

1 **Prevalence of Work-Related Musculoskeletal Disorders among Dental Workers in Enugu**  
2 **Metropolis, Nigeria**

3

4 Running (short) title: **WRMSDs among Dental Workers**

5 Canice Chukwudi Anyachukwu<sup>1,2</sup>, Faith Nkechi Ezugwu<sup>1</sup>, Stephen Sunday Ede<sup>3</sup>, Ogochukwu  
6 Kelechi Onyeso<sup>1,4</sup>, Charles Ikechukwu Ezema<sup>1</sup>, Chisom Favour Ede<sup>1</sup>

7 <sup>1</sup>Department of Medical Rehabilitation, Faculty of Health Sciences and Technology, College of  
8 Medicine, University of Nigeria,

9 <sup>2</sup>Molecular Pathology Institute, Enugu, Nigeria,

10 <sup>3</sup>School of Sports and Health Sciences, University of Central Lancashire, Preston, UK, 4 Faculty  
11 of Health Sciences, University of Lethbridge, Alberta, Canada

12

13 **Address for correspondence:** Mr. Stephen Sunday Ede, School of Sports and Health Sciences,  
14 University of Central Lancashire, Preston, UK. E-mail: [SSEde@uclan.ac.uk](mailto:SSEde@uclan.ac.uk)

15

16

17

18

19

20

21

22

23

24

25

26

## 27 **Abstract**

28 **Background:** Work-related musculoskeletal disorders (WRMSD) are the main occupational  
29 health hazard among several clinicians, but its prevalence among dental workers in Nigeria has  
30 not been well-studied. Objective: This study evaluated the pattern and prevalence of WRMSDs  
31 among dental workers in the Enugu metropolis, Nigeria. **Materials and Methods:** Six hospitals  
32 with dental clinics participated in this cross-sectional survey in the Enugu metropolis. One-  
33 hundred and fifty standardized musculoskeletal symptom (Nordic) questionnaires were adopted  
34 and distributed, of which 141 were returned. The questionnaire elicited data on demographic  
35 characteristics and carrier profiles, ergonomics, and the body parts involved in the occupational  
36 activities. **Results:** The results indicated that 83% of the respondents sustained musculoskeletal  
37 injury more than once. Bending (66%) and performing repetitive tasks (58.2%) were the most  
38 performed risk activities. The lower back (66%) was the most affected body part, followed by  
39 the upper back (58.9%), neck (51%), shoulder (47.5%), and hip (46.1%). The most common  
40 preventive measures taken by individuals were resting (57%) and avoiding lifting (53.2%).  
41 **Conclusion:** There is a high prevalence of WRMSD among dental workers, with a consequent  
42 negative effect on their work habits, and reduced productivity.

43 **Keywords:** Dental workers, Enugu Nigeria, prevalence, work-related musculoskeletal disorders

## 44 **Introduction**

45 Musculoskeletal disorders affect nerves, tendons, muscles, and supporting structures such as  
46 intervertebral discs with symptoms ranging from mild periodic discomfort to several chronic and  
47 severe pain[1]. It majorly affects the neck, shoulder, back, wrist, and hand with common signs like  
48 a decreased range of motion, deformity decreased grip strength, and loss of muscle function.  
49 Symptoms include pain, numbness tingling, burning cramping, and stiffness[2].

50 The term Work-related musculoskeletal disorders (WRMSDs) was used in this study as signs and  
51 symptoms arising due to a series of micro-traumas to bones, joints, ligaments, muscle tendons,  
52 blood vessels, and nerves that accumulate and intensified by work[3]. Many occupations place

53 high physical and mental demands on employees, putting them at risk of developing a work-related  
54 musculoskeletal disorder (WRMSD). Workers' habits must be continually reassessed to ensure  
55 proper posture, body mechanics, equipment use, stretching techniques, frequent breaks, and  
56 overall healthy lifestyles[4]. A multi-center epidemiologic study has shown that over 65 percent  
57 of dental health care workers suffer from musculoskeletal disorders during their working careers,  
58 ceasing pain and discomfort, forcing them to take time off from the surgery, and in some cases  
59 leading to retirement.<sup>2</sup> The work of Leggat et al.[5] also, highlighted that WMSD among dental  
60 health workers might contribute considerably to sick leaves, reduced productivity, and the future  
61 possibility of leaving the profession at an early age. Similarly, the work of Hayes et al.[6] on the  
62 prevalence of work-related musculoskeletal disorders amongst dental healthcare workers showed  
63 that the prevalence of WRMSD had contributed as high as 64 to 93 percent of pain reported to the  
64 clinicians.

65 According to Yasobant and Rajkumar[7], the causes of WRMSD are multi-factorial, including  
66 workplace conditions and exposures and organizational, psychosocial, and socio-cultural variables  
67 among others. Daily exposure to physical risk factors and insufficient rest or recovery time are  
68 among the principal organizational factors that can lead to musculoskeletal disorders[8]. The  
69 intrinsic and extrinsic (physical) factors which include the work procedures, equipment, and  
70 environment lead to biomechanical stress on the muscle, tendons, spinal discs, and nerves[9,10].  
71 Force, repetition, awkward or long-term static postures, vibration, and work in low temperatures  
72 are also considered the principal physical work-related risk factors concerning musculoskeletal  
73 disorders[11,12].

74 Thus, this makes it necessary that adequate knowledge, skills, and information on working  
75 methods and techniques, as well as on working movements, postures, and loads are provided to

76 help reduce the risk of musculoskeletal disorders[13]. It has been suggested that injuries caused  
77 by WRMSD or similar cumulative trauma disorders, can be reduced or prevented by applying  
78 ergonomics in dental equipment and instrument design[14]. Occupation ergonomics attempts to  
79 improve the fit between the workforce and the work environment through the optimized design of  
80 jobs and work systems. Ergonomics programs most often focus on physical job features, such as  
81 tool or workstation dimensions, heavy lifting, awkward postures, and repetitive tasks[2].

82 However, much of the focus regarding WRMSD has not been thoroughly addressed among dental  
83 workers in Nigeria. Dental workers due to the nature of their profession may be subjected to tasks,  
84 which can be very physically challenging and labour-intensive involving direct contact with  
85 patients. They include performing manual work, continuous bending, or transferring dependent  
86 patients, with few breaks to relieve the continuous load of static muscle contractions[15,16].  
87 Previous studies have shown that dental workers are commonly involved in the process of  
88 repetitive work using the same muscles and tendons for a considerable part of the working day,  
89 which may be responsible for fatigue and injuries[16,17]. They also engage in awkward postures;  
90 with the hands above shoulder height or with the wrist noticeably bent, in which the joints are  
91 more susceptible to injuries and muscles have less capacity for exerting force[18]. Evidence is  
92 scarce on WRMSD prevalence and pattern of presentation among Dental workers in Nigeria. An  
93 assessment of the WRMSD amongst dental workers and the underlying factors associated with it  
94 is required to elucidate the nature of this important issue and to guide in drawing ergonomic  
95 programs targeted at improving their working practices. Thus, the present evaluated the pattern  
96 and prevalence of WRMSDs among dental workers in the Enugu metropolis.

## 97 **Materials and methods**

### 98 **Design**

99 This is a cross-sectional descriptive survey to investigate the work-related musculoskeletal  
100 disorders (WRMSD) prevalence among dental workers in the Enugu metropolis, which was  
101 randomly selected from six hospitals with dental clinics including the University of Nigeria  
102 Teaching Hospital, Ituku-Ozalla Enugu, Federal School of Dental Technology, and Therapy  
103 Enugu, the State Dental clinic; and three private dental clinics within Enugu metropolis.

#### 104 **Ethical considerations**

105 The ethical approval for this study was obtained from the University of Nigeria Teaching  
106 Hospital Research Ethics Committee (NHREC/05/01/2008B-FWA00002458-1RB00002323).  
107 All participants gave their informed consent, and the study was conducted in accordance with the  
108 ethical principles of the Declaration of Helsinki.

#### 109 **Participants**

110 This study utilized a convenience sampling technique to recruit participants from the selected  
111 hospitals in Enugu metropolitans. This study involved 141 dental workers between the age  
112 ranges of 21-70 years who are operating within Enugu Metropolis, registered with the selected  
113 hospitals, who are willing and available to participate in the study. Those who had a history of  
114 surgery to their lower back, ankle, and foot or any deformity of the spine, knee, foot ankle joints,  
115 and who had cognitive impairment affecting their ability to understand the context of the  
116 questionnaire were excluded from this study.

#### 117 **Procedure**

118 Participants were contacted in person within the dental unit of the selected hospitals. The purpose,  
119 procedures, and relevance of the study were explained to the participants on which basis their  
120 written informed consent was requested and obtained.

121 The biodata of the participants (age, marital status, rank or occupation, and religion and tribe), job  
122 history and method of work, physical load, and musculoskeletal complaints were identified and  
123 defined by the presence or observed of pain in each specific body region using the standard and  
124 prophylactic method adopted concerning the musculoskeletal complaint.

## 125 **Questionnaire**

126 A standardized musculoskeletal symptom (Nordic) questionnaire was adopted and distributed to  
127 collect data for this study. The questionnaire comprised two sections: demographic characteristics  
128 and carrier profiles, Ergonomics, and the body parts involved in the occupational activities. The  
129 section elicited information on the general characteristics of the dental workers while the second  
130 section comprised four-part Nordic questionnaires which consisted of 20 items (WRMSDs based).  
131 Each eliciting information on job history and method of work, physical load, and musculoskeletal  
132 complaints were identified and defined by the presence or observed of pain in each specific body  
133 region using the standard and prophylactic method adopted concerning the musculoskeletal  
134 complaint. Also, their respective knowledge of musculoskeletal symptoms and their prevalence  
135 were evaluated.

## 136 **Statistical Analyses**

137 Before data collection, PASS and NCSS computer software version 2000 determined the sample  
138 size power (n=200). Further, D-Augustino normality test to confirm normal population sampling.  
139 The descriptive statistical analysis of frequency and percentages was used to analyse the data.  
140 All analyses were carried out with the SPSS computer statistical software version 20.

## 141 **Results**

142 Table 1 shows that most of the respondents were male (57.4%), within the age range of 21–30  
143 years (36.2%) with a mean age of 37 years, most of them were married (64.5%), and the majority  
144 (91.5%) were Christians. The table also demonstrates that most of the respondents (85%) were  
145 Igbos and the proportion of the respondents who had worked for 5 years (38.3%) was more than  
146 those who had worked 4 (19.1%), 3 (14.2%), 1 (14.2%), and 2 (11.3%) years, in that order.

147 Table 2 shows that most respondents (96.4%) have sustained WRMSD, while five (3.6%) have  
148 not. The most affected part of the body includes lower back injuries (66.1%), upper back (58.9%),  
149 neck (51.1%), shoulder injuries (47.5%), and hip (46.1%), while the ankle/foot was the least  
150 (22.7%) affected.

151 Table 3 shows that most (58.2%) of the dental workers sustained injuries when applying modalities  
152 and performing a repetitive task. Most (66.0%) of them indicated that they were bending when the  
153 injury occurred, while 34.8% and 19.1% claimed that their injuries occurred when lifting heavy  
154 equipment/patients and when transferring patients, respectively.

155 As indicated in Table 4, the majority of the respondents (57.4%) used rest to treat WRMSD,  
156 followed by medical treatment (52.5%) and exercise (51.1%). In addition, 30.5% used postural  
157 adaptation while 26.2% used surgical treatment.

158 Finally, Table 5 showed that WRMSD affected the ability of the dental workers to lift objects  
159 (53.2%); in 35.5% of them, it led to the change of working positions frequently, while in 24.1%,  
160 there was a change in the work schedule. Also, 21.3% decreased the use of manual techniques,  
161 17.7% of the dental workers encouraged patients' responsibility in carrying out treatment, and  
162 49.6% increased their use of mechanical aids. In addition, there was a decrease in patients' care

163 time in 17.7% of the respondents; 42.6% claim that they increased their use of other personnel;  
164 while 30.5% and 50.4% stopped working when hurt and took rest, respectively. Only 14.3% of  
165 them applied an improved body mechanics.

## 166 **Discussion**

167 This study aimed to assess the pattern and prevalence of work-related musculoskeletal disorders  
168 (WRMSDs) among dental workers in the Enugu metropolis. The result of the study revealed that  
169 a high percentage of the respondents have sustained low back pain followed by an upper back  
170 injury. This is in line with the findings of Buckle et al.[19] which revealed that WRMSD majorly  
171 affects the lower back, neck, shoulder, elbows, forearms, wrist, and hands. This finding also  
172 corroborates the findings of Blyth et al.[20], which showed that musculoskeletal pain is the major  
173 and most common cause of chronic pain and physical disability that affects hundreds of workers  
174 across the world. As well, Adegoke et al.[21] reported similar findings on the prevalence of work-  
175 related musculoskeletal pain among physiotherapists, which revealed that the majority of the  
176 physiotherapists have sustained low back pain followed by wrist pain. This high prevalence could  
177 be due to the frequent bending and poor posture associated with their work[6,21].

178 The result showed that the subjects sustained WRMSD when they were utilizing modalities,  
179 performing repetitive tasks, bending, transferring dependent patients, and lifting heavy equipment.  
180 This confirmed the findings of Adegoke et al.[21], which showed that transferring dependent  
181 patients and performing repetitive tasks were the most frequent causes of WRMSD in their study  
182 among dental workers.

183 On the type of treatment commonly used by dental workers when they sustain WRMSD, the  
184 highest used treatment modality reported in this study was rest, followed by medical treatment and

185 exercise. Other treatments include postural adaptation and surgical treatment. These findings did  
186 not agree with the findings of Adegoke et al.[21], which stated that only a few (4.2%) of the injured  
187 physiotherapists in their study used rest to reduce pain but mostly modified their position and work  
188 environment to reduce their symptoms. This difference in their findings could be due to the  
189 difference in the professional population studied. Adegoke et al.[21] assessed physiotherapists,  
190 which is a reference profession on the concepts of ergonomics and best intervention for WRMSDs.  
191 This difference could signpost a path for improvement and is noteworthy in interventional  
192 programs designed to improve ergonomics practice among dental health workers.

193 On the contrary, the sustained injury affected their work habit in different patterns as most of the  
194 dental workers altered their work habits due to WRMSD while around two-fifths of them did not.  
195 It was also observed that the dental workers mostly avoided lifting heavy objects, as they also  
196 frequently changed their working positions, and working schedules, decreased manual techniques,  
197 encouraged patients' responsibility, increased the use of mechanical aids, increased administrative  
198 aids, increased patient; care time, increased use of other personnel, stopped working when hurt,  
199 took a rest break and use improved body mechanics all as a coping strategy.

200 Finally, this study revealed a high prevalence of WRMSD among dental workers in the Enugu  
201 metropolis. This is consequent to an adverse effect on their work habit and can contribute  
202 considerably to sick leaves, reduced productivity, and the future possibility of leaving the  
203 profession at an early age as opined by Leggat et al.[5] as recommended in the work of Ambarwati  
204 et al.[22], there is a high need for interventions that help reduce the risk of WRMSD among dental  
205 workers as well as other health workers considering the manual and ergonomic dynamics of their  
206 work. Such intervention could include educating them on the basic principles of ergonomics and  
207 providing ergonomic chairs and proper working tools that are designed with ergonomic sense.

208 Study limitations: Being a cross-sectional design its utilization of self-report for the assessment of  
209 the ergonomics practices may have a diminishing effect on the study findings. Nevertheless, this  
210 study adds valuable information to the literature on the knowledge gaps and poor ergonomics  
211 practices of dental workers in the Enugu metropolis with their resultant prevalence of high  
212 WRMSDs.

### 213 **Conclusion**

214 This study showed a high prevalence of WRMSD among dental workers in the Enugu metropolis  
215 with a consequent negative effect on their work habits and reduced productivity mostly due to  
216 loss in man-hours. Interventions to promote ergonomic work settings are suggested to foster a  
217 healthier working experience among dental workers. In addition, because most of the affected  
218 clinicians resorted to self-medication; there is a need to educate the working population on  
219 management and preventive measures against WRMSDs.

220 **Authors contribution:** CCA, FNE, and SSE conceptualized and designed the study. CCA, FNE,  
221 CFE, OKO, and CIE were involved in data collection/acquisition and statistical analysis; All  
222 authors (SSE, CCA, FNE, CFE, OKO, and CIE) were involved in the writing and revising of the  
223 manuscript for intellectual content. All authors read and approved the final manuscript and  
224 agreed to be accountable for all aspects of the work.

225 **Ethical approval:** The ethical approval for this study was obtained from the University of  
226 Nigeria Teaching Hospital Research Ethics Committee (NHREC/05/01/2008B-FWA00002458-  
227 1RB00002323).

228 **Informed consent:** All participants gave their written informed consent before enrollment into  
229 the study.

230 **Declaration of Helsinki:** the study was conducted following the ethical principles of  
231 the Declaration of Helsinki.

232 **Availability of research data:** Authors are available and ready to supply the data upon request  
233 through the corresponding author.

234 **Funding or financial support:** the authors did not receive any funding or financial support for  
235 this study.

236 **Conflict of Interest Statement.** Authors have no conflict of interest to declare.

237 **Acknowledgement:** Not applicable.

238

## 239 **References**

240 1. El-Tallawy SN, Nalamasu R, Salem GI, LeQuang JAK, Pergolizzi JV, Christo PJ.  
241 Management of musculoskeletal pain: an update with emphasis on chronic musculoskeletal pain.  
242 Pain Ther. 2021;10(1):181-209.

243 2. Glover W, McGregor A, Sullivan C, Hague J. Work-related musculoskeletal disorders  
244 affecting members of the Chartered Society of Physiotherapy. Physiotherapy. 2005;91(3):138-  
245 47.

246 3. McCauley-Bush P. Ergonomics: foundational principles, applications, and technologies. CRC  
247 Press; 2011;13:225-62.

248 4. Hayes M, Cockrell D, Smith DR. A systematic review of musculoskeletal disorders among  
249 dental professionals. Int J Dent Hyg. 2009a;7(3):159-65.

- 250 5. Hayes MJ, Smith DR, Cockrell D. Prevalence and correlates of musculoskeletal disorders  
251 among Australian dental hygiene students. *Int J Dent Hyg.* 2009b;7(3):176-81.
- 252 6. Leggat PA, Kedjarune U, Smith DR. Occupational health problems in modern dentistry: a  
253 review. *Ind Health.* 2007;45(5):611-21.
- 254 7. Yasobant S, Rajkumar P. Work-related musculoskeletal disorders among health care  
255 professionals: A cross-sectional assessment of risk factors in a tertiary hospital, India. *Indian  
256 journal of occupational and environmental medicine.* 2014;18(2):75.
- 257 8. Ziaei M, Choobineh A, Abdoli-Eramaki M, Ghaem H. Individual, physical, and organizational  
258 risk factors for musculoskeletal disorders among municipality solid waste collectors in Shiraz,  
259 Iran. *Ind Health.* 2018;56(4):308-19.
- 260 9. National Research Council (US) and Institute of Medicine (US) Panel on Musculoskeletal  
261 Disorders and the Workplace. *Musculoskeletal Disorders and the Workplace: Low Back and  
262 Upper Extremities.* Washington (DC): National Academies Press (US); 2001.
- 263 10. Whiting WC, Zernicke RF. *Biomechanics of musculoskeletal injury.* Human Kinetics; 2008.
- 264 11. Kolgiri S, Hiremath R, Bansode S. Literature review on ergonomics risk aspects association  
265 to the power loom industry. *IOSR JMCE Ver. III.* 2016;13(1):2278-1684.
- 266 12. Tang KHD. Abating biomechanical risks: A comparative review of ergonomic assessment  
267 tools. *Eng. Res Reprod.* 2020;17:41-51.

- 268 13. Capodaglio EM. Participatory ergonomics for the reduction of musculoskeletal exposure of  
269 maintenance workers. *Int J Occup Saf Ergon*. 2022;28(1):376-86.
- 270 14. Morse T, Bruneau H, Dussetschleger J. Musculoskeletal disorders of the neck and shoulder  
271 in the dental professions. *Work*. 2010;35(4):419-29.
- 272 15. Berlin C, Adams C. *Production ergonomics: designing work systems to support optimal*  
273 *human performance*. Ubiquity press; 2017.
- 274 16. Dajpratham P, Ploypetch T, Kiattavorncharoen S, Boonsiriseth K. Prevalence and associated  
275 factors of musculoskeletal pain among the dental personnel in a dental school. *J Med Assoc Thai*  
276 *Chotmaihet Thangphaet*. 2010;93(6):714-21.
- 277 17. Yamalik N. Musculoskeletal disorders (MSDs) and dental practice Part 2. Risk factors for  
278 dentistry, magnitude of the problem, prevention, and dental ergonomics. *Int Dent J*.  
279 2007;57(1):45-54.
- 280 18. Gupta A, Bhat M, Mohammed T, Bansal N, Gupta G. Ergonomics in dentistry. *Int J Clin*  
281 *Pediatr Dent*. 2014;7(1):30-4.
- 282 19. Buckle PW, Devereux JJ. The nature of work-related neck and upper limb musculoskeletal  
283 disorders. *Applied ergonomics*. 2002;33(3):207-17.
- 284 20. Blyth FM, Briggs AM, Schneider CH, Hoy DG, March LM. The global burden of  
285 musculoskeletal pain-where to from here? *Am J Public Health*. 2019;109(1):35-40.

286 21. Adegoke BO, Akodu AK, Oyeyemi AL. Work-related musculoskeletal disorders among  
287 Nigerian physiotherapists. BMC musculoskeletal disorders. 2008;9(1):1-9.

288 22. Ambarwati T, Wicaksana B, Sopianah Y, Miko H. Posture work to complaint  
289 musculoskeletal disorders at the dentist. Journal of International Dental and Medical Research.  
290 2018;11(1):57-61.

291

292

293

294

295

296

297

298

299

300

301

302

303 Table 1: General characteristics of participants

Variables		Frequency	Percentage
Sex	Male	81	57.4

	Female	59	41.8
Marital status	Single	40	28.4
	Married	91	64.5
Religion	Islamic	03	2.1
	Christianity	129	91.5
Tribe	Igbo	21	85
	Hausa	1	0.7
	Yoruba	6	4.3
Year of Experience	1	20	14.2
	2	16	11.3
	3	23	16.3
	4	27	19.1
	>5	54	38.3

304

305

306 Table 2: The pattern and prevalence of WRMSDs among dental workers in Enugu metropolis.

Variables	Frequency	Percentage
-----------	-----------	------------

Have sustained WRMSD	136	96.5
Have not sustained WRMSD	5	3.6
Have sustained WRMSD at		
Neck	72	51.1
Shoulder	67	47.5
Hip	65	46.1
Upper back	83	58.9
Elbow	35	24.8
Knee	42	29.8
Wrist/hand	34	24.1
	32	22.7

307 Key: WRMSD= Work Related Musculo-Skeletal Disease

308

309

310

311 Table 3: Distribution of WRMSD across work characteristics among dental workers

Variables	Frequency	Percentage
-----------	-----------	------------

---

Applying modalities	60	42.6
Repetitive task	82	58.2
Bending	93	65.0
Transferring Patient (s)	27	19.1
Lifting heavy equipment	49	34.8

---

312

313

314

315

316

317

318

319

320

321

322

323 Table 4: Type of treatment used by the subjects who sustained WRMSDs

Variables	Frequency	Percentage
Surgery	37	26.2
Medical	74	52
Rest	81	57.4
Exercise	72	51.1
Postural adaptation	43	30.5

324

325

326

327

328

329

330

331

332

333

334

335 Table 5: Adjustment of work tasks due to WRMSDs

Variables	Frequency	Percentage
Avoid lifting	75	53.2
Frequently Change working position	50	35.5
Change schedule	34	24.1
Decrease manual techniques	30	21.3
Encourage patients' Responsibility	25	17.7
Increase use of mechanical aids	70	49.6
Increase administrative time	5	3.5
Decrease patients' care time	25	17.7
Increase use of other personnel	60	42.6
Stop working when hurt or Symptom occur	43	30.5
Take rest breaks or pause during work day	71	50.4
Use improved body mechanics	20	14.2

336

337

338