in singers. Specific treatment approaches and reactions from individual practitioners were collected to allow comparison and further breadth of knowledge to inspire the design of resource two. Case study data was subjected to word frequency analysis and initial content was thematically analysed by hand using in vivo coding. This approach allowed for both breadth and depth in capturing practitioner reasoning and informed the iterative development of resource two.

6.2.4 Data Collection

Practitioners and participants were provided with detailed participant information sheets (PIS) and consent forms to ensure informed participation, outlining the project aims, ethical considerations, and their rights(Appendix F). The PIS offered flexible submission options for documenting the case studies, allowing practitioners to choose between providing: (1) typed written reports, (2) audio recordings (to be transcribed by the candidate), or (3) voice notes with accompanying transcripts. This flexibility was designed to accommodate practitioners' individual working styles and time constraints.

In practice, all three practitioners opted to submit typed written case study reports, rather than audio or voice note formats. While the study design allowed for multiple modalities, this uniform choice may reflect a preference for greater control over the clarity and structure of information presented, and the ability to anonymise and edit details more easily before submission. It may have reflected considerations of time efficiency and data protection, as written submissions avoided the need for additional transcription by the candidate or potential confidentiality risks associated with audio recordings.

The practitioner participants comprised of;

Participant 1, a speech and language therapist – identified as SLT#12.

Participant 2, a singing voice rehabilitation specialist – identified as SVRS#4.

Participant 3, and a singing teacher/vocal coach – identified as ST/VC#8.

Each practitioner independently documented their work with a musical theatre singer diagnosed with muscle tension dysphonia (MTD), detailing between three and six sessions. Notes were anonymised and compiled in a single Word document, using the identifiers 'S' (for participants) and 'P' (for practitioner), with individual numbers to distinguish between each case during the analysis process.

The data was thematically analysed using in vivo, inductive coding. This process generated 11 initial codes, which were subsequently grouped into overarching themes. Notably, each of the codes subsequently corresponded with four of the five key themes previously identified through the questionnaire data, offering a level of triangulation between practitioner case study insights and the broader dataset. This method allowed for identification of recurring patterns while remaining sensitive to the idiosyncrasies of individual practitioner approaches, balancing interpretive depth with systematic analytic rigour.

6.2.5 Strengths and Limitations of Case Study Approach

The case study design provided several advantages. It supported exploration of practitioner decision-making in real-world clinical contexts, allowed for professional autonomy in reporting, and enabled collection of rich, idiographic data relevant to the development of practical resources. Triangulation with questionnaire data enhanced validity, while flexible submission options facilitated participation and adherence to ethical constraints.

However, limitations include potential self-report bias, variability in the detail and quality of reports across practitioners, and a small sample size that limits generalisability. While observational or longitudinal methods could have yielded more controlled or objective measures of clinical outcomes, these were not feasible due to ethical, logistical, and confidentiality constraints in private and NHS practice settings (Creswell & Poth, 2018). The case study format therefore represents a pragmatic compromise, optimising data richness and ecological validity while maintaining ethical and practical feasibility.

6.3 Thematic Analysis

The analysis of data followed the same process as was used within study two (Chapter 5). An adapted in vivo coding process (Table 22) was employed, and eleven codes were identified during the initial ordering and categorised in four final themes (Table 23). It was noted that although an inductive approach was used, the process generated four of the five themes noted within study two. The theme of

‘Professional Relationships’ which had previously been identified in the questionnaire response analysis was not represented within case study data.

Table 22

Case Study Coding Process (Adapted contextualised In Vivo Coding and Saldaña (2013)).

Cycle No.	Description	Form	Optimum amount: Narrowing Process	
1.	The collected qualitative raw data	Raw Data – Written Case Study Notes	3 Case studies of treatment of MTD	
2.	Meaningful Quotes Paragraphs	Brief lines/ chunking	Split into paragraphs/sections	
3.	First Order Codes development	One to two words	2-4 codes per paragraph	11 codes
4.	First output major categories	One-word codes	4 categories Narrowing of concepts	Aligning codes with categories
5.	Refinement into themes	One-word codes	4 themes	4 themes – refine labels
6.	Comparison with questionnaire themes	Aligned under themes	4 of 5 themes present in case study data	

Table 23

Identified categories and corresponding themes in case study report data.

Categories	Themes
Diagnosis	Logistics
Client History Communication Client Driven Progress	Client Driven
Symptoms Assessment	Assessment
Impact on Singing Voice Treatment Client Lifestyle Possible Causes of MTD	Therapeutic Approaches

6.3 RESULTS

6.3.1 Key Findings

Key findings suggest that differences in practitioner approaches between the distinct roles were identified, however underlying similarities noted in exercise content and session design seemed to reflect practitioner interest and skill. The impact of these findings suggests that there is value to be found in the establishment of a shared vernacular between speech and language therapists and those working with the voice beyond therapeutic intervention. Communication and awareness of potential approaches taken by each practitioner type are important for the progression of the singer. Future research should consider examining practitioner attitudes towards collaborative working and the boundaries within which each may usefully operate for the good of the singer. A brief overview of the themes of logistics, client driven, assessment and therapeutic approaches follow prior to detailed discussion in section 6.4.

Logistics

Although a significant aspect within the questionnaire findings, the theme of logistics, here incorporating the category of diagnosis, was minimally represented in the case study data. SLT#12 and SVRS#4 mentioned diagnosis briefly within the context of clinical referral notes, while ST/VC#8 described the reported diagnosis using the descriptive language of the singer themselves (Figure 13).

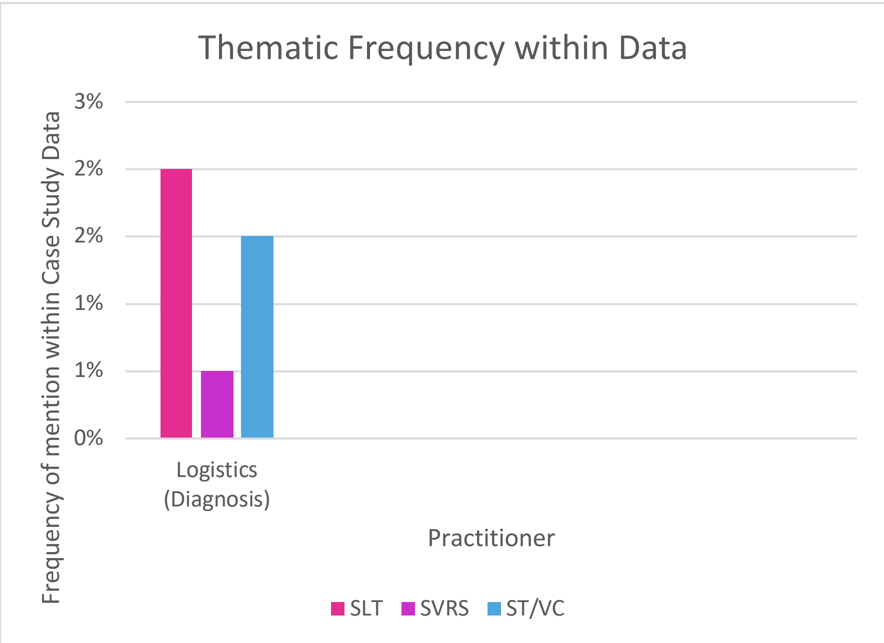

Figure 13

Frequency of logistics referencing within case study reports.

These discrepancies in frequency of mention may illustrate the distance from the initial diagnosis experienced by each practitioner. Clinical reporting may lack the richer client response which may help to shape treatment based on client goals, lifestyle and need, however the specificity of a clinical report may provide valuable insights not appreciated by the client (Danaher et al., 2023). The ST/VC reliance on singer self-reporting without access to the ENT or SLT report could lead to ambiguity around treatment response. On the other hand, the descriptive nature of client-self reporting can provide additional insight, understanding and appreciation of singer attitude towards vocal issue (Thomas, et al., 2023).

"Treated for reflux" (SLT#12) without specification of type of treatment, *"diagnosed with muscle tension dysphonia"* (SVRS#4), with no mention of type of MTD in diagnosis.

ST/VC#8 noted the singer reported that the ENT had told her she had

"No pathology, but additional swelling and redness…due to reflux". (ST/VC#8)

Client Driven

The case study data incorporates the categories of client history, communication, client driven and progress within the theme of client driven and makes up between 13% and 27% of the practitioner report (Figure 14).

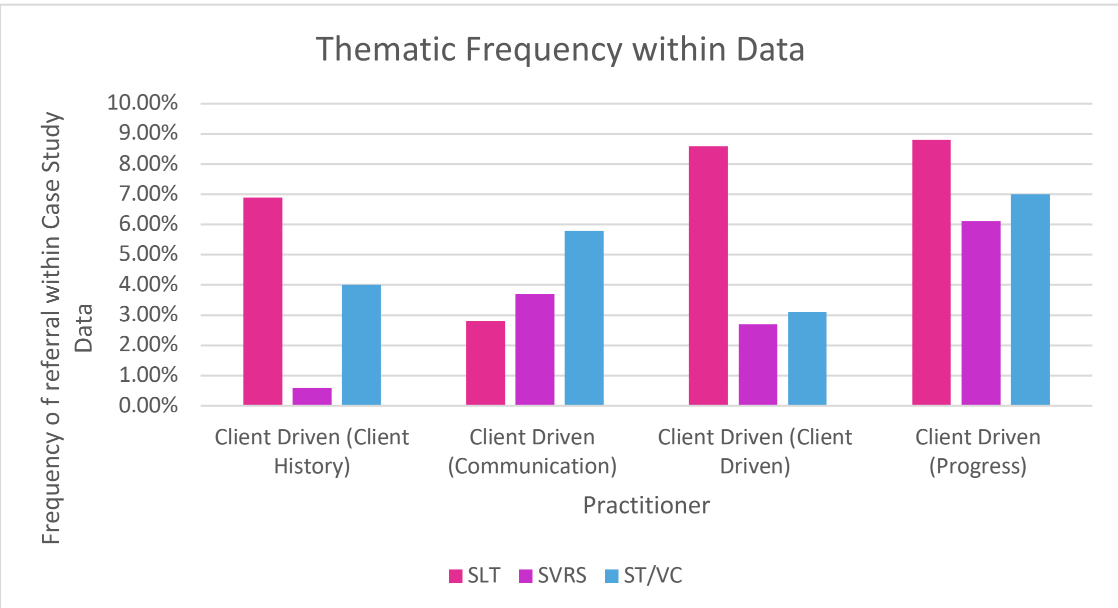

Figure 14

Frequency of client driven referencing.

Overall, the theme of client driven was referred to most by SLT#12, who spent 27% of the session report discussing aspects and considerations of treatment which are client driven. Client history is considered in some depth, including both previous ENT consultation details and a personalised history from the client point of view. SVRS#4 reported a minimal amount of detail with regards to history, referring only to the client's previous vocal range. SVRS#4 did, however, report in detail a high level of communication between practitioner and client, alongside enthusiastic reports of progress from the client. ST/VC#8 consistently gave the highest amount of detail regarding communication, suggesting the ST/VC continuation of initial therapeutic intervention relies far more on singer feedback and goal setting in partnership.

Client-driven

"*Her medical background allows us to discuss the physiological reasons behind her progress". (ST/VC#8)

Communication:

"We discussed how S1 had got on with the homework" (SLT#12)
"We discussed the diagnosis and agreed on the following plan" (SVRS#4)
"This led to a discussion around the last time she had sung in this thinner, lighter style" (ST/VC#8)

Assessment

The theme of 'Assessment' incorporated the codes of both assessment and symptoms within the data. As each set of data was collected at the start of a working relationship with a new client, it was hypothesised that this aspect may feature prominently and possibly be an ongoing aspect of session design.

SLT#12 assessed using palpation and pitch glides each week and 45% of the report concerned aspects of assessment and/or symptoms. SVRS#4 describes assessment and symptoms briefly, not returning to them in subsequent discussion – only 3% of SVRS#4's report is concerning assessment or symptoms (Figure 15). ST/VC#8 however, provides continued integration of assessment and observation/discussion of symptoms through each of the three sessions.

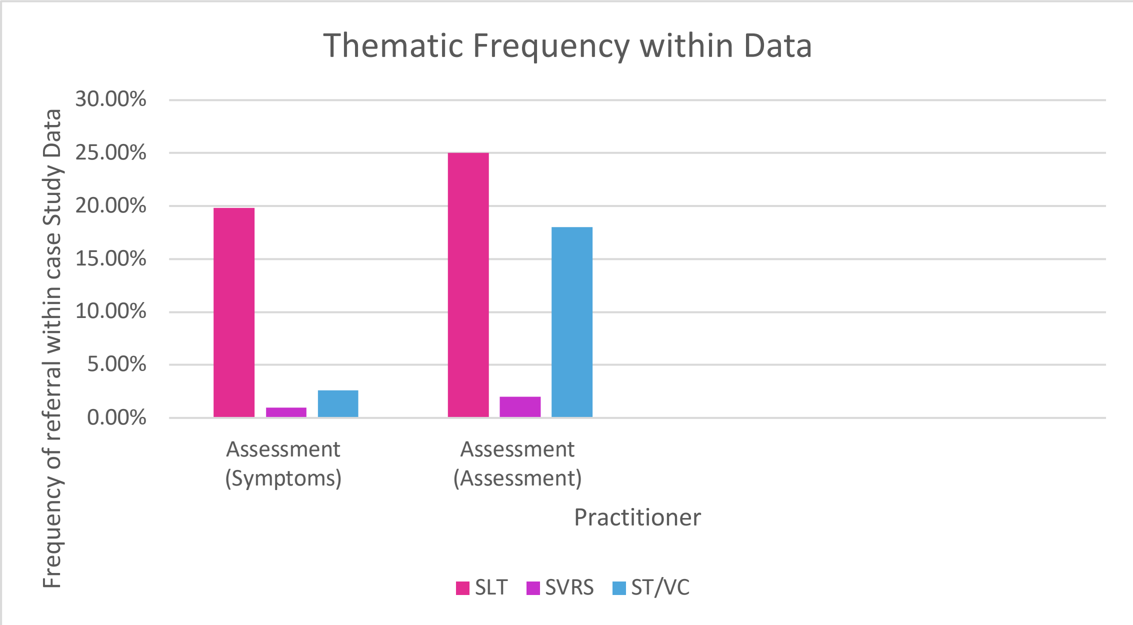

Figure 15

Frequency of assessment referencing.

While it was difficult to generalise based on frequency of mention, the richer qualitative data provides a picture of the use of a mixture of objective and subjective assessment methods in the approach of SLT#12, which were repeated to allow a baseline of sort to be used in all three sessions. The assessment methods of SVRS#4 and ST/VC#8 were either objective via pitch testing which relied on practitioner interpretation, or fully subjective via client self-reporting. Both SVRS#4 and ST/VC#8 assessed pitch and voice quality in different ways, with SVRS#4 using a five-note scale, which ST/VC 8 used a combination of puffy cheeks and lip trills to divert the singer's attention to a new exercise to avoid habitual tension. A lack of agreed or baseline methods of assessment were reported, indicating a potential lack of consistency when working subjectively to assess tension or progress with a client who may be working with several different practitioners.

"Extreme vocal fatigue" (SLT#12)

"I observed her based around Shewell's profile" (SVRS#4)

"Listened to client/student history and got a feel for how S3 feels about her voice" (ST/VC#8)

Therapeutic Approaches

Treatment approaches incorporated the codes of treatment, client lifestyle, possible causes of MTD and the impact on the singing voice. Treatments ranged from laryngeal manipulation to Lax Vox, resonance work and song work. An element of consistency was the inclusion of breath work within their session notes, usually at the start of treatment and the setting of homework in the form of exercises for the client. SLT#12 spent 25% of the report discussing therapeutic treatment, SVRS#4 spent 83% of the report outlining therapeutic approaches, and ST/VC#8 spent 57% of the report outlining therapeutic approaches through sung exercises (Figure 16).

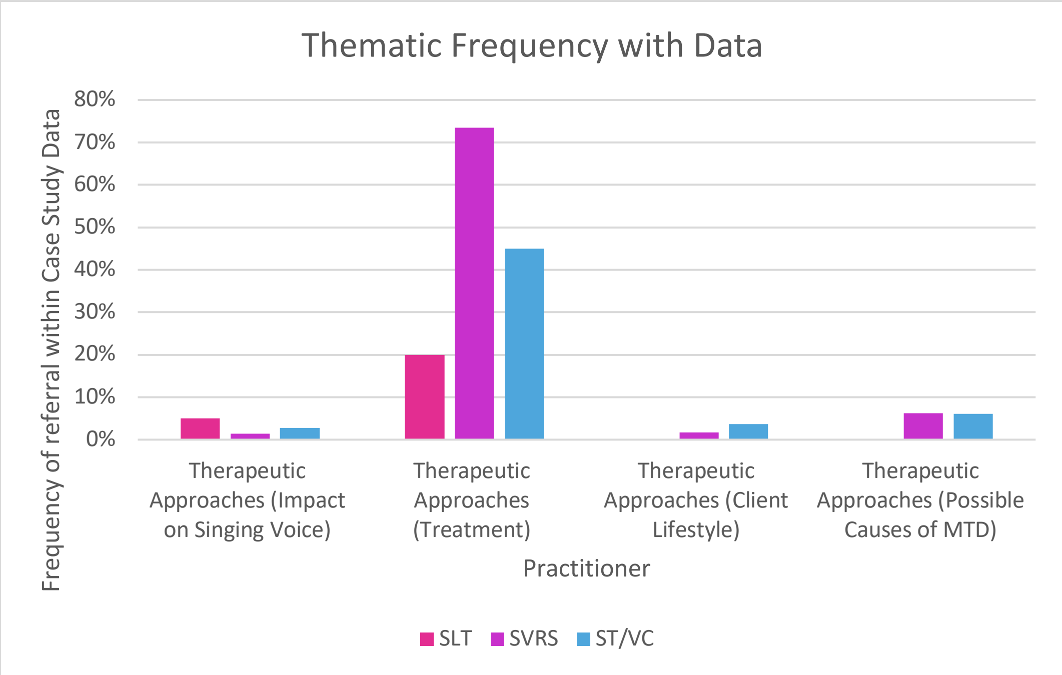

Figure 16

Frequency of Therapeutic Approaches referencing.

SVRS#4 provided significant detail with regards to each exercise given to the singer, however, this differs with the level of communication previously detailed by SVRS#4 yet confirms the singer's ability to self-report and chart their own progress. The balance between therapeutic input and continued assessment from ST/VC#8 appears to build upon the element of communication which was previously identified as an integral aspect of the ST/VC/singer relationship which may be attributed to this practitioner's ability to cultivate a longer-term relationship with the singer, as opposed to SLT#12 and SVRS#4 who may only intervene for a short time.

"Laryngeal massage, breath work" (SLT#12)

"Stress release. Relaxation exercises", "Tension release within the whole body is the primary objective" (SVRS#4)

"We explored 3 different levels of resistance for breath – using a sigh, unvoiced fricative and voiced fricative on the outbreath" (ST/VC#8)

Professional Relationships

The previously identified theme of professional relationships was not found to be applicable to case study data.

6.4 DISCUSSION

Study three set out to establish in more depth the processes involved in working with MTD in the singing voice from several different voice practitioner viewpoints. Case study reports were derived from a minimum of three individual sessions from a speech and language therapist, a singing voice rehabilitation specialist, and a singing teacher, each of which were working with singers diagnosed with MTD by an initial ENT examination.

Although reliant on practitioner memory, reporting and objectivity, the method was chosen to ensure client confidentiality, avoid direct impact on practitioner or client/singer and collect greater depth of detail with regards to the practicalities of working with MTD. Based within the interpretivist paradigm of the overarching research design, no hypothesis was created prior to the case study report data collection, however the results were intended to be compared with those found both within the literature and study two findings and guide the design of resource two further.

Logistics

The initial category of diagnosis was identified which correlated to the previous coding process employed within practitioner questionnaire data analysis. Diagnosis was determined to be the most significant aspect of initial treatment design (Harris, 2018), although contrary to the focus and discussion found within the literature, the type of MTD was not mentioned in the case study reports. P3 reported that the singer had been told their swelling and redness was possibly due to reflux, however no clear treatment was mentioned with regards to this potential cause. These insights may raise questions as to whether a lack of information regarding identification of MTD type might impact treatment/vocal task design. Harris (2018) is clear in aligning treatment types with MTD type, although this could be suggested to increase the responsibility of knowledge for the singing teacher beyond that which is useful although provides the opportunity for tailored approaches to voice work based on the specific MTD type.

Client Driven

As the theme of client driven incorporates the categories of client history, communication, client driven and progress, the observation of the impact of distance from initial diagnosis was of interest. The further from initial consultation, the more descriptive and reliant on client/singer recollection and interpretation the information was noted to be, supporting initial findings within the practitioner questionnaire which illustrated a clear lack of direct communication channels between practitioner types. The impact of the lack of shared knowledge and experience in this respect may be to the detriment of longer-term singer progression.

Assessment

Both assessment and symptoms were included as distinct categories within the broader theme of assessment. Assessment is based on practitioner subjectivity and if designed to be objective, it was based around practitioner experience, preference or perceived client/singer need rather than previously used assessment measures or objective progress markers that could be employed across the rehabilitation process. A lack of consistent assessment approach may reduce singer understanding of progress, resulting in delayed independent progression (Thomas et al., 2023).

Therapeutic Approaches

Specific treatments and approaches to voice work were combined with client lifestyle factors, potential causes of MTD and perceived impact on the singing voice within the theme of therapeutic approaches. Although the design of singing voice exercises may not be described as therapeutic in a clinical definition, findings from the case study reports collectively suggest that design was developed to increase freedom of movement and decrease the potential for additional tension.

Greater detail of existing voice use which may be useful in determining possible causes and impacts of MTD on the singing voice was observed to be present in SVRS 4 and ST/VC 8, suggesting increased time spent with the practitioner may allow more useful depth of information to be gathered. The relationship between limited contact time and resources relative to practitioner roles may benefit from further investigation, with a view to establishing the impact of relationship-building and optimum contact time on singer progress.

The following research question responses are summarised after analysis of case study data:

1. **How is tension currently measured?**

Tension was regularly assessed by each practitioner within the case study data. Methods were diverse and included palpation, audio-perceptual observation, client-reporting, perception of voice quality. No common methods were consistently used across the different practitioner roles, suggesting a preference for individual approaches and the potential for a mixture of objective and subjective assessment methods across practitioners which may either result in more comprehensive assessment due to the combined assessment methods reported or result in a discrepancy of progress assessment as the client moves between practitioner types. The impact on singer confidence with regards to progress should be considered within these possible outcomes.

2. **What are the main/potential causes of MTD?**

The case study data suggested possible causes of MTD in the participants as a mixture of overuse (both sung and spoken voice), prior reflux, and spoken voice muscle function maladaptation. Data was not detailed enough to ascertain whether the causes were linked to additional external impacts such as stress, allergies, postural habits, or a combination thereof.

3. **What is the impact of MTD on the singing voice?**

The impact of MTD on the singing voice was described as reduced range, reduced volume and increased breathiness in each of the three studies. Although the type of MTD was not specified in two of the three studies, the three symptoms reflect those found in review three (Chapter 3). Additional impacts were noted to be psychological, including a loss of confidence and increased worry around future voice use, an aspect supported by Stemple and Fry (2010) who state that voice disorder *"also carries with it a high level of emotional strain and anxiety"* (p 311).

4. **What are the main treatment approaches to MTD?**

Breathwork was noted as a fundamental treatment approach in all three studies, yet beyond that, approaches were varied, reflecting individual practitioner interest, experience and design. Elements of various therapeutic models were noted across each practitioner approach. These included SOVTEs, resonant voice therapy, laryngeal massage, Accent Method and pitch work using small interval jumps.

6.5 Strengths and Limitations of Study Three

Qualitative research allows the researcher to present a deeper understanding of a social setting or activity as viewed from the perspective of the research participant while emphasising exploration, discovery, and description (Bloomberg & Volpe, 2008). By using a case study method, the reader is provided with a detailed description of a setting and its participants, created by an analysis of the data for themes, patterns, and issues (Merriam, 1998; Stake, 1995). The qualitative data is strengthened by the addition of quantitative analysis of word frequency analysis, providing useful descriptive statistics within which to contextualise the findings further.

As with study two, although practitioners who were associated with BVA, BAPAM and AOTOS were approached to participate, study three did not provide an opportunity for the inclusion of different types of voice rehabilitation specialists and practitioners who may practice independently of these bodies. Data for study three was collected during a fixed period, allowing the researcher to obtain a brief account of practitioner viewpoints and approaches used in the treatment of MTD in the singing voice. While the viewpoints and approaches may be appropriate for the participants involved and period of the study observed, it may not represent the breadth of practitioner knowledge or creativity. While the data collected may be transferable, study three alone does not provide a complete evaluation of the treatment approaches to MTD for all singers. Finally, while the researcher intends to portray the current approaches to MTD treatment in the singing voice, the potential for bias and personal interest in treatment development is acknowledged. While case studies are used to help gain a deeper understanding of the participant's approach to the MTD treatment process, the researcher acknowledges that the data gathered may be influenced by the practitioner-gatherer reporting and the potential bias associated with volunteer participation.

6.6 CONCLUSION

Study three set out to gather additional detail with regards to the practical nature of work with MTD in the singing voice. To ensure contemporary practice could be documented, case study reports from a minimum of three individual voice sessions from different practitioner roles were collected to reflect the varied approaches and perspectives. Although limited to three individual practitioner/client approaches, the findings from the session reports illustrated both fundamental similarities and clear differences between the approaches taken by each practitioner type. Session structure remained similar across each of the case studies and usually included assessment of vocal impact or effect of practical homework, encouraging and reacting to client input, providing practitioner input and setting homework. The importance of establishing a positive working relationship between practitioner and singer was more prominent in the SVRS and ST/VC practitioner reporting. Depth of detail was varied and impacted by distance from initial diagnosis and time spent with practitioner which may reflect the importance in clear communication processes in gathering pertinent client/singer data. Across practitioner interaction, the cultivation of longer-term partnerships to establish a greater level of connection, trust, may impact subsequent progress and client/singer experience. Future research into the potential for practitioner collaboration, awareness and standardised methods of progress measurement maybe of value.

Chapter VII – SYNTHESIS OF FINDINGS TOWARDS THE DEVELOPMENT OF RESOURCE TWO DESIGN

7.1 INTRODUCTION

With a goal of creating an accessible and flexible resource to allow the gap to be bridged between SLT therapeutic intervention after ENT diagnosis of MTD and a return to performance-level singing voice use with the support of a singing teacher, the overarching design of this body of research sought to answer the questions proposed in Chapter 1 through resource creation (Chapter 2), literature review (Chapter 3), questionnaire (Chapter 5) and case study (Chapter 6) data collection and analysis.

Having previously discussed the findings of each data collection method in isolation and linked them to the relevant research questions (Chapters 3, 5 & 6), it is necessary to align these findings with the design of resource two.

7.2 Rationale for Resource Two Design and Content

A scoping review (Study One) was completed to identify the methods which have been developed or tested to measure laryngeal muscle activity in participants with MTD. A total of 12 different measurement methods were identified from the literature included in the scoping review (Thomas et al., 2023). Each method was assessed as far as the literature allowed for reliability, validity, ability to detect change, and feasibility. Within the literature reviewed, patient history, laryngoscopic and video stroboscopic assessment and palpation were the most used assessment methods. The most feasible methods were patient history, perceptual and acoustic assessment. With regards to reliability and ability to detect change, the review was unable to determine which method/s were the most successful. Due to the variability in assessment methods and results, study one concludes that there is a need for greater objective practical methodological standardisation to ensure accurate diagnosis, determine appropriate care, and provide improved information about patient progress. Study one further concludes that the most reliable, valid methods of objective measurement include sEMG and RTE, both of which ensure a high level of ability to detect change, while the patient history and self-assessment remain the most feasible.

Study two sought to establish the most commonly used methods of assessment from the SLT and voice practitioner point of view to assess if the most feasible are used regularly in practice with a wide variety of assessment methods included in the questionnaire responses. Although methods of assessment varied within and between practitioner groups in studies two and three, the case report findings largely supported the questionnaire findings, despite no established scales being used by any of the three practitioners involved in the case studies, a surprising finding as each study documented the first session of three or six which would be assumed to required initial measurement to chart progress.

An examination of these findings demonstrated the need for accessible and reliable ways of measuring the symptoms and impact of MTD within a singing studio setting. Ideally a two-pronged approach to assessment, incorporating both objective and subjective measurement would provide reliable measurement. Use of auditory-perceptual and acoustic objective measures such as Consensus Auditory Perceptual Evaluation – Voice (CAPE-V), Dysphonia Severity Index (DSI) or Acoustic Voice Quality Index (AVQI) alongside valuable client-driven self-reporting may allow a comprehensive recording of measurable factors along with the client-driven 'why' which underpins treatment design and approach in general. The possibility of adapting objective measures specifically for use in the singing studio was considered as part of resource two design, although this poses a difficulty for the singing teacher who does not have access to quantifiable methods of measurement such as DSI or AVQI, or the prior training required to interpret findings accurately. Resource two therefore encourages the singing teacher to communicate with the SLT to find out what assessment methods were used as resulting knowledge may allow the same approach to be continued, or an adaptation of the approach which may provide some continuity for the singer.

Practical methods of assessing vocal tension are reflected in resource two through a multi-modal design that integrates both subjective and objective measures. These include singer self-report tools such as the Singing Voice Handicap Index-10 (SVHI-10), Evaluation of Ability to Sing Easily (EASE), Vocal Tract Discomfort Scale (VTDS), and the Voice Symptom Scale (VoiSS). These self-assessment instruments provide valuable insight into the singer's own perception of their vocal health, discomfort, and performance ease. A key strength of self-reporting lies in its ability to capture internal experiences of tension and fatigue that may not be externally observable, allowing singers to express nuanced concerns. Limitations of self-reporting include the potential for bias or inaccurate self-evaluation, particularly if a singer is not attuned to subtle changes in their voice or is influenced by psychological factors such as anxiety, perfectionism, or denial. In addition, the process of listening, observing, and asking questions allows for a more holistic, clinician- or teacher-led evaluation. These approaches support the triangulation of information, offering context and potentially revealing discrepancies between a singer's perception and their actual vocal behavior. This qualitative observation can detect tension-related habits, compensatory strategies, or changes in tone quality, posture, and breath management. The strength of this approach lies in its flexibility and responsiveness to real-time performance, although it is inherently subjective and may vary depending on the assessor's training, experience, or personal biases.

Routine and repeated range assessments are suggested, providing measurable, trackable data that can reflect vocal capacity over time. When used consistently, these comparisons can highlight improvements or regressions in vocal function. It must be noted that this method may oversimplify complex changes, as range alone may not fully represent functional efficiency, vocal fatigue, or the quality of tone production. The use of Shewell's (2009) perceptual profile, adapted for the singing voice, adds a structured and systematic lens through which to evaluate specific vocal qualities. This tool can offer consistency in perceptual judgment when well-calibrated among assessors. Still, perceptual evaluation remains vulnerable to inter-rater variability and can be influenced by contextual factors such as repertoire demands or room acoustics. Finally, where feasible, repeated video stroboscopic assessments serve as the most direct visual confirmation of vocal fold behavior and laryngeal function. This objective, clinical tool can identify signs of strain, incomplete glottal closure, or supraglottic activity, and can provide robust evidence of change over time. Nevertheless, access to stroboscopic imaging is limited by cost, availability, and the need for trained medical personnel. Additionally, stroboscopy captures only a snapshot of vocal function, typically in a sustained vowel, which may not fully reflect dynamic or high intensity singing demands.

The multi-modal assessment approach outlined in resource two offers significant strengths by combining subjective and objective data across time. Each method carries limitations that must be recognised and mitigated through triangulation, professional judgment, and contextual interpretation. A nuanced, flexible, and singer-centred approach to assessment is therefore essential to accurately monitor and support progress. Inclusion of these measurement options is intended to allow supportive frameworks alongside objective measures to suit the experience and confidence of the individual singing teacher (See Supplementary Resource Two, Part Three). Based on the current findings within this thesis, additional training in the best way to interpret results with regards to singing voice progression, ideally through liaison with clinical practitioners, is recommended.

MTD has multi factorial aetiologies such as higher vocal demands, excessive voice use, gastroesophageal reflux disorder, allergies, insufficient technical training and an imbalance of laryngeal and para laryngeal muscle use. There are, however, many possible causes, specific to the personality, lifestyle and environment of the singer. To determine which of the given etiological factors are most important to treat, the study of the most common causes is necessary. To ensure appropriate prevention and successful treatment of MTD resulting from laryngeal tenson, a wide number of causes must be considered, before a clinical pattern emerges, with which voice care teams may begin to design appropriate treatment. Within questionnaire responses, the possible or identified causes were discussed within treatment design. They incorporated maladaptive habits, psychological factors and the assessment of cause through communication and client-driven interactions. In case study data, however, causes of MTD were referred to with minimal detail within the case study reporting. Time spent with client seemed to be a factor here, with the ST/VC practitioner describing many interactions which allowed the singer to share prior voicing history and potential contributing factors. SLT reporting was more clinical in nature, without mention of client reaction. The singing teacher may potentially have a longer time and more regular sessions with the singer. Through the development of a positive working relationship the singing teacher may be able to explore more thoroughly the potential cause/s of MTD and work to apply initial therapeutic approaches introduced by the SLT, alongside indirect approaches designed to encourage the client to re-assess their current lifestyle, commitments, attitudes and habits. Re-visiting and reflecting on potential causes throughout progression toward voicing free from MTD may help to modify behaviour and encourage reflective practice by the singer.

Within resource two, several potential causes of MTD are introduced under the section of 'Understanding Muscle Tension Dysphonia' (See Supplementary Resource Two, Part Two) which encourages the singing teacher to explore the full breadth of the current circumstances of the client. Initial and ongoing exploration/discussion will allow assessment of the requirements of session design. Reflecting the dual approaches of direct and indirect therapeutic approaches, the singing teacher can design both immediately practical and longer-term behavioural activities to enable continued progression both supervised and autonomous.

Further research on the impact of MTD on singing voice qualities depends somewhat on a standardisation of terminology and understanding of the vernacular applied to musical theatre voice qualities (Titze, 1988). It is recommended that further measurement of MTD within specific voice qualities relating to the musical theatre voice be undertaken. As the genre has been reported to require higher laryngeal tension than other singing styles to create the various voice qualities needed (Koufman et al., 1996), it would seem vital that ENT specialists, singing voice rehabilitation specialists and musical theatre voice teachers should have the knowledge to identify issues early and work collaboratively to ensure recovery is swift and measurable. By collating information on the different causes and effects of MTD on several musical theatre voice qualities, this aspect of the body of work highlights the multifaceted nature of diagnosis and treatment of MTD in musical theatre singers. Part five of resource two (Advanced considerations for musical theatre Performers) contains the findings of rapid review three linked to the impact of MTD on M1, M2 and Belt quality. The review of the available literature found that the production of each musical theatre voice quality may be impacted differently, depending on the cause of MTD in the singer. It is hoped that further research into the specific physiological and acoustic effects of MTD on the singing voice qualities required by the musical theatre performer may help to tailor diagnosis and treatment and subsequently allow voice care teams to track recovery more accurately within the specific demands of musical theatre voice use. The questionnaire responses to musical theatre-specific questions linked directly to the client-driven nature of treatment design. Communication with the singer, alongside perceptual assessment of current vocal abilities and goals were the main approaches to investigating the impact of MTD on the singing voice. The impacts appeared to vary depending on the perception of the singer as to their own voice goals and prior voice use. The impact of MTD on the singing voice was referred to with regards to vocal range in each case study, and the impact on vocal quality was not mentioned, although wider impacts including loss of confidence, low feeling and reduced duration of voicing were noted. In each case study, therapeutic approaches were designed in response to both the diagnosis and the experience of the practitioner. Specific voice qualities were only discussed within the singing teacher case study report which noted the difference between a speech quality (M1), mix, and a more cricothyroid (CT) dominant classical approach to the upper register.

The main approach to MTD treatment within the rapid review four examined was concluded to be combined voice therapy with both direct and indirect therapeutic activities used by the practitioner (Chapter 3). Questionnaire responses in study two highlighted the typical focus on spoken voice work by SLTs, combined spoken and sung by SVRSs, and exclusively sung by ST/VCs. Commonalities within combined therapeutic approaches include breathing, SOVTE use, vocal function exercises, and body release. Within case study data, however, each practitioner approach differs and appears to be personalised to the client and to the strengths of the individual practitioner with laryngeal manipulation provided by the SLT practitioner, while the SVRS focuses on breath work, RVT exercises, body release and gradual pitch work. The ST/VC approach includes several practical elements, including breath work, release through movement and incorporating these into the singing voice range, suggesting the benefit of open and clear communication between the singing teacher and the provider of initial therapeutic intervention. The differences in approach may be linked directly to singer need or suggest a potential missing link between practitioner treatment design which may reduce continuity of progression for the singer who responds well to initial treatment, implying that greater awareness of SLT approaches in general would equip the singing teacher with the knowledge required to allow flexible design which is unique to the singer.

Resource two includes basic overviews of the therapeutic programmes identified by the literature and study two and three findings (See Supplementary Resource Two, Part Four: Therapeutical and Practical Approaches). The need for appropriate shared knowledge between practitioner roles builds upon the codes and themes found across the literature, questionnaire and case study data of client motivated and professional relationships. Approaches linked to initial MTD treatment are provided under wider main headings of SOVT, Body Release, Respiration, Phonation, Resonance and Moving on to More Demanding Repertoire.

Although consideration of singing style is acknowledged briefly by the combined SVRS/ST/VC practitioner response, musical theatre singing styles or vocal qualities are not discussed in any detail within either the questionnaire or case studies, although prompts were included in data collection design. There were very brief responses to the additional demands of musical theatre which included choreography, raked stages and costuming impacts and the suggestion of taking these into consideration during and beyond treatment without the inclusion of specific examples, representing a gap in shared considerations across practitioner groups. Resource two addresses this gap with an examination of additional physical and psychological demands found in musical theatre performance (See Supplementary Resource Two, Part Five). The singing teacher may have to adapt approaches to fit the specifics of musical theatre voice use which includes demanding voice qualities, incurring a minimum degree of useful tension which is greater than that of other genres such as western classical singing, and intensive vocal loading within rehearsal and performance. Voice qualities/vocal mechanisms are described physiologically in resource two (See Supplementary Resource Two, Part Five) and the impacts, both acoustic and physiological, of MTD in each voice quality/mechanism are included to allow the singing teacher to continue to develop an awareness of possible symptoms/changes which may indicate the presence or relief of MTD.

Available literature concerning generalised treatment of singers with MTD reveals that approaches follow the established SLT spoken voice methodology, using several generalised exercises aimed at targeting as many possible causes at the same time. As most treatments consist of combined therapy, it is difficult to accurately assess the success of each component, making it difficult to determine which exercises may be most effective if treating a specific genre of singing. Resource two provides approaches and exercises linked directly to the physiology of the impact of MTD on phonation and categorised by SOVT use, Body Release, Respiration, Phonation, Resonance and Moving on to More Demanding Repertoire. Exercises and approaches are adaptable in line with the varied and individual needs of the singer. In addition, there is a continuing lack literature discussing how MTD affects the musical theatre voice, despite the recommendation by Scearce (2016) that treatment should be designed with the vocal physiology and number of voice qualities required in the musical theatre singing voice in mind. There is some recognition of the multi-faceted nature of musical theatre performance and the variety of demands which may cause or exacerbate MTD, however little or no provision for exercises designed specifically for MTD in musical theatre voices. The physical demands, instrumental elements and additional spoken aspects of musical theatre performance are not routinely considered or evidenced in the literature. Scearce (2016) appears at the forefront of singing voice rehabilitation, however explorations and a robust evidence base is still lacking for differentiated therapeutic work in the musical theatre genre. For the musical theatre singer seeking genre-specific treatment for MTD, until treatment is developed that considers the additional demands on the musical theatre singer, input may not be able to fully treat the cause of the problem. It may only provide rehabilitation of symptoms, which may then be exacerbated after treatment by a return to tension-provoking habits, therefore further research into the additional demands placed on the musical theatre performer and their role in the development of MTD is recommended. A search of the literature highlighted a gap whereby additional demands were not synthesised and a rapid review (Chapter 3) was undertaken to provide this synthesis. Several specific physical and psychological demands were identified and evaluated with regards to their link to additional laryngeal tension within the genre including choreography demands, use of musical instrument, vocal loading, use of fog/haze, being a swing, employment insecurity and associated stress. Additional treatment considerations regarding the musical theatre performer were offered by SVRS and ST/VC practitioners within the questionnaire responses which included increased direct communication with choreographers, taking raked stages into consideration, discussing hydration and aspects of vocal hygiene with performers, and designing treatment around rehearsal and performance commitments, suggesting a greater need for awareness of these additional demands and their potential impact on MTD symptom reduction and continued progress is vital. It is hypothesised that establishing voice practitioner networks which allow shared experience and knowledge, the acknowledgement of the multifaceted nature of musical theatre rehearsal and performance, alongside continued flexibility in treatment design to both relieve and mitigate symptoms would provide a firm foundation upon which singer progress can be facilitated.

To reflect this hypothesis, resource two provides general approaches and resources to help ameliorate MTD symptoms in the singing voice while the fifth part of the resource offers additional physical and psychological considerations specific to the musical theatre performer (See Supplementary Resource Two, Part Five). These are based on the combined findings of the literature and questionnaire responses and are found under the headings of Additional Physical Demands, Instrumental Use, and Additional Psychological Demands.

7.3 CONCLUSION

Study one (Chapter 3), a scoping review, set out to establish the validity, reliability and accessibility of methods of measuring laryngeal tension (Thomas et al., 2023). A series of rapid reviews (Chapter 3), anonymous online questionnaire (Chapter 5) and collection of practitioner case study reports (Chapter 6) were undertaken to ensure as broad a view as possible was established with regards to the assessment and treatment of MTD in the singing voice (Chapter 3). Study two (Chapter 5) aimed to gather practitioner input with regards to the assessment and treatment of MTD in the singing voice, while study three (Chapter 6) was designed to build on this data and add further detail around specific approaches during individual voice work sessions. Collectively the studies were designed to provide fundamental information upon which to base the creation of novel supporting resource for singing teachers working with singers recovering from MTD.

The questionnaire (study two) and case study findings (study three) were able to support and expand upon aspects of the literature review findings, while at times presenting a wide variety of approaches. Although these results made finding a clear pattern of approach upon which to base resource design difficult, it presented the opportunity to explore a wide variety of activities and approaches which may be linked to, or continue to build upon, prior therapeutic intervention, or be used to re-direct previous singing behaviours or learning through tasks aligned to prior experience.

Rather than lamenting the lack of standardisation in measurement across responses and the literature, the study presents the opportunity to highlight and celebrate this aspect, and focus on building a wider knowledge base from which singing teachers may draw, develop a network of professional relationships, undertake collaborative and mentor input, design flexible and adaptive approaches, and establish the tools required to support initial MTD intervention with the opportunity to foster continuity.

Chapter VIII - RESOURCE TWO: Muscle Tension Dysphonia in The Singing Voice: Establishing Links between Therapy and Performing Voice Use

8.1 INTRODUCTION

In the clinical care pathway for voice disorders such as muscle tension dysphonia, access to video stroboscopic examination remains an essential although inconsistently available diagnostic tool. This limited access is often due to a lack of resources or trained specialists, particularly in non-tertiary or community settings (Chang et al., 2023; Roy et al., 2005). Videostroboscopy enables high-resolution visualisation of vocal fold vibration, mucosal wave behavior, and phase symmetry - features that are crucial for distinguishing MTD from organic or neurological conditions such as vocal fold paralysis or benign lesions, which may present with similar auditory symptoms (Hirano & Bless, 1993; Paniagua et al., 2023). Its clinical impact is substantial; stroboscopic findings have been shown to alter diagnosis and management in 40-70% of patients presenting with dysphonia, particularly in cases where previous diagnoses (e.g., laryngopharyngeal reflux) were inaccurate (Chang et al., 2023).

Despite its clinical utility, videostroboscopy is not always available, leading many clinicians to rely on auditory-perceptual evaluations or flexible nasendoscopy, however, these methods lack the fine vibratory detail needed to detect subtle abnormalities, increasing the risk of misdiagnosis (Behrman, 2005; McGrath et al., 2023). A recent scoping review emphasized that videostroboscopy, when used in conjunction with detailed patient history and circumlaryngeal palpation, remains one of the most valuable tools for identifying MTD, especially in the absence of structural lesions or neurological signs (Dauda & Sridharan, 2023).

If dysphonia occurs in the spoken or singing voice, in the UK an initial referral from a General Practitioner (GP) consultation may lead to an examination by an ear, nose and throat (ENT) consultant who will then diagnose and refer on to a speech and language therapist, or alternatively direct referral to an SLT may form the route of treatment and assessment (NHS.uk, 2025). A diagnosis of primary MTD in the singing voice may be treated in the UK by initial delivery of speech and language therapy. After the treatment sessions (which may predominantly focus on spoken voice therapy and holistic behavioural work), the singer may often be advised to return to or find a singing teacher to help them return to healthy, sustainable singing voice use. There may be liaison between the SLT and the singing teacher, although this may depend on existing networking, confidence and interest by both parties, or a specific desire to continue and build upon initial SLT approaches on the part of the singing teacher. This can lead to singing teachers working with minimal input with regards to initial treatment approaches or the knowledge required to join the dots between SLT input and a return to singing voice use. Several different avenues are currently available for singing teachers to improve their post-therapeutic knowledge, including short courses, clinical texts and vocal rehabilitation resources. None are specific to MTD or provide adaptable foundational information linking what may happen in SLT sessions with a continued return to singing voice use. Through personal experience of helping singing students to progress onwards after an MTD diagnosis, the researcher noted a lack of accessible, collated information regarding the treatment of MTD upon which she could design appropriate approaches, therefore information was gathered from a wide variety of pedagogical, anatomical and clinical sources, resulting in the realisation that the process could be made easier for singing teachers, helping to create a link to initial SLT input which would be directly beneficial for the singer and their supported progress.

In practice, the delivery of voice therapy for singers may be limited to as few as three or four sessions, depending on the provider and need (Dastolfo-Hromack et al., 2016), although Stemple and Fry (2010) propose that a higher number of sessions may allow more singing-voice specific treatment. This may not be possible within the UK healthcare system, with NHS delivery reported in study two to consist of between three and six sessions of voice therapy and subsequent sessions delivered privately at singer expense. Most SLT treatment approaches for MTD are initially based in spoken voice work and singers are then asked to 'consciously associate techniques and principles for speaking with those for singing' (Stemple & Fry, 2010), however Leborgne and Rosenberg (2014) continue to highlight the value of input from and collaboration with voice teachers during the therapy process, with a qualitative case study by Goffi-Fynn and Carroll (2013) finding that collaborative treatment from both a speech and language therapist and singing teacher produced the most successful results in rehabilitating a singer with MTD. Within this context a resource has been designed to provide linking exercises and approaches for singing teachers who are helping singers progress back to performance level voice use after initial treatment for MTD. Study four employed the qualitative research method of semi-structured interviews to collect views of clinical voice practitioners surrounding the content, design and delivery method of the pedagogical resource.

The resource combines anatomy, physiology, logistical design, practical ideas and considerations specific to the musical theatre voice, aiming to provide additional knowledge in anatomy, assessment and common treatment approaches of SLTs towards MTD, alongside practical examples of specific aspects of voice production/body use linked to MTD treatment which would allow singing teachers to adapt and develop their own approach for each individual singer. A final additional section of the resource explores the specific demands faced by musical theatre performers, potential links to increased laryngeal tension and approaches to help to mitigate their impacts.

The resource is considered unique in its content and approach and has the potential to be developed in future to support a wider range of voice disorders to promote specific post-therapeutic treatment and progression.

8.2 Resource Two design

Within the development of resource two, the research design specified the intended audience, the resource's goals and objectives, and the techniques employed in its creation and assessment (Thoring et al., 2020). The proposed needs, and expectations of the user, as well as the context in which the resource will be used, were considered during the design process. Methods for evaluating and improving the resource, including useability testing (vom Brocke, Hevner & Maedche, 2020) were included in the study design and are intended to be continued beyond the period of current study.

Difficulty in creating a resource that truly meets the needs and preferences of the intended users is one of the challenges associated with user-centred design. As this resource seeks to fill a previously unacknowledged gap in support for the singing voice user, care must be taken to gather professional practitioner feedback specific to the content presented (Mishra & Koehler, 2006), to guarantee usability and accessibility. As this resource can be categorised as an educational artefact to be used in educational settings, creative design approaches must be balanced with practicality, allowing the final product to remain realistic and workable, therefore initial resource design intends to incorporate logistical and practical support for singing teachers in an accessible and adaptable format.

8.3 Resource Two Design process

8.3.1 Intended Users

The intended users of the resource are singing teachers and/or vocal coaches who have not trained as singing voice rehabilitation specialists however are working with a singer who has already had therapeutic intervention for muscle tension dysphonia from an SLT. It is expected that the singing teacher will have a basic understanding of the anatomy and physiology of the singing voice and an interest in understanding functional dysphonia of this type.

8.3.2 Resource Two Intended Impact on the singing teacher

Resource two sought to achieve overarching outcomes based on the information gathered within studies one (Chapter 3), two (Chapter 5) and three (Chapter 6). A central aim of the resource is to enhance the knowledge and confidence of singing teachers in applying progressive, evidence-informed pedagogical strategies when working with singers who have undergone initial therapeutic intervention for muscle tension dysphonia. In doing so, the resource seeks to support the transition from clinical rehabilitation to sustainable, performance-based vocal practice. A key objective is to increase singing teacher awareness of interdisciplinary collaboration, particularly in relation to the multidisciplinary team (MDT) model. The resource encourages engagement with a broader network of professionals such as speech and language therapists, laryngologists, and other allied health practitioners with the intention of promoting a more integrated and communicative approach to voice care. This outcome encompasses the potential for professional network development, which is essential for holistic, context-sensitive support of singers in post-therapeutic phases.

Further, the resource is designed to foster individual professional development by enabling singing teachers to identify and engage with areas of their practice that would benefit from focused growth. Through reflective practice and engagement with new knowledge, teachers are supported in aligning their pedagogical approaches with current research and clinical understanding of vocal health. In addition, the resource aims to cultivate a learning culture that extends beyond the initial rehabilitation of vocal disorders. It encourages ongoing professional inquiry, collaboration, and the sharing of knowledge within the voice community. Ultimately, the resource aspires to support singer progression by facilitating the development of structured, measurable outcomes that reflect both vocal recovery and artistic advancement.

8.3.3 Resource Two Aims and Objectives

Aims and objectives designed around the intended user were developed to guide the content design (Table 24).

Table 24
Resource two aims and objectives.

	The aims of the development of this resource are:	**The resource intends to accomplish the above aims through the following objectives:**
1	To provide a link between initial therapeutic input for MTD and the continued progression of the singer back to functional, healthy voice use in performance.	Provide information and overviews of current vocal therapy programmes alongside assessment and organisational templates to adapt or inspire singer-specific session design.
2	To increase the confidence of the singing teacher who is working with a singer diagnosed with and treated for MTD, particularly those performing in the musical theatre genre.	Link exercises and activities to the anatomy and physiology of MTD and include approaches and activities specific to the additional demands of musical theatre performance.
3	To provide stimuli for the design of personalised vocal exercises and approaches to the continued recovery from MTD.	Include detailed overviews of vocal exercises and activities relevant to reducing the symptoms of MTD
4	To encourage the development of practitioner networking and collaboration.	Signpost practitioner networking opportunities

8.3.4 Methodology for the creation of resource two

Resource two was created using a systematic approach to design. The fundamental aspects of voice therapy; body release, respiration, phonation and resonance were chosen as a basis upon which to develop a collection of exercises and activities. Literature review findings, existing voice therapy resources, researcher knowledge, questionnaire and case study results, along with Christina Shewell's perceptual profile content (Shewell, 2009) were used to influence sub-categories within the main headings.

Definitions of each aspect of vocal technique were included and followed by the identification of their value with regards to reducing/relieving MTD symptoms. Practical approaches were then described with suggestions for personalisation and development for the individual singer.

8.3.5 Expectations of the user

The user is expected to be able to understand basic anatomy and physiology of the voice, although additional information is provided in the anatomy section of the combined resource (Supplementary Resource One). An existing level of confidence in their knowledge of the singing voice and changes in function is required.

8.3.6 Context in which the resource will be used

The resource is designed to be used with singers who have been diagnosed with primary MTD and have received initial therapeutic input from an SLT before seeking ongoing help from a singing teacher. It is acknowledged that input from a SVRS who is linked to the voice clinic and initial SLT would be the optimum pathway for rehabilitation, however the nature of SVRS availability and current accreditation status suggests that a likely pathway is that of progression from SLT to singing teacher. Singing teachers may wish to work with multiple sections of the resource or select exercises specific to areas of technical deficiency. The activities included are adaptable to voice type, range, genre and need.

8.4 Initial Resource Structure

The resource was initially designed in a four-part structure to be used alongside resource one: The Muscles of Singing Voice Production (Supplementary Resource One). The resource aims were informed by a theory-driven approach to assist singing teachers to support singers during the transition from initial therapeutic intervention to performance voice use (Figure 17).

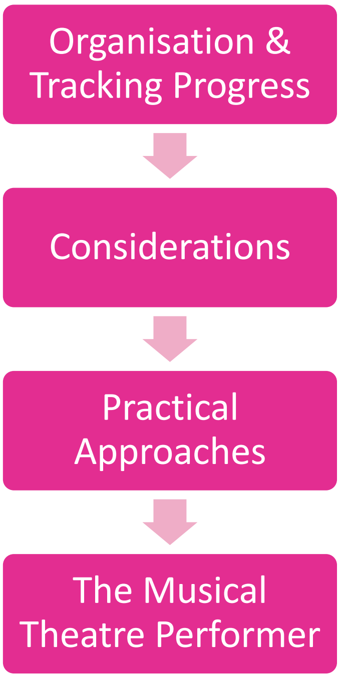

Figure 17

Initial structure of resource two.

In the early stages of the evaluation, the resource structure and content were reviewed by the researcher and key elements of the therapeutic process were identified as being helpful to future singing lesson design. Subsequently, the content and structure were further refined with input from external supervisor and colleagues and compiled in a basic document format to illustrate the context and application of the resource content before pilot evaluation. The pilot evaluation aimed to answer the following question: ***What value do voice clinic practitioners place on a pedagogical resource providing information to singing teachers supporting the link between initial therapy and return to regular singing voice use?***

Chapter IX – PILOT EVALUATION OF RESOURCE TWO: Muscle Tension Dysphonia in The Singing Voice: Establishing Links between Therapy and Performing Voice Use

9.1 INTRODUCTION

Although the overarching thesis aim does not stipulate the requirement to evaluate the resource at this stage, it was deemed prudent to undertake a pilot consultation to determine the initial perceived usefulness, comparability, content, and delivery mode of the resource. To this end study four sought the views and recommendations of voice clinic practitioners on the development of a resource specifically aimed at singing teachers working with MTD post initial therapeutic input through the collection of qualitative data through practitioner interview. Along with pedagogical literature, research study input which included data collected during study two and study three was used to guide the creation of resource two.

A review of literature regarding treatment approaches to muscle tension dysphonia in singers highlighted a gap in supporting resources between initial combined indirect and direct therapy approaches taken by SLT practitioners and a return to performance singing voice use (Chapter 3). Although collaborative working between SLT practitioners and singing teachers/vocal coaches was recommended as a pathway which increased positive outcomes for singers diagnosed with MTD (Goffi-Fynn & Carrol, 2013), a dearth of tailored supporting resources for singing teachers faced with this challenge was noted upon examination of available pedagogical literature.

Muscle Tension Dysphonia (MTD) is consistently reported as one of the most common diagnoses in voice clinics. Estimates of its prevalence vary, with studies suggesting that MTD accounts for approximately 10% to 40% of clinical caseloads in voice centres (Morrison & Rammage, 1994; Spencer et al., 2015). In a review of 558 patients presenting with voice disorders, 31.1% were diagnosed with MTD (Jiang et al., 2023). Similarly, Rubin, Blake, and Mathieson (2007) noted that up to 40% of patients referred for hoarseness may receive a diagnosis of primary MTD. These findings underscore the significant representation of MTD among functional voice disorders seen in otolaryngology and voice specialty clinics. Although often cited as a catch all term, there is evidence to distinguish and diagnose by type of MTD, allowing links to be made between potential impact on the singing voice and tailored treatment approaches. These developments can be of note when the singing voice user moves to work with a singing teacher after initial SLT input and seeks to return to full use of their singing voice. Without the intention of blurring the lines between practitioner responsibility, there remains a gap in singer care which may begin to be filled through the generation of a series of pedagogical resources which include additional information pertinent to the initial therapeutic input received by the singer. This knowledge, while not detailed enough to threaten the established and essential order of care from GP referral to ENT, SLT and onwards, can empower the singing teacher to design input which is complimentary and supportive of initial input, allowing a progressive linear pathway to a return to full voicing.

Study four reports the findings of the qualitative evaluation of the initial design of resource two, 'Muscle Tension Dysphonia in The Singing Voice: Establishing Links between Therapy and

Performing Voice use' (Supplementary Resource Two). The resource aimed to provide a series of pedagogical supporting resources to improve the ongoing care for singers diagnosed with MTD who have received initial SLT input through improved knowledge of anatomy, physiology, aetiology of MTD, common treatment approaches to MTD, and potential impacts of MTD on the singing voice. Practical approaches were then included to be used or developed as required by the singing teacher. Given that this concept was novel, the pilot evaluation offered the opportunity to gather views from current clinical voice practitioners regarding the development, refinement, and usefulness of the resource. The main aim of the evaluation was to assess the value voice clinic practitioners placed on a pedagogical resource providing information to singing teachers which supports the transition from initial therapy to regular singing voice use. In this way, evidence of practitioner views and recommendations could inform decision-making to further refine and develop the resource.

9.2 METHODOLOGY

To evaluate the content and purpose of resource two, study four sought to understand whether practitioners recognise the value of the MTD pedagogical resource and see the benefits of supporting information for singing teachers who are providing the link between initial therapy and a return to regular singing voice use. Study four sought to further establish the current views of practitioners about how they might recommend the resource be delivered and refined to translate these views and perceptions into an impactful output by developing the resource design and content.

9.2.1 Participants and Methods

A variety of voice clinic practitioners were invited to be interviewed. Practitioners were defined as ear, nose and throat consultants, speech and language therapists, and singing voice rehabilitation specialists and were purposively recruited if they identified as working with the singing voice in the context of a voice clinic and/or vocal rehabilitation either in private practice or within the NHS.

Target numbers of three to five practitioners across disciplines and roles were initially sought to gather diverse feedback, in the hope that representation from a range of roles and backgrounds would contribute to a broad representation of views and perspectives in the interviews. This sampling decision was based on both the previously established multidisciplinary nature of delivery and the participant population of studies two and three.

Initial contact took place via email to invite expressions of interest from potential participants who fulfil the inclusion criteria, and a participant information sheet was provided. They were invited to reply to the first email expressing a desire to take part in the study and a follow up email or Teams meeting (format as preferred by the participant) was offered to provide an overview of the study and the resource (Supplementary Resource Two). Willing and eligible participants were required to complete a consent form. Subsequently participants were sent resource two digitally prior to the interview and it was made available through screen share during the meeting. Participants were invited to add comments to their copy of the resource and send these back to the researcher in addition to the conversation generated which was recorded and transcribed via Teams. The researcher had no direct relationship or potential influence over the participants involved in the pilot evaluation of resource two, however participants were not anonymous through the process of feedback collection.

Three practitioners agreed to take part. They were made up of a private practice based SLT who was a lecturer in SLT undergraduate training (SLT#13), an SLT clinical lead (SLT#14), and a singing voice rehabilitation specialist affiliated with a voice clinic (SVRS#2). The singing voice rehabilitation specialist had previous research experience specific to MTD in the singing voice and took part in study two. As previously noted, SVRS#2 was involved in two of the participant studies and can be tracked throughout data analysis.

The pilot evaluation (study four) was undertaken over a three-month period from October 2024 in three practice settings across three National Health Service (NHS) Board regional areas in the UK. The practices were of varied size, location and voice specialism, and study participants were the members of (SLTs), or volunteered with (SVRS), voice clinic teams in each of the three voice clinics. Participants were targeted for interview based on the pragmatic decision that they had, potentially, the greatest experience and insights regarding the evaluation of the resource content. Purposive sampling was employed to represent a wide range of views and reflect fundamental characteristics of interest to the evaluation, such as structure, content and relevance to the intended audience. Two participants were based in Scotland. This geographical factor is of particular interest to the researcher as they may form the first therapeutic input for continued evaluation of the resource in the future due to their proximity.

9.2.2 Inclusion and Exclusion Criteria

Inclusion criteria required participants to be over the age of 18 years old, have been working in a voice clinic context with the singing voice, and able to give informed consent to collection of data regarding their interview input. Practitioners working outside the voice clinic setting and/or only with spoken voice were excluded from the recruitment process to ensure relevance to the intended user and focus of the resource evaluation (Appendix I).

9.2.3 Data Collection

By analysing the data collected, an initial and exploratory overview of participant attitudes towards resource two was evaluated, allowing refinement underpinned by a shared knowledge and understanding of the resource purpose. The research design collected qualitative data within field research in the form of individual interview and optional written feedback.

The interview was guided by seven questions:

1. What are your views with regards to the general content of MTD resource?
2. How useful do you consider it to be for singing teachers who wish to develop the singing voice after initial therapeutic delivery?
3. How far does the content allow a flexible approach depending on what the initial therapy included?
4. Is there anything you would like to see included or removed? Why?
5. How do you think this resource should/could be made available? Hard copy, digital, online, webpage, blog, etc?
6. How useful would a resource like this be in supporting client progression beyond the clinic?
7. Do you have any additional recommendations or thoughts about the resource?

As the aim was to generate good discussion and recommendations for refinement, rather than reach a final agreement as to content, it was important that views were acknowledged without researcher bias. Due to the nature of the practitioner recruitment, it was hoped that there would be the possibility of additional content resulting from the discussion. To this end, the interviews were recorded, transcribed via MS Teams and analysed to extract themes. Direct comments on the resource were subjected to content analysis (Kleinheksel et al., 2020). The selection of individual interviews with optional written feedback was guided by both ethical and practical considerations. Interviews allowed for in-depth exploration of practitioner perspectives, capturing rich narrative data and enabling the researcher to probe for clarification or elaboration. Written feedback provided an additional, low-burden mechanism for participants to offer reflections without time pressure or constraints of the interview format. This mixed qualitative approach aligns with recommendations for flexible, inclusive research designs in applied clinical contexts (McGrath et al., 2023). The choice of this methodology was informed by several considerations. Semi-structured interviews allowed for flexibility in discussion, facilitating the emergence of unanticipated insights while still addressing core research questions (Brinkmann & Kvale, 2018). The combination of interview and written commentary maximised participation flexibility, accommodating the workload and scheduling constraints of busy practitioners. The design supported application of findings to real world situations by enabling participants to evaluate the resource in contextually relevant settings, providing feedback grounded in professional practice rather than abstract or hypothetical scenarios.

Limitations in study design were noted in the choice of the methodology with regards to both the practitioner group and subject matter. Schedules and workloads limited the ability to convene.

9.2.4 Strengths and Limitations of Methodology

The methodological choices offer multiple strengths. Purposive sampling ensured informed, practice-based insights; interviews supported in-depth exploration of views; written feedback allowed reflection and low-burden contribution; and thematic and content analysis provided systematic, transparent interpretation of findings. Triangulation across multiple forms of input helped mitigate the limitations of small sample size and potential subjectivity inherent in qualitative research. Limitations include the modest sample size and the non-anonymity of participants during interview, which may have influenced openness in some responses. Scheduling constraints limited participation, and the focus on a specialist population may restrict generalisability. Additionally, the inclusion of a participant involved in earlier stages of the research introduces potential continuity bias, although reflexive methodological safeguards were implemented to monitor and contextualise this influence.

Overall, the chosen methods provided a pragmatic, ethically sound, and contextually relevant approach to evaluating resource two, balancing the need for rich, actionable practitioner insights with practical constraints in specialist clinical settings.

9.2.5 Analysis

Data was coded and categorised on a deductive basis immediately post interview to inform refinement and development of resource two and then subjected to a structural thematic analysis. From the outset, the guiding questions used in interview explicitly shaped how data was analysed and provided a basic framework to present the evolving themes that were generated.

Due to the nature of the guiding question framework the decision was taken to create codes prior to data analysis of the resource evaluation interviews (Bingham, 2023). Using Namey et al.'s (2008) definition of structural coding as a *"question-based code that acts as a labelling and indexing device"* (p. 141), the opportunity to code and categorise simultaneously was deemed fitting for the discussion content under analysis (Saldaña, 2013).

The structural codes were based on the question subject (Table 25) and used to categorise transcribed and written content from both recorded discussion and written comments as copies of the resource in Word document format were provided to participants who were invited to add direct comments recommending subsequent design and content editing. Both content types were analysed for direct recommendations at both thematic and granular levels, along with deductive thematic analysis to determine recurring aspects of design discussion which may be useful during the refinement process.

Table 25

Structural codes for discussion and written feedback of resource two.

Structural Code	Process Abbreviation
General content	(GC)
How useful – singing teachers	(HU ST)
Flexible approach	(FLEX)
Inclusion	(INCL)
Removal	(REM)
Made available	(MA)
How useful beyond the clinic	(HU clin)
Additional recommendations	(+ REC)

9.3 RESULTS

9.3.1 Key Findings

Study four set out to gather initial feedback through pilot evaluation interviews on the design and content of resource two from a voice clinic practitioner perspective. In (2017) describes a pilot study as a precursor to a main trial or larger study to help the planning or modification process. In the context of resource two evaluation, initial feedback with regards to resource concept, content and design was sought to further refine and develop the resource prior to subsequent evaluation and publication.

Although limited to three interviews, structured by key questions, the response to resource two was positive. Views were gathered from three practitioners who held the following roles either in combination or alone: Prior and current NHS SLT practitioners, SLT trainer, SVRS working in voice clinic, private SLT practitioner.

General content was supported with specific recommendations around either the simplification of language use, or the opportunity to access more in-depth physiology if desired by the individual. Usefulness for the singing teacher and beyond the clinic was highlighted, with SLT practitioners mentioning the value of the resource for SLTs in practice and in training. Flexibility of approach was not discussed in depth, although the inclusion of existing therapeutic models was mentioned as a positive addition to allow the singing teacher to develop knowledge of previous treatment to design their own vocal tasks. Key recommendations were made with regards to language use and the inclusion of clinical detail, questioning whether the level of detail provided would be overwhelming for the singing teacher. Views were contrasting when the topic of how the resource should be made available was discussed. The idea of having a hard copy to be able to use as a reference book was strongly suggested, while a combination of online, digital access and the use of QR codes through the printed resource was mentioned by two of the three participants. Recommendations to split the resource up into separate volumes were consequently discussed by two of the three participants.

The findings suggest high levels of positivity for the resource, alongside specific practical refinements and design recommendations which will be implemented by the researcher before a larger evaluation study is undertaken. The results were overwhelmingly positive with practitioners offering positive feedback with regards to the content and design.

The value with regards to singing teacher use and supporting the singer beyond initial therapeutic intervention was thought to be very good, and distinctions were made to highlight the in-depth nature of the resource which could be accessed at several levels by both inexperienced and experienced teachers. The option to work more in depth in the anatomical aspects or to move straight to the practical approaches was suggested.

9.4 DISCUSSION of Pilot Evaluation of Resource Two Findings

The aim of study four was to assess the value voice clinic practitioners placed on a pedagogical resource providing information to singing teachers which supports the transition from initial therapy to regular singing voice use. The key findings generated by study four through participant discussion suggest a positive response to the purpose and content of the resource, with recommendations to refine the format and delivery. The impact of the findings suggest that this type of resource may be a valuable tool in providing shared knowledge appropriate to the practitioner role, which may improve singer outcomes for those diagnosed with MTD. The potential for use of resource two in initial SLT training was noted. It is recommended that future evaluation and refinement be undertaken to ensure the resource is accessible, adaptable and appropriate for a range of voice practitioners.

The initial guiding questions asked participants about their views with regards to the **general content** of resource two. The comprehensive nature of information included and the opportunity for the resource to encourage practitioners to work together for the good of the singer were mentioned in a positive light. Furthermore, SLT#13 highlighted the use of content for the singing teacher, and potentially for use by SLTs in training, however further investigations are needed to establish this.

"So, you've got Shewell in there and […] we would direct them towards Shewell so they could go into that as a resource […] there's way more in here than an SLT student would get taught so in terms of amount then there's loads." (SLT#13)

This was developed later in the interview as SLT#13 discussed the usefulness in providing specific in-depth information to student SLTs while on placement working with voice disorders and the singing voice. SLT#13 went on to qualify this view, describing student SLTs as having

“X number of classes, you know, over a defined number of weeks and that takes in kids voice, MTD, nodules, transgender and so actually our students if they go out on placement they would get to experience of some of this but they wouldn't necessarily have all the information.”

SLT#14 described the value in the resource content, commenting on the inclusion of the overviews of therapeutic voice models. SLT#14 felt that outlining

“all therapy tools [..] allows singing teachers to select the most appropriate tool” (SLT#14)

Although consistently positive in response to the resource content, particularly the concept of ensuring shared practitioner understanding contributes to a positive singer journey of progression, SVRS#2 commented that

“This resource could be the go-to resource for singing teachers wanting to know more and build links […] It’s about forming links, communication - working together for the good of the singer” (SVRS#2),

reflecting the clarity of the resource aim, supporting the validity and appropriate nature of the initial design and content.

When asked how **useful** resource two might be for **singing teachers** who wish to develop the singing voice after initial therapeutic delivery, SLT 13 felt that it would provide clear links between the two

“I mean, […] it's so detailed in a way that so I can see crossovers with what we would do.” (SLT#13)

This aspect of the resource is consistently observed by participants and while it is a key aim of resource 2, it must be acknowledged that not all voice clinic practitioners, particularly ENT consultants and SLTs may be supportive of a resource which encourages crossover between role boundaries of singing teachers and the more therapeutic aspects of clinical intervention which is overseen by a governing body. SLT#13, however, was positive about the sharing of experience and potential for practitioners to support each other to the benefit of the singer;

“If somebody if a client has been to an SLT that maybe doesn't have specialist voice experience which they might do you know if they're in the NHS they go and see somebody, a generalist or even a newly qualified therapist. They might not get half of this, so this certainly elevates what a singing teacher could do.” (SLT#13)

The progression of involvement was discussed by SLT#13 who supported the findings in previous literature review by stating

"If I get the speaking voice working really well, there will come a point where I think the singing teacher needs to take over." (SLT#13)

This moment of 'taking over' is the point at which additional information and support may be valuable to both parties, as SLT#13 highlights

"Yeah and I think also you know for people who are working in voice you know like clinic SLT, I think it would be useful to see right this is what some singing teachers might have access to so you know if somebody comes in and says my singing teachers just read this book and you know they've done whatever and […] just being able to then say to the client OK so this is my this might be how we would describe it in SLT it's a slightly different way of describing but essentially we're doing the same thing you know." (SLT#13)

A generalised comment by SLT#14

"It is a fantastic resource and will give teachers confidence" (SLT#14)

was supported upon with the additional comment that

"I think it would be a valuable tool for SLTs too - I think it will be useful for singing teachers to develop and as you state with support and shadowing. You really have covered all areas." (SLT#14)

The least amount of input was noted when asked how far the content allowed a **flexible approach** depending on what the initial therapy included. SVRS#2 did not comment specifically on the flexibility of approach, however SLT#13 and SLT#14 felt that

"I mean, I think you've got the in terms of practical exercises and what to do. I mean, they're all in there and once you know, like I wouldn't, I'm not trained, I've not done anything on accent method, so I wouldn't use that." (SLT#13)

"[…] singing teachers can go in and select the appropriate technique, try it and go back in again and try another with good, explained rationale." (SLT#14)

Furthermore, SLT#14 felt that the content was appropriate and did not include any recommendations when asked if there was anything that could be **included or removed**. SLT#13 however raised the broader question of the level of language and science which was useful for the singing teacher.

"Swelling – is there too much information here? How much does the singing teacher need to know? Oh yeah so one of the comments what I've put in terms of. It was about the swelling sorry so I've said comprehensive account of swelling, and I wouldn't have thought the whole process was needed but it's certainly informative and relevant […] is this all needed but I don't know what a singing teacher does or doesn't know so? I'm looking at that thinking do you know an SLT student wouldn't probably get told all that so […] from a clinical perspective if we wouldn't go into that much detail but it would be good for somebody sort of you know postgraduate working then the resource could come in so I swither as to how much the science was needed…". (SLT#13)

This aspect was echoed by SVRS#2 who added specific language use recommendations throughout the resource document and added

"Consider simplifying descriptors or adding reference pages for anatomical information".

This has been taken into consideration and the format updated to a series made up of separate parts, rather than a single volume. SVRS 2 strongly recommended including more of the overarching concept of

"linking up between practitioners throughout the resource from the outset" (SVRS#2)

to ensure the aim was clear.

Contrary to the feedback given by SLT#13, SVRS#2 recommended the addition of

"physiological to […] aid understanding of laughing". (SVRS#2)

This specific reference to incorporating anatomy and physiology with a given practical approach can be indicative of the opportunity to link to these via QR codes or similar in the final resource.

When asked how the resource should/could be **made available** SLT#13 responded with

"[…] interestingly one of my colleagues at work one of the psychology colleagues had spotted on his Twitter recently. That he had reposted it was, I think it was a systematic review and basically, they had looked at various studies and I can't remember how many but a decent number of studies that basically said we retain information far better when it's on paper than on digital form and so". (SLT#13)

In response to the same question SLT#14 felt that a

"*digital resource would be perfect with perhaps some videos of a singing teacher carrying out the techniques".* (SLT#14)

This recorded element is already in progress with several of the relaxation and body mapping tasks having been recorded on audio tracks by the researcher and the remaining examples to be finalised before additional evaluation. The idea of a combination of hard copy and online resources has been further developed based on the feedback given in this pilot evaluation. SVRS#2 elevated the format concept by asking

"could this be a series rather than one resource? Part 1 Understanding MTD Part 2 Logistical considerations for singing teachers, Part 3 Therapeutical and practical techniques, Part 4 Advanced considerations for musical theatre performers. Then: supplementary materials". (SVRS#2)

This format seems appropriate and will allow greater depth of detail to be added to the separate parts, alongside accessible online resources which could be linked via QR code and allow the reader the choice to expand knowledge or simply use the practical approaches provided. SVRS#2 suggested a link to an app in the future.

The question as to how **useful** resource might be in supporting client progression **beyond clinical input** was re-framed by SLT#13 who shifted the question towards how useful it may be for SLTs in training, stating

"You've got everything in here and if I if I think of what our students would get and again it's because you know that they've got X number of classes you know over a defined number of weeks invoice and that takes in kids voice, MTD, nodules, transgender, and so actually our students if they go out on placement they would get experience of some of this but they wouldn't necessarily have all the information". (SLT#13)

The concept of the resource being used by or introduced to SLTs had not featured in the design, this potential user and any changes to design will be evaluated once additional refinement has taken place.

Additional recommendations beyond those include the need to choose between using ‘singer’ or ‘client’ or ‘patient’ throughout the resource to ensure continuity for the reader. The decision was made to use the term ‘singer’ as the resource is currently aimed at the singing teacher. SLT#14 reiterated the need for practical hands-on accessible videos, while SVRS#2 suggested a title change to incorporate voice users and remove any ambiguity around the term ‘initial’ with regards to therapeutic intervention. The recommendation of clarification around the need for singing teacher awareness of MTD was given by SVRS#2 who suggested the following format for the introductory section: Definition, relevance for singing teachers, connection between therapy and singing, goals of resource. Clarification of the line between what is medical and what is for the singing teacher was included in this aspect of the discussion with SVRS#2. The illustration of the vocal folds was thought to potentially indicate glottal gap, and it was recommended that the illustration be refined slightly.

9.5 Strengths and Limitations of Study Four

Study four used a qualitative methodology to uncover the content and relevance of the concept and initial design of a novel pedagogical resource by SLT practitioners as a pre-cursor to a larger-scale post-doctorate evaluation study. This approach provided some evidence of the potential transferability, relevance of content and usefulness of the resource.

On reflection, the data collection design was arguably unrealistic in the short timeframe available, particularly regarding the target participant group workload and existing time pressures. Caution must be exercised when interpreting the findings, largely due to the small number of enthusiastic volunteer participants. The study was primarily a short-term feasibility pilot which resulted in a lack of objective, longer term outcome measures being collated, resulting in the evaluation process being largely descriptive and having benefited from a greater analytical focus, although this is perhaps a reflection of the volume of information within resource two and the broad evaluation approach employed for this type of pilot study.

The approach adopted in study four was with hindsight, ambitious. Efforts were focused on collecting feedback on the design, content and delivery methods simultaneously of a large resource within a relatively short timeframe. Although many findings are promising, further testing with larger groups of representative SLT, SVRS and ST/VC groups is necessary to more fully inform the ambitions of this type of resource, the usefulness of content (particularly anatomical and physiological supporting information), the perceived impacts on continued professional learning, the value of shared knowledge between practitioner roles, and the potential for the resource to encourage more consistent and successful support systems for singers. Future study of specific improvement interventions (and related evaluation) will require much greater clarity about the processes that need to be measured and altered to achieve the desired supporting resource.

The study findings are currently informing the re-design, refinement and delivery of resource two which will be delivered in a six-part series to allow choice and flexibility of use. Further testing and refinement of the resource are ongoing with more representative user participants. There is growing evidence of the impact of collaborative working and shared knowledge to improve progression of rehabilitation of the singing voice (Goffi-Fynn & Carrol, 2013), however there are still question marks over the effectiveness of such initiatives and large-scale collaborative programmes in achieving and sustaining the desired improvements in the quality and safety of singer care. Overall, evidence of which resources work to enhance progression in voice care in the way this body of research has attempted to do is less well developed. This evaluation provides some evidence of the transferability and utility of specific supporting methods in voice care.

9.6 Practical Recommendations

The following specific recommendations were gathered from the findings of the evaluation:

- Signposting the opportunity to bypass the anatomical/physiological/clinical content to the practical ideas.
- Possibly less clinical descriptors or the opportunity to access them as personally required.
- Use of the term singer rather than client or patient throughout.
- Video demonstrations by a singing teacher
- Split the resource into distinct parts to form a series of resources.
- Consistently design holistically and think big.
- Re-design medical descriptors where these may be too clinical.
- Make clear the line between what is medical and what the singing teacher needs to know.

9.7 Resource Two Refinement Process

The following refinements and recommendations were applied to the resource following this initial evaluation and feedback:

- The resource is split more clearly into distinct parts, including, anatomy, the overview of MTD and physiological aspects with signposting to the reader to indicate they may wish to move directly to the practical approaches if desired.

- Client or patient has been changed to singer throughout the resource.
- Clinical aspects of MTD causes have been revised.

The following developments and refinements will continue to be applied to the resource as it is prepared for publication:

- Split into a series of books/volumes
- QR codes will be added throughout linking to examples of practical application.
- Continue to review clinical descriptors under the supervision of contemporary researchers to provide the most up to date information available.

9.8 CONCLUSION

The pilot evaluation study sought initial feedback with regards to general content, concept and design of resource two. Several practitioners were approached to take part in interviews, with data gathered showed the resource aim to provide a link between SLT input for singers experiencing MTD and the singing teachers who subsequently work with them to help continued progression back to performing voice use was clear. The intention to give singing teachers a useful amount of information with regards to the format and content of initial SLT input was acknowledged as achieved. The establishment of the boundary between anatomical and medical awareness and singing teacher input was achieved by including clear descriptors of commonly used methods of spoken voice therapy, alongside examples of a variety of practical exercises. Through this format the resource aims to inspire the design and development of singing voice work that may join up practitioner approaches for the singer.

Study four allowed valuable insight and feedback which will be used to further shape the design and content of the resource. The initial design and content of resource two was positively received by all participants; however, two participants questioned the depth of anatomical knowledge included and asked whether a change to the delivery may allow singing teacher to access this information at a level aligned with their individual interests. The evaluation provided valuable insights into how the resources may be used and adapted, which has already led to further refinements and improvements in design, content and proposed delivery methods. Several technical implementation challenges (e.g. the use of QR codes to enable accessibility of recorded examples of exercises) were identified that need to be taken into consideration when the resource is developed on a larger scale. That said, a significant time commitment for this approach is required with continued evaluation, and consultation to support the refinement of additional design and delivery of resource two.

The primary limitation of initial resource two design seems to be the breadth of vision by the researcher. Pilot study feedback advised that the resource be expanded to a series of books rather than being limited to a single volume. By re-designing the resource format in this way, accessibility and depth may be improved. Considering the pilot study recommendations, the next steps for resource refinement include the re-design of resource two format.

The version of resource two currently in refinement is divided into the following parts:

Part 1: The Muscles of Singing Voice Production
Part 2: Understanding MTD
Part 3: Logistical considerations for singing teachers
Part 4: Therapeutical and practical techniques
Part 5: Advanced considerations for musical theatre performers
Part 6: Supplementary materials

Additional medical proofreading, checking, and input with regards to contemporary research and definitions will take place before more formal evaluation studies are undertaken to gain user input from SLTs, singing teachers and singing voice users working with the exercises in resource two developed as an innovative and novel output from the body of work presented in the thesis. These studies are expected to start in 2026, and the findings will shape the final published output of resource two.

10 CONCLUSION

The body of work which makes up this thesis explores the complex nature of muscle tension dysphonia (MTD) in singers, particularly those in musical theatre, and highlights the need for stronger collaboration between clinical voice professionals and singing teachers. Recognising the singer as a vocal athlete - whose instrument is not only artistic but physiological - this research emphasises the high-performance demands placed on the singing voice and the corresponding need for precision in its care and rehabilitation.

The thesis investigates the anatomy of voice production, current diagnostic and treatment methods, and the unique vocal load experienced by musical theatre performers, whose routines often include frequent rehearsals, live performance, and stylistic versatility. The overarching aim was to create practical resources that bridge the gap between initial clinical intervention and the return to full, performance-level singing, empowering singing teachers to confidently support post-therapy rehabilitation. The findings presented offer several innovations both to the field of singing pedagogy and to approaches that extend beyond traditional therapeutic interventions in the voice studio.

Through literature reviews, practitioner questionnaires, and case studies, the study confirmed that MTD is a multi-factorial condition, with causes ranging from vocal overuse and suboptimal technique to environmental pressures and psychological stress. While treatment strategies varied, commonly used methods such as breath work, semi-occluded vocal tract exercises (SOVTEs), and tension release were consistently reported. It became clear that initial therapy often prioritises the speaking voice, with less emphasis on restoring the full functional capacity required of the singing voice, particularly in genres like musical theatre, where singers must meet demanding physical and vocal expectations. Given this gap, the study argues that singing teachers, as practitioners working with vocal athletes, must deepen their understanding of voice physiology, therapeutic methods, and assessment practices to better support the transition from clinical treatment to full vocal performance. Two key resources were developed: one detailing vocal muscle function, and another providing strategies for progressing beyond the therapeutic phase. These tools are intended to enhance communication between pedagogical and clinical professionals and equip singing teachers to take a more informed role in the recovery process of the vocal athlete.

Building upon the approaches identified by practitioners in studies two and three, the researcher has begun incorporating these strategies into ongoing work with singers in both studio and higher education settings. Reflection both *in* and *on* action (Schön, 1983) during post-therapeutic sessions allows for the continual refinement and development of effective support practices. Additionally, providing opportunities for singing teachers to observe clinical treatments specific to

MTD in singers could foster a deeper understanding of therapeutic approaches, supporting the confident application of appropriate exercises and techniques in the studio.

Looking ahead, the study recommends more integrated, multidisciplinary models of voice care that reflect the complex needs of singers as vocal athletes. Further research is needed to evaluate the effectiveness of specific interventions, such as SOVTEs, across different vocal styles, levels of athletic demand, and individual voice qualities. Greater inclusion of singers' perspectives in shaping therapeutic pathways is also encouraged. Ultimately, this thesis challenges the traditional divide between clinical and pedagogical voice care and advocates for a more unified, collaborative approach that reflects the professional realities of the modern singing performer.

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Appendix A – Study 1: Scoping Review

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Methods of Measuring Laryngeal Muscle Tension in Patients with Muscle Tension Dysphonia: A Scoping Review

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Summary: Background. In clinical practice and research relating to Muscle Tension Dysphonia (MTD), several laryngeal muscle tension measurement methods are used to diagnose, to identify specific muscle strengths and deficits, and to measure therapeutic outcomes. The variety and reliability of available measurement methods presents challenges within diagnosis and treatment. The lack of methodical standardization presents a barrier to homogeneous practice in this area. There is a need for a comprehensive scoping review of laryngeal muscle tension measurement methods.

Study Design. Scoping review.

Objectives. (1) To identify current methods of laryngeal muscle measurement which have been developed or tested with people with MTD; and (2) To identify the construct/s measured, reliability, validity, ability to detect change, efficiency and accessibility of identified methods.

Method. This scoping review was conducted using the Arksey and O'Malley framework. Studies were identified through searches of 4 major databases. The reviewer independently assessed titles, abstracts, and full-text articles.

Results. Twenty seven papers published from 2000 to 2022 that satisfied the inclusion criteria were selected from 194 studies. The papers showed a variety of approaches with regards to the measurement of laryngeal activity and tension in subjects with MTD. Just over a quarter (25.9%) were reviews of the validity of assessment methods of MTD, including surface electromyography (sEMG), while 22.2% discussed surface electromyography as a measurement of muscle activity in subjects with MTD. 96.3% used a published methodological framework.

Conclusions. Assessment methods for Primary MTD are multifaceted, including patient history, laryngoscopic examination, and voice-related musculoskeletal features. Potential use of objective measurement methods, including sEMG, Real Time Elastosonography, Magnetic Resonance Imaging was noted. Due to variability in assessment methods and results, there is a need for greater objective practical methodological standardization to ensure accurate diagnosis, appropriate care, and chart patient progress.

Key Words: Laryngeal—Muscle—Tension—Dysphonia—Measurement.

INTRODUCTION

Laryngeal tension has been identified as a primary factor in the development of muscle tension dysphonia (MTD) in singers. The concept of MTD has been described by Altman et al[1] as "a compensatory adaptation to glottal insufficiency" and by Koufman and Isaacson[2] as "altered laryngeal biomechanics" caused by "inappropriate or abnormal muscle tension." The term muscle tension dysphonia is a general term for an imbalance in the coordination of the muscles and breathing patterns needed to create voice. This imbalance can be seen without any anatomical abnormality (primary MTD) or in the presence of an anatomical abnormality (secondary MTD). In the case of secondary MTD, the muscle tension is thought to be the body's natural compensatory process to adjust for the vocal injury.[3]

In Muscle Tension Dysphonia (MTD) diagnosis and rehabilitation, laryngeal tension is measured in many ways and for many reasons; to screen and diagnose, to identify areas of deficit and strength, and to assess outcomes, the changes in status following treatment.[4] Currently the process of measuring laryngeal muscle tension is complicated by considerable variation in what is measured and how best to measure it. Morrison et al[5] developed a set of diagnostic criteria and definitions in this area in the hope that *"some form of system could be devised that would permit establishment of diagnostic criteria for the various voice disorders."*

Irrespective of what a measurement method is called, choosing one, or the optimum combination of methods, requires consideration of the following factors: (1) Reliability (2) Validity (3) Ability to detect change and (4) Feasibility and Acceptability of using the measurement method within a given context/population.[6]

In diagnosis, reliability (achieving the same response on repeated measurements) and validity (the degree to which the content and scores are an adequate reflection of the construct to be measured) are essential. In outcome assessment, responsiveness (the ability to detect change) is also crucial.[6] Feasibility will depend on the context in which the measurement instrument is being used, for example, clinical practice versus research.[7] Considerations may span factors including cost, time, and resources required for administration.[8] It may be important to consider acceptability to the patient or client, such as whether the task or assessment is something they are willing to do.[9] The choice of a measurement

Accepted for publication March 13, 2023.
No financial support was obtained for this review.
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Journal of Voice, Vol. ■■, No. ■■, pp. ■■-■■
0892-1997

https://doi.org/10.1016/j.jvoice.2023.03.013

method has become increasingly examined in recent years, with a proliferation of measurement methods being developed for diagnosis and charting progress of those with MTD.[10–22] The number of available methods, combined with a lack of agreement on what should be measured and how, presents challenges for the ENT, SLT and researcher.

The first to develop the term muscle tension dysphonia were the team of Morrison et al[8] who analyzed the diagnostic criteria used over a 4-year period of treating 1000 patients. Prior to this data collection, Koufman and Blalock[23] distinguished 5 types of functional voice disorders based on a study of 52 patients (Figure 1).

That said, Morrison & Mathieson[24] developed a 5-point assessment which continues to form the broad basis for current consultation (Table 1). Further, Morrison & Mathieson[24] categorized MTD into different "types" (Table 2).

Within the categorization of subjects presenting as type 1, 81% of the 1000 presented with a posterior glottal gap (previously termed "posterior glottal chink"), 67% of subjects presented with a high larynx, 71% of subjects presented with suprahyoid tension and 81% with breathiness (Morrison et al[8]). In both clinical practice and MTD research, consideration must be given to the relevance of what is measured (Dworkin-Valenti et al[25]). Across all types of MTD, high incidences of high larynx, suprahyoid muscle tension and a posterior glottal gap were present. (Morrison et al[8]) These characteristics are summarized in (Table 3).

In contrast to Morrison & Mathieson,[24] The European Laryngological Society (ELS) protocol includes 5 methods (Table 4).

While the diagnostic process related to MTD is often assessed in adherence to clinical guidelines, outcome measurement methods are usually selected and administered by individual clinicians.[26]

Although many measurement methods are of a complex and varied nature, it appears that the most successful diagnoses are the result of several methods used in conjunction to allow substantiation of the overall result/diagnosis.[10,12,13,14,15,18,24,27,28,29,30] The various assessment methods used to evaluate MTD have not yet been extensively reviewed simultaneously with regards to their inter-rater reliability. Comparison studies, focused on two approaches at most, including laryngeal palpation vs surface electromyography,[11] vocal fatigue index vs videostroboscopy,[31] surface electromyography vs videostroboscopy[32,33] and laryngeal aerodynamic analysis vs videoendostroboscopy[22] agreed that there was a need for combination methodologies in diagnosis as hyperfunctional features are not always acoustically or visibly perceptually distinguishable between typical and atypical voices.

The purpose of each method of laryngeal assessment is to identify the presence or absence of known symptoms of MTD, seeking to present a diagnosis which can then form the basis of treatment.[10,28] Assessment methodology generally includes several different approaches, often relying on one method to support the findings of the previous.[12]

Type 1. Hysterical Aphonia/Dysphonia

1. Onset: sudden.
2. Indirect laryngoscopy: normal.
3. Often associated with a discrete precipitating event.
4. No history of prior laryngitis.
5. Associated symptoms: none.
6. Voice quality:
   a. Aphonia or whisper.
   b. Pitch-locked (if any voice present).
   c. Stable dysfunction (not intermittent or fluctuant).

Type 2. Habituated Hoarseness

1. Onset: persistence of hoarseness (for months or years) usually following an acute episode of laryngitis.
2. Indirect laryngoscopy; normal (except for occasional plica ventricularis).
3. Associated symptoms: none.
4. Not associated with a discrete precipitating event but frequently associated with "secondary gain."
5. Voice quality:
   a. Breathy, raspy, diplophonia, plica ventricularis (or a combination).
   b. Pitch-locked.
   c. Stable dysfunction (not intermittent or fluctuant).

Type 3. Falsetto

1. Onset: developmental or sudden.
2. Indirect laryngoscopy: normal.
3. Associated symptoms: none.
4. Voice quality:
   a. Abnormally high-pitched.
   b. Pitch-locked.
   c. Stable dysfunction (not intermittent or fluctuant).

Type 4. Voice Abuse

1. Onset: usually long-standing, intermittent or fluctuant dysphonia.

FIGURE 1. Five Types of functional voice disorders—Koufman and Blalock.[23]

TABLE 1.
Morrison & Mathieson (1993) Assessment Methods.

Assessment Method	
1	Patient History
2	Laryngoscopic examination
3	Perceptual-acoustic assessment (including GRBAS)
4	Voice-related musculoskeletal (assessed via palpation and observation)
5	Psychological evaluations

TABLE 2.
Morrison & Mathieson (1993) Description of MTD Types

Type	*Description*
1	Structurally normal larynx with open posterior chink left between the arytenoid cartilages on phonation.
2a	Vocal Nodules
2b	Chronic Laryngitis
2c	Polypoidal Denegation

TABLE 3.
Diagnostic Features of MTD[8]

Muscle Tension Dysphonia	Will have	May have
1. HISTORY		
1 = Simple	Increased dysphonia with vocal use	Increased dysphonia with psychological stressors
2a = with vocal nodules	Significant vocal identity	Throat pain and/or tightness
2b = with chronic laryngitis	Income related voice use	Organic trigger
2c = with polypoidal degeneration	Prolonged and/or intensive voice use (2a,b,c)	Inhibition of voice use Smoking (esp. 2c)
Psychogenic "functional" dysphonia		
Vb = ventricular band	Varying dysphonia	Increased dysphonia with stresses
B = with bowing	Voice effortful	An organic trigger (eg, Virus, reflux)
Ha = hypo adducting (aphonia)	Voice fatigue with minimal use	Recognisable psychological precipitant of voice disorder
Ns = non specific		Periods of normal voice
2. LARYNGOSCOPIC FEATURES		
1 = Simple	Open posterior glottic chink No mucosal changes	Reduced posterior chink with masked resonance
2a = with vocal nodules	Open posterior glottic chink Vocal nodules	Lesser amounts of erythema and oedema
2b = with chronic laryngitis	Open posterior glottic chink Erythema, oedema and thickening	Less open posterior chink
2c = with polypoidal degeneration	Open posterior glottic chink Polypoid degeneration	Lesser amounts of erythema and oedema
Psychogenic "functional" dysphonia		
Vb = ventricular band	False fold adduction Altered true fold tension	Some erythema, edema or early polypoidal degeneration Triangular open posterior glottic chink
B = with bowing	False fold adduction Altered true fold tension	Triangular open posterior glottic chink Hyper adducted vocal processes
Ha = hypo adducting (aphonia)	False fold adduction Altered true fold tension Full fold movement with inhalation and cough	Hyper adducted vocal processes
Ns = non specific	False fold adduction Altered true fold tension	
3. PERCEPTUAL-ACOUSTIC FEATURES		
1 = Simple	Breathiness Glottal Attack Glottal Fry	Inappropriate pitch
2a = with vocal nodules	Glottal Attack	Pitch breaks
2b = with chronic laryngitis	Glottal Fry	Mono pitch Inappropriate pitch
2c = with polypoidal degeneration	Stridency/harshness	Inappropriate pitch
Psychogenic "functional" dysphonia		
Vb = ventricular band	Breathiness Stridency	Pitch breaks Glottal Attack
B = with bowing	Stridency	Reduced pitch or loudness range Inappropriate or mono pitch
Ha = hypo adducting (aphonia)	Glottal Fry Whisper Stridency	Hyper adducted onset and/or release
Ns = non specific	Stridency	Glottal Attack

(*Continued*)

TABLE 3. (*Continued*)

Muscle Tension Dysphonia	Will have	May have
4. MUSCULOSKELETAL FEATURES		
1 = Simple	Palpable increased suprahyoid tension Atlanto-occipital extension with increased pitch (jaw jut) Tongue retraction Reduced mandible use with phonation	Rise of larynx in neck with rising pitch Inappropriate posture of head, neck, and shoulders (shoulders raised and retracted) Increased intrathoracic phonatory pressure
2a = with vocal nodules		
2b = with chronic laryngitis		
2c = with polypoidal degeneration		
Psychogenic "functional" dysphonia		
Vb = ventricular band	Restricted mandibular movement	Larynx rise with pitch rise Visible/palpable strap muscle or suprahyoid tension Jaw jut
B = with bowing		Larynx rise with pitch rise Visible/palpable strap muscle or suprahyoid tension
Ha = hypo adducting (aphonia)		
Ns = non specific		
5. PSYCHOLOGICAL FEATURES		
MTD – all types	An intense attitude, generally uptight Voice function highly valued	Identifiable psychological stress factors
Psychogenic "Functional" Dysphonia	Recognisable etiological psychological stressors Stressors lead to feed-forward mechanism which participates in and promotes dysphonia	Psychological conflict recognised to be outside patient's awareness and definitively symbolised by voice dysfunction Denial that voice disability affects their life

Assessment methodologies also aim to provide a descriptive overview of the reported and observed symptoms while amalgamating evidence from different assessments and can be classified into two distinct groups:

1. Non-instrumental methods which require training, but do not need any equipment for examination. (eg, case history, palpation)
2. Instrumental methods which use tools for objective diagnosis of conditions and include laryngoscopic and videostroboscopic assessment, radiography and electromyography.

In recent years, there has been an increased focus on the measurement of laryngeal muscle activity with regards to quantifying the success of different therapeutic approaches. Several research studies and reviews have been published across a range of disciplines relating to the speaking voice and associated fields of study[12,13,14,15,28,34] These include the attempt to determine protocols for the assessment of voice,[35] the examination of reliable laryngoscopic features with which to determine MTD,[10] study of aerodynamic profiles in patients with MTD,[36] description of glottal aerodynamic measures in patients with MTD,[37] study of the parameters of compression of the supraglottis in dysphonic patients,[38] the establishment of protocols relating to sEMG signal in phonation evaluation[39] and the determination of strain elastosonography measurements in patients with primary MTD.[17] To date, however, little has been published with regards to the standardization of methods of measurement of MTD in the singing voice, suggesting the need for different measures to assess MTD while singing. Studies of clinical practice in this area also reveal considerable heterogeneity in the assessment methods used.[12,14,30] Performance-based and clinician-reported measures predominate, while the use of objective outcome measures remains limited.

TABLE 4.
European Laryngological Society Assessment Protocol

1	Laryngeal imaging
2	Auditory-perceptual evaluation
3	Aerodynamic measures
4	Acoustic analysis
5	Self-evaluation by the patient

In research, it is critical that the effects of treatment are quantified through considered measurement.[26] Outcome measurement methods must be carefully selected to ensure that change because of treatment can be detected.[15] If an outcome measurement instrument is not equipped to reliably detect change in the area of interest, significant research wastage can occur.[4] To this end, it has been increasingly recommended that approaches to outcome measurement be standardized. Several studies agree that objective and standardized determinants of physiology are critical for the differential diagnosis of MTD and its effective treatment, recommending further research be undertaken using standardized assessment methods.[11,12,13,14,17,18,28,29,30,34,40,41]

As heterogeneity in measurement methods produces incompatible data[33] which is not easily synthesised,[42] this may limit opportunities to amass treatment evidence across trials. In systematic reviews and meta-analyses of MTD treatments, variability in measurement instruments is frequently cited as a key factor limiting the combination and comparison of research results.[13]

There is a need for standard measurement protocols and synthesized information to assist clinicians and researchers to make informed choices in the selection of laryngeal muscle measurement instruments. To date, several reviews of laryngeal muscle tension assessment methods have been performed.[12,14,34] The majority undertake to compare 2 or more methods and assess the reliability and success of each. Reviews have been completed for: (1) vocal parameters, muscle palpation, self-perception of voice symptoms, pain and vocal fatigue[27]; (2) laryngeal electromyography[20]; (3) comparison of neck tension palpation rating systems with sEMG and acoustic measures[13]; (4) evidence-based clinical voice assessment[14]; (5) assessment methods of laryngeal muscle activity in MTD[12]; (6) sEMG as a useful tool in identifying MTD[34], (7) comparison of sEMG and laryngeal palpatory scale,[11] and (8) reliable laryngoscopic features for diagnosis.[10]

The purpose of this paper is to provide a contemporary perspective of the available literature on laryngeal muscle tension measurement methods relating to MTD. The addition of this study to current literature may provide useful information regarding subjective and objective methods of diagnosis and progress. It is hoped that this study may be used to encourage the standardization of assessment methods in practice and future studies relating specifically to MTD in the singing voice. To this end, it seeks to; (1) Identify all available methods of laryngeal muscle measurement which have been developed or tested with people with MTD; and (2) Identify the construct/s measured, reliability, validity, efficiency and accessibility of the identified methods.

METHODS AND PROCEDURES

Study design

Within the context of developing therapeutic tools to aid transition back to performance for singers who have experienced MTD, this scoping review was undertaken after an initial investigation into the muscles of the singing voice was collated into a compendium to be published later. The reviewer identified the broad research question to be addressed and the overall study protocol, including identification of search terms and selection of databases to search.

The methodology for this scoping review was based on the framework outlined by Arksey and O'Malley[43] and subsequent recommendations made by Levac et al.[44] The review included the following five key phases and final optional phase: (1) identifying the research question, (2) identifying relevant studies, (3) study selection, (4) charting the data, and (5) collating, summarizing, and reporting the results. The final optional "consultation exercise" was not undertaken due to time constraints. The scoping review protocol was not registered in advance of completion.

For the purposes of this study, a scoping review is defined by Daudt et al,[45] as a type of research synthesis that aims to "map the literature on a particular topic or research area and provide an opportunity to identify key concepts; gaps in the research; and types and sources of evidence to inform practice, policymaking, and research."

Step 1. Identifying the research question

This review was guided by the question, "*What are the most successful and accessible methods of measuring muscle tension dysphonia?*"

Data management

Step 2. Identifying relevant studies

After identifying the principal methods of muscle tension measurement as non-instrumental assessment (case history, palpation) and instrumental assessment (observation, radiography, electromyography),[12] an initial broad search was undertaken to identify the various types of instrumental measurement of muscle tension available and implemented on February 06, 2022, across five electronic databases: NHI/PubMed (National Centre for Biotechnological Information), Wiley Online Library (multidisciplinary), Elsevier (multidisciplinary) ResearchGate (multidisciplinary) and Science Direct (Voice-focused, current awareness). The databases were selected to be comprehensive and to cover a broad range of laryngeal measurement approaches. A limit on date to include studies and reviews published no earlier than 2000 was imposed to ensure that only the most recent developments in methodologies were considered. This decision was made due to the amount of literature available dealing with earlier papers. No limit on primary language was placed on the database search, if the paper had previously been translated into English. The search string was developed in 3 phases before a final string was implemented.

Initial search string: Muscle, tension, dysphonia, electromyography, measurement, methods of assessment.

Second development of search string: Muscle tension dysphonia AND laryngeal AND muscle measurement AND methods of assessment.

Final string used throughout search process: "Muscle tension dysphonia" AND laryngeal AND muscle measurement AND methods of assessment.

The search string consisted of terms considered by the author to describe the subject and its methodology: laryngeal, muscle tension, muscle, measurement, methods of assessment. The search string was repeated within each database.

The following websites were also searched manually: The British Voice Association (http://www.britishvoiceassociation.org.uk). The British Association of Laryngology (https://www.britishlaryngological.org), Science Direct (https://www.sciencedirect.com) and Google (www.google.com).

Primary searches were run using PubMed, Wiley, ResearchGate, Elsevier, and Science Direct databases in February 2022. Secondary searches of individual measurement methods, reference list reviewing, and hand searching of hard-copy publications were conducted between May and August 2022.

Eligibility criteria (Table 5)

Step 3. Study selection

The reviewer independently assessed titles, abstracts, selected full-text articles, and reference lists of the studies retrieved by the literature search. A "snowball" technique was also adopted in which citations within articles were searched if they appeared relevant to the review. A second review was not implemented due to time constraints.

RESULTS

Search results

Figure 2 shows the PRISMA flow diagram of study selection. Initial searches yielded 3426 articles. Following the removal of duplicates and non-MTD specific literature, 194 articles were screened by title and abstract: with 25 articles undergoing full-text review. Secondary searches of individual measurement instruments and hand searching of journals identified a further 22 publications. In total, 47 references for 12 measurement methods were included in this review.

Identified measurement instruments

Step 4. Charting the data

A total of 12 measurement methods were identified. All had been developed or tested with people with MTD, in that at least one study of the psychometric properties of the measurement method had been undertaken and published (Table 6).

DISCUSSION

Step 5. Collating, summarising and reporting the results

The results of this scoping review are discussed with respect to the initial aims: (1) To identify current methods of laryngeal muscle measurement which have been developed or tested with people with MTD; and (2) To identify the construct/s measured, method of report, structure (components and scoring system), efficiency and accessibility of identified methods. A total of 12 different measurement methods were identified.

MTD does not always present itself similarly from patient to patient. Behrman et al,[38] concluded that supraglottic activity can also be observed in healthy speakers and should not necessarily be deemed as excessive laryngeal muscle tension, highlighting the need for assessment methods to include patient history, laryngoscopic and videostroboscopic assessment, perceptual-acoustic assessment (including GRBAS and CAPE-V), observations, voice-related musculoskeletal features, physiological or behavioral examinations, self-report (VHI), duration of a variable, and questionnaires.[10,12,14,15,27,28,40,41,46] Perceptual voice assessment, palpation, laryngoscopic and videostroboscopic assessment can be considered as subjective diagnosis methods while instruments such as electromyography, radiography and acoustic analysis allow objective measures to describe structure and function.[11,12,17,18,20,27,29,32,39,47,48] Differential diagnosis of MTD should include both subjective and objective data.

Based on the current review of 25 publications that met the inclusion and exclusion criteria, most studies investigated the assessment method of laryngeal muscle palpation,[11,13,19,27,49–51] followed closely by those

TABLE 5.
Study Inclusion and Exclusion Criteria

Study Inclusion Criteria	Study Exclusion Criteria
Studies focusing on the development or practical evaluation of measurement methods or their cultural/linguistic adaptation/translation.	Studies evaluating the effectiveness of interventions where a measurement instrument is used as an endpoint (without studying the measurement properties).
Studies including participants with MTD.	Studies reporting normative data without examining other measurement properties.
Studies reporting standardised measurement methods (defined as measurement methods with clear procedures for administration and scoring).	
Studies reported in full-text peer-reviewed publications.	

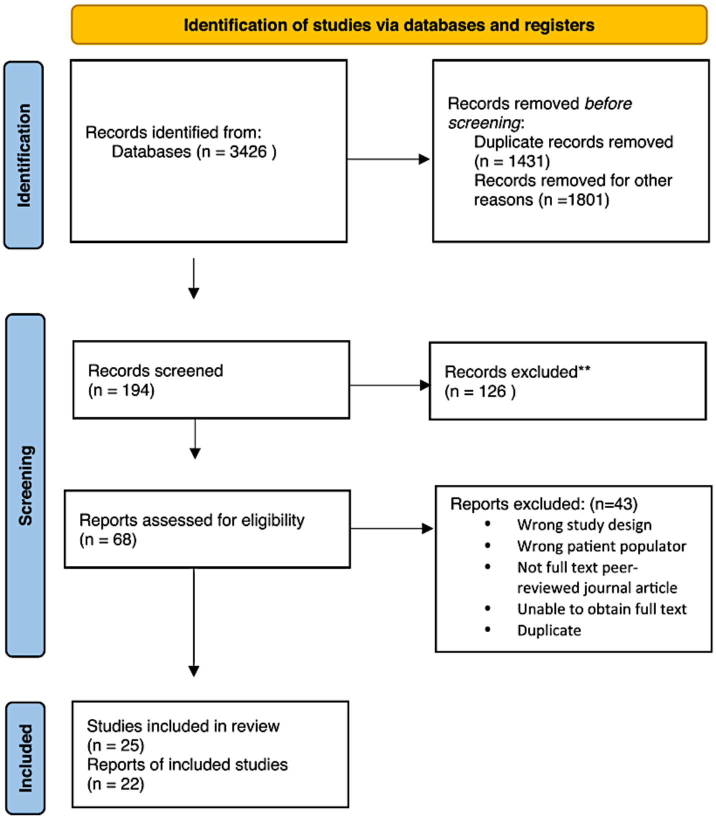

FIGURE 2. PRISMA SC-R study selection process.

discussing the use or limitations of surface electromyography as an additional objective measure.[13,32,34,39,47,52] The focus of most studies was to determine how well the test method identified the presence or absence of MTD, using a mix of healthy subjects and those diagnosed muscle tension dysphonia.[11,16,17,27,32,39,40,46,47,52]

OVERVIEW OF ASSESSMENT METHODS

Patient history

Overview

A non-instrumental, subjective method which requires confirmation by palpation, perceptual-acoustic or objective methods. Khoddami et al[12,32] highlight the *"disadvantage of history-taking associated with subjectiveness."*

Forming the initial basis of direction of diagnosis and informing the choice of subsequent assessment, the patient history allows a holistic view of the patient which can lead to more detailed questioning, the opportunity to rule diagnoses in and out, and the collation of common symptoms.[46] Good history taking allows the clinician to build a rapport with the patient, help the patient feel more comfortable about discussing their symptoms.[53] It also provides the opportunity to explore a patient's concerns and expectations *(Appendix A: Voice Case History example).*

In a study to investigate the affect of the accuracy of case histories on the interpretation of laryngoscopic and videostroboscopic assessment, Sauder et al[46] found accurate case histories suggesting specific abnormalities increased the probability of detection and percieved severity of MTD, while inaccurate case histories led to false-positive findings and failures to detect abnormalities or to interpret them as less severe. The patient histories in the reviewed studies did not provide any diagnostic support specific to MTD, but were designed for a broad range of vocal disorders. In general, case histories have been found to affect visual-perceptual judgements and contributed to decisions about clinical impressions and treatment.*(Appendix B: Patient's symptomatic complaints (aches and pains) and the practitioner's considerations[54])*

TABLE 6.
Study Characteristics

	Patient History	Self-Assessment	Laryngoscopic/ Videostroboscopy	Perceptual (a) / Acoustic (b) Assessment	Voice Related Musculoskeletal Features	sEMG/HDsEMG	RTE	Aero-dynamic Voice Analysis	LEMG
Useful papers:	Saunder et al. (2019)	Martinez et al. (2020)	Garaycochea et al. (2018), Sama et al. (2001), Morrison (1986)	Martinez et al. (2020), Latoszek et al. (2018)	Martinez et al. (2020), Kunduk (2016), Stepp (2009), Lowell (2012)	Khoddami et al. (2016), Balata et al. (2015), Van Houtte et al. (2013), Stepp (2012), Bracken et al. (2019), Wang & Yiu (2021),	Ata et al. (2020)	Gillespie et al. (2013), Espinoza et al. (2017), Garaycochea et al. (2018), Zheng (2010)	Martins et al. (2020)
What does it measure?	See Appendix 1	Patient sensation, history and impact on life	Depends on which classification system is followed – Van Lawrence (see Sama), Morrison-Rammage or Koufman.	a)GRBAS Dysphonia, roughness, breathiness, asthenia, tension. CAPE-V DSI (see Latoszek p697) AVQI b)maximum phonation times	Assesses resistance in right and left sternocleidomastoid, supralaryngeal area, laryngeal resistance to lateral pressure. Also assesses height of larynx.	The electrical potential present on the skin in consequence of a muscle contraction	The strain of Para laryngeal muscles (suprahyoid, thyrohyoid, cricothyroid on each side)	Sub-glottic pressure / laryngeal resistance	Electrical activity in specific muscles as targeted by needle measurement
How is it structured? (Components and scoring system	No scoring system included. Designed for data recording.	CAPE-V VoiSS VFI NMQ (See Martinez p 3)	Variety of vocal tasks (not standardised). Eg, Sustained "ee" and slowly breathing. Scores based on which system is used.	a)0-3 – See GRBAS template CAPE-V (see template) b)statistics via frequency and percentage	Each item ranges from 1 (minimum resistance to 5 (max resistance) – the lower the resistance, the greater mobility and flexibility the structure presents. Larynx height classified as 1 high, 2 neutral, 3 low and 4 forcibly low.	Voltage measured by electrodes on the skin. The signal increases as the muscle becomes more active.	Non-invasive imaging technique to chart the state of muscles. Produces image to be interpreted.	Sustained vowel. Data collected on air pressure, airflow and sound pressure level	Invasive imaging technique to chart the state of muscles. Produces image to be interpreted.
Efficiency?	Fair	Good	No	Fair	Yes - good	No	Yes	Fairly long, involved research type test.	No
Accessibility?	Good	Good	No	Yes	Yes	No	No	Specialist equipment required – not widely available.	No – requires needle insertion in VFs
Reliability (Same responses on repeated measures)	Dependent on patient sensation at time of completion	Dependent on patient sensation	Fair, requires same operator and relies on some subjectivity	Subject to reviewers impression	Fair, Requires same clinician	Good (if same electrode placement and operator)	Good - objective	The aerodynamic profile of a patient with MTD differs from that of a nondysphonic person. (Zheng, et al 2012)	Good - objective

(Continued)

TABLE 6. (*Continued*)

	Patient History	Self-Assessment	Laryngoscopic/ Videostroboscopy	Perceptual (a) / Acoustic (b) Assessment	Voice Related Musculoskeletal Features	sEMG/HDsEMG	RTE	Aero-dynamic Voice Analysis	LEMG
Validity (Are the scores a reflection of what needs measured)	Yes, but requires examination of physiology to support or clarify aspects to be measured	Subjective – requires interpretation by clinician	Laryngoscopic features commonly associated with MTD are prevalent in the nondysphonic population and sometimes fail to distinguish patients with MTD from normal subjects. (Sama)	Subjective	Not validated	Yes – objective measurement	Yes – objective measurement	Additional assessment methods are required to fully measure.	Yes – objective measurement
Responsiveness (Ability to detect change)	Dependent on patient perception – subjective only	Subjective	Yes – but this relies on the same operator	Subjective	Dependent on same clinician	Yes – objective measurement, if limited to few muscles	Yes - good	Fair to good	Good
Feasibility (Cost, time, resources, ease for client)	Good feasibility - little cost, little time required, good level of ease.	Good	High cost, high time, specialist resources, uncomfortable for client	Fair	Fair - Requires specialist training.	Low feasibility - High cost, long time, limited resources, hard to access.	High cost, high time, costly resources, hard to access	Low feasibility - High cost, high time and not easy for patient.	Low feasibility - High cost, high time and not easy for patient.

Assessment of reliability, validity, ability to detect change and feasibility

The reliability of a patient case history depends upon both the patient and clinician as history-taker[35,48] and therefore cannot be finally assessed within the studies reviewed. Accuracy of case history may be compromised by the level of communication between patient and clinician, bias due to exisiting clinician agenda, leading questioning, lack of rapport, use of closed questioning and an environment not condusive to an open sharing. The validity of the case history requires correlation with other variables, usually at a later time, few of which were included in the studies reviewed. The case history may detect change if performed at regular intervals, although this would more likely be the role of self-perception scoring due to the ease of completion. The ability to detect change is unable to be assessed within the studies reviewed. A case history is easy and fairly convenient, requiring only the patient and clinician to complete it, allowing the feasibility score to be assessed as high. In a scoping review of the heterogenous nature of case history questionnaires, Krosch et al[42] found a need for standardisation in terms of number of questions, number of categories and preference for question-type and structure across the method.

Self-assessment

Overview

Self-assessment is a non-instrumental, subjective method requiring confirmation by palpation or objective methods. The Vocal Symptoms Scale (VoiSS), Vocal Fatigue Index (VFI), Voice Handicap Index (VHI) are the most used in patients displaying symptoms of MTD. Martinez et al[27] examined self-perception in women with MTD using the vocal symptoms scale (VoiSS), the Vocal Fatigue Index (VFI) and the Nordic Musculoskeletal Questionnaire (NMQ), Each questionnaire was validated and completed without clinician interference. The study identified high scores for vocal fatigue, voice symptoms and self-perception of pain in women with MTD compared to vocally healthy women. They concluded that the results of self-assessment may assist the speech therapist in the decision, using clinical reasoning strategies, which protocol(s) and assessment resources are most suitable for the specific case of the patient with MTD.

Assessment of reliability, validity, ability to detect change and feasibility

Self-assessment relies heavily on previous vocal experience and the patient's perception of their voice and self. The reliability may be impacted by emotional factors and/or dysmorphic issues surrounding the voice. The various methods of self-assessment of voice, including VFI and VoiSS are valid and reliable in patient assessment of MTD. Nanjundeswaran et al[31] explored test-reliability for VFI and found good reliability, validity, sensitivity and specificity. Deary et al[53] found the VoiSS to be simple and easy for patients to score, while being sensitive enough to reflect the wide range of communication, physical symptoms and emotional responses implicit in MTD. The repetition of self-perception methods may easily detect change from the patient point of view which may not be observed by a clinicial with physical examination. Each method differs slightly in feasibility only with regards to the length of questioning. Any assessment in this review of the ability of self-assessment to detect change is reliant on the use of the same method, questions and clinician interpretation. The range between 12 and 30 questions may impact ease of completion slightly, but this impact can be described as minimal.

Laryngoscopic/videostroboscopy

Overview

Laryngoscopic and videostroboscopic assessment is an instrumental, subjective method, based on perception of examiner. Videostroboscopy visualizes and records vocal fold vibration to evaluate the pliability of the vocal folds to measure the health and function of the mucosal tissue. Interpretation of recordings may allow practitioners to identify some criteria such as supraglottic activity which may lead to the diagnosis of MTD.

Sama et al[50] compared the Van Lawrence[56] (Table 7) and Morrison-Rammage[6] (Table 8) features of functional dysphonia. The study, along with Stager et al[57] and Behrman et al,[38] concluded that supraglottic activity can also be observed in healthy speakers and should not necessarily be deemed as excessive laryngeal muscle tension.

Garaycochea et al[10] further evaluated the findings in subjects with MTD that had been objectively diagnosed by means of aerodynamic voice assessment. The laryngoscopic features most strongly related to an aerodynamic profile of MTD were vestibular fold contribution to phonation, anterior-posterior compression of the larynx, and lateral compression of the larynx. The results revealed a reduced number of strictly relevant laryngoscopic features and may be useful in the development of a less subjective and more straightforward classification system for diagnosing and distinguishing subtypes of MTD.

TABLE 7.
Van Lawrence Fibreoptic Features of Vocal Hyperfunction

Intrinsic	
VL1	Harsh approximation of arytenoids and poor "pointed arc"
VL2	Minimal vocal cord length visibility
VL2	Vestibular fold contribution to phonation
Extrinsic	
VL4	Excessive vertical movement of larynx
VL5	Anteroposterior compression of larynx
VL6	Lateral compression of larynx

TABLE 8.
Morrison-Rammage Classification of MTD

MR 1	Laryngeal isometry
MR2a	Glottic lateral contraction
MR2b	Supraglottic lateral contraction
MR3	Anteriorposterior compression
MR4	Incomplete adduction
MR5	Bowing

Assessment of reliability, validity, ability to detect change and feasibility

Laryngoscopic features commonly associated with MTD are prevalent in the nondysphonic population and sometimes fail to distinguish patients with MTD from normal subjects, leading to a question of reliability with regards to the results.[10] Due to the variety of laryngoscopic diagnostic criteria available to the clinician, the validity of diagnosis depends on the knowledge, experience and, to some extent, vocal specialism of the examiner, this review was unable to fully assess validity based on the studies reviewed. The ability of the laryngoscopic and videostroboscopic assessment to detect physical change through observation is good.[10] Comparison of each examination is possible, and if combined with patient self-perception and other variables, can provide evidence of progress during therapeutic intervention. The feasibility of laryngoscopic and videostroboscopic assessment may be fairly low[13] as it relies on specialist equipment, the ability of the patient to tolerate the scoping procedure (the gag reflex may be activated which can induce supraglottic constriction depending on use of ridgid or flexible scope), and time to explore a variety of phonatory tasks to allow clear diagnostic examination.

Auditory perceptual assessment

Overview

Auditory perceptual assessment is a non-instrumental, subjective method, based on perception of examiners. The auditory-perceptual evaluation of voice is one of the most traditional approaches used to analyze voice quality. The evaluation is based on the auditory impression of the evaluator when listening to altered and non-altered voices and is then compared with physiological findings. These aspects are then added to the patient's complaints, history of dysphonia and vocal self-evaluation to allow a treatment plan to be developed.[58] CAPE-V (Consensus Auditory Perceptual Evaluation – Voice) adopts a visual scale and used predetermined vocal tasks and analysis criteria to assess overall dysphonia grade, roughness, breathiness, asthenia, strain. It also evaluates pitch and loudness, and allows the classification of resonance. (*Appendix C: CAPE-V Template*). The GRBAS scale assesses overall dysphonia grade, roughness, breathiness, asthenia and strain.[58] It is reliable, valid and offers no discomfort or inconvenience to the patient or therapist (Table 9) (*Appendix D: Overview of GRBAS Scoring*

TABLE 9.
Aspects of GRBAS Scale

GRBAS ASPECT	SCORE	NOTES
GRADE		
ROUGHNESS		
BREATHINESS		
ASTHENIA		
STRAIN		

System). Voice auditory-perceptual evaluation is one part of the multidimensional evaluation process.

Assessment of reliability, validity, ability to detect change and feasibility

Both CAPE-V and GRBAS scales are highly reliable[58] and may be used in any situation in which voice-related auditory-perceptual evaluation is relevent, including MTD assessment.[14] CAPE-V adopts a visual analog scale and has predetermined vocal tasks and analysis criteria. Results of each scale rely on the perception of the clinician, and therefore, may be impacted by experience or interpretation. Overall, Nemr et al[58] found that the GRBAS scale provides "*more promptitude and objectivity, with focus on glottic level, regardless of sample type,*" whereas the CAPE-V scale considers more detail and analytical parameters, with pre-defined voice sample collection and evaluation. validity and ability to detect change may be assessed to be good based on single clinician interpretation throughout the diagnosis and assessment of progress Evaluators found the GRBAS scale was the fastest to apply, leading to it's assessment as most feasible, while the CAPE-V was the most sensitive,[58] especially for detecting small changes in the voice. Both scales offer no discomfort or inconvenience to the patient or clinician.

Acoustic assessment

Overview

Acoustic assessment is an instrumental, objective method used to determine dysphonia classification using non-invasive techniques to derive quantitative information on vocal function. Barsties et al[41] studied the diagnostic accuracy of the software-based Dysphonia Severity Index (DSI) and the Acoustic Voice Quality Index (AVQI) for those with a variety of voice disorders including functional dysphonia (MTD). DSI includes four parameters, weighted and then tallied to quantify voice quality[59] (Table 10). AVQI requires continuous speech and sustained phonation for the analysis of six acoustic parameters (Table 11).

DSI showed slightly greater potential to evaluate dysphonia in general.

Assessment of reliability, validity, ability to detect change and feasibility

Both AVQI and DSI has been deemed to have acceptable interexaminer variability,[41] relying on software interpretation of results, rather than subjective perceptual evaluation. Both DSI and AVQI have been found to be valid means by which to objectively quantify voice quality.[59] In addition, each of the multivariate indices can recognise vocally healthy and voice-disordered subjects, including those with MTD. AVQI is able to measure vocal sound quality, and the quantitative nature of data collection enables the detection of change during therapeutic intervention.[60] DSI is considered a measure of vocal function and evaluated as feasible and useful,[58] although it relies on sustained phonation to measure outcomes, which may limit some patient participation.

TABLE 10.
Acoustic and Aerodynamic Parameters of DSI Software

1	Jitter
2	Highest fundamental frequency
3	Lowest sound intensity
4	Maximum phonation time

Voice related musculoskeletal features (including palpation*)*

Overview

A non-instrumental, subjective method, based on perception examiner. In cases where excess laryngeal tension has persisted for some time, additional musculoskeletal features may be present. Patients commonly report a dull to severe ache and tightness of the anterior neck, larynx, and shoulder regions which is accompanied by increased vocal effort and fatigue, episodic anterior neck "swellings/lumps" and ear "fullness," with all symptoms intensifying with extended voice use.[54,61–63] According to Morrison,[62] the inferior bellies of the omohyoid muscles where they cross the supraclavicular fossae, are often tense and prominent during speech. General body posture may be rigid with the jaw jutting forward.[63] Jaw, tongue, and respiratory movements can be restricted, reflecting the "held" nature of the voice and articulatory system.[62] Boone and McFarlane[64] observed "we see too many people with vocal hyperfunction who appear to speak through clenched teeth, with very little mandibular or labial movement" (p. 177). Similarly, Sapir[65] recognized the complex effects of laryngeal tension on both voice and

TABLE 11.
AVQI Analysis of Acoustic Measures Using Scripted Sentences

1	The smoothed cepstral peak prominence
2	Harmonics to noise ratio
3	Shimmer percent
4	Shimmer dB
5	General slope of the spectrum
6	Tilt of the regression line through the spectrum

TABLE 12.
Angsuwarangsee and Morrison Palpation System (2002)

Rating	Description
Suprahyoid muscles	
0	Soft at rest but may slightly contract on phonation
1	Soft at rest but mild low pitch and moderate high pitch on contraction
2	Some tension at rest and tense with jaw protrusion on phonation
3	Tense all the time and maximally tight on phonation
Thyrohyoid	
0	No muscular contraction at rest but mild on phonation
1	Soft thyrohyoid space at rest and some contraction on phonation
2	Tense, narrow thyrohyoid space at rest and moderate contraction on phonation
3	Very tense with closed thyrohyoid space all the time
Cricothyroid muscles	
0	Normal cricothyroid space and phonatory movement
1	Narrowing of cricothyroid space at rest and some movement on phonation
2	Anterior displacement of cricoid cartilage with narrowing of cricothyroid space at rest and closing of the space on phonation
3	Closed cricothyroid space all the time
Pharyngolaryngeal muscles	
0	Soft, easy to rotate the larynx to 90 degrees and palpate PCA muscle and arytenoid movement on sniffing
1	Slightly tense and cannot palpate posterior cricoarytenoid (PCA) muscle movement on sniffing
2	Moderately tense and difficult to rotate the larynx but still can palpate the posterior edge of thyroid cartilage
3	Very tense and cannot rotate the larynx at all

articulation. He noted *"articulatory movements may induce or exacerbate, via mechanical or neural coupling, the phonatory abnormalities"* (p. 49). Thus, abnormal peri laryngeal tension may spread to the articulatory system, or alternatively, abnormal tongue and jaw tension can affect phonatory function *(Appendix E: Postural assessment for hyperfunction dysphonia*[64]*)*. Similarly, Angsuwarangsee and Morrison[16] suggested that hyperlordosis of the cervical spine may lead to an abnormal laryngeal posture and consequently may change into a persistently tense resting tone of laryngeal musculature.

Aronson[61] and Kunduk et al[28] suggested that chronic posturing of the larynx in an elevated position leads to cramping and stiffness of the hyolaryngeal musculature and voice mutation. Furthermore, Aronson[61] argued that *"all patients with voice disorders, regardless of etiology, should be tested for excess musculoskeletal tension, either as a primary or as a secondary cause of the dysphonia"*.

Angsuwarangsee and Morrison[16] developed a 4-point grading system based on the work of Lieberman[63] (Table 12) to document muscle tension severity of the suprahyoid, the cricothyroid, the thyrohyoid and the pharyngolaryngeal muscles.

The use of laryngeal palpation to determine the presence of hyperfunction in laryngeal muscles is one of the most widely used assessment techniques in the diagnosis of MTD. Mathieson et al[19] created a palpatory rating system to document the resistance of the supralaryngeal muscle area, thyroid cartilage and sternocleidomastoid muscles using a 5-point grading scale (Figure 3). The laryngeal position in the vocal tract is also assessed on a four-point scale.

Lieberman's protocol was initially intended to accompany the instructional course on the interdisciplinary assessment and treatment of hyperfunctional voice disorder to achieve satisfactory practitioner agreement.[63] Emphasis was placed upon the importance of accurate assessment of the laryngeal musculature and cricothyroid joints. In response to the lack of practitioner agreement, Jafari et al[11] introduced the Laryngeal Palpatory Scale (LPS) *(Appendix F: Jafari et al Laryngeal Palpatory Scale)* to provide a novel, valid and reliable instrument for assessing patients with MTD. Jafari et al[11] concluded that the use of LPS alongside surface-electromyography may provide useful evidence for researchers and clinicians to document treatment outcomes, leading to more standardized care and improved information about patient progress.

Khoddami et al[62] described the heterogeneous assessment tasks, assessed structures and difference in tension grading systems within palpation protocols as negative qualities. In addition to the issue of non-standardization, the validity and reliability of palpation techniques were found to be scarce or not reported in the reviewed articles.

Assessment of reliability, validity, ability to detect change and feasibility

Assessment of voice-related musculoskeletal features can only be as reliable as the clinician. The subjective nature of

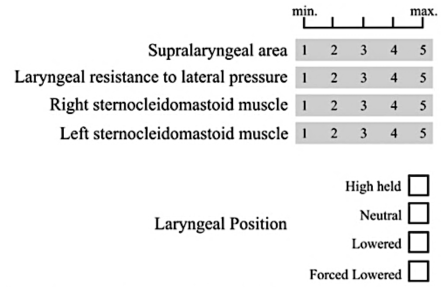

FIGURE 3. Mathieson et al. (2009) palpatory rating system.

laryngeal palpation and observation relies on practictioner experience, knowledge, and area of expertise.[13] Reliability studies of rating systems for assessing muscle tension show poor interrater reliability.[12,13] Low validity was found due to the low number of developed standardised scales by which to measure initial tension and subsequent change after therapeutic intervention.[13] Unless palpation is repeated by the same examiner who is able to descern individual muscle tension change, it may be difficult to use this method to track patient progress, resulting in low scores with regards to the ability to detect change . Palpation presents as feasibile, requiring no special equipment and is a simple way to assess muscular tension, however, successful results depend on experienced practitioners, who may be difficult to locate.

Aero-dynamic voice analysis

Overview

Aerodynamic assessment is an instrumental, objective method which has been used to discriminate normal vocal function from pathologic function to assess severity of MTD. Subjects phonate into a mask which records the subglottic pressure into computer software. Iwata[66] initially demonstrated that increased subglottic pressure was often associated with hyperfunctional voice use patterns, which could be found in MTD. Zheng et al[23] concluded that subglottic pressure could be significantly different in MTD patients when compared to healthy patients. A credible model, with subglottic pressure and maximum phonation time as predictors, was established and may assist MTD diagnosis alongside history physical examination, fibrolaryngoscopy and/or videoendostroboscopy.

Assessment of reliability, validity, ability to detect change and feasibility

Further studies are required to confirm the reliability and validity of aerodynamic voice analysis, as a result, this review was unable to determine reliability or validity from the studies reviewd. As an objective method of measurement, aerodynamic voice analysis may be able to detect change in subglottic pressure, which might suggest a release of muscle tension and reduction in "pressed" phonation, however, the use of a face mask within the measurement task may lead to tension in patients who are not able to tolerate this. Aero-dynamic voice analysis can be assessed to have low feasibility as it requires specialist equipment, software and the ability to interpret results.

Surface electromyography/high-definition surface electromyography (sEMG/HD sEMG)

Overview

Surface Electromyography (sEMG) is an instrumental, objective method measuring the electrical potential present on the skin in consequence of a muscle contraction. The voltage is detected by electrodes placed on the skin. Merlo et al[67] concluded that the voltage measured on the skin can be related to the activity of a single specific muscle. In their 2022 study using sEMG to evaluate the external laryngeal muscles of opera singers, Krasnodebska et al[29] highlighted the need for laryngeal assessment to be undertaken on different phonation and non-phonation tasks, as significant differences in the asymmetry of sternocleidomastoid muscles when phonating and swallowing were noted.

While reviewing common assessment methods of measuring muscle tension in MTD patients, Khoddami et al[12] describe history taking, laryngoscopy and palpation as "prone to subjectiveness," and point to surface electromyography as an objective instrument with which to measure the tension of extrinsic laryngeal muscles (strap or suprahyoid) in patients with MTD. Krasnodesbska et al,[29] Wang & Yiu,[34] Bracken et al[18] and Stepp,[47] describe sEMG as a valuable measure of the vocal tract as well as for diagnosis or outcome assessment in MTD. Conversely, Van Houtte et al,[53] Stepp et al,[13] Jafari et al,[11] Khodammi et al,[32] and Balata et al[39] found that sEMG was unable to detect an increase in muscle tension in patients with MTD. As patients with MTD may present with minimal symptoms, further studies are required to fully assess the value of this approach.

The lack of agreement may be a result of the heterogeneity in measurement methods. The current lack of a standardized, validated sEMG assessment method results in inconsistencies between findings, highlighting the need for homogeneity.

In response to the spatial selectivity limitations of sEMG, Bracken et al[18] studied the application of high-density sEMG (HD sEMG) in subjects with healthy voice users. The study concluded that HD sEMG was able to identify differences in anterior neck muscle activity between rest, low and high-pitched phonation.[18] The potential to diagnose and monitor therapeutic progress for pathologies of pathologies of laryngeal function was highlighted.

Assessment of reliability, validity, ability to detect change and feasibility

sEMG can provide objective and robust data on muscle activity,[12,13,18,29,32,33,34,39] however, a benchmark normal for comparison is needed if it is to be useful in tracking progression in MTD patients. sEMG can only detect extrinsic laryngeal tension, rather than intrinsic laryngeal tension, which is typically seen to impact vocal fold function in MTD. While there are a number of routinely used phonatory exercises used to assess the speaking voice, there are also currently no standardised testing methods, phonatory exercises or specific measurement protocols for the singing voice during measurement. The may reduce the future validity of sEMG measurements in assessment of the singing rather than spoken voice. Current research provides conflicting conclusions with regards to validity,[18,33] future standardisation may ensure greater validity. Change can be detected using sEMG if electrodes are placed with precision at each measurement session,[13] as this is not guaranteed between different clinicians, the ability to detect change is assessed as low. sEMG is not widely available however, requires specialist equipment and needs training to use and interpret data,[13] leading to a low feasibility assessment.

Real-time elastosonography (RTE)

Overview

Ata et al[17] found that the instrumental, objective method of real-time elastosonography (RTE) can discriminate patients with primary MTD from healthy subjects in specific laryngeal muscles, specifically the suprahyoid muscle group and cricothyroid muscles, and may be regarded as a clinical instrument in the assessment of MTD in the future.

Assessment of reliability, validity, ability to detect change and feasibility

Further studies are required to prove reliability of RTE in diagnosing and tracking recovery in those with MTD. This review was therefore unable to assess reliability. Furthermore investigations that prove validity of RTE in diagnosing and tracking recovery in those with MTD may be useful to consider. The objective nature of RTE measurement may allow the detection of change in muscle activity in the cricothyroid and suprahyoid muscle groups, which may be useful to chart progress during therapeutic treatment, however data is not currently available to allow assessment of ability to detect change. RTE requires specific treatement and training to interpret results, which reduces the feasibility and accessibility.

Radiography

Overview

Radiography is an instrumental, objective method which uses radiation to provide images of tissue, organs and bones inside the body. Lowell et al[40] undertook a study to determine whether radiographic measures for patients with primary MTD were different from those of normal subjects. Higher positions of the hyoid and larynx were reported during phonation in patients with MTD, leading to the conclusion that radiography may provide differential diagnosis for MTD. This aligns with the earlier findings of Morrison et al[8] with regards to 67% of MTD patients presenting with a high larynx.

Assessment of reliability, validity, ability to detect change and feasibility

Radiography can provide objective evidence for a raised hyoid and larynx (hyolaryngeal elevation).[40] Hyolaryngeal elevation may be present in non-dysphonic individuals, however, bringing into question the reliability and validity of findings with regards to the diagnosis of MTD. As radiography principally measures the height of the larynx and hyoid, it is unable to detect change in muscle function beyond this posture. Radiography can be assessed has having low feasibility as is not available for routine clinical use in voice clinics[13] as suggested by the literature within this scoping review.

Laryngeal **intramuscular** electromyography (laryngeal iEMG)

Overview

Laryngeal intramuscular electromyography uses needle electrodes to measure electrical activity in specific larynegal muscles. The four paired muscles relevent to LiEMG are the posterior cricoarytenoideus (PCA), the thyroarytenoideus (TA), the lateral cricoarytenoideus (LCA) and the cricothroideus (CT). At present, no data exists to support the use of LiEMG in measurement of muscle activity relating to MTD, although Sataloff et al[20] found that Laryngeal iEMG is also routinely used in the differential diagnosis of vocal fold paralysis, in addition to aid in administering Botox in Adductor spasmodic dysphonia.

Assessment of reliability, validity, ability to detect change and feasibility

Laryngeal intramuscular electromyography can provide objective evidence for activity of specific muscles in the larynx.[68] LiEMG has been validated as an objective method of measurement by the American Association of Electrodiagnostic Medicine's Laryngeal EMG Task Force in 1999.[20] LiEMG may detect a change in pressed phonation if the measurement can be undertaken using the same protocols and without causing distress to the patient.[13] LiEMG is not available for routine clinical use in voice clinics as it is a highly invasive technique, and may not be suitable for many patients[68] and also due to a lack of trained professionals to administer the method of measurement.[20]

LIMITATIONS

The searches used within the current review limited the year of study publication to between 2000 and 2022. It must be considered whether all assessments maintain relevancy in contemporary treatment research or current clinical practice. A further limitation of the current study is that as per a scoping methodology, the researcher did not seek to evaluate the quality of the measurement properties of each included measurement instrument. This research identified measurement instruments and classified them according to instrumental or non-instrumental, and subjective or objective status. Future research should evaluate these measures in terms of their full range of psychometric properties.

This scoping review was also limited by the lack of standardized criteria for each method of measurement under consideration, resulting in a lack of evidence of inter-rater reliability. Included studies were determined by only one reviewer (CT), therefore discrepancies or bias for inclusion may have occurred.

CONCLUSIONS

The aim of this scoping review was to identify the methods which have been developed or tested to measure laryngeal muscle activity in subjects with MTD. A total of 12 different measurement methods were identified from the literature included in the scoping review.

Each method was assessed as far as the literature allowed for reliability, validity, ability to detect change, and feasibility. Within the literature reviewed, patient history, laryngoscopic and videostroboscopic assessment and palpation were the most used assessment methods. The most feasible methods were patient history and perceptual and acoustic assessment.

With regards to reliability and ability to detect change, the review was unable to determine which method/s were the most successful (See Table 6), however self-assessment (specifically VFI) and auditory and perceptual assessment showed good reliability, while auditory perceptual assessment (specifically CAPE-V) and laryngoscopic and videostroboscopic assessment score well in their ability to detect change in patients with MTD. Due to the variability in assessment methods and results, this review concludes that there is a need for greater objective practical methodological standardization to ensure accurate diagnosis, determine appropriate care, and provide improved information about patient progress.

Practical implications

This scoping review provides a comprehensive overview of measurement methods for use with people with MTD. It provides a compendium of available measurement methods, which may be useful in both clinical practice and treatment research. This review provides a basis for future quality assessment of identified measurement methods and reflects the need for the development of a standardized assessment protocol for MTD treatment research. This may improve the quality of research evidence for MTD treatments, assisting clinicians in evidence-based decision making.

This study also concludes that the most reliable, valid methods of objective measurement include sEMG and RTE, both of which ensure a high level of ability to detect change, while the patient history and self-assessment remain the most feasible.

With regards to current development in practice, the nearest to standardisation may be laryngeal palpation with laryngoscopic and videostroboscopic assessment showing the greatest potential for accessible clinical standardization. Although providing objective measurement, validity and reliability, sEMG currently remains the furthest from standardization.

COLLABORATION

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DECLARATION OF COMPETING INTEREST

No potential conflict of interest was reported by the author.

APPENDIX A. VOICE CASE HISTORY FORM TEMPLATE, EASTERN KENTUCKY UNIVERSITY, 2013

Name:____ ____________________
(Last) (First) (Middle) (Date)

Address:____
(City) (State) (Zip Code)

D.O.B.__________ Age:_______ Gender:______________

Home Phone:________________ Cell Phone:________________ Work Phone: __________________________

Occupation:____________________________________ Education: (Check one) High School___ College___

Marital Status: (check one) Single____ Married____ Widowed____ Divorced____

Spouse's Name:_________________________________

Children (names and ages):____

____

Referred By: _____________________________

VOICE HISTORY

What is the problem that brings you here today?____

____

When did you first start to notice this problem? ____

____

Have you ever experienced any previous voice changes or difficulties? If yes, explain: _________________________

____

How would you describe the severity of your voice problem? ____________________________________

____

Do you ever lose your voice completely? If yes, explain. ______________________________

____

Do you ever have difficulty swallowing? If yes, explain. ______________________________

____

Do you often get sore throats? ______________________________

____

Do you have difficulty projecting your voice? ______________________________

____

MEDICAL HISTORY

Have you had any major surgeries or illnesses? If yes, describe. ______________________________

____

Have you ever been intubated (breathing tube)? If yes, describe. ______________________________

____

Do you have any neurological conditions? If yes, describe. ______________________________

____

Do you have any respiratory problems (e.g., asthma, allergies, postnasal drip)? If yes, describe. ______________

____

Do you have acid reflux or heartburn? If yes, describe. ______________________________

____

Do you have any hormonal problems (e.g., hypo- or hyperthyroidism)? If yes, describe. ______________

____

If you are a female, do you take oral contraceptives or other hormonal medications? If yes, describe. ______________

____

List all medications you take, including prescription, over-the-counter, vitamins, and supplements. ________________

____

____

Circle if you have ever had any of the following:

AIDS	Arthritis	Cancer
Chronic fatigue	Depression	Diabetes
Dizziness	Ear infections	Ear pain/tinnitus
Eating disorder	Headaches	Hearing loss
Heart disease	Hiatal hernia	Nasal blockage
Neck injury	Psychiatric disorder	Seizures
Sinus problems	Sleep problems	Stroke
Temporomandibular joint problems	Weight loss	Tremor
Ulcer		

OCCUPATIONAL VOICE DEMANDS

Are you a professional voice user (e.g., teacher, salesperson, customer service representative, etc.)? If yes, explain. ____

____

Are you a professional or amateur singer? If yes, explain. ____

____

On a scale of 1-5 where 1 = very little and 5 = excessive, how would you characterize your daily average voice use?

1 2 3 4 5

Is there a high level of noise in your workplace? If yes, explain. ____

____

Are you exposed to fumes, pollutants, and other irritants in your workplace (e.g., ammonia, chemicals, dust, etc.)? If yes, explain. ____

____

On a scale of 0-5, where 0 = never and 5 = always, how often do you do the following?

Shout or scream	0	1	2	3	4	5
Talk loudly	0	1	2	3	4	5
Talk a lot	0	1	2	3	4	5
Talk over noise	0	1	2	3	4	5
Use the phone	0	1	2	3	4	5
Sing	0	1	2	3	4	5

PHYSICAL SYMPTOMS

Do you have any burning, soreness, tickling, or irritation in your throat? ______________________________

____

Do you sometimes have the sensation of a "lump" in the throat? ______________________________

____

Do you have any aching or tightness in your throat? ______________________________

____

Do you ever feel tension in your neck area? ______________________________

____

Does your voice get tired easily? ______________________________

____

Do you feel as if you have to strain to produce voice? ______________________________

____

Do you feel as if you need to cough or clear your throat a lot? ______________________________

____

LIFESTYLE CONSIDERATIONS

How many people live in your house? ______________________________

How many children live with you? ________________________________

Do you have an active social life? Explain. ____

____

Does anyone in your family or your social circle have a hearing loss? ____

____

What are your hobbies? ____

____

Do you participate in activities such as debate, cheerleading, singing, etc.? If yes, explain. _______________________

____

Do you smoke? If yes, how many cigarettes/cigars per day? ____

____

If no, did you smoke previously? When? ____

____

Do you drink alcohol? If yes, how much per week? ____

____

Do you drink caffeinated beverages (e.g. tea, coffee, soda)? If yes, how many per day? _________________________

____

Do you exercise on a regular basis? If yes, how often per week? ____

____

Do you have a healthy diet? Explain. ____

____

APPENDIX B. PATIENT'S SYMPTOMATIC COMPLAINTS (ACHES AND PAINS) AND THE PRACTITIONER'S CONSIDERATIONS. LIEBERMAN, 2003

Patient's complaints	Questions in the practitioner's mind
General non-specific pain in the throat that is unrelated to voice production or swallowing	Leaves the practitioner puzzled and in need of further information
When is the voice worst (am, pm, before or after voice use, etc?)	AM – suggests the possibility of acid reflux, congestion or emotion PM – with voice use usually indicates muscular dysfunction PM – without voice use is likely to be emotional in origin
Pain or aching around the margin of the thyrohyoid muscle, or the thyrohyoid membrane and ligaments	Very typical of long-term hyper functional voice use
Discomfort during or after performance of vocal task, recovering with rest	Strap musculature, thyrohyoid Mechanism or pharyngeal constrictor hypertonicity
Voice slow to warm up in the morning	Reflux, congestion, muscle fatigue, emotional or overuse the previous day without proper rest
Pain and discomfort in the anterior aspect of the neck	When specific, the tissue of origin should be identifiable with palpation
Globus pharyngeus/hystericus (lump in the throat)	Very tight inferior strap and sternocleidomastoid muscles
Recurrent sore throat	Tonsillitis, reflux, vocal fatigue, or emotional origin. On palpation, characteristically the anterior neck muscles are hypertonic
Difficulty swallowing (initiation, noisy with laryngeal click)	Neurological, postural suprahyoid muscle hypertonicity, hypertonic geniohyoid, omohyoid tightness or thyrohyoid muscles
Dryness	May be indicative of chronic anxiety state
Cough	May be associated with a deep underlying emotional component
Heat burn (acid reflux) with associated oesophageal discomfort, sore throats, globus and throat tightness	May be associated with hiatus hernia/stomach problems, stress/emotional issues or both combined (often responds well to manipulation)
Unilateral muscle ache with the larynx deviated from the midline	The larynx moves with the torso so this condition may be associated with a rotation of the torso
Head and neck postural problems, such as neck ache, headaches, sinus pain, earache, especially around the mastoid process	May be associated with a hyper lordotic segment of the cervical spine
Emotional components	*As felt by the practitioner*
As disclosed voluntarily by the patient	What is it all about? What is the communication?

APPENDIX C. CAPE-V TEMPLATE. AMERICAN SPEECH-LANGUAGE-HEARING ASSOCIATION, 2009

Consensus Auditory-Perceptual Evaluation of Voice (CAPE-V)

Name:__________________________ **Date:**__________

The following parameters of voice quality will be rated upon completion of the following tasks:

1. Sustained vowels, /a/ and /i/ for 3-5 seconds duration each.
2. Sentence production:
   a. The blue spot is on the key again.
   b. How hard did he hit him?
   c. We were away a year ago.
   d. We eat eggs every Easter.
   e. My mama makes lemon muffins.
   f. Peter will keep at the peak.
3. Spontaneous speech in response to: "Tell me about your voice problem." or "Tell me how your voice is functioning."

Legend: C = Consistent I = Intermittent
MI = Mildly Deviant MO = Moderately Deviant SE = Severely Deviant
Although the PDF scale is accurate, printer configurations vary. Verify that your paper copy has accurate 100-mm lines before reproducing this form.

Overall Severity ______________________ C I ___/100
MI MO SE

Roughness ______________________ C I ___/100
MI MO SE

Breathiness ______________________ C I ___/100
MI MO SE

Strain ______________________ C I ___/100
MI MO SE

Pitch (Indicate the nature of the abnormality): ______________
______________________ C I ___/100
MI MO SE

Loudness (Indicate the nature of the abnormality): ______________
______________________ C I ___/100
MI MO SE

__________ ______________________ C I ___/100
MI MO SE

__________ ______________________ C I ___/100
MI MO SE

COMMENTS ABOUT RESONANCE: NORMAL OTHER (Provide description):________________

____

ADDITIONAL FEATURES (for example, diplophonia, fry, falsetto, asthenia, aphonia, pitch instability, tremor, wet/gurgly, or other relevant terms):

Clinician:__________________

APPENDIX D. OVERVIEW OF GRBAS SCORING SYSTEM

Grade (G) represents the overall degree of hoarseness or voice abnormality.

Roughness (R) quantifies the degree to which the listener detects the effect of irregular fluctuations in pitch-frequency and amplitude either cycle to cycle or in the short-term energy of the vocal tract excitation. Roughness is also affected by perceived randomness or "noisiness" of the spectrum. Any perception of roughness might take into account the possibility of severe irregularity due to vocal fry and double excitation (diplophonia).

Breathiness (B) arises from non-periodic sound generated by a turbulent flow of air which leaks through the glottis when it is supposed to be closed. The turbulence is created by the constriction of a partially closed glottis. Its energy will be correlated to the vocal cord activity, ie, its energy will decrease as the glottis becomes fully open and increase again as the vocal cords try to close. At its source, the turbulence will be spectrally flat (white), but it will spectrally be colored by the vocal tract resonances and maneuvers (eg, opening/closing at the lips) as it contributes to perceived speech. As the sound heard from normal breath or unvoiced speech is due to turbulent airflow caused by some constriction in its passage, the sound created by imperfectly closing vocal cords will sound like breath or unvoiced speech. The perceived quality of breathy voice quality is related to the amount of airflow. Breathy voice lacks clarity of tone and is reduced in loudness. Most voices have a degree of breathiness which contributes to their individuality and natural characteristics.

Asthenia (A) is weakness or lack of energy in the voice. The asthenic variety of hoarse voice is mostly characterized by weak intensity. It can be because of an impaired energy distribution in the glottal excitation with a spectral damping which is a sign of a lack of elasticity in the vocal cords. The higher harmonics in the perceived sound will then have a lack of brightness and richness.

Strain(S) is indicative of undue effort needed to produce voiced sound due to an inability to employ the normal functionality of vibrating vocal cords. There is often psychological stress involved in trying to overcome the disability and this is perceivable by the trained listener. The abnormally functioning vocal cords and the stress in trying to control them can produce sound with abnormally high fundamental frequency, with unnatural and constantly changing periodicity and roughness in the higher frequency range of the speech. Strain due to speaking with abnormality func- tioning vocal cords is perhaps the most subjective GRBAS measurement and the most variable effect. Strain is associated with increased and poorly regulated laryngeal muscle tension. When speech is being produced, there is the perception of an inability to control it as it fades in and out. Difficulty in initiating phonation and a struggle to maintain phonation takes place due to strain. Furthermore, constantly changing periodicity in the higher frequency harmonics is indicative of strain, giving the perception of noise or roughness in the higher frequency range of the speech.

(Hirano, 1981)

APPENDIX E. POSTURAL ASSESSMENT FOR HYPERFUNCTION DYSPHONIA. LIEBERMAN, 2003

General Considerations 1. Observations			
Observations while the patient is sitting and giving the history of the problem, etc			
Sitting			
	Is the anterior neck compartment smooth or are the muscles very conspicuous?	Smooth	Conspicuous
	Is activity in the anterior neck compartment visible? (eg, Obvious omohyoid activity)	Yes?	
	Habitual head tilting?	Left?	Right?
	Habitual head gestures (eg, Yes or no by nodding)	Yes?	
B. Observations the patient has been asked to stand passively. Frontal and lateral viewing required.			
Knee locking	Left	Right	Both
Weight distribution	Left	Right	Central
Pelvic rotation	Forwards		
Raised shoulders (rest)	Left	Right	Both
Weight bearing (centre of gravity)	Posterior	Anterior	

(*Continued*)

General Considerations 2. Palpation				
Palpate	Pelvic tilt	Left	Right	
Patient standing	Lumbar spine lordosis	Exaggerated		
	Lumbar spine scoliosis	Left	Right	
	Anterior head translocation	A. Normal posture	1-2 cms / over 3cms	
		B. Occipital contact with vertical surface	Contact Yes?	
Patient required to lie down	Thoracic/cervical spine	Contact of C7 with horizontal surface?		
Osteopathic	Thoracic spine fixed segment	Indicate level. Vertebrae		
Cervical and Laryngeal Considerations 3. Palpation				
Neck vertebrae	Cervicodorsal vertebral shelf (level of hyperplordotic segment)	C2-3(4)	C4-5	Other
Posterior Musculature	Paravertebral muscular tenderness lateral to the hyperlordotic segment	Left	Right	Both
	Occipital/Submastoid tenderness (delete if N/A)	Left	Right	Both
	TMJ tenderness	Left	Right	Both
Anterior Musculature	Sternomastoid muscles while standing erect	Lax L R	Hyperactive	
	Suprahyoid tension	Slight	Great	
	Larynx in midline	Left of midline	Right of midline	
	Infralaryngeal strap ms.	Hyperactivity	Underactive or absent	
Laryngeal musculature	Overall tension of laryngeal suspension	Tightly held	Loosely Held	
(For experienced practitioners only)	Possible to palpate structures medial to the posterior margins of the thyroid laminae?	Left	Right	Neither

APPENDIX F. JAFARI ET AL (2018) INTRODUCED THE LARYNGEAL PALPATORY SCALE (LPS)

LARYNGEAL PALPATORY SCALE (LPS)

Patient's name: ……….............. Date: …………………

Item	Absent	Mild	Moderate	Severe
Patient's symptomatic complaint				
• Pain in the anterior/posterior neck during rest/speaking (pain area: …………)	0	1	2	3
Observation				
• Habitual posture (head and neck, larynx, shoulders)				
A. Lateral view				
1 Head and neck extension	0	1	2	3
2 Geniohyoid pull (double chin)	0	1	2	3
B. Anterior and posterior view				
1 Head tilt (from midline: left or right)	0	1	2	3
2 Raised shoulders during rest/speaking (left, right or both)	0	1	2	3
3 Deviated larynx (from midline: left or right)	0	1	2	3
Palpation				
• Muscles condition				
A. Static				
*Tenderness				
1 Submental area	0	1	2	3
2 Infrahyoid area (left)	0	1	2	3
3 Infrahyoid area (right)	0	1	2	3
4 Cricothyroid (left)	0	1	2	3
5 Cricothyroid (right)	0	1	2	3
6 SCM (left)	0	1	2	3
7 SCM (right)	0	1	2	3
*Tightness				
1 Submental area	0	1	2	3
2 Infrahyoid area (left)	0	1	2	3
3 Infrahyoid area (right)	0	1	2	3
4 Cricothyroid (left)	0	1	2	3
5 Cricothyroid (right)	0	1	2	3
6 SCM (left)	0	1	2	3
7 SCM (right)	0	1	2	3
B. Dynamic (counting 1-10, vowel extension /i/)				
*Tenderness				
1 Submental area	0	1	2	3
2 Infrahyoid area (left)	0	1	2	3
3 Infrahyoid area (right)	0	1	2	3
4 Cricothyroid (left)	0	1	2	3
5 Cricothyroid (right)	0	1	2	3
6 SCM (left)	0	1	2	3
7 SCM (right)	0	1	2	3
*Tightness				
1 Submental area	0	1	2	3
2 Infrahyoid area (left)	0	1	2	3
3 Infrahyoid area (right)	0	1	2	3
4 Cricothyroid (left)	0	1	2	3
5 Cricothyroid (right)	0	1	2	3
6 SCM (left)	0	1	2	3
7 SCM (right)	0	1	2	3
• Laryngeal and hyoid position				
A. High position of larynx	0	1	2	3
B. High and back position of hyoid	0	1	2	3
• Movement limitation				
A. Limitation in lateral movement of larynx	0	1	2	3
B. Limitation in vertical movement of larynx				
1 Swallowing	0	1	2	3
2 Vowel extension /i/	0	1	2	3
3 Counting 1-10	0	1	2	3
C. Limitation in lateral movement of hyoid	0	1	2	3
• Laryngeal space/gap reduction				
A. Cricothyroid visor				
1 Static	0	1	2	3
2 Dynamic: /i/ in habitual, low, high pitch; pitch gliding; counting 1-10	0	1	2	3
B. Thyrohyoid				
1 Static	0	1	2	3
2 Dynamic: /i/ in habitual pitch; counting 1-10	0	1	2	3

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Appendix B – Ethical Approval Study 2 – HEALTH01062

University of Central Lancashire
UCLan

University of Central Lancashire
Preston PR1 2HE
01772 201201
uclan.ac.uk

6th November 2023

Jill Alexander / Claire Marianne Thomas
School of Sport and Health Sciences
University of Central Lancashire

Dear Jill / Claire,

Re: HEALTH Ethics Panel Application
Unique Reference Number: HEALTH 01062

The HEALTH Ethics Review Panel has granted approval of your proposal application, 'Investigating existing approaches to the release of laryngeal tension in singers diagnosed with Muscle Tension Dysphonia (MTD)'. Approval is granted up to the end of project date*.

It is your responsibility to ensure that

- the project is carried out in line with the information provided in the forms you have submitted
- you regularly re-consider the ethical issues that may be raised in generating and analysing your data
- any proposed amendments/changes to the project are raised with, and approved, by Committee
- you notify ethicsinfo@uclan.ac.uk if the end date changes or the project does not start
- serious adverse events that occur from the project are reported to Panel
- a closure report is submitted to complete the ethics governance procedures (Existing paperwork can be used for this purpose e.g. funder's end of grant report; abstract for student award or NRES final report. If none of these are available use e-Ethics Closure Report Proforma).

Yours sincerely,

Jane Fitzgerald
Deputy Vice-Chair
HEALTH Ethics Panel

* for research degree students this will be the final lapse date

NB - Ethical approval is contingent on any health and safety checklists having been completed, and necessary approvals gained.

Appendix C – Participant Recruitment Email, Informed Consent and Participant Information Sheet – Study 2

University of Central Lancashire
UCLan

Dear ________________,

My name is Claire Thomas, and I am a singing teacher and voice researcher currently working towards my Professional Doctorate in Elite Performance with a focus on Muscle Tension Dysphonia in the singing voice.

I would like to invite you to participate in a research study.

The study involves analysis of the approaches used to treat Muscle Tension Dysphonia in the singing voice.

After undertaking a number of scoping, literature and rapid reviews into the current methods of measurement of laryngeal tension and the impact of Muscle Tension Dysphonia (MTD) in the singing voice, this aspect of my doctorial project hopes to identify the most common treatment approaches from questionnaire responses.

The online questionnaire has been sent to selected speech and language therapists, singing teachers, and singing voice rehabilitation specialists. Responses will be collated, compared in number and type of approach, and the data will be disseminated in a written report. You have been chosen due to your professional standing and affiliation with voice rehabilitation and/or the MT genre.

The questionnaire responses will be anonymous and should take no more than 10 minutes to complete, depending on the level of detail you wish to add.

Thank you for your time and your participation.

Anonymous questionnaire link:
https://qfreeaccountssjc1.az1.qualtrics.com/jfe/form/SV_1RFi9EmVIuQE7Xw

Kind Regards,

Claire Thomas
Med (RCS), MA, PGDE, PGCPSE, CTABRSM, DipLCM

University of Central Lancashire
UCLan

Participant Consent Form

Version number & date: V 1.0 08.09.2023
Research ethics approval number:
Title of the research project: Investigating existing approaches to the release of laryngeal tension in singers diagnosed with Muscle Tension Dysphonia (MTD)
Name of researcher(s): Claire Thomas

Please initial box

1. I confirm that I have read and have understood the information sheet dated [**DATE**] for the above study, or it has been read to me. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. ☐ ☐
2. I understand that taking part in the study involves submitting my responses to an online questionnaire.
3. I understand that my participation is voluntary and that I am free to stop taking part and can withdraw from the study at any time without giving any reason and without my rights being affected. In addition, I understand that I am free to decline to answer any particular question or questions. ☐
4. I understand that I can ask for access to the information I provide and I can request the destruction of that information if I wish at any time prior to two weeks after submission. I understand that following two weeks after submission, I will no longer be able to request access to or withdrawal of the information I provide. ☐
5. I understand that the information I provide will be held securely and in line with data protection requirements at the University of Central Lancashire until it is [fully anonymised] and then deposited in the [Archive] for sharing and use by other authorised researchers to support other research in the future. ☐
6. I understand that other authorised researchers may use my words in publications, reports, webpages, and other research outputs, if their study has been approved by a research ethics committee, and they agree to preserve the confidentiality of the information as requested in this form. ☐
7. I understand that personal information collected about me that can identify me, such as my name or where I live, will not be shared beyond the study team. ☐
8. I understand that the information I provide will be held securely and in line with data protection requirements at the University of Central Lancashire. ☐
9. I understand that the research team will respect my confidentiality and I give permission for them to have access to my responses. ☐

10. I understand that confidentiality and anonymity will be maintained and it will not be possible to identify me in any reports, presentations or publications arising from the research. ☐
11. I agree that my information can be quoted in research outputs such as Thesis publication. ☐
12. I understand that signed consent forms and questionnaires will be retained in a password protected account for up to seven years. ☐

Where the participant information sheet has been read aloud to the participant:
I have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands to what they are freely consenting:

13. I agree to take part in the above study. ☐

______________________	________	____________________
Participant name	Date	Signature
______________________	________	____________________
Name of person taking consent	Date	Signature

Principal Investigator
Jill Alexander
University of Central Lancashire, Preston
01772201201
Jalexander3@uclan.ac.uk

Student Investigator
Claire Thomas
University of Central Lancashire, Preston
Cmthomas5@uclan.ac.uk

Investigating existing approaches to the release of laryngeal tension in singers diagnosed with Muscle Tension Dysphonia (MTD)

Participant Information Sheet

You are being invited to participate in a research study. Before you decide if you wish to take part, it is important that you understand why the research is being done and what it will involve. Please take time to read the following information carefully and if you would like more information or if there is anything that you do not understand, please contact us using the contact information below. Please also feel free to discuss with others if you wish.
Thank you for reading this.

What is the purpose of the study

The study is being completed by Claire Thomas, as part of the professional Doctorate in Elite performance at the University of Central Lancashire and is being completed under the supervision of Dr. Jill Alexander.

The term 'Muscle Tension Dysphonia' has long been employed as a catch-all term for several muscular disorders in and around the larynx. After a previous scoping review into the current methods of measurement of laryngeal tension, and a rapid review of the impact of Muscle Tension Dysphonia (MTD) in the singing voice, this current project aims to create an overview of the approaches used to treat MTD in the singing voice. As treatment of MTD is varied, and therefore not currently standardised across practitioners, the project hopes to identify the most common approaches from questionnaire responses. The project has an additional interest in the treatment of MTD in the Musical Theatre (MT) voice.

The information collated will help to inform a collection of described exercises to help singing teachers to continue to develop the singers' initial speech and language therapy treatment on their return to the voice studio. These responses will form the basis for comparison of treatment approaches within a subsequent case study.

The participants have been selected from three groups who may work with muscle tension dysphonia in the singing voice: Speech and Language Therapists (SLTs), Singing Voice Rehabilitation Specialists and Singing Teachers. It is hoped to identify aspects of treatment that may be easily transferred into singing voice exercises, allowing singing teachers the confidence and skills to support initial SLT intervention.

Why have I been invited to take part?

The questionnaire will be sent to speech and language therapists, singing teachers, and singing voice rehabilitation specialists, identified by a British Voice Association list of practitioners and input from external supervisor, Melanie Mehta. Responses will be collated, compared in number and type of approach, and the data will be disseminated in a written report. The choice of potential participants can be justified by their professional standing and affiliation with voice rehabilitation and/or the MT genre.

What will happen if I take part?

The study involves taking part in a Qualtrics online questionnaire, which will be completed anonymously. No data will be stored by the survey platform. The questionnaire asks 13 questions on the treatment of muscle tension dysphonia in the singing voice and should take approximately 10 minutes to complete, depending on how much information you choose to share. Before you complete the survey, you will be asked to read and consent to a series of statements before proceeding.

If you are interested in taking part, please download a copy of this participant information sheet and retain this for your records before starting the questionnaire.

Do I have to take part?

No, it is entirely up to you if you want to take part or not. Participation in the study is voluntary. You will be able to withdraw at any point for any reason before submitting your answers by closing the questionnaire browser. Data is not collected until the whole form is submitted.

How will my data be used?

We will not collect or process any personal data. All data you provide will be completely anonymous, which means that no-one could use any reasonable means to identify you from the data.

The answers that you provide will only be accessible to the research team at UCLan.

The results from the data will be written up to form part of thesis for a Professional Doctorate.

The answers you provide will be held securely and will be password encrypted and stored in a password-protected electronic file on the UCLan's secure servers.

The responses will be kept for 7 years and then destroyed, in line with University policy.

Are there any risks in taking part?

There are no perceived risks or disadvantages involved.

Are there any benefits from taking part?

There are no anticipated direct benefits to you. However, we hope that the collective responses may lead to a better understanding about the treatment of muscle tension dysphonia in singers and help to equip singing teachers to support singers with MTD more effectively.

What will happen to the results of the study?

The results of the study will be written up as part of a thesis for a Professional Doctorate. If you wish to read the final report, please request it by email from CMThomas5@uclan.ac.uk.

What will happen if I want to stop taking part?

As this study is completely anonymous it is not possible to withdraw your data once you have submitted your responses. When you select "Complete Survey" at the bottom of the last page, the data will be submitted. Up until this point, you can stop at any time and data provided to that point will not be saved.

Who has reviewed this study?

The study has been reviewed and approved by the HEALTH Ethics Review Panel at the University of Central Lancashire. Reference number HEALTH 01062.

What if I am unhappy or if there is a problem?

If you are unhappy, or if there is a problem, please feel free to let us know by contacting Claire Thomas – CMThomas5@uclan.ac.uk and we will try to help. If you remain unhappy or have a complaint which you feel you cannot come to us with, then please contact the Ethics, Integrity and Governance Unit at UCLan via OfficerforEthics@uclan.ac.uk.

Who can I contact if I have further questions?

Claire Thomas, Institute of Coaching and Performance, UCLan, Preston, PR1 2HE, CMThomas5@uclan.ac.uk

Appendix D – Study 2 Questionnaire Content

Please note all questions relate to your experience of treating PRIMARY Muscle Tension Dysphonia in patients who identify as semi-professional/professional singers.

Section 1 – For Semi-professional/professional singers

How do you initially measure Primary Muscle Tension Dysphonia (MTD) to chart progress?

What are the main considerations taken into account before designing treatment?

If you are a speech and language therapist (SLT), do you liaise directly with the Ear, Nose and Throat (ENT) clinic who provided the initial diagnosis of MTD to the singer? If so, please give details of this handover.

If you are an SLT, how many sessions are usually allocated to the treatment of primary MTD in singers?

If you are a singing voice rehabilitation specialist or singing teacher, do you liaise directly with the Speech and language therapist who provided initial therapeutic intervention? If so, please give details of the handover.

Do vocal therapy exercises reflect the style of singing most used by the singer?

Do you regularly use specific therapeutic programmes? (i.e./ VFE, RVT, etc) If so, which?

What are the initial approaches and/or exercises used when rehabilitating a singer with primary MTD?

How do you guide singers to bring results from their therapeutic work into wider vocalising?

What follow-up is built in to the therapeutic intervention timeline?

If you are a singing teacher, what exercises do you generally find most useful for the continuing treatment of MTD in singers?

The next section relates specifically to MUSICAL THEATRE singers as patients.

Section 2 - MUSICAL THEATRE SECTION – singers as patients

How do the demands of each specific musical theatre voice quality influence treatment design?

How are considerations of movement, choreography and/or instrumental playing demands built into treatment?

Appendix E – Ethical Approval Study 3 – HEALTH01087

University of Central Lancashire
UCLan

University of Central Lancashire
Preston PR1 2HE
01772 201201
uclan.ac.uk

31st January 2024

Claire Marianne Thomas / Jill Alexander
School of Health, Social Work and Sport
University of Central Lancashire

Dear Claire / Jill,

Re: HEALTH Ethics Panel Application
Unique Reference Number: HEALTH 01084

The HEALTH Ethics Review Panel has granted approval of your proposal application, 'Investigating practical approaches to the release of laryngeal tension in musical theatre singers diagnosed with Muscle Tension Dysphonia (MTD)'. Approval is granted up to the end of project date*.

It is your responsibility to ensure that

- the project is carried out in line with the information provided in the forms you have submitted
- you regularly re-consider the ethical issues that may be raised in generating and analysing your data
- any proposed amendments/changes to the project are raised with, and approved, by Committee
- you notify ethicsinfo@uclan.ac.uk if the end date changes or the project does not start
- serious adverse events that occur from the project are reported to Panel
- a closure report is submitted to complete the ethics governance procedures (Existing paperwork can be used for this purpose e.g. funder's end of grant report; abstract for student award or NRES final report. If none of these are available use e-Ethics Closure Report Proforma).

Yours sincerely,

Alan Farrier, Deputy Vice-Chair
HEALTH Ethics Panel

* for research degree students this will be the final lapse date

NB - Ethical approval is contingent on any health and safety checklists having been completed, and necessary approvals gained.

Appendix F – Participant Recruitment Email, Informed Consent and Participant Information Sheet – Study 3

University of Central Lancashire
UCLan

Dear ________________,

My name is Claire Thomas, and I am a singing teacher and voice researcher currently working towards my Professional Doctorate in Elite Performance with a focus on Muscle Tension Dysphonia in the Musical Theatre singing voice.

I would like to invite you to participate in a research study.

The study involves analysis of the approaches used by a number of practitioners to treat Muscle Tension Dysphonia in the singing voice.

After illustrating a written book of the muscles of the singing voice, gathering data from a number of literature reviews and collecting data from a questionnaire sent to SLTs, SVRSs and singing teachers, the next aspect of this doctorial study hopes to further identify current approaches to treatment/rehabilitation of MTD by analysing one-to-one treatment sessions.

You have been selected to participate due to your professional standing and affiliation with voice rehabilitation within the MT genre.

You will be asked to either record voice notes or take written notes over a maximum of 10 individual sessions working with a musical theatre singer who has been diagnosed with MTD. Observational data will be collated, compared in type of approach, and reported progress, and the data will be disseminated in a written report.

The observational data recorded will be kept anonymous, stored in a password-protected account and laptop and destroyed within 7 years in line with University of Central Lancashire guidelines. Participants will not be identifiable from information used in the final report. You are welcome to request a copy of the final report and may do so by emailing me: Cmthomas5@uclan.ac.uk.

A full participant information sheet is attached to this email.

Thank you for your time and your participation, it is greatly appreciated.

Kind Regards,

Claire Thomas
Med (RCS), MA, PGDE, PGCPSE, CTABRSM, DipLCM

I

University of Central Lancashire
UCLan

Participant Consent Form

Version number & date: V2.2 03.02.2024
Research ethics approval number: HEALTH 01084
Title of the research project: Investigating existing approaches to the release of laryngeal tension in singers diagnosed with Muscle Tension Dysphonia (MTD)
Name of researcher(s): Claire Thomas

Please initial box

1. I confirm that I have read and have understood the information sheet dated 03.02.24 for the above study, or it has been read to me. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. ☐
2. I understand that taking part in the study involves observational information I gather about a patient/student/client being shared with the researcher. ☐
3. I understand that my participation is voluntary and that I am free to stop taking part and can withdraw from the study at any time without giving any reason and without my rights being affected. In addition, I understand that I am free to decline access to my observations and information. ☐
4. I understand that I can ask for access to the information I provide, and I can request the destruction of that information if I wish at any time after submission. ☐
5. I understand that the information I provide will be held securely and in line with data protection requirements at the University of Central Lancashire until it is fully anonymised and then deposited in the archive for sharing and use by other authorised researchers to support other research in the future. ☐
6. I understand that other authorised researchers may use my words in publications, reports, webpages, and other research outputs, if their study has been approved by a research ethics committee, and they agree to preserve the confidentiality of the information as requested in this form. ☐
7. I understand that personal information collected about me that can identify me, such as my name, recordings, or where I live, will not be shared beyond the study team. ☐
8. I understand that the information I provide will be held securely and in line with data protection requirements at the University of Central Lancashire. ☐
9. I understand that the research team will respect my confidentiality and I give permission for them to have access to my responses. ☐

10. I understand that confidentiality and anonymity will be maintained, and it will not be possible to identify me in any reports, presentations or publications arising from the research.
11. I agree that my data can be quoted in research outputs such as Thesis publication.
12. I understand that signed consent forms and written/recorded observational information will be retained in a password protected account for up to seven years.

Where the participant information sheet has been read aloud to the participant:

I have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands to what they are freely consenting:

13. I agree to take part in the above study.

______________________	________	__________________
Participant name	Date	Signature
______________________	________	__________________
Name of person taking consent	Date	Signature

Principal Investigator
Jill Alexander
University of Central Lancashire, Preston
01772201201
Jalexander3@uclan.ac.uk

Student Investigator
Claire Thomas
University of Central Lancashire, Preston
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I

University of Central Lancashire
UCLan

Participant Consent Form

Version number & date: V 2.2 03.02.2024
Research ethics approval number: HEALTH 01084
Title of the research project: Investigating existing approaches to the release of laryngeal tension in singers diagnosed with Muscle Tension Dysphonia (MTD)
Name of researcher(s): Claire Thomas

Please initial box

1. I confirm that I have read and have understood the information sheet dated 03.02.24 for the above study, or it has been read to me. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. ☐
2. I understand that taking part in the study involves observational information about me being shared with the researcher. ☐
3. I understand that my participation is voluntary and that I am free to stop taking part and can withdraw from the study at any time without giving any reason and without my rights being affected. In addition, I understand that I am free to decline access to my observations and information. ☐
4. I understand that I can ask for access to the information I provide, and I can request the destruction of that information if I wish at any time after submission. ☐
5. I understand that the information I provide will be held securely and in line with data protection requirements at the University of Central Lancashire until it is fully anonymised and then deposited in the archive for sharing and use by other authorised researchers to support other research in the future. ☐
6. I understand that other authorised researchers may use my words in publications, reports, webpages, and other research outputs, if their study has been approved by a research ethics committee, and they agree to preserve the confidentiality of the information as requested in this form. ☐
7. I understand that personal information collected about me that can identify me, such as my name, recordings, or where I live, will not be shared beyond the study team. ☐
8. I understand that the information I provide will be held securely and in line with data protection requirements at the University of Central Lancashire. ☐
9. I understand that the research team will respect my confidentiality and I give permission for them to have access to my responses. ☐

10. I understand that confidentiality and anonymity will be maintained, and it will not be possible to identify me in any reports, presentations or publications arising from the research.
11. I agree that my data can be quoted in research outputs such as Thesis publication.
12. I understand that signed consent forms and written/recorded observational information will be retained in a password protected account for up to seven years.

Where the participant information sheet has been read aloud to the participant:

I have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands to what they are freely consenting:

13. I agree to take part in the above study.

______________________	________	___________________
Participant name	Date	Signature
______________________	________	___________________
Name of person taking consent	Date	Signature

Principal Investigator
Jill Alexander
University of Central Lancashire, Preston
01772201201
Jalexander3@uclan.ac.uk

Student Investigator
Claire Thomas
University of Central Lancashire, Preston
Cmthomas5@uclan.ac.uk

Investigating existing approaches to the release of laryngeal tension in singers diagnosed with Muscle Tension Dysphonia (MTD)

Participant (Practitioner) Information Sheet

University of Central Lancashire
UCLan

You are being invited to participate in a research study. Before you decide if you wish to take part, it is important that you understand why the research is being done and what it will involve. Please take time to read the following information carefully and if you would like more information or if there is anything that you do not understand, please contact us using the contact information below. Please also feel free to discuss with others if you wish.
Thank you for reading this.

What is the purpose of the study

The study is being completed by Claire Thomas, as part of the professional Doctorate in Elite performance at the University of Central Lancashire and is being completed under the supervision of Dr. Jill Alexander.

The term 'Muscle Tension Dysphonia' has long been employed as a catch-all term for several muscular disorders in and around the larynx. After creating an illustrated book of the muscles of the singing voice, undertaking a literature review into the current methods of measurement of laryngeal tension, and rapid reviews of the causes, impacts and treatments of Muscle Tension Dysphonia (MTD) in the singing voice, this current project aims to create a clear overview of the approaches used to treat MTD in the Musical Theatre singing voice.

As treatment of MTD is not standardised across practitioners, the project hopes to identify the most common approaches from observations made during one-to-one sessions.

The information collated will inform a collection of described exercises to help singing teachers to continue to progress following the singers' initial speech and language therapy on their return to the voice studio.

These observations will be compared with reported treatment approaches gathered through a previous questionnaire and triangulated with the current literature.

The participants have been selected from three groups who may work with muscle tension dysphonia in the singing voice: Speech and Language Therapists (SLTs), Singing Voice Rehabilitation Specialists and Singing Teachers. It is hoped to identify aspects of treatment that may be easily transferred into singing voice exercises, allowing singing teachers the confidence and skills to best support initial SLT intervention.

Why have I been invited to take part?
You have been chosen due to your professional standing and affiliation with voice rehabilitation within the MT genre.

The data collection study will follow the work of speech and language therapists, singing teachers, and singing voice rehabilitation specialists.

Therapeutic session notes will be collated, compared in type of approach, and the data will be disseminated in a written report.

What will happen if I take part?

The study involves you noting activities undertaken within your one-to-one vocal sessions and assessing progress. You will be asked to either record the sessions or take notes which will be shared with Claire Thomas. The study will follow a minimum of 3 and a maximum of 6 sessions involving the treatment of muscle tension dysphonia in the musical theatre singing voice.

To take part in the study you must have a client who fulfils the following criteria:

a) Musical Theatre Performer – amateur, professional, in training or returning to performance.
b) They are over the age of 18.
c) They can give informed consent to collection of data regarding their treatment.
d) They have been diagnosed with MTD.
e) They are receiving treatment from the participant within the timeframe of the study.

You will be allocated a participant and subject number, and asked to take notes on the following aspects of each session:

1. Initial assessment of MTD progress/status. Please use your own words or refer to a standardised method of measurement if used.
2. Exercises/activities undertaken during the session and functional or behavioural outcomes observed in the client.
3. Any musical-theatre specific considerations included in treatment.
4. Any additional information you feel is notable with regards to treatment progress.

You may choose to record session notes in one of 3 ways:
a) Via recorded voice notes

b) Via a typed document.
c) Record the full session (Claire will transcribe these for data analysis).

When sessions have been completed and your notes have been compiled, they should be labelled with file names which only contain your participant and subject numbers to ensure subject anonymity.

Before you decide to take part in the study, you will be asked to read and consent to a series of statements before proceeding.
If you are interested in taking part, please retain this participant information sheet for your records before starting the study.

Do I have to take part?
No, it is entirely up to you if you want to take part or not. Participation in the study is voluntary. If you do decide to take part, you will be able to withdraw at any point for any reason and your data will not be used.

How will my data be used?
The University processes personal data as part of its research and teaching activities in accordance with the lawful basis of 'public task', and in accordance with the University's purpose of "advancing education, learning and research for the public benefit".

Under UK data protection legislation, the University acts as the Data Controller for personal data collected as part of the University's research. The University privacy notice for research participants can be found on the attached link https://www.uclan.ac.uk/data_protection/privacy-notice-research-participants.php

Further information on how your data will be used can be found in the table below.

How will my data be collected?	Data will be collected via your own notetaking or voice memo recordings, whichever is easiest for you. This will then be sent via a password protected email to the researcher where it will be stored securely and then analysed.
How will my data be stored?	The information provided will be held securely and will be password encrypted and stored in a password-protected electronic file on the UCLan's secure servers.

How long will my data be stored for?	Data will be stored in line with UCLan's data storage policy ad destroyed after 7 years.
What measures are in place to protect the security and confidentiality of my data?	Data will be secured during transfer between your field collection/ storage/ researchers by the use of password protected and encrypted transfer methods.
Will my data be anonymised?	The data will be anonymised after analysis has taken place. Only the researcher will have access to the original data set.
How will my data be used?	• Details of exercises and approaches to treatment of MTD will be collected and analysed to inform the design of subsequent exercises. • This is necessary to ensure that exercises provided to singing teachers are as closely aligned as possible to current practices.
Who will have access to my data?	The information that you provide will only be accessible to the research team at UCLan.
Will my data be archived for use in other research projects in the future?	No.
How will my data be destroyed?	The data will be securely erased after 7 years, in line with UCLan's data storage policy.

The results from the data will be completely anonymised when written up to form part of thesis for a Professional Doctorate.
The information will be kept for 7 years and then destroyed, in line with University policy.

Are there any risks in taking part?
There are no perceived risks or disadvantages involved.

Are there any benefits from taking part?
There are no anticipated direct benefits to you. However, we hope that the collective responses may lead to a better understanding about the treatment of

muscle tension dysphonia in musical theatre singers and help to create an impactful final resource for singing teachers.

What will happen to the results of the study?
The results of the study will be written up as part of a thesis for a Professional Doctorate.

What will happen if I want to stop taking part?
Although this study will be completely anonymised, it will be possible for you to withdraw your data and from the study at any point. Please contact Claire Thomas at Cmthomas5@uclan.ac.uk if you would like to withdraw your participation.

Who has reviewed this study?
The study has been reviewed and approved by the Health Ethics Review Panel at the University of Central Lancashire – HEALTH 01084.

What if I am unhappy or if there is a problem?
If you are unhappy, or if there is a problem, please feel free to let us know by contacting Claire Thomas – CMThomas5@uclan.ac.uk and I will try to help. If you remain unhappy or have a complaint which you feel you cannot come to me with, then please contact the Ethics, Integrity and Governance Unit at UCLan via OfficerforEthics@uclan.ac.uk.

Who can I contact if I have further questions?
Claire Thomas, Institute of Coaching and Performance, UCLan, Preston, PR1 2HE, CMThomas5@uclan.ac.uk

Investigating existing approaches to the release of laryngeal tension in singers diagnosed with Muscle Tension Dysphonia (MTD)

Participant (subject) Information Sheet

University of Central Lancashire
UCLan

You are being invited to participate in a research study. Before you decide if you wish to take part, it is important that you understand why the research is being done and what it will involve. Please take time to read the following information carefully and if you would like more information or if there is anything that you do not understand, please contact us using the contact information below. Please also feel free to discuss with others if you wish.
Thank you for reading this.

What is the purpose of the study

The study is being completed by Claire Thomas, as part of the professional Doctorate in Elite performance at the University of Central Lancashire and is being completed under the supervision of Dr. Jill Alexander.

The term 'Muscle Tension Dysphonia' has long been employed as a catch-all term for several muscular disorders in and around the larynx. After creating an illustrated book of the muscles of the singing voice, undertaking a literature review into the current methods of measurement of laryngeal tension, and rapid reviews of the causes, impacts and treatments of Muscle Tension Dysphonia (MTD) in the singing voice, this current project aims to create a clear overview of the approaches used to treat MTD in the Musical Theatre singing voice.

As treatment of MTD is not standardised across practitioners, the project hopes to identify the most common approaches from observations made during one-to-one sessions.

The information collated will inform a collection of resources to help singing teachers to continue to progress following the singers' initial speech and language therapy on their return to the voice studio.

These observations will be compared with reported treatment approaches gathered through a previous questionnaire and triangulated with the current literature.

Your practitioner has been selected from those who work with muscle tension dysphonia in the singing voice: Speech and Language Therapists (SLTs), Singing Voice Rehabilitation Specialists and Singing Teachers. It is hoped to identify aspects of treatment that may be easily transferred into singing voice exercises, allowing singing teachers the confidence and skills to best support initial SLT intervention.

Why have I been invited to take part?
You have been chosen because of your ability to meet the following criteria:

a) Musical Theatre Performer - amateur, professional, in training or returning to performance.
b) You are over the age of 18.
c) You can give informed consent to collection of data regarding their treatment.
d) You have been diagnosed with MTD.
e) You are receiving treatment from the participant within the timeframe of the study.

The observation studies will follow the work of speech and language therapists, singing teachers, and singing voice rehabilitation specialists.

Observational data will be collated, compared in type of approach, and the data will be disseminated in a written report.

What will happen if I take part?
The study involves your practitioner tracking the activities undertaken within your one-to-one vocal sessions. They will be asked to either record the sessions or take notes which will be shared with Claire Thomas. The study will follow a minimum of 3 and a maximum of 6 sessions involving the treatment of muscle tension dysphonia in the singing voice.

Before you decide to take part in the study, you will be asked to read and consent to a series of statements before proceeding.

If you are interested in taking part, please retain this participant information sheet for your records before starting the study.

Do I have to take part?
No, it is entirely up to you if you want to take part or not. Participation in the study is voluntary. If you do decide to take part, you will be able to withdraw at any point for any reason and your data will not be used.

How will my data be used?
The University processes personal data as part of its research and teaching activities in accordance with the lawful basis of 'public task', and in accordance with the University's purpose of "advancing education, learning and research for the public benefit".

Under UK data protection legislation, the University acts as the Data Controller for personal data collected as part of the University's research. The University privacy notice for research participants can be found on the attached link https://www.uclan.ac.uk/data_protection/privacy-notice-research-participants.php

Further information on how your data will be used can be found in the table below.

How will my data be collected?	Data will be collected via your practitioner taking notes or voice memo recordings, whichever they prefer.
How will my data be stored?	The information provided will be held securely and will be password encrypted and stored in a password-protected electronic file on the UCLan's secure servers.
How long will my data be stored for?	Data will be stored in line with UCLan's data storage policy ad destroyed after 7 years.
What measures are in place to protect the security and confidentiality of my data?	Data will be secured during transfer between your field collection/ storage/ researchers by the use of password protected and encrypted transfer methods.
Will my data be anonymised?	The data will be anonymised after analysis has taken place. Only the researcher will have access to the original data set.
How will my data be used?	• Details of exercises and approaches to treatment of MTD will be collected and analysed to inform the design of subsequent exercises. • This is necessary to ensure that exercises provided to singing teachers are as closely aligned as possible to current practices.
Who will have access to my data?	The information that you provide will only be accessible to the research team at UCLan.

Will my data be archived for use in other research projects in the future?	No.
How will my data be destroyed?	The data will be securely erased after 7 years, in line with UCLan's data storage policy.

The results from the data will be completely anonymised when written up to form part of thesis for a Professional Doctorate.
The information will be kept for 7 years and then destroyed, in line with University policy.

Are there any risks in taking part?
There are no perceived risks or disadvantages involved.

Are there any benefits from taking part?
There are no anticipated direct benefits to you. However, we hope that the collective responses may lead to a better understanding about the treatment of muscle tension dysphonia in musical theatre singers and help to create an impactful final resource for singing teachers.

What will happen to the results of the study?
The results of the study will be written up as part of a thesis for a Professional Doctorate.

What will happen if I want to stop taking part?
Although this study will be completely anonymised, it will be possible for you to withdraw your data and from the study at any point. Please email Claire Thomas at Cmthomas5@uclan.ac.uk if you would like to withdraw your participation.

Who has reviewed this study?
The study has been reviewed and approved by the Health Ethics Review Panel at the University of Central Lancashire - HEALTH 01084.

What if I am unhappy or if there is a problem?
If you are unhappy, or if there is a problem, please feel free to let us know by contacting Claire Thomas – CMThomas5@uclan.ac.uk and I will try to help. If you remain unhappy or have a complaint which you feel you cannot come to me with, then please contact the Ethics, Integrity and Governance Unit at UCLan via OfficerforEthics@uclan.ac.uk.

Who can I contact if I have further questions?
Claire Thomas, Institute of Coaching and Performance, UCLan, Preston, PR1 2HE, CMThomas5@uclan.ac.uk

Appendix G - Study 3 Participant Notes Guide

Investigating existing approaches to the release of laryngeal tension in singers diagnosed with Muscle Tension Dysphonia (MTD)

Participant (Practitioner) Instruction Sheet

University of Central Lancashire
UCLan

Thank you for expressing interest in taking part in this study. This instruction sheet will provide you with more detailed information with regards to the information required during your note-taking. Please contact Claire Thomas on CMThomas5@uclan.ac.uk if you require further information.

Inclusion Criteria for Client

To take part in the study you must have a client who fulfils the following criteria:

a) Musical Theatre Performer – amateur, professional, in training or returning to performance.
b) They are over the age of 18.
c) They can give informed consent to collection of data regarding their treatment.
d) They have been diagnosed with primary MTD.
e) They are receiving treatment from the participant within the timeframe of the study.

Client consent

Prior to undertaking the study, informed consent should be obtained from the client. Included in the information pack is a subject participant information sheet and consent form. Please ensure the client has adequate time to read over the information sheet and decide whether they wish to take part or not.

If they wish to give consent and participate, they should sign the consent form (a digital signature is acceptable) and this should be returned to Claire Thomas via email at CMThomas5@uclan.ac.uk prior to documentation of sessions.

What will happen if my client consents to take part?

You will be allocated a participant and subject number, and asked to take notes on the following aspects of each session:

1. Initial assessment of MTD progress/status. Please use your own words or refer to standardised method of measurement if used.

2. Exercises/activities undertaken during the session and functional or behavioural outcomes observed in the client.
3. Any musical-theatre specific considerations included in treatment.
4. Any additional information you feel is notable with regards to treatment progress.

You may choose to record session notes in one of 3 ways:

a) Via Voice Notes.
b) Typed document.
c) Record the full session (Claire will transcribe these for data analysis).

What do I do once the sessions are completed?

When you have taken notes for a minimum of 3 and a maximum of 6 sessions, you can send the files containing your notes to Claire Thomas via CMThomas5@uclan.ac.uk.

Please ensure that the files are labelled with only your participant and subject numbers to ensure anonymity of your client.

Thank you for you participation in this case study. Results will be written up and made accessible to all participants who wish to read them.

Appendix H - Ethical Approval Study 4 – HEALTH01084

University of Central Lancashire
Preston PR1 2HE
01772 201201
uclan.ac.uk

16 September 2024

Claire Thomas / Jill Alexander
School of Health, Social Work and Sport
University of Central Lancashire

Dear Claire / Jill

Re: Health Ethics Review Panel Application
Unique Reference Number: HEALTH 01084 Phase_2

The Health Ethics Review Panel has granted approval of your proposal application 'Muscle Tension Dysphonia in the singing voice: An exploration leading to the development of resources to connect therapeutic interventions with vocal use in performance'. Approval is granted up to the end of project date.*

It is your responsibility to ensure that:

- the project is carried out in line with the information provided in the forms you have submitted
- you regularly re-consider the ethical issues that may be raised in generating and analysing your data
- any proposed amendments/changes to the project are raised with, and approved by, the Ethics Review Panel
- you notify EthicsInfo@uclan.ac.uk if the end date changes or the project does not start
- serious adverse events that occur from the project are reported to the Ethics Review Panel
- a closure report is submitted to complete the ethics governance procedures (existing paperwork can be used for this purpose e.g. funder's end of grant report; abstract for student award or NRES final report. If none of these are available, use the e-Ethics Closure Report pro forma).

Yours sincerely

K Patel

Kulsum Patel
Deputy Vice-Chair
Health Ethics Review Panel

* for research degree students this will be the final lapse date

NB - Ethical approval is contingent on any health and safety checklists having been completed and necessary approvals gained as a result.

Appendix I - Participant Recruitment Email, Informed Consent and Participant Information Sheet – Study 4

Dear _________________,

Following a successful practitioner questionnaire examining current treatment approaches, along with the collection of initial treatment case study data, I have put together a resource for singing teachers which will compliment initial MTD treatment by Speech and language therapists while providing a collection of useful approaches to link initial therapy with a return to singing voice use.

I would be grateful of you would consider participating in a short interview around the content, design, and future delivery of the resource. The interview can take part in person or online via Teams and will be recorded. The discussion will be transcribed and the content analysed to help refine and design the resource further.

All practitioners will have the option to be anonymised before data analysis, and information sheets, consent forms and data protection details will be provided to all prior to undertaking the study.

The results of the discussion will be used to inform the re-design or refinement of the resource for singing teachers to compliment initial MTD therapeutic interventions. The final resource will be made available freely via the final thesis and in book/online format.

I hope that gives you a quick overview, and of course just let me know if it of interest and you think you may have time to spare – there is absolutely no obligation to take part and I am very grateful for your time so far.

I have attached an information sheet, consent form and interview guidance to this email. If you are happy to take part, we can organise the best time for you to feed back and I will send the resource to you 2 weeks before the date to give you some time with it before you provide your insight.

If you would like more information or to chat through the study, please just get in touch by reply to this email. Alternatively, if you know of any other practitioners who may fit the criteria and be willing to take part, please pass this email on.

Many thanks for your time and help,
Best Wishes
Claire

Claire Thomas,
MEd (RCS), MA, PGDE, PGCPSE, CTABRSM, DipLCM
Vocal Coach and Voice Researcher

University of Central Lancashire
UCLan

Participant Consent Form

Version number & date: Version 1: 12.4.23
Research ethics approval number: HEALTH 01084 Phase_2
Title of the research project: Muscle Tension Dysphonia in the singing voice: An exploration leading to the development of resources to connect initial therapeutic interventions with vocal use in performance.

Name of researcher(s): Claire Thomas & Dr Jill Alexander

Please initial box

1. I confirm that I have read and have understood the information sheet dated 14/11/24 for the above study, or it has been read to me. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. ☐
2. I understand that taking part in the study involves an audio recorded interview. ☐
3. I understand that my participation is voluntary and that I am free to stop taking part and can withdraw from the study at any time without giving any reason and without my rights being affected. In addition, I understand that I am free to decline to answer any question or questions. ☐
4. I understand that I can ask for access to the information I provide, and I can request the destruction of that information if I wish at any time prior to 1 month from the agreement of the interview date. I understand that following 1 month from the interview, I will no longer be able to request access to or withdrawal of the information I provide. ☐
5. I understand that the information I provide will be held securely and in line with data protection requirements at the University of Central Lancashire. ☐
6. I understand that signed consent forms and original audio recordings will be retained in an encrypted password protected laptop with a password within a protected file owned by Claire Thomas and NOT accessible to any other individual until submission of the doctoral thesis (anticipated May 2025) when it shall be deleted. ☐
7. I understand that personal information collected about me that can identify me, such as my name or where I live, will not be shared beyond the study team. ☐

Audio / video recordings

8. I understand and agree that my participation will be audio recorded and I am aware of and consent to use of these recordings for the following purposes: thematic analysis, coding and key sentences or phrasing.

Storage of documents

9. I understand that a transcript of my interview will be retained for the period of the research programme expected May 2025.

Confidentiality of the data

10. I understand that the research team will respect my confidentiality and I give permission for them to have access to my responses.
11. I understand that confidentiality and anonymity will be maintained, and it will not be possible to identify me in any reports, presentations or publications arising from the research without my permission (see box 12 -14)

Use of quotes and fully identifiable information

12. I agree that my information can be quoted in research outputs such as [peer reviewed journals].

13. I would like my name to be reported and I understand and agree that what I have said or written as part of this study will be used in reports, publications and other research outputs so that anything I have contributed to this project can be recognised.

14. I agree that my real name can be used for quotes.

Re-contacting participants for the purpose of inviting them to take part in future studies

15. I agree to being contacted at a later date and invited to take part in future relevant studies. I understand that I am only agreeing to receive information and I am under no obligation to take part in any future studies. I understand that if I do not consent to being contacted in the future it will not have any influence on my involvement in this particular research study.

16. I agree to take part in the above study. ☐

______________________	________	___________________
Participant name	Date	Signature
______________________	________	___________________
Name of person taking consent **Student Investigator**	Date	Signature

Participant Information Sheet

Title of Study

Muscle Tension Dysphonia in the singing voice: An exploration leading to the development of resources to connect initial therapeutic interventions with vocal use in performance.

You are being invited to participate in a research study. Before you decide whether to participate, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and feel free to ask us if you would like more information or if there is anything that you do not understand. Please also feel free to discuss this with your friends, relatives and colleagues if you wish. We would like to stress that you do not have to accept this invitation and should only agree to take part if you want to.

Thank you for reading this.

What is the purpose of the study?

Muscle Tension Dysphonia (MTD) is commonplace in amateur and professional singing voice, particularly the musical theatre singing voice. There has been significant research undertaken with regards to the treatment of MTD in the spoken voice, yet very little research has been carried out in the singing voice. There are a lack of resources available to help singers once the initial therapy has been delivered. Practitioners are expected to be able to help singers to progress back to full performance-level voicing after an MTD diagnosis, and have the necessary skills, knowledge and expertise to be effective. There is, however, little accessible guidance, support or training available for practitioners on how to design post-therapeutic input for those who have received initial voice therapy for MTD.

The purpose of this study is to collect practitioners' views about the content and design of a pedagogical resource. The results of interview data will inform the design of a voice resource that will enhance singing teacher working methods.

University of Central Lancashire
UCLan

Why have I been invited to take part?

If you are a voice-related practitioner working as part of a voice clinic or as an independent Speech and Language Therapist, we would like to gather your views on a devised resource which is intended to provide singing teachers with a link between initial therapeutic intervention and a return to performance singing voice use.

Having worked with MTD in the singing voice, your experiences and views are of interest in helping us to refine the content and delivery modes of post-therapeutic voice resources for singing teachers.

Do I have to take part?

Participation in this research is voluntary. Participants are free to withdraw their consent to participate at any time, without explanation, and without incurring a disadvantage.

What will happen if I take part?

If you agree to take part in an interview you will be invited to either an in-person or video meeting that will be offered to you on specified dates and times. The meeting will be both recorded and transcribed for subsequent analysis. The researcher will work with you to try and accommodate a meeting time that best suits you. Prior to the meeting, you will be asked to sign and return your participant information sheet and informed consent that explains how your data will be used and reminds you of your freedom to withdraw from the research at any time. Prior to the interview you will be sent the resource digitally to allow you time to read through and form any opinions which may be useful to the study.

On the day of the interview, you will meet in person or log in to your session via MS Teams.
The researcher (Claire Thomas) will give you pre interview brief which will include a verbal consent to participate, the expectations of the session, and instructions. You will then be invited to participate in an interview.

At the end of the interview, you will be given some debrief instructions (by Claire Thomas) and reminded of your rights as a voluntary participant in this research.

Participants will be invited to confirm the transcription or request corrections. If corrections are required, these will be made and the transcription send back to the participant for confirmation before analysis.
The interviews will last no more than 60 minutes and we encourage you to be as open, honest and forthcoming as possible.

Doctoral candidate Claire Thomas is leading this research with Dr Jill Alexander. Your data (video/audio recording and transcription) will be accessible to Claire Thomas who is responsible for analysing the results. Any findings from this study might be published however no participants information including specific voice clinics will be identifiable.

How will my data be used?

The University processes personal data as part of its research and teaching activities in accordance with the lawful basis of 'public task', and in accordance with the University's purpose of "advancing education, learning and research for the public benefit".

Under UK data protection legislation, the University acts as the Data Controller for personal data collected as part of the University's research. The University privacy notice for research participants can be found on the attached link https://www.uclan.ac.uk/data_protection/privacy-notice-research-participants.php

Further information on how your data will be used can be found in the table below.

How will my data be collected?	Video recording and transcribed notes using Teams meeting facilities. If the interview takes place in person, a portable encrypted Dictaphone,

	borrowed from UCLan will be used and the data will be transferred to a password protected laptop and deleted from the recording device upon transfer.
How will my data be stored?	Data submitted will be stored on a password protected laptop and held on UCLAN office 365 application which is also password protected.
How long will my data be stored for?	The data captured for this study will be held for the duration of the doctoral research. A period of no longer than 5 years.
What measures are in place to protect the security and confidentiality of my data?	Data will be stored on a password protected encrypted laptop. If using an encrypted Dictaphone borrowed from UCLan (only in the case of an in-person interview) the data will be transferred to a password protected laptop and deleted from the recording device upon transfer. The data held for the research is stored on password protected files. Your personal data will not be shared with any other individual and by giving consent to participate (in an interview) you acknowledge you will be sharing views and perspectives with other practitioners.
Will my data be anonymised?	Participants will have the option to ask to be identified or remain anonymous. No identifiable data will be made public as part of this study unless consent is obtained.
How will my data be used?	Your data will be analysed for content, similarities, differences, and to refine and shape the resource content and delivery method. This subjective data will be used to inform subsequent resource design.
Who will have access to my data?	No identifiable data will be made available to any other individual. Non identifiable data (transcriptions) will be available to the research team (Dr Jill Alexander) only.

Will my data be archived for use in other research projects in the future?	No
How will my data be destroyed?	Any initial data recorded on an encrypted recording device borrowed from UCLan will be deleted after transfer to a password protected laptop. On completion of the doctoral research all raw data will be deleted from computer devices and outlook 365 will be closed. Anticipated May 2025

Transferring data outside the EU

NA

Are there any risks in taking part?

There are no risks or danger in taking part in this research. Should you experience any discomfort (mental, emotional, or physical) or disadvantage as part of the research, please inform Claire Thomas (CMThomas5@uclan.ac.uk) or Jill Alexander (JAlexander3@uclan.ac.uk)

What will happen to the results of the study?

The findings of this study will inform resource design for singing teachers working with singers who have had therapeutic treatment for MTD. The results might be published in a research journal. No individuals or organisations will be identifiable.

What will happen if I want to stop taking part?

Participation in this project is voluntary, and you can withdraw at any time without giving a reason by contacting Claire Thomas [CMThomas5@uclan.ac.uk]. If you wish to withdraw, please note that data already collected can only be withdrawn up to 4 weeks after the interview. After this point, the researcher will have combined the data and your information will have been anonymised ready for analysing and it won't be possible to identify who you are.

What if I am unhappy or if there is a problem?

If you are unhappy, or if there is a problem, please feel free to let us know by contacting [Dr Jill Alexander at [JAlexander3@uclan.ac.uk] and we will try to help. If you remain unhappy, or have a complaint which you feel you cannot come to us with, then please contact the Ethics, Integrity and Governance Unit at OfficerForEthics@uclan.ac.uk.

The University strives to maintain the highest standards of rigour in the processing of your data. However, if you have any concerns about the way in which the University processes your personal data, it is important that you are aware of your right to lodge a complaint with the Information Commissioner's Office by calling 0303 123 1113.

Who can I contact if I have further questions?

Claire Thomas
CMThomas5@uclan.ac.uk

PDF 1 – Resource 1 The Muscles of Singing Voice Production (Pre-publication - Additional file available on request after 2026)

PDF 2 – Resource 2 Muscle Tension Dysphonia in The Singing Voice Establishing Links between Therapy and Performing Voice (Pre-publication - Additional file available on request after 2026.