JACC: CARDIOVASCULAR INTERVENTIONS
VOL. 7, NO. 5, 2014

ISSN 1936-8798/$36.00
PUBLISHED BY ELSEVIER INC.
http://dx.doi.org/10.1016/j.jcin.2013.08.018

IMAGES IN INTERVENTION

Feasibility and Efficacy of Bioresorbable Vascular Scaffolds Use for the Treatment of In-Stent Restenosis and a Bifurcation Lesion in a Heavily Calcified Diffusely Diseased Vessel

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A 70-year-old man underwent coronary angiography that demonstrated in-stent restenosis (ISR) and long calcified disease extending from the left main stem (LMS) to the left anterior descending coronary artery (LAD), with involvement of the LAD/diagonal bifurcation (Fig. 1A). After rotational atherectomy (1.5-mm burr) and aggressive pre-dilation, a mini-crush technique was utilized with a 2.25 × 12-mm everolimus-eluting stent (EES) implanted in the diagonal ostium. The protruding EES was crushed with a balloon (Figs. 1B to 1G), followed by the implantation of a

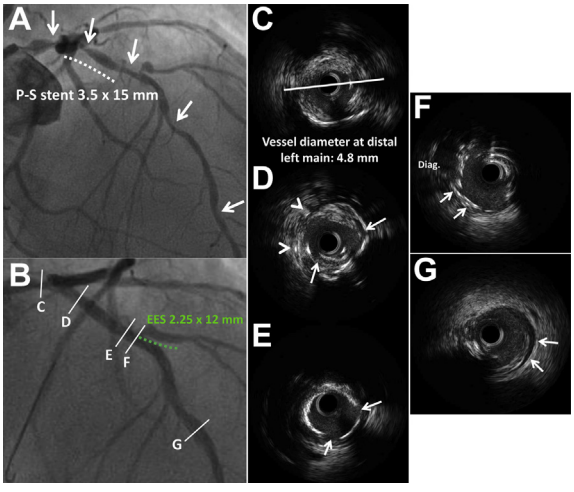

Figure 1. Coronary Angiogram and Intravascular Ultrasound Images of the Left Coronary System

(A) Pre-procedural angiogram demonstrating a restenosed 3.5 × 15-mm Palmaz-Schatz stent (Cordis, Johnson & Johnson Company, Warren, New Jersey) **(dotted line)** implanted 20 years ago on the proximal LAD and a long segment of calcified disease extending from the LMS to the distal LAD, with involvement of the LAD/diagonal bifurcation **(arrows)**. **(B)** Angiogram after rotational atherectomy with 1.5-mm burr and aggressive pre-dilation with 3.0- to 3.5-mm noncompliant balloons on LAD. A 2.25 × 12-mm EES in the diagonal ostium with crushed protruding EES struts **(dotted line)**. **(C)** Intravascular ultrasound showing lumen area of 3.2 mm^2 with a vessel diameter of 4.8 mm at the distal LMS. **(D)** Palmaz-Schatz stent struts **(arrowheads)** with evident dissection in the restenosed segment **(arrows)**. **(E)** Cracked napkin-ring calcification after rotational atherectomy and pre-dilation **(arrows)**. **(F)** Crushed EES struts on to the LAD vessel wall at the bifurcation of the LAD and diagonal-branch (arrows). **(G)** Dissection in the middle LAD **(arrows)**. EES = everolimus-eluting stent; ISR = in-stent restenosis; LAD = left anterior descending coronary artery; LMS = left main stem; P-S stent = Palmaz-Schatz stent.

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Manuscript received July 23, 2013; accepted August 1, 2013.

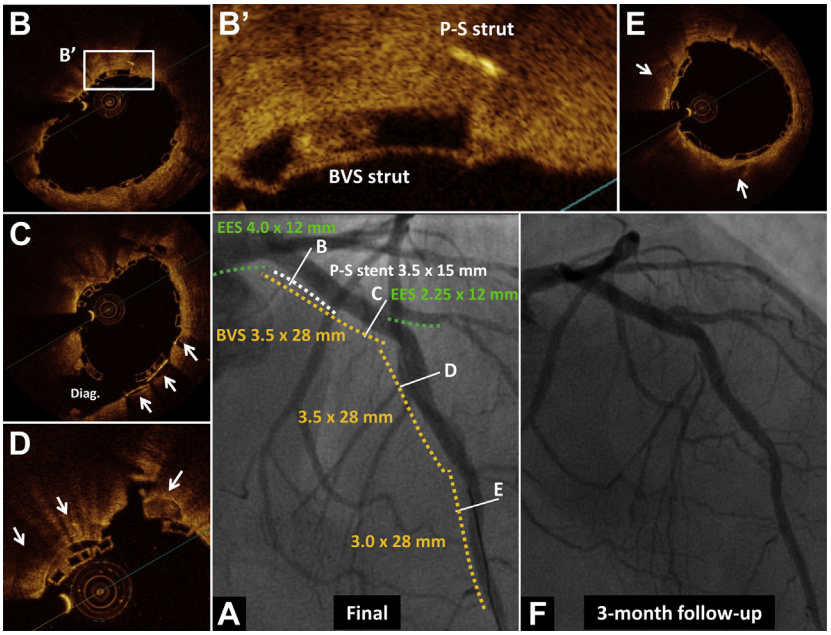

Figure 2. Optical Coherence Tomography Images Following the Implantation of 3 BVS on the LAD With 3-Month Angiographic Results

(A) Final angiography showing no evidence of residual stenosis on the LAD. **(B)** Good expansion of the 3.5 × 28-mm BVS (scaffold area: 10.7 mm^2) after post-dilation with a 4.0-mm noncompliant balloon within the P-S stent of the proximal LAD. **(B′)** BVS strut on the luminal surface overlying P-S strut in the treated restenosed segment. **(C)** Successful mini-crush stenting with a BVS on the LAD and an EES on the diagonal branch. Fully expanded BVS with complete compression of protruded EES struts **(arrows)**. **(D)** BVS overlying a well-prepared, cracked calcified lesion **(arrows)**. **(E)** Adequate expansion of BVS (3.0 × 28 mm) on a calcified plaque **(arrows)** in mid-distal LAD with a scaffold area of 8.9 mm^2. **(F)** Angiographic image at 3 months with no evidence of scaffold recoil and restenosis. BVS = bioresorbable vascular scaffold; other abbreviations as in Figure 1.

3.5 × 28-mm ABSORB bioresorbable vascular scaffold (BVS) (Abbott Vascular, Santa Clara, California) that also covered the restenotic segment. After kissing balloon inflation, 2 further BVS were implanted distally with minimal overlap. The procedure was completed with the implantation of a 4.0 × 12-mm EES in the LMS followed by a 4.5-mm balloon dilation. Optical coherence tomography demonstrated a crushed diagonal EES and an adequately expanded, well-apposed BVS without any evidence of scaffold disruption (Figs. 2A–2E). Three-month follow-up angiography showed no evidence of scaffold recoil and restenosis (Fig. 2F).

Although BVS has been used for complex lesions (1,2), its use for the treatment of ISR has yet to be reported. BVS use in this context is particularly attractive because it avoids the addition of further metal layers, and this, in conjunction with its greater biocompatibility as compared with conventional stents, can potentially reduce the risk of recurrent restenosis and stent thrombosis. This case also demonstrates that BVS can be successfully used for the treatment of diffusely diseased, heavily calcified vessels, as well as in systematic 2-stent strategies for the treatment of bifurcation lesions. Follow-up angiography suggests that as long as meticulous lesion preparation, appropriate BVS sizing, and adequate post-dilation are performed, BVS can achieve excellent results, at least at early follow-up. Longer-term data are, however, required to fully investigate the role of BVS in these complex lesions.

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Key Words: bioresorbable vascular scaffold ■ complex lesion ■ in-stent restenosis ■ optical coherence tomography.