Optical coherence tomography enhanced by novel software to better visualize the mechanism of atherosclerosis and improve the effects of percutaneous coronary intervention

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Optical coherence tomography (OCT) uses near-infrared light to provide high-definition images of the artery. The OCT provides automated, accurate measurements to help guide stent sizing and post-stent optimization among patients treated with percutaneous coronary interventions (PCIs) [1, 2]. OCT has also been proven to be significantly related to long-term clinical outcomes [3].

We present the case of a 65-year-old man with a history of prior PCI to the circumflex artery with drug-eluting stent (DES) implantation in 2006. Additionally, the patient suffered from arterial hypertension, diabetes mellitus, hyperlipidemia, chronic obstructive pulmonary disease, ventricular extrasystolia, and was a heavy smoker in the past. Two months earlier, the patient was treated with PCI of the left anterior descending artery with DES implantation, and due to borderline stenoses in the right coronary artery (RCA), the patient underwent FFR measurement (PressureWire™ X, Abbott Vascular, Santa Clara, CA, USA). Hyperemia was induced by an intracoronary bolus of 200 µg adenosine. The instantaneous wave-free ratio (iFR) was 0.96 and FFR 0.77. The pull-back demonstrated two distinct gradients in the distal segment before bifurcation and in the medial segment (Figure 1A). After introducing the Balance Middle-weight Universal II guidewire (Abbott Vascular), we performed OCT (Dragonfly OpStar, Abbott Vascular) of the RCA with the use of Ultreon™ Software (Abbott Vascular) (Figure 1B–D). Afterward, pre-dilatation with the non-compliant Solarice (Medtronic, Minneapolis, MN, USA) catheter balloon was carried out in the distal (2.0 × 12 mm, 12––14 atm) and medial segments (3.0 x 20 mm, 12–14 atm). Based on the results of the OCT examination, 3.5 × 38 mm and 3.5 × 12 mm, 18 atm DES Xience Pro stents were implanted (Figure 1E). An additional stent was implanted into the distal segment of the RCA and the right posterior descending artery (DES Xience Pro 2.5 × 15 mm, 18 atm). Due to the suboptimal stent expansion demonstrated by OCT, post-dilatation was conducted with 2.5 × 15 mm, 3.0 × 15 mm, and 4.0 × 15 mm non-compliant catheter balloons alongside the proximal optimization technique up to 24 atm. The optimal, final effect was confirmed via OCT (Figure 1E).

In conclusion, the presented modern software offers precise guidance following the assessment of morphology, lesion length, and artery diameter to aid decision-making at every step of the PCI [4]. It helps determine proper treatment technique pre-PCI and assess the PCI result including potential dissections, stent apposition, and expansion. The Ultreon™ Software can detect the degree and thickness of calcification and can display calcification angle and maximal thickness values throughout the pullback in real-time. The highlighted calcifications overlay on the vessel with the co-registration view. Using this software, we can visualize the external elastic lamina and artery lumen diameter, which helps in identifying landing zones for accurate stent placement. Side-by-side viewing of live and co-registered angiography enables precise stent deployment. We have a better opportunity to ensure the completeness of
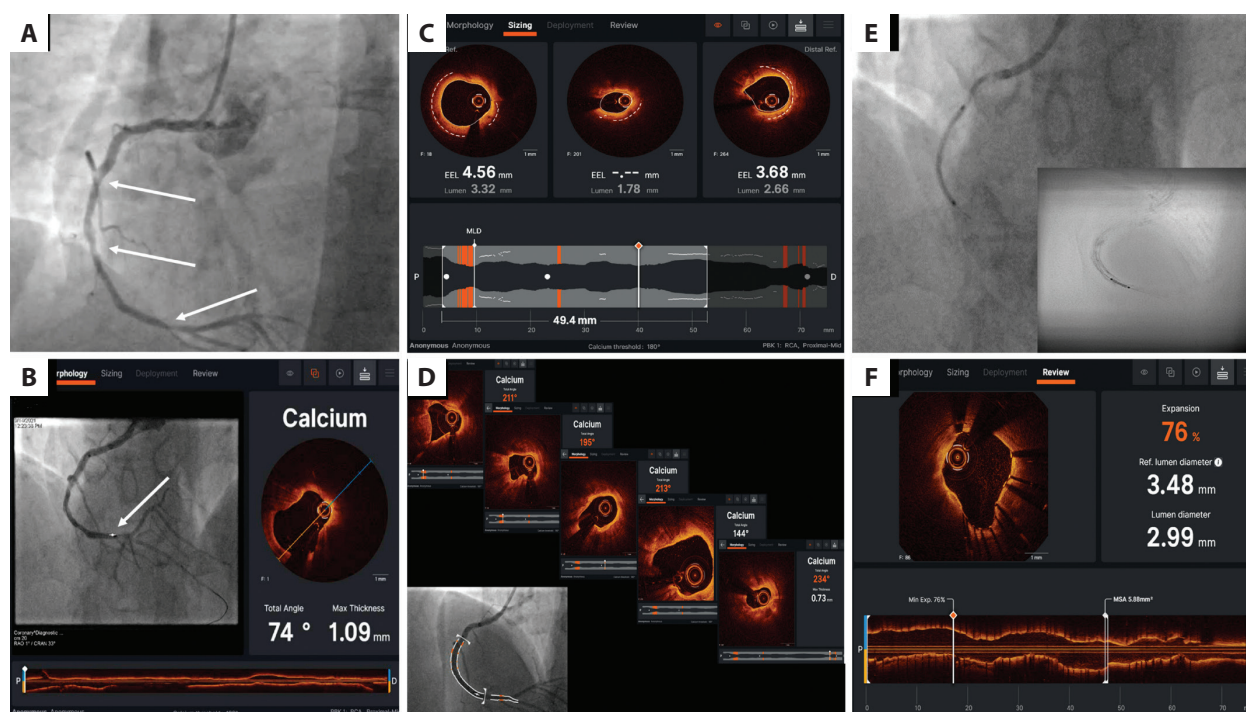
Figure 1. A. Coronary angiography of the RCA before PCI (white arrows indicate stenoses). **B.** OCT with co-registration before stent implantation – intuitive workflow interface (white arrow indicates the position marker of the OCT image in a cross-section). **C.** Cross-sectional images in OCT before stent placement — sizing interface images. **D.** Cross-sectional images in OCT before stent placement — an assessment of calcifications with co-registration. **E.** Coronary angiography of RCA — proximal stents implantation. **F.** Control OCT after stent implantation — longitudinal cross-section

Abbreviations: OCT, optical coherence tomography; PCI, percutaneous coronary intervention; RCA, right coronary artery

lesion coverage and avoid landing the stent edges on unfavorable morphology. We are also assisted in ensuring optimal stent expansion and apposition with the instantaneous display of expansion and apposition results.

Article information

Conflict of interest: None declared.

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