IVUS examination, demonstrating that the mean late luminal loss at 12-months follow-up was significantly smaller with the FP-PES than the PCS. Enhanced inhibition of neointimal hyperplasia and better stent expansion capacity may contribute to clinical benefits of FP-PES over PCS.

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RESEARCH CORRESPONDENCE

Increase in Coronary Lumen Area and Stent Apposition After Treatment of CTO Using a Coronary Self-Expanding Stent

After successful percutaneous coronary intervention (PCI) of a chronic total occlusion (CTO), vessel diameter can increase over time due to restoration of flow and recuperation of endothelial and smooth muscle cell function, resulting in periprocedural stent sizing difficulties and the possibility of post-procedural malapposition (1). Given these findings, we evaluated whether a self-expanding stent, capable of increasing in diameter after recanalization, might result in better stent sizing and apposition.

In this prospective, single-center study, 15 patients who underwent recanalization of a CTO using antegrade techniques and considered suitable for implantation with the self-expanding, nitinol STENTYS drug-eluting stent (DES) were enrolled (STENTYS, Paris, France). Two diameters of STENTYS DES were used; small-sized, indicated in vessels with distal reference diameters from 2.5 to 3.0 mm and capable of self-expansion to a maximum vessel diameter of 4.0 mm post-procedure, and a medium-sized DES, indicated for distal reference diameters from 3.0 to 3.5 mm and capable of self-expansion to a maximum of 5.0 mm post-procedure. Index optical coherence tomography (OCT) was performed after finalization of the CTO procedure. A 6-week angiographic follow-up was scheduled, including OCT of the target lesion. All patients provided written informed consent.

Strut apposition was evaluated according to 2 methods. First, OCT console software (St. Jude Medical, Minneapolis, Minnesota) automatically identified strut apposition. According to this algorithm, a strut was labeled malapposed if the outer stent area was inside the lumen. In addition, malapposition was also calculated according to the definition of Prati et al. (2) using a tolerance of 200 μm from the inside of the stent.

Overall, the mean age was 63 ± 9.6 years, and most patients were male (73.3%). Left anterior descending coronary artery was the most common target vessel (n = 9, 60.0%). Mean J-CTO score was 2.2 ± 1.2. All procedures were performed using antegrade wire escalation.

A total of 15 lesions and 29 stents were analyzed. OCT demonstrated a significant increase of 14.5% in mean lumen area over time (7.8 ± 2.0 mm^2 to 8.9 ± 2.5 mm^2; $p < 0.001$). Minimal lumen area increased 6.9% (5.9 ± 1.5 mm^2 to 6.4 ± 2.7 mm^2; $p = 0.036$) and maximum lumen area increased 19.2% (10.1 ± 3.9 mm^2 to 11.8 ± 3.7 mm^2; $p < 0.001$).

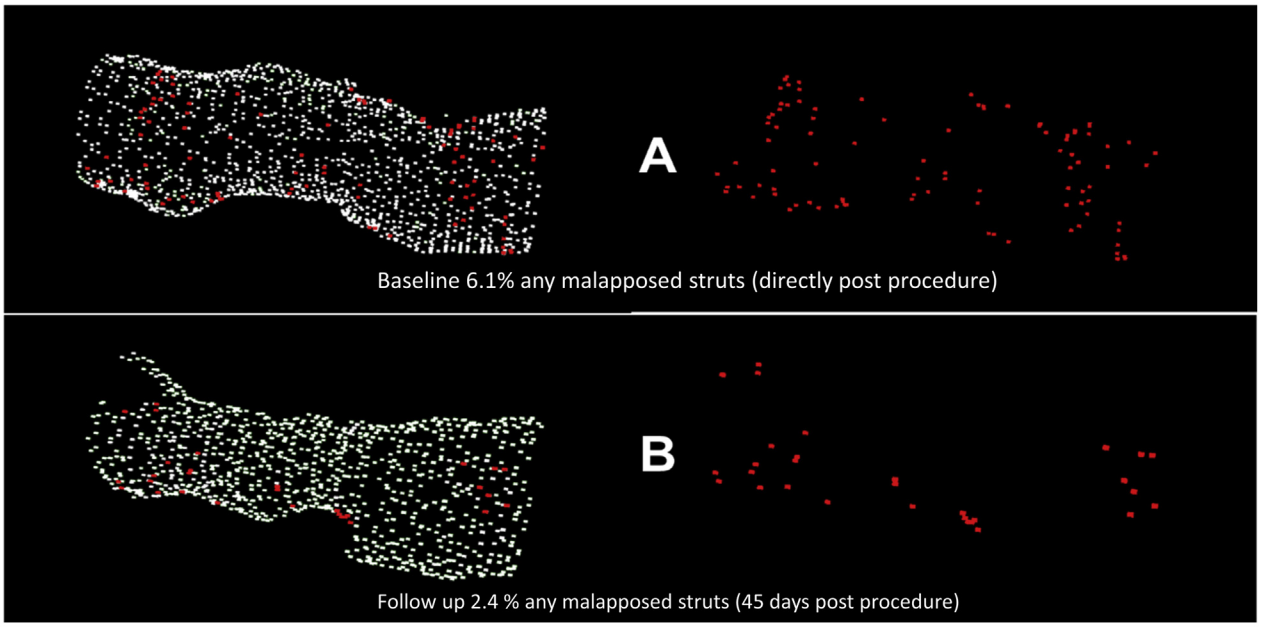
At 6 weeks, mean stent area increased 28.4% (8.3 ± 1.9 mm^2 to 10.6 ± 2.4 mm^2; $p < 0.001$). Minimal stent area increased 21.3% (6.4 ± 1.5 mm^2 to 7.6 ± 2.2 mm^2; $p < 0.001$), and maximum stent area increased 34.8% (10.4 ± 3.8 mm^2 to 13.6 ± 3.4 mm^2; $p < 0.001$).

OCT analysis of distal reference segment at follow-up revealed an increase of 4.9% in mean lumen diameter ($p = 0.035$). Minimum and maximum distal reference diameter increased 3.8% ($p = 0.096$) and 5.9% ($p = 0.087$), respectively.

Malapposition of any strut was demonstrated 8.6% of the struts at baseline (2,903 of 33,651). Follow-up OCT showed a significant decrease of malapposed struts to 0.9% (307 of 32,356; $p < 0.001$). Using the

FIGURE 1 **OCT Imaging at Baseline (Post-Procedure) and at Follow-Up**

A 3D rendering from detected struts; illustration of one patient



B Optical Coherence Analysis per lesion

	Baseline	Follow-up	Mean Δ (%)	Z-value	p-value
Mean Lumen Area, mm^2 (mean± SD)	7.8 (±2.0)	8.9 (±2.5)	14.5	-4.011	<0.001
Max Lumen Area, mm^2 (mean± SD)	10.1 (±3.9)	11.8 (±3.7)	19.2	-3.687	<0.001
Min Lumen Area, mm^2 (mean± SD)	5.9 (±1.5)	6.4 (±2.2)	6.9	-2.098	0.036
Mean Stent Area, mm^2 (mean± SD)	8.3 (±1.9)	10.6 (±2.4)	28.4	-4.703	<0.001
Max Stent Area, mm^2 (mean± SD)	10.4 (±3.8)	13.6 (±3.5)	34.8	-4.530	<0.001
Min Stent Area, mm^2 (mean± SD)	6.4 (±1.5)	7.8 (±2.2)	21.3	-4.054	<0.001
Mean Distal Ref diameter. mm. (mean± SD)	2.4 (±0.3)	2.5 (±0.6)	6.3	-2.104	0.035
Total struts analyze, n	33651	32356			
Mean struts per frame, n (mean± SD)	21.87(±2.0)	20.7 (±2.3)			
Total malapposed struts, n (any apposition)	2903/33651	307/32356	- 89.0	-4.703	<0.001
Total malapposed struts, n (200micron)	198/33651	114/32356	- 40.1	-2.289	0.022

(A) Three-dimensional rendering of stent struts on optical coherence tomography (OCT) imaging at baseline after the procedure **(top)** and at 6-week follow-up **(bottom)**. On the basis of apposition versus separation from the arterial wall, the struts are color-coded: opposed struts are in **white**, malapposed in **red**. The **right side** shows the malapposed struts significantly decreasing in number upon follow-up imaging. **(B)** Optical coherence analysis per lesion.

200-μm Prati criterion, we observed a low incidence of malapposition at baseline, and that improved significantly over time (0.59% vs. 0.35%; p = 0.022) (**Figure 1**).

We were able to quantify vessel growth at 6 weeks after CTO treatment. Such growth is likely to result in stent malapposition over time, as previously demonstrated in the ACE-CTO study (Angiographic Evaluation of the Everolimus-Eluting Stent in Chronic Total Occlusions), in which a strut malapposition rate of 9.3% was reported 8 months after successful stenting of CTOs with a standard balloon-expandable DES (3). To the best of our knowledge, our study is the first to demonstrate the advantage of a self-expanding DES with respect to a significantly improved apposition at follow-up.

There are several limitations to this study. It is a single-center pilot study with a limited sample size and thus limited external generalizability. Study investigators were highly experienced in implantation of self-expanding DES, which may not be applicable to most interventional operators. Furthermore, all procedures were performed through antegrade wire escalation. This does not provide any insights into the outcome of self-expanding stents in other techniques, such as dissection and re-entry, which result in longer subintimal trajectories.

In conclusion, a self-expanding DES may overcome the problem of stent malapposition due to late vessel enlargement after successful CTO-PCI, because the self-expanding stent conforms to the shape of the coronary vessel over time.

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RESEARCH CORRESPONDENCE

Spontaneous Coronary Artery Dissection and Incident Ventricular Arrhythmias

Frequency, Clinical Characteristics, and Outcomes

The role of implantable cardioverter-defibrillators (ICDs) for secondary prevention is uncertain for spontaneous coronary artery dissection (SCAD) patients presenting with ventricular tachycardia/ventricular fibrillation (VT/VF) (1). Practice patterns vary, and the decision for ICD implantation may not depend on high-risk features such as recurrent ventricular arrhythmias or reduced left ventricular ejection fraction (LVEF) (2). Given the possible harms of procedure-related complications or unnecessary shocks, additional data are required to assess the utility for prophylactic ICD.

A retrospective cohort study was performed of 349 SCAD patients treated at Kaiser Permanente Northern California from 2002 to 2018. The incidence of VT/VF in SCAD patients was 5.7% (N = 20). For the VT/VF cohort, patients had a mean age of 47 ± 12 years (range 30 to 74 years), 95% were female, and 67% were Caucasian. The prevalence of hypertension was 30%, hyperlipidemia was 30%, and diabetes, 5%; 25% of patients reported active smoking and 10%, active illicit drug use (e.g., marijuana, methamphetamine). Two patients were multiparous (parity ≥4) Two patients had SCAD within 3 months of pregnancy or abortion, and 5 patients were on oral contraception, hormonal replacement, or fertility treatment. Of the 8 patients screened, 4 had fibromuscular dysplasia. The clinical presentation was ST-segment elevation myocardial infarction (STEMI) in 65%, with 25% proximal and 15% multivessel involvement. VT/VF