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Serial quantitative optical coherence tomography for luminal volume changes following either paclitaxel or sirolimus coated balloon in de novo small coronary artery lesions

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ABSTRACT

Background: Drug coated balloons (DCB) are a treatment option for lesions in small coronary arteries, with treatment using paclitaxel coated balloons (PCB) associated with less angiographic late lumen loss than sirolimus coated balloons (SCB).

Methods: This single-center sub-study of the TRANSFORM-I study compared quantitative optical coherence tomography (OCT) data in patients with de novo lesions in small coronary arteries treated with the MagicTouch (SCB) or SeQuent Please Neo (PCB). The relationship between the lumen volume of the treated segment immediately post procedure and at 6-month follow-up was evaluated. Late lumen volume loss (LLVL, mm^3) was defined as the post-procedural lumen volume – lumen volume at 6 months.

Results: Serial OCT analysis was performed in 19 patients with 21 lesions (SCB: 9 patients/11 lesions; PCB: 10 patients/10 lesions). There was a significant decrease in lumen volume between post-procedure and 6 months in the SCB group (97.35 ± 71.09 mm^3 vs 87.96 ± 61.48 mm^3, $p = 0.03$), but not in the PCB group (69.67 ± 38.24 mm3 vs 71.64 ± 42.22 mm3, $p = 0.64$). The LLVL was 9.39 ± 12.76 mm^3 and -1.97 ± 12.90 mm^3 in the SCB and PCB group, respectively (SCB vs PCB, $p = 0.06$). A trend for interaction between SCB and PCB was observed in the relationship between dissection volume and LLVL (SCB: LLVL $= 1.28 *$ dissection volume $+ 7.42$, $p = 0.37$; PCB: LLVL $= -2.84 *$ dissection volume $+ 4.51$, $p = 0.12$; p for interaction $= 0.07$).

Conclusion: In de novo lesions of small coronary arteries, treatment with an SCB lead to a significant decrease in lumen volume at 6-months compared to post-procedure, with no significant change observed after treatment with a PCB.

1. Introduction

Percutaneous coronary intervention (PCI) using a drug coated balloon (DCB) reduces neointima and constrictive remodeling compared to plain old balloon angioplasty (POBA), resulting in post-procedural lumen gains been maintained at mid to long term follow-up [1]. DCB technologies have been endorsed in society guidelines for the treatment of in-stent restenosis, whereas their use in de novo coronary stenoses remains under investigation [2,3].

Currently the majority of DCBs use paclitaxel as a cytotoxic immunosuppressive agent, however newer devices eluting sirolimus have been developed and have undergone clinical evaluation [4]. Previous studies suggested that late lumen loss in de novo coronary lesions was greater after using sirolimus coated balloons (SCB) compared to paclitaxel coated balloons (PCB) [4–6].

DCB angioplasty is frequently associated with acute coronary dissection, which is more readily identified using optical coherence tomography (OCT) than coronary angiography; in the TRANSFORM-I trial, acute dissections were noted in 17 % of angiograms and 97 % of OCT pullbacks [5]. Previous studies, as well as the international consensus on DCB, only recommend conversion to coronary stenting in cases of National Heart, Lung and Blood Institute (NHLBI) Type C, D or E dissections [1,7]. In the era of POBA, acute lumen gain was almost systematically associated with late lumen loss, while coronary dissection resulted in the best mid-term

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performance in terms of quantitative angiography and was dubbed "therapeutic dissection" [8–10]. The exact interaction between dissection, immunosuppressive drug and vessel healing after using a DCB has not yet been fully established.

In this single center sub-study of the TRANSFORM-I trial, intravascular OCT was performed after pre-dilatation, after using a DCB and at 6-month planned angiographic follow-up. The aim of this study is to compare the impact of two different DCBs (PCB and SCB) on late luminal changes at 6 months, and to examine the impact of dissection volume on these late luminal volume changes.

2. Methods

The TReAtmeNt of Small Coronary Vessels: MagicTouch Sirolimus Coated Balloon (TRANSFORM I) study (NCT03913832) was a prospective, randomized, multi-center, open-label noninferiority trial conducted in Europe that enrolled 121 patients with stabilized acute coronary syndrome or chronic coronary syndrome who had at least one de novo coronary artery lesion in a small coronary vessel (defined as a reference vessel diameter [RVD] <2.75 mm by quantitative coronary angiography [QCA] prior to the procedure). Patients with major angiographic dissections (NHLBI type C, D, E or F) or Thrombolysis in Myocardial Infarction (TIMI) grade ≦2 after pre-dilatation were excluded prior to randomization [11,12]. The trial design and primary endpoints are reported elsewhere [5,13]. Patients were randomized 1:1 to treatment with the MagicTouch (SCB) or SeQuent Please Neo (PCB). During the planned 6-month angiographic follow-up, one center (Galway University hospital, Galway, Ireland) performed OCT pullbacks in the target vessel after the primary angiographic endpoint assessment had been completed. OCT was performed using the Dragonfly Optis imaging catheter and the Optis imaging system (Abbot vascular, Santa Clara, CA, USA). The study complied with the Declaration of Helsinki and was approved by the institutional ethics committee. All patients provided written informed consent for participation in the trial.

2.1. OCT assessment

OCT analysis was performed between anatomical landmarks such as a side branch in the segment treated with a DCB. First, using angiography, landmarks proximal and distal to the treated segment (including 5 mm proximal and distal to the ballooned segment) were identified and colocalized on OCT. In this analysis segment, the dissection area as well as lumen area were measured (Fig. 1). The dissection area was delineated by connecting the tips of intimal or medial flap and following the contour of the dissected area (Fig. 1D). In frames where dissection was observed, the lumen area was defined as the region encompassing both the dissection area and the true lumen area (Fig. 1B). The analysis was performed with longitudinal intervals of 200 μm and the volume of dissection/lumen was calculated using Simpson's rule; sum of the dissection/lumen area times 0.2 mm (200 μm) (mm^3) (Fig. 1E) [5]. During follow-up, the same analysis segment was identified using angiography and OCT, with the lumen area and volume measurements in this segment again made at 200 μm intervals. Quantitative analysis of the OCT was performed using QCU-CMS (Leiden, NL). The relationship between the post-procedural and 6-month lumen volume was investigated. To examine the impact of dissection on luminal changes, the relationship between the post-procedural dissection volume and late lumen volume loss (LLVL, mm^3), which was defined as post-procedural lumen volume minus lumen volume at 6 months (i.e. a positive LLVL indicates lumen volume loss, and a negative LLVL indicates lumen volume gain at 6 months) was evaluated. The calcium score was assessed in the post-DCB OCT images [14]. On one occasion the OCT after pre-dilatation was used because the OCT immediately after the DCB was not available.

2.2. Angiographic assessment

QCA analysis at baseline, post-procedure and 6 months was performed using the CAAS system, (version 8.1, Maastricht, NL) as described in the main report [5]. Diameter stenosis was calculated using interpolated RVD at the point of minimum lumen diameter.

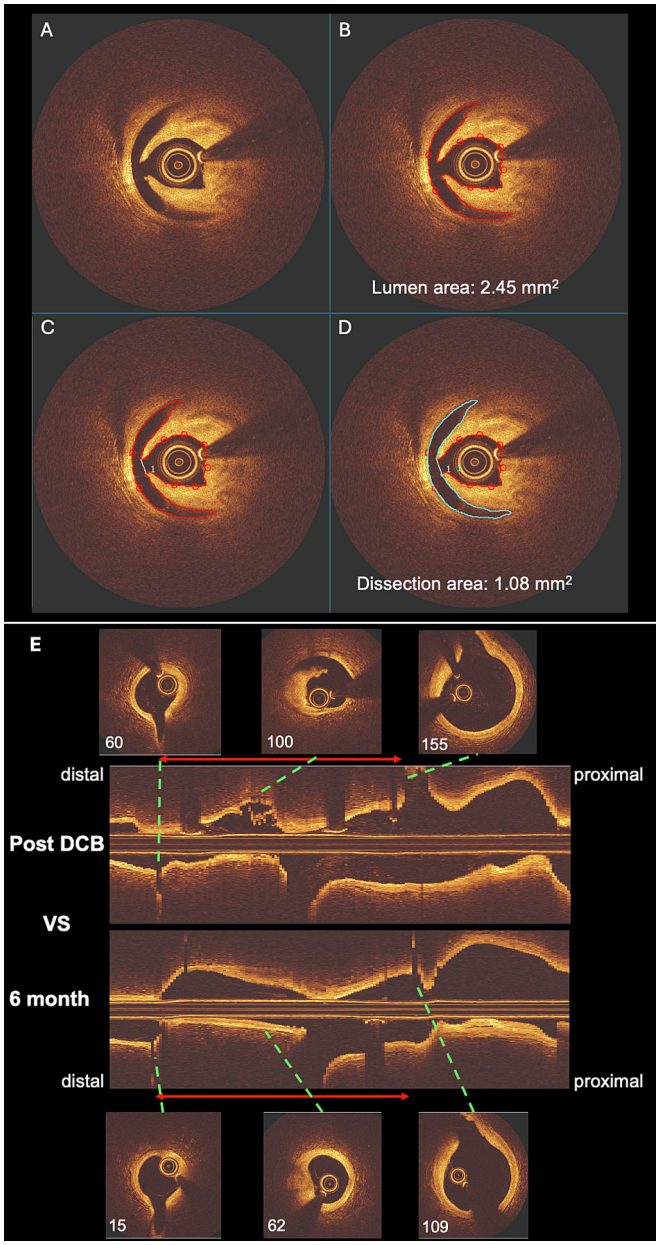

Fig. 1. Measurement of lumen and dissection area. A: An OCT frame with dissection. B: The area outlined in red represents the lumen area. C: Connecting the tips of the flaps (white line). D: The area outlined in blue represents the dissection area. E: Longitudinal OCT images post DCB and at 6 months. The same distal and proximal anatomical landmarks were used between the two analyses. The frame No. 60 in the post DCB OCT and the frame No. 15 in the six-month OCT show the distal landmark (side branch). The frame No. 155 in the post DCB OCT and the frame No. 109 in the six-month OCT shows the proximal landmark (side branch). The analysis was performed from the carina of the distal landmark side branch to the carina of the proximal landmark side branch. The frame No. 100 in the post DCB OCT shows the dissection. The frame No. 62 in the six-month OCT shows that the dissection was healed. DCB: drug-coated balloon, OCT; optical coherence tomography.

2.3. Statistical analysis

Categorical variables are expressed with n (%), and continuous variable are presented as mean ± standard deviation. For comparison of two arms,

Table 1
Baseline patient, lesion and procedural characteristics in 26 patients with 30 lesions.

Patients	MagicTouch, n = 13	SeQuent Please NEO, n = 13	P-value
Age	70.1 ± 6.4	70.4 ± 1.6	0.90
Male	12 (92.3 %)	12 (92.3 %)	1.00
Medically treated diabetes	4 (30.8 %)	2 (15.4 %)	0.64
Hypertension	10 (76.9 %)	8 (61.5)	0.67
Dyslipidemia	12 (92.3 %)	10 (76.9 %)	0.59
Use of station	13 (100 %)	9 (69.2 %)	0.10
Previous myocardial infarction	5 (38.5 %)	2 (15.4 %)	0.38
Chronic obstructive pulmonary disease	0	1 (7.7 %)	1.00
History of heart failure	1 (7.7 %)	0	1.00
Renal failure	0	0	NA
Previous PCI	8 (61.5 %)	5 (38.5 %)	0.43
Previous CABG	0	0	NA
Number of target lesions			1.00
1	11 (84.6 %)	11 (84.6 %)	
2	2 (15.4 %)	2 (15.4 %)	

Lesions	SCB, n = 15	PCB, n = 15	P-value
bifurcation	8 (53.3)	7 (46.7 %)	1.00
AHA/B2C	2 (13.3 %)	1 (6.7 %)	1.00
Vessel			1.00
RCA	4 (26.7 %)	3 (20.0 %)	
LAD	3 (20.0 %)	4 (26.7 %)	
LCX	8 (53.3 %)	8 (53.3 %)	
Lesion length (QCA)	12.3 ± 4.7	12.9 ± 9.3	0.84
RVD (QCA)	2.19 ± 0.43	2.22 ± 0.47	0.86
MLD (QCA)	0.99 ± 0.33	0.97 ± 0.22	0.85
%DS (QCA)	55.1 ± 12.3	55.1 ± 13.3	0.99
Procedures			
Balloon pre-dilatation performed, n (%)	15 (100)	15 (100)	NA
Diameter of pre-dilatation balloon, mm	2.22 ± 0.34	2.07 ± 0.15	0.13
Length of pre-dilatation balloon, mm	14.0 ± 2.4	15.7 ± 3.4	0.13
DCB crossing time, second	29.4 ± 8.7	29.5 ± 11.9	0.98
DCB diameter, mm	2.22 ± 0.34	2.08 ± 0.15	0.18
DCB length, mm	19.7 ± 3.99	18.3 ± 5.23	0.44
DCB pressure, atm	10.5 ± 3.1	8.5 ± 2.3	0.046
DCB duration time, second	70.3 ± 7.2	71.9 ± 12.8	0.68
Acute percent recoil, %	−0.8 ± 9.0	4.3 ± 15.4	0.30
Angiographic dissection after DCB, n (%)	0	2 (13.3)	0.48
Bail out stenting, n (%)	0	0	NA

CABG; coronary artery bypass grafting, DCB; drug coated balloon, MLD; minimal lumen diameter, PCI; percutaneous coronary intervention, QCA; quantitative coronary angiography, RVD; reference vessel diameter.

Fisher's exact or chi square test was used for categorical variables as appropriate, whereas Student's *t*-test was used for continuous variables. A paired t-test was performed to compare OCT measurement after DCB and at 6 months. A linear regression analysis was constructed for each DCB group in order to assess the relationship between the post-procedural and 6-month lumen volumes, as well as between post-procedural dissection volume and LLVL. Interaction effect of the DCB groups was evaluated. The significance level was set at $p < 0.05$. Statistical analyses were performed using R software (version 4.4.0).

3. Results

In total, this sub-study enrolled 26 patients with 30 lesions. The mean age was 70.2 ± 5.9 years old, 92.3 % (n = 24) were male and 4 patients (15.4 %) had two target lesions (Table 1). OCT immediately after DCB treatment was available in 25 patients with 28 lesions. There were two lesions where OCT immediately after the DCB was not available, with one because the OCT images were not analyzable, and the other because the OCT was not performed (Fig. 2). In these two cases, the OCT after pre-dilatation, but before using the DCB, was used as a substitute. Dissections immediately after using the DCB were observed in 93.3 % (n = 28/30) of lesions when using OCT, and in only 6.7 % (n = 2/30) of lesions when using angiography.

3.1. OCT follow-up at 6 months

Six-month OCT follow-up was available in 19 patients with 21 lesions (Fig. 2) comprising of 9 patients with 11 lesions in the SCB group, and 10 patients with 10 lesions in the PCB group (Supplemental Table 1). The LLVL was calculated in these 19 patients with 21 lesions using the OCT at baseline, which was performed immediately after DCB treatment (18 patients with 20 lesions) or after pre-dilatation and before DCB treatment (1 patient with 1 lesion), and at 6-month follow-up. The representative angiographic and OCT images are shown in the Supplementary Fig. 1.

The 6-month OCT was performed in these 21 lesions at a median of 175 (interquartile range 168–182) days from the index PCI. No dissections were observed on angiography, however they were noted in 9.5 % (n = 2/21) of lesions on OCT. The mean LLVL was 9.39 ± 12.76 mm^3 in the SCB group and −1.97 ± 12.90 mm^3 (i.e. late lumen gain of +1.97 ± 12.90 mm^3) in the PCB group (SCB vs PCB, p = 0.06, Table 2). In the intra-group paired comparison, there was a significant decrease in lumen volume between

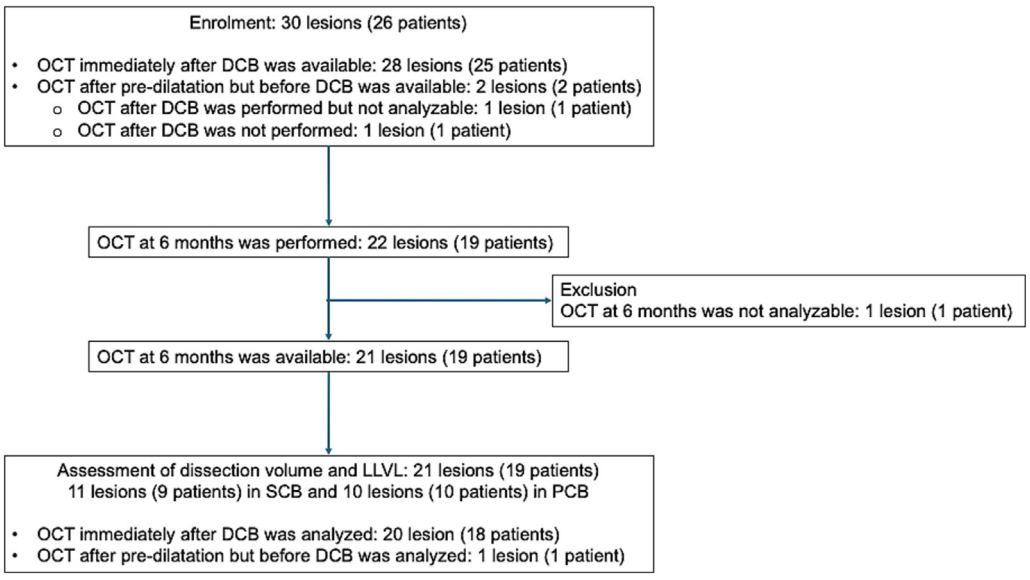

Fig. 2. Flowchart of the patients/lesions. OCT; optical coherence tomography, DCB; drug coated balloon, PCB; paclitaxel coated balloon, SCB; sirolimus coated balloon, LLVL; late lumen volume loss (post-procedural lumen volume – lumen volume at 6 months).

Table 2
OCT assessment immediately after DCB treatment and at 6-month follow-up.

	MagicTouch, N = 11 lesions	SeQuent Please Neo, N = 10 lesions	P-value
Immediately after DCB			
Vessel			0.60
RCA	3 (27.3 %)	2 (20.0 %)	
LAD	1 (9.1 %)	3 (30.0 %)	
LCX	7 (63.6 %)	5 (50.0 %)	
Calcium score, n (%)			0.18
0	1 (9.1 %)	5 (50.0 %)	
1	4 (36.4 %)	3 (30.0 %)	
2	4 (36.4 %)	2 (20.0 %)	
3	0	0	
4	2 (18.2 %)	0	
Length (mm)	21.45 ± 13.32	20.20 ± 9.37	0.80
Lumen			
Avg Lumen Diameter (mm)	2.24 ± 0.47	2.06 ± 0.27	0.31
Max Lumen area (mm^2)	7.34 ± 3.20	5.74 ± 2.62	0.22
Minimum Lumen area (mm^2)	2.17 ± 0.94	2.08 ± 0.52	0.79
Dissection area at MLA (mm^2)	0.07 ± 0.11	0.08 ± 0.15	0.82
Average Lumen area (mm^2)	4.19 ± 1.60	3.49 ± 0.96	0.24
Lumen Volume (mm^3)	97.35 ± 71.09	69.67 ± 38.24	0.28
Dissection			
Max Dissection Area (mm^2)	0.68 ± 0.72	0.96 ± 0.95	0.49
Minimum Dissection Area (mm^2)	0.01 ± 0.01	0.01 ± 0.01	0.88
Average Dissection Area (mm^2)	0.23 ± 0.23	0.28 ± 0.24	0.68
Dissection volume (mm^3)	1.54 ± 3.02	2.28 ± 2.36	0.54
6 months			
Length (mm)	21.35 ± 12.75	19.42 ± 8.87	0.69
Lumen			
Avg Lumen Diameter (mm)	2.17 ± 0.38	2.10 ± 0.24	0.63
Max Lumen area (mm^2)	7.31 ± 3.08	6.02 ± 2.31	0.29
Minimum Lumen area (mm^2)	1.97 ± 0.59	2.02 ± 0.41	0.82
Average Lumen area (mm^2)	3.90 ± 1.32	3.61 ± 0.91	0.56
Lumen Volume (mm^3)	87.96 ± 61.48	71.64 ± 42.22	0.48
Late minimum lumen area loss (mm^3)	0.20 ± 0.41	0.06 ± 0.42	0.45
Late lumen volume loss (mm^3)	9.39 ± 12.76	−1.97 ± 12.90	0.06

6 months and immediately post-procedure in the SCB group (97.35 ± 71.09 mm^3 vs 87.96 ± 61.48 mm^3, p = 0.03), whereas this did not change significantly in the PCB group (69.67 ± 38.24 mm^3 vs 71.64 ± 42.22 mm^3, p = 0.64) (Table 3). The scatter plot of post-procedural and 6-month lumen volume is shown in Fig. 3. The coefficient of the regression line for SCB is below 1, while that for PCB slightly exceeds 1 (P for interaction = 0.09).

3.2. Dissection volume and LLVL

In the PCB group, the slope of the correlation between post-procedural dissection volume and LLVL was negative (LLVL = −2.84 ∗ dissection volume + 4.51; p = 0.12), whereas in the SCB group, the slope was positive (LLVL = 1.28 ∗ dissection volume + 7.42; p = 0.37). However, neither correlation was statistically significant. There was a tendency of interaction between SCB and PCB in the coefficient of regression line ($P_{interaction}$ = 0.07).

Sensitivity analysis excluding one lesion in the PCB group for which OCT after pre-dilatation (before DCB) was used are shown in the Supplementary Tables 2 and 3. The results were similar.

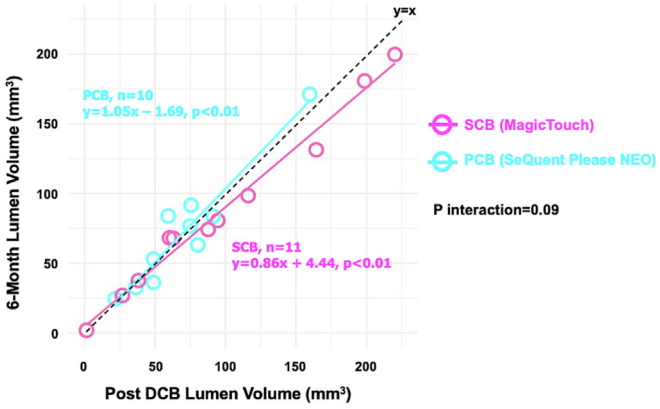

Fig. 3. Correlation between lumen volume immediately after DCB and at 6 months. DCB; drug coated balloon, PCB; paclitaxel coated balloon, SCB; sirolimus coated balloon.

4. Discussion

This sub-analysis of the TRANSFORM-I trial showed the potential differential impact of two types of DCBs on the relationship between post-procedural and 6-month lumen volumes, with a significant decrease seen following treatment with the SCB (MagicTouch), and no significant change seen with PCB (SeQuent Please NEO). As an exploratory purpose, the relationship between post-procedural dissection volume and lumen volume changes at 6 months were investigated. In the PCB group, the slope of the correlation between post-procedural dissection volume and LLVL was negative, whereas it was positive in the SCB group, although neither correlation was statistically significant. To the best of our knowledge, this is the first serial OCT study comparing different types of DCB with a quantitative measurement of dissection volume.

There are numerous different DCBs on the market, however, there is no class effect since the type, amount and formulation of anti-proliferative drug is different [1]. SeQuent Please NEO is coated with 3 μg/mm^2 crystalline paclitaxel with the excipient iopromide, whereas MagicTouch is coated with 1.27 μg/mm^2 sub-micron sirolimus with a phospholipid based excipient [15,16]. In the TRANSFORM-I trial, MagicTouch failed to show non-inferiority for angiographic net lumen gain at 6 months compared to SeQuent Please NEO [5]. The superiority of PCB compared to SCB in terms of angiographic outcomes in de novo coronary lesions was also reported in a previous study which compared SeQuent Please NEO and SeQuent SCB, as well as in a meta-analysis comparing PCB and SCB [4,6]. Furthermore, Aihara et al. conducted an animal study investigating the histological effects of two PCBs (AGENT and SeQuent Please NEO) and one SCB (MagicTouch) [17]. The medial smooth muscle cell loss scores, which reflect drug efficacy, were significantly higher with AGENT and SeQuent Please NEO than with MagicTouch, highlighting the superior efficacy of PCBs. Our findings in this serial OCT study are consistent with these previous results.

In the TRANSFORM-I trial, there was a significant and positive correlation between dissection volume and angiographic late lumen loss (angiographic late lumen loss = 0.049 × dissection volume + 0.181; P = 0.035) after MagicTouch treatment, whereas the relationship was flat with a slightly

Table 3
Comparison of OCT analysis between post DCB and 6 months (paired t-test).

	MagicTouch, n = 11 lesions			SeQuent Please Neo, n = 10 lesions		
	Post DCB	6 M	P-value	Post DCB	6 M	P-value
Length (mm)	21.45 ± 13.32	21.35 ± 12.75	0.83	20.20 ± 9.37	19.42 ± 8.87	0.32
Max Lumen area (mm^2)	7.34 ± 3.20	7.31 ± 3.08	0.90	5.74 ± 2.62	6.02 ± 2.31	0.20
Minimum Lumen area (mm^2)	2.17 ± 0.94	1.97 ± 0.59	0.13	2.08 ± 0.52	2.02 ± 0.41	0.64
Average Lumen area (mm^2)	4.19 ± 1.60	3.90 ± 1.32	0.14	3.49 ± 0.96	3.61 ± 0.91	0.43
Lumen Volume (mm^3)	97.35 ± 71.09	87.96 ± 61.48	0.03	69.67 ± 38.24	71.64 ± 42.22	0.64

negative slope (angiographic late lumen loss = −0.010 × dissection volume + 0.071; P 1/4 0.035; $P = 0.32$) after SeQuent Please NEO. The P value for interaction was significant (P interaction = 0.013, Supplementary Figure adopted from Ninomiya K et al. [5]). Although the present serial OCT analysis is not statistically significant, which is attributable to the small patient cohort, the observed relationship between post-procedural dissection volume and LLVL was similar to the relationship between dissection volume and angiographic late loss in the main trial.

During the POBA era, angiographic acute lumen gain was associated with angiographic late lumen loss. Foley DP et al. investigated this relationship in 3302 coronary lesions and reported that acute lumen gain was positively associated with late lumen loss with the following formula: late luminal loss = −0.11–0.14 ∗ vessel size + 0.31 ∗ preprocedural minimal lumen diameter + 0.62 ∗ acute lumen gain + 0.07 ∗ LAD [8]. This phenomenon is known as “the more you gain, the more you lose”. Dissection plays an important role in acute lumen gain, however at the same time it induces inflammatory and proliferative reactions resulting in restenosis (lumen narrowing and/or constrictive remodeling) [18]. DCBs, and especially the SeQuent Please NEO, may modify the dissection's natural healing process through the immunosuppressive effects of paclitaxel, and thereby help maintain the acute luminal area/vessel volume. Therefore, in the case of SeQuent Please NEO, the phrase “the more you gain, the more you get” may hold true [19,20].

Several SCBs other than MagicTouch are available; however, randomized data comparing SCBs with paclitaxel-coated balloons (PCBs) remain limited and have shown mixed results. SCBDNMAL was a randomized controlled trial conducted in Malaysia comparing the SeQuent SCB (n = 35) with the SeQuent Please PCB (n = 35) in de novo coronary lesions. The SCB met the criteria for non-inferiority in terms of angiographic late lumen loss at six months (SCB: 0.10 ± 0.32 mm, PCB: 0.01 ± 0.33 mm; mean difference: 0.08 mm, 95 % confidence interval: −0.07 to 0.24 mm). However, late lumen enlargement was observed more frequently in the PCB group (32 % vs. 60 %, $p = 0.019$) [6]. Scheller B et al. conducted a similarly designed trial in Europe. The SeQuent SCB achieved non-inferiority compared to the SeQuent Please NEO PCB regarding angiographic late lumen loss at six months (SCB: 0.11 ± 0.37 mm, PCB: 0.04 ± 0.39 mm; mean difference: 0.07 mm, 95 % confidence interval: −0.12 to 0.26 mm). The incidence of late lumen enlargement was numerically higher in the PCB group, though the difference was not statistically significant (56 % vs. 44 %, $p = 0.54$) [21]. The SELUTION SLR™ (MedAlliance, Nyon, Switzerland, Irvine California) has demonstrated favorable safety and efficacy in de novo or restenotic lesions in single-arm studies with small sample sizes [22,23]. To date, no comparative studies between SELUTION and PCB have been reported. The SELUTION DeNovo trial is ongoing and will compare a PCI strategy using SELUTION with provisional drug-eluting stent implantation versus a strategy involving the systematic use of drug-eluting stents in de novo coronary lesions [24].

There are limited numbers of studies that have conducted serial intracoronary imaging assessments following DCB treatment for de novo coronary lesions, but their findings are consistent especially for the SeQuent Please, with serial intravascular ultrasound (IVUS) studies reporting an increase in extra elastic membrane (EEM) or lumen areas/volumes [25–27]. Yamamoto T et al. reported that a larger dissection index was associated with an increased lumen volume [26]. Her AY et al. performed serial OCT and IVUS assessment after PCI using the SeQuent Please in 21 de novo coronary lesions and reported significantly larger lumen area and volume on OCT at 9 months compared to pre- and post-balloon angioplasty [27]. Sogabe K et al. assessed serial OCT images in 95 de novo coronary lesions treated with SeQuent Please and reported that dissections extending into the tunica media were associated with late lumen enlargement at 8 months [28]. Yamamoto M et al. analyzed serial OCT images following SeQuent Please treatment in 108 de novo coronary lesions and observed that late lumen enlargement, which was defined as an increase in lumen volume of ≧10 %, occurred in 41 % of lesions at 6-month follow-up. Notably dissections involving the medial layer with a circumferential arc >90° were also associated with late lumen enlargement [29]. Altogether, these serial intracoronary imaging studies reported late EEM and/or lumen enlargement after treatment of de novo coronary lesions with a SeQuent Please, with a larger/deeper dissection also positively associated with late lumen volume enlargement. The findings of this study with the SeQuent Please NEO are in line with these previous findings with SeQuent Please. On the other hand, there are no reported serial intracoronary imaging studies after SCB, with our unique findings showing a statistically significant decrease in lumen volume between immediately post-procedure and at 6 months following use of the MagicTouch SCB.

This sub-study has several limitations. First, it was conducted in a single center with a small number of patients. Due to the limited sample size, each individual data point had a greater influence on the values, potentially affecting the robustness of the findings. Second, performing OCT in small vessels is often challenging, and some OCT images did not have sufficient quality for analysis. Third, several inclusion/exclusion criteria of the trial may hinder the applicability of the findings of this study: patients with stable angina or stabilized acute coronary syndrome who had a de novo lesion in a small coronary artery were eligible for the TRANSFORM-I study, whereas those with a large vessel [30] or those with major angiographic dissection (NHLBI type C, D, E or F) or a TIMI grade ≦2 after pre-dilatation were excluded. Fourth, in the TRANSFORM-I trial, the size of balloon for pre-dilatation was recommended with a balloon-to-vessel ratio of 0.8 to 1.0, and the size of DCB was selected based on OCT assessment after pre-dilatation. Therefore, the findings of this study may not apply to different strategies. Fifth, serum cholesterol levels were not collected in this trial. Sixth, the findings of this sub-analysis may not apply to DCBs other than SeQuent Please NEO and MagicTouch. The impact of dissection volume on the luminal changes at follow-up needs to be further investigated with a larger number of patients and different DCBs.

5. Conclusions

In this serial OCT study, treatment with the MagicTouch SCB lead to a significant decrease in lumen volume at 6-months compared to post-procedure, with no significant change observed after treatment with the Sequent Please NEO PCB.

CRediT authorship contribution statement

Akihiro Tobe: Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Patrick Serruys:** Writing – review & editing, Supervision, Conceptualization. **Kotaro Miyashita:** Formal analysis. **Asahi Oshima:** Formal analysis. **Pruthvi Chenniganahosahalli Revaiah:** Formal analysis. **Tsung-Ying Tsai:** Formal analysis. **Dijkstra Jouke:** Software, Methodology. **Scot Garg:** Writing – review & editing. **Angela McInerney:** Investigation. **Yoshinobu Onuma:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Conceptualization. **Faisal Sharif:** Writing – review & editing, Supervision, Investigation.

Declaration of competing interest

Dr. Serruys reports consulting fees from SMT, Meril Life, Novartis and Philips.

Dr. Angela McInerney reports lecture fees from Medtronic, Boston Scientific, Abbott Vascular, and Shockwave medical.

Dr. Scot Garg reports a consulting fee from Biosensors.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.carrev.2025.03.025.

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