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IMAGES IN INTERVENTION

# Short- and Long-Term Implications of a Bioresorbable Vascular Scaffold Implantation on the Local Endothelial Shear Stress Patterns

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The angiographic and optical coherence tomographic data acquired at baseline and at 2-year follow-up from a 59-year-old patient, who had been implanted with an Absorb bioresorbable vascular scaffold (Absorb BVS, Abbott Vascular, Santa Clara, California), were fused to reconstruct the coronary anatomy of the treated left anterior descending artery (1). Blood flow simulation was performed and the endothelial shear stress (ESS) was computed at these 2 time points and portrayed on the luminal surface with the use of a color-coded map (Fig. 1) (2). The rugged surface created at baseline following scaffold implantation resulted in predominantly low ESS (62.6% of the segment had ESS <1 Pa) that predisposed to neointimal formation. At 2-year follow-up, the ESS distribution was normalized and only 16.5% of the scaffolded segment had ESS <1 Pa, whereas the developed neointima had a mean thickness of 160 μm and covered the vessel wall.

This case highlights the short- and long-term implications of an Absorb BVS implantation on the local ESS patterns. The low ESS detected after device implantation is likely to contribute to neointimal formation that smooths the luminal surface and normalizes the ESS. At follow-up, the scaffolded segment is predominantly exposed to an atheroprotective hemodynamic environment; has restored its geometry, physiologic function, and vasomotion; and is covered by a thin layer of neointima that seals the underlying plaques (3). The prognostic implications of these findings and the potential value of the Absorb BVS in the invasive passivation of potential vulnerable plaques require further investigation.

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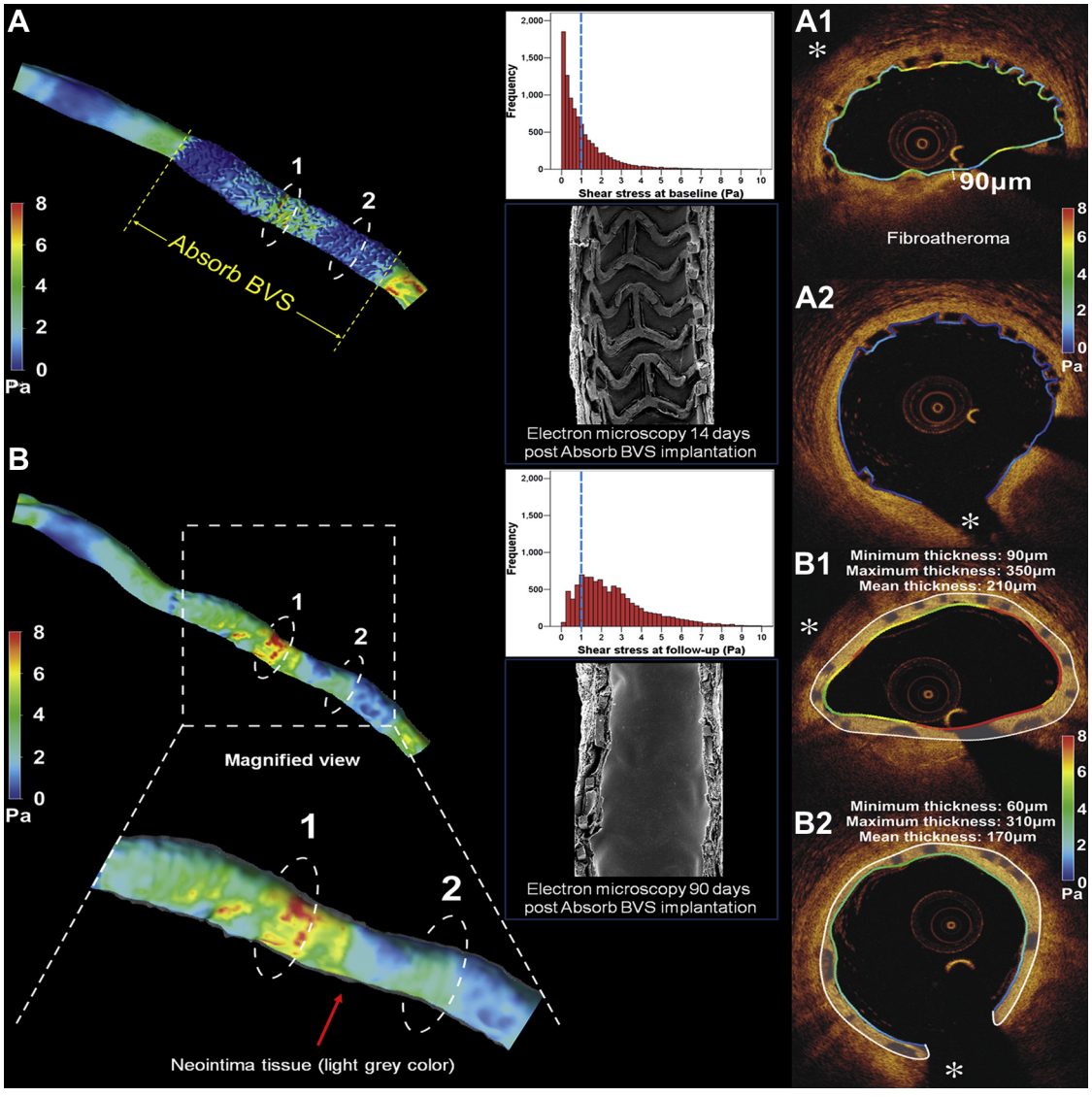


**Figure 1. Scaffold Reconstruction and Blood Flow Simulation at Baseline and Follow-Up**

Three-dimensional reconstruction of coronary anatomy from the baseline coronary angiographic and optical coherence tomographic (OCT) data and blood flow simulation, with the local endothelial shear stress (ESS) being portrayed in a color-coded map (**blue** indicates low and **red** high ESS) **(A)**. The distribution of the ESS in the scaffolded segment is illustrated at the top right side of the panel, whereas below there is an electron microscopy image acquired 14 days after an Absorb bioresorbable vascular scaffold (BVS) implantation in an animal model showing the rugged luminal surface. **(A1, A2)** The images illustrate the baseline ESS distribution around the circumference of the vessel wall in 2 OCT cross-sectional images. Normal-to-high ESS noted over a fibroatheroma with a cap thickness of 90 µm in **A1,** whereas in **A2**, the ESS is low over the vessel wall and normal over the struts. The **asterisk (*)** in both images indicates a side branch. At follow-up, the ESS values are normalized in the scaffolded segment and appear to be increased when compared to baseline **(B)**. The magnified view demonstrates the thin layer of neointima that has developed and is portrayed with **light gray**. High ESS was noted over the fibroatheroma detected at baseline, but the neointima tissue has sealed the plaque **(B1)**. The low ESS estimated at baseline across the circumference of the vessel wall in **A2** is normalized at follow-up **(B2)**. Reprinted with permission from Bourantas et al. (2).

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**Key Words:** bioresorbable scaffolds ■ endothelial shear stress ■ optical coherence tomography.