The 29th TCTAP 2024
Bifurcation PCI
2024/4/27 (Sat), 7:51 AM ~ 7:58 AM, Presentation Room 1

OCT-guided PCI: Bifurcation, Procedure Guidance and Flow

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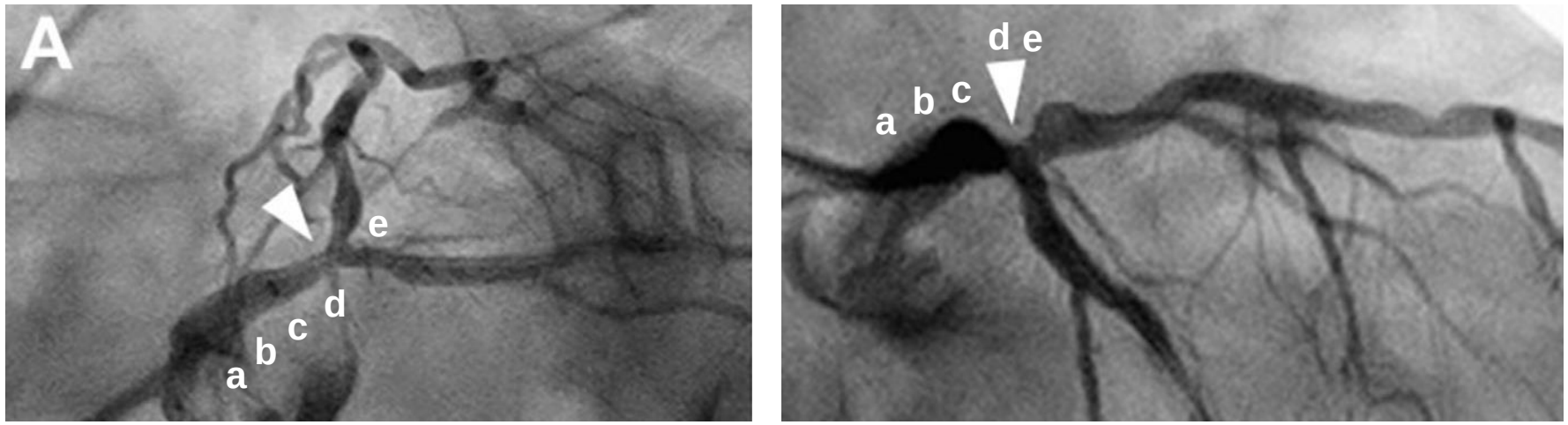
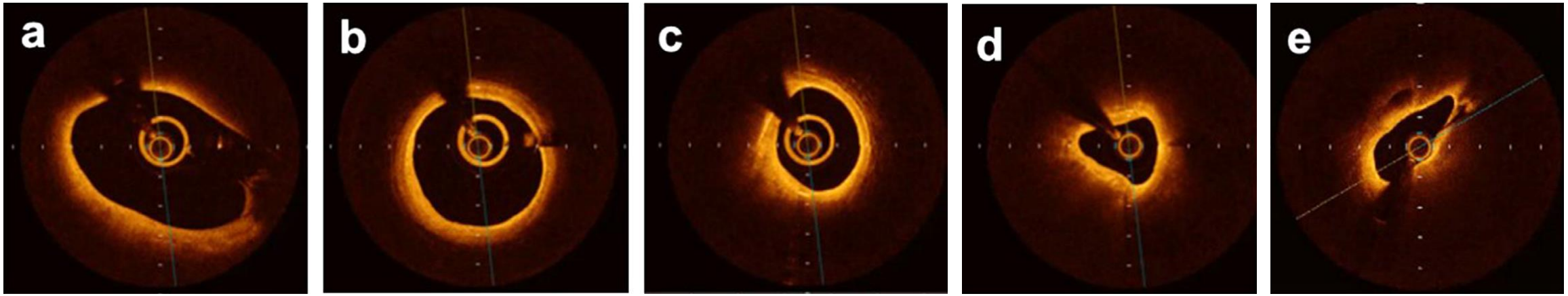
Disclosure statement of financial interest

Within the past 12 months, I or my spouse/partner have had a financial interest/arrangement or affiliation with the organization(s) listed below.

Affiliation/Financial Relationship	Company
Grant/Research Support	No
Consulting Fees/Honoraria	No
Major Stock Shareholder/Equity	No
Royalty Income	No
Ownership/Founder	No
Intellectual Property Rights	No
Other Financial Benefit	No

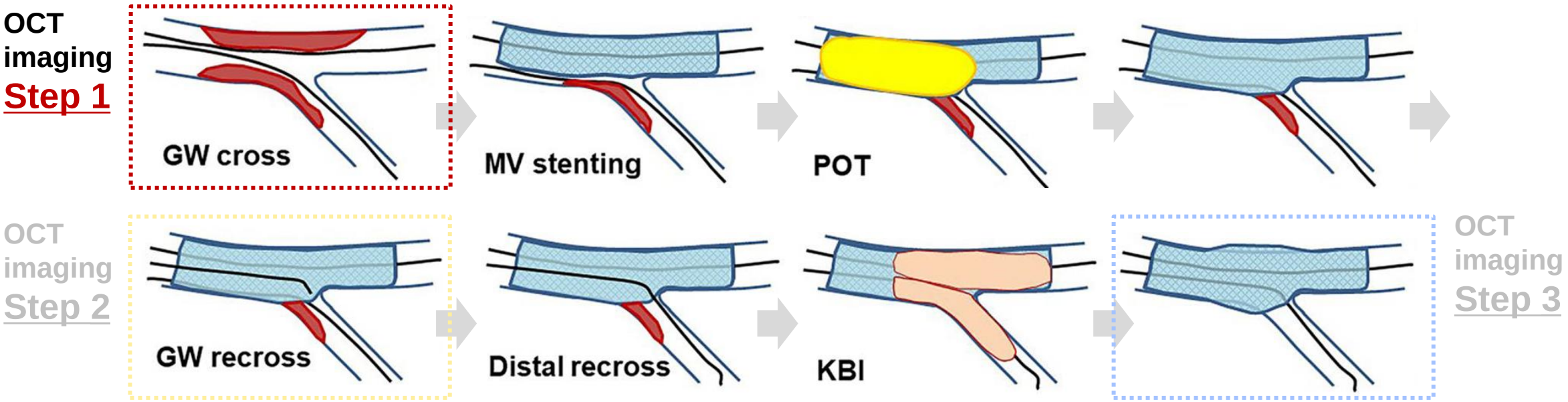
OCT in left main bifurcation





OCT provides accurate information about lumen and vessel dimensions, plaque characteristics, and bifurcation morphology.

Flow of OCT-guided bifurcation stenting



Step 1 (lesion assessment)

- Stent diameter, length, landing zone
- SB ostium length, branching angle
- MV calcification

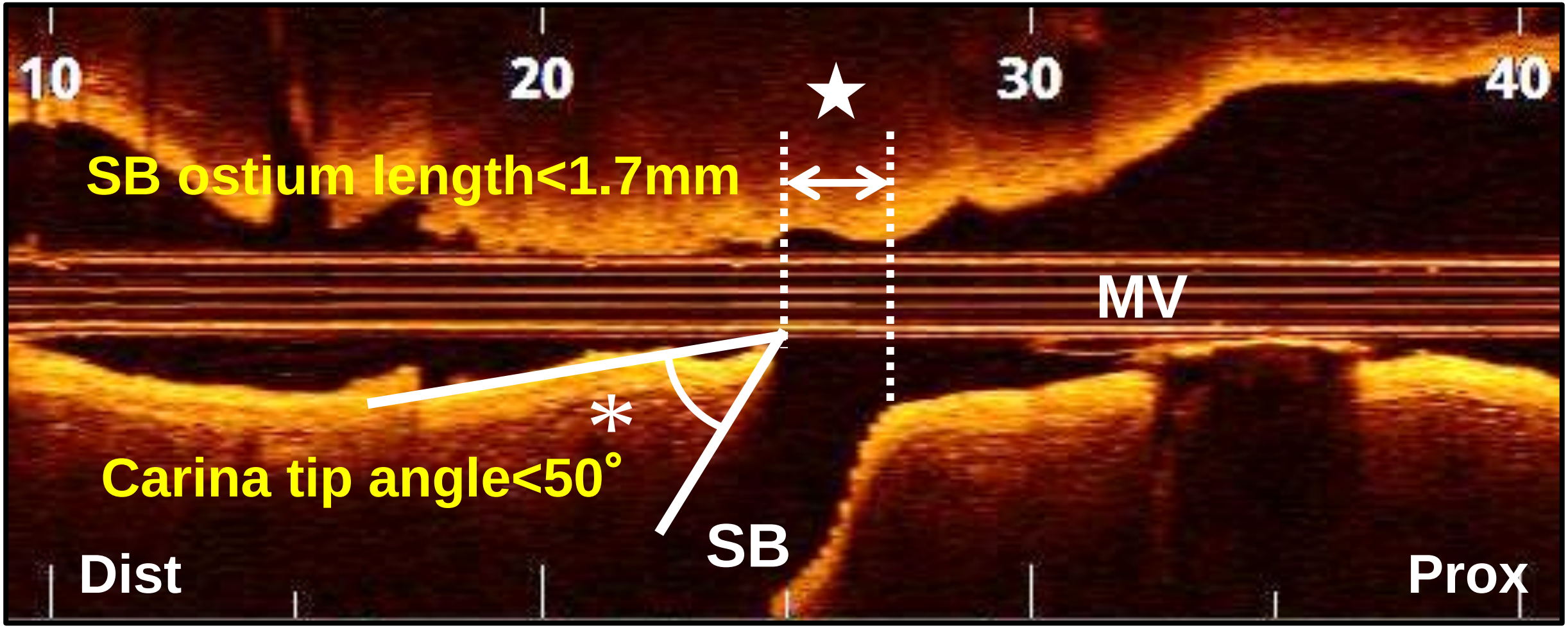
Step 2 (GW re-cross)

- Stent struts covering SB ostium
- Stent link location
- GW re-crossing site

Step 3 (Optimization)

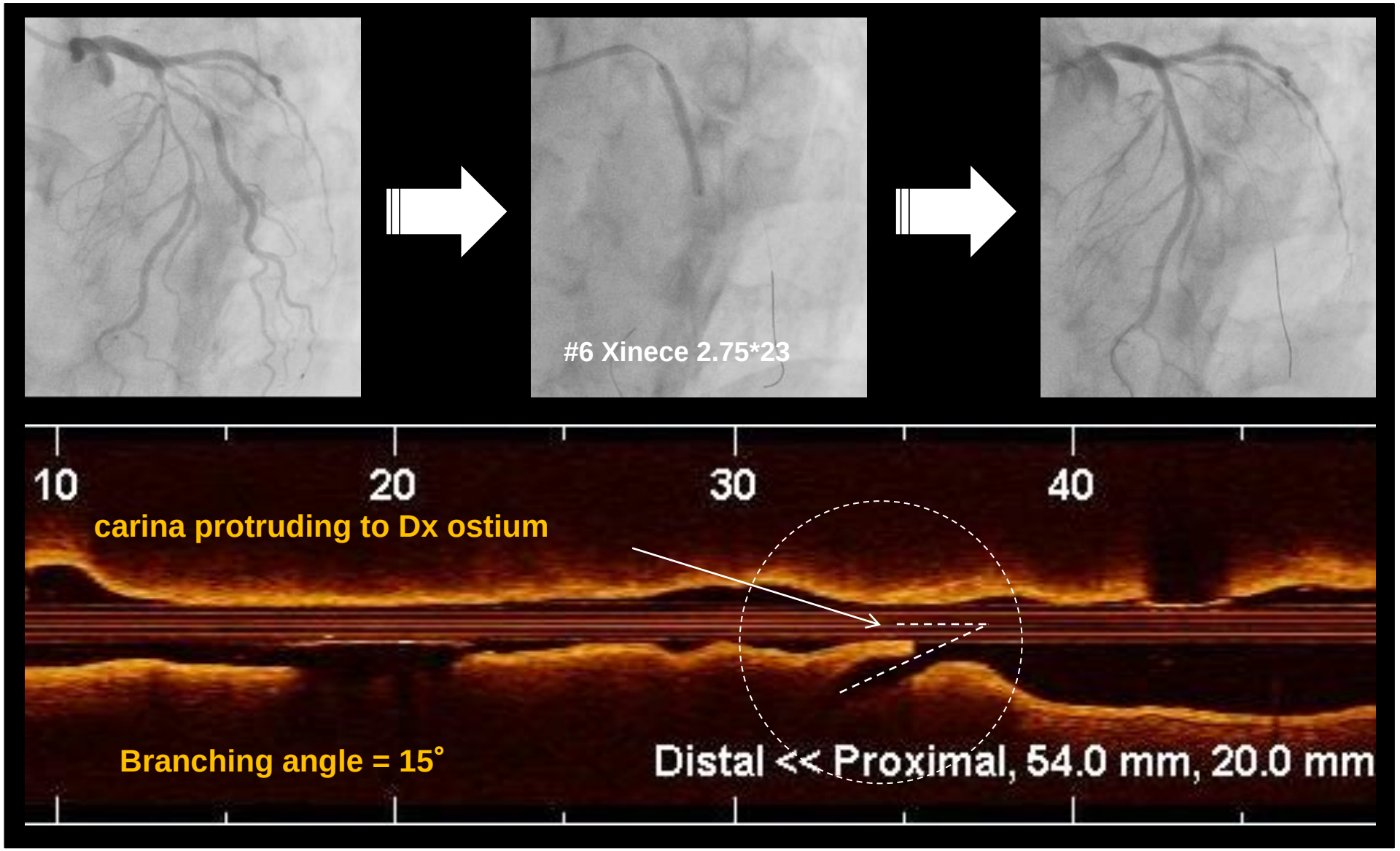
- Stent deformation
- Stent underexpansion, malapposition
- Stent edge dissection

Criteria for predicting side branch occlusion

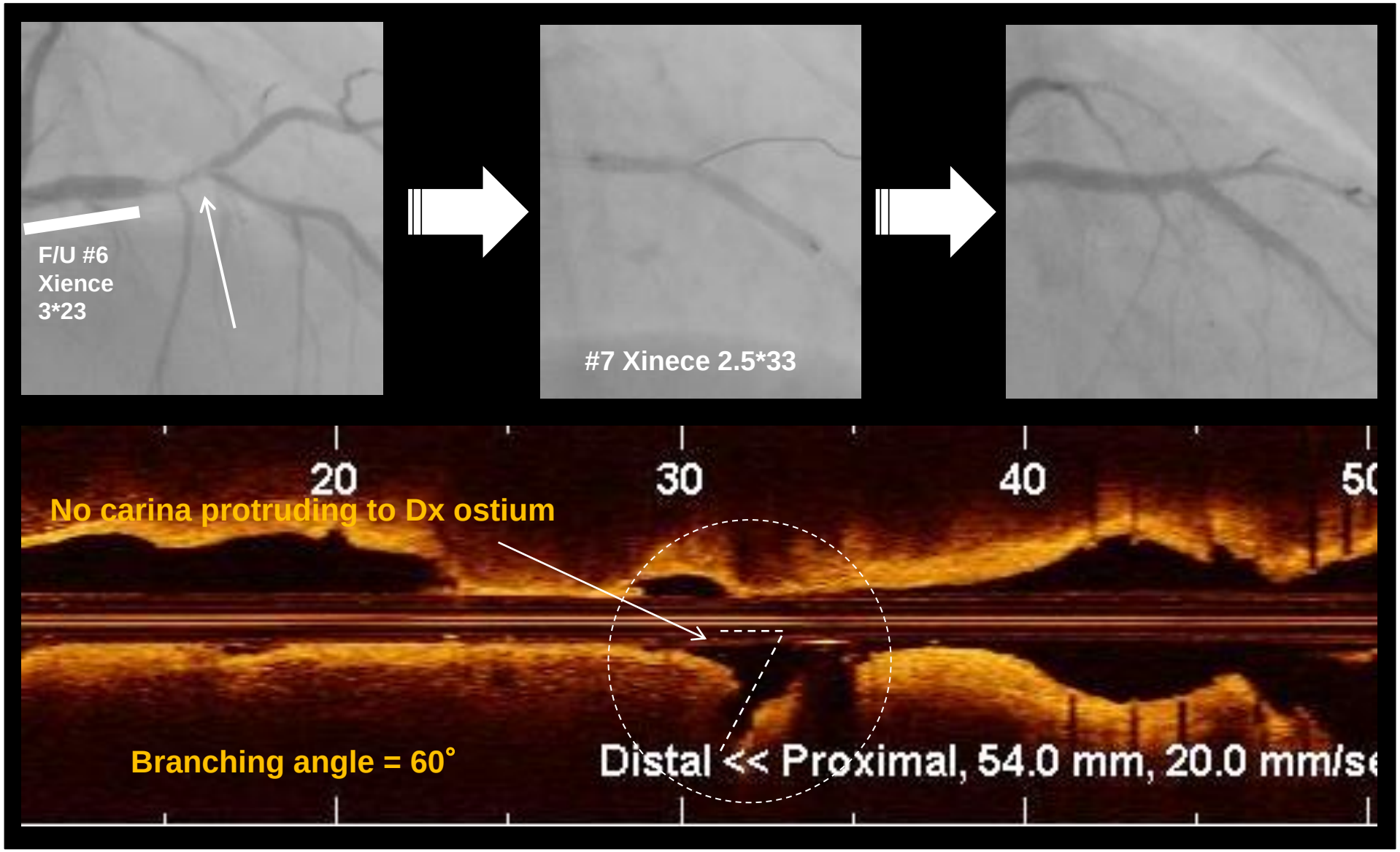


Measurements of carina tip angle (defined as the angle between lumen contour lines of main branch and SB at the carina, asterisk) and length between proximal branching point to carina tip (star) in longitudinal OCT image.

An example of SB occlusion after MV stenting

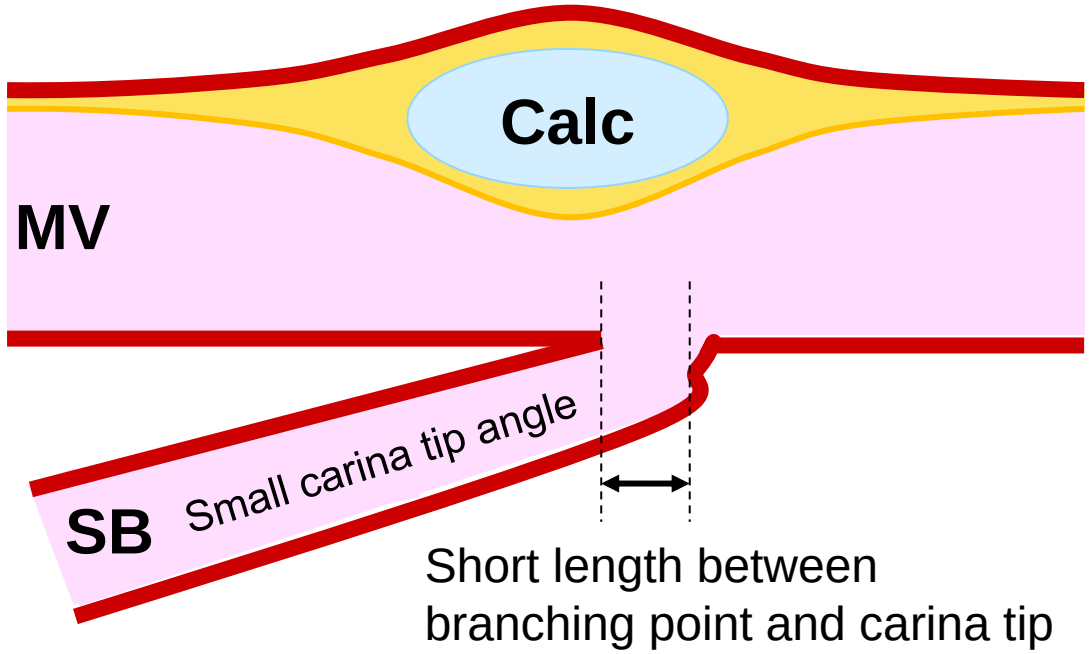


An example of *no* SB occlusion after MV stenting

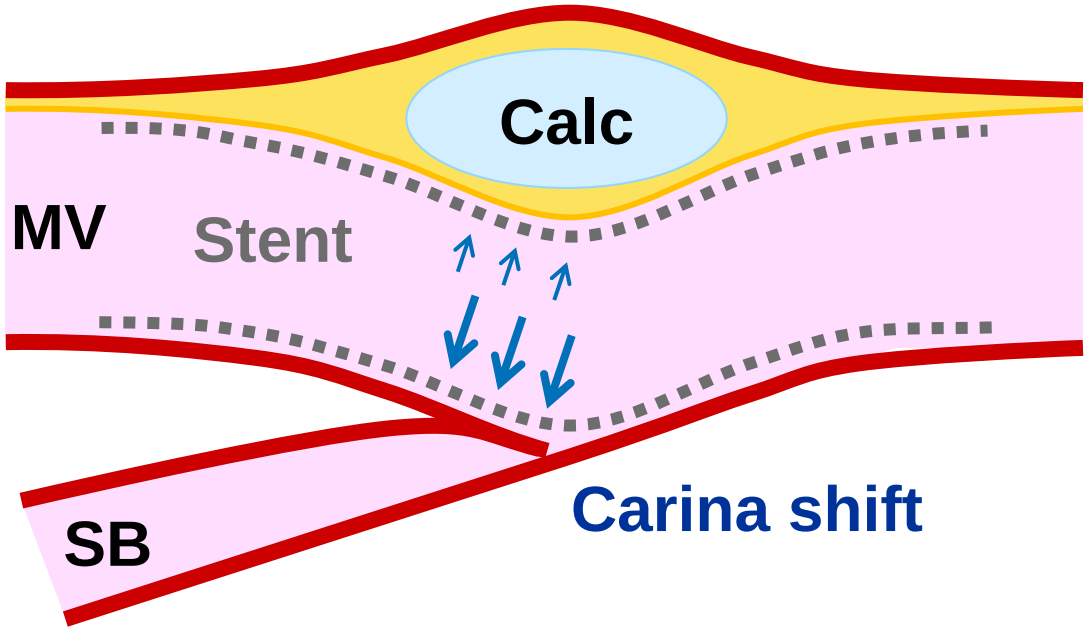


Calcification as a risk for SB complication

Pre-intervention



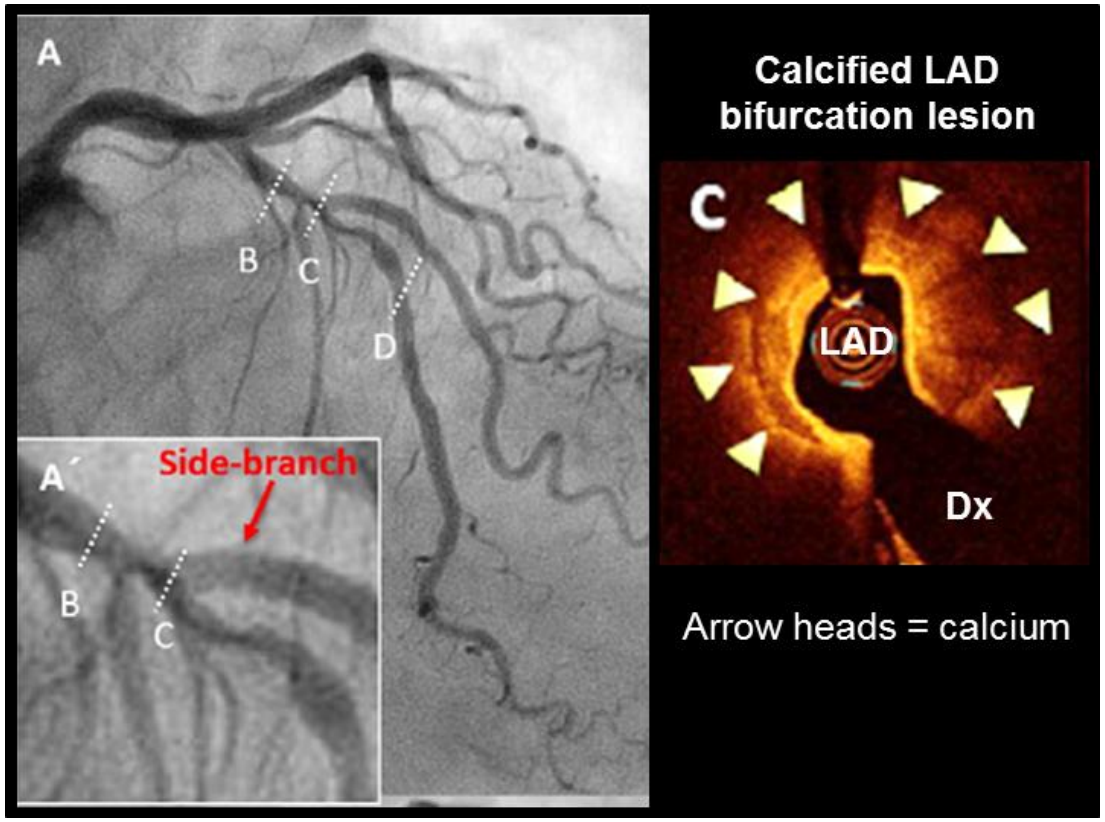
Post stent implantation



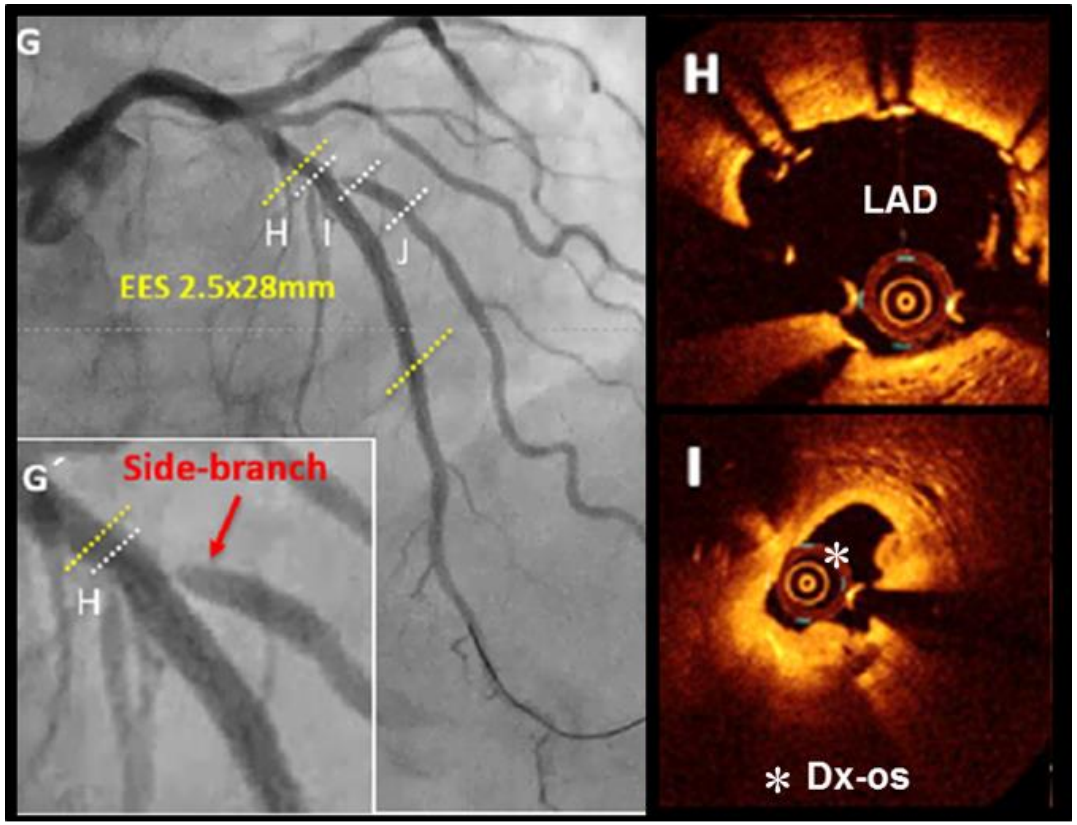
- Carina without atherosclerotic change is thin and easy to shift toward SB ostium, and results in ostial stenosis.
- The existence of a large calcified plaque in the opposite side SB leads to stent expansion toward the SB side because of elastic characteristics of atherosclerotic plaque. This mechanism might also play a role in carina shift.

An example of calcified plaque at bifurcation

Pre-intervention

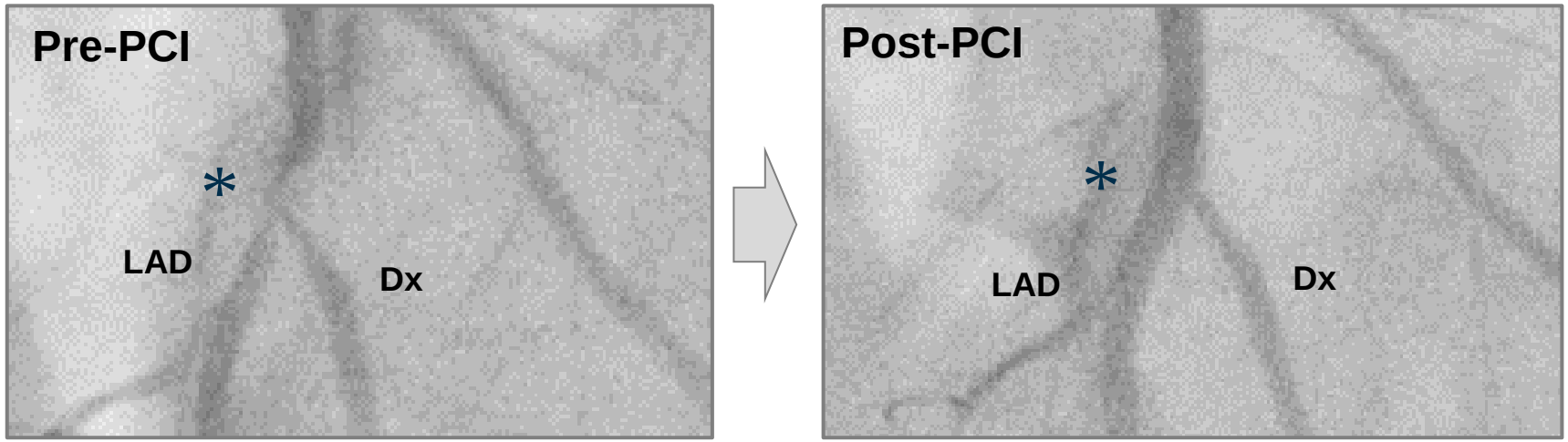


Post stent implantation in LAD

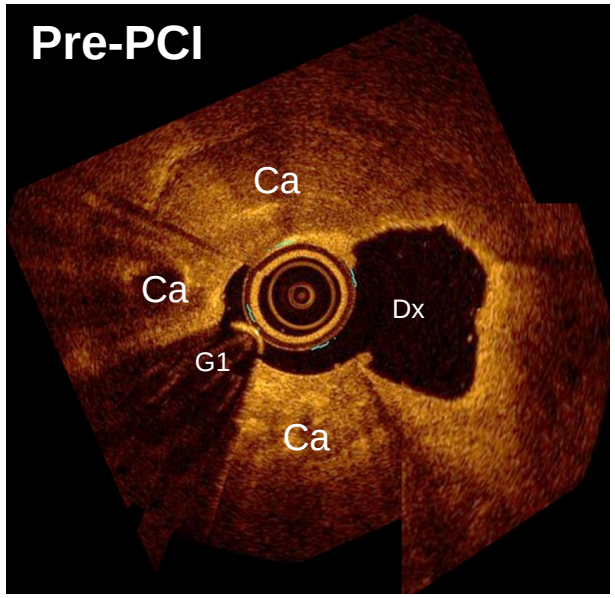


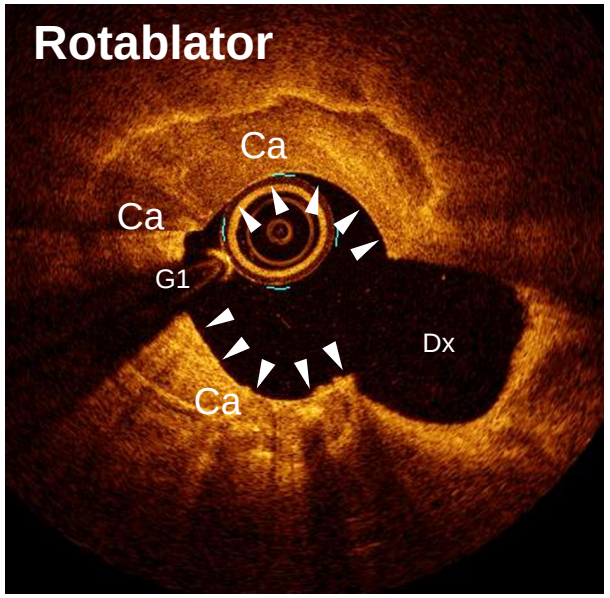
Angiography at pre-stent implantation showed LAD bifurcation lesion. OCT demonstrated severe calcification in the LAD bifurcation lesion (C). After stent implantation in LAD, angiography and OCT disclosed stenosis at side branch ostium.

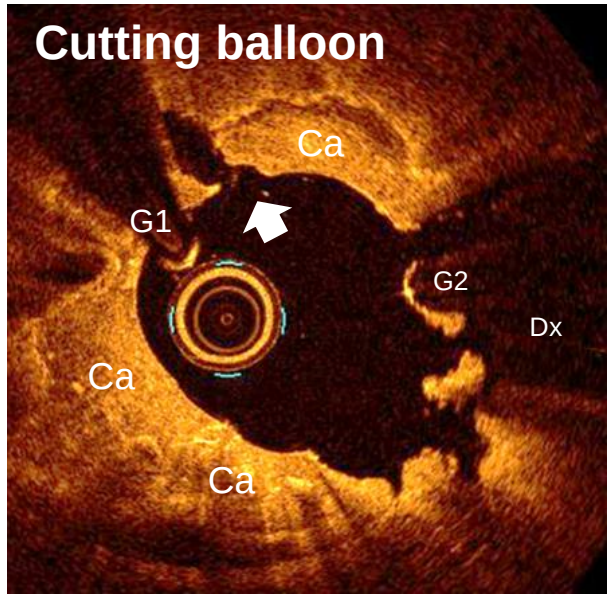
Rotablator + stent in calcified bifurcation lesion

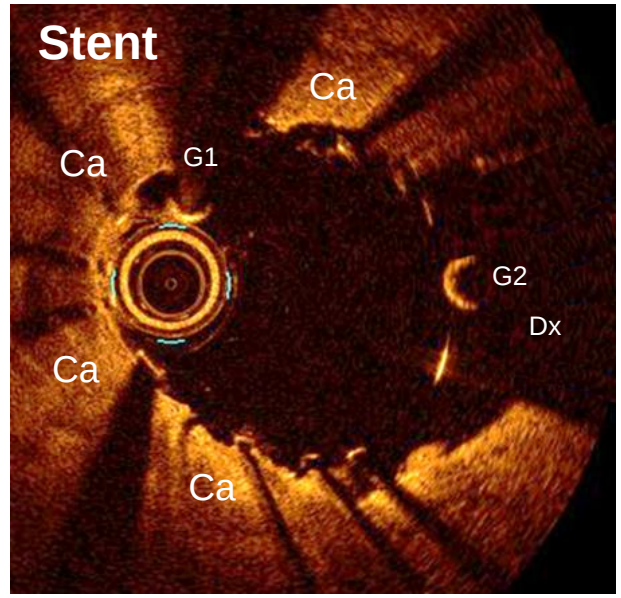


Arrow = calcium fracture
Arrow heads = cutting surface after rotablator atherectomy
Asterisk = target lesion
Ca = calcification
Dx = diagonal branch
G = guidewire
LAD = left anterior descending

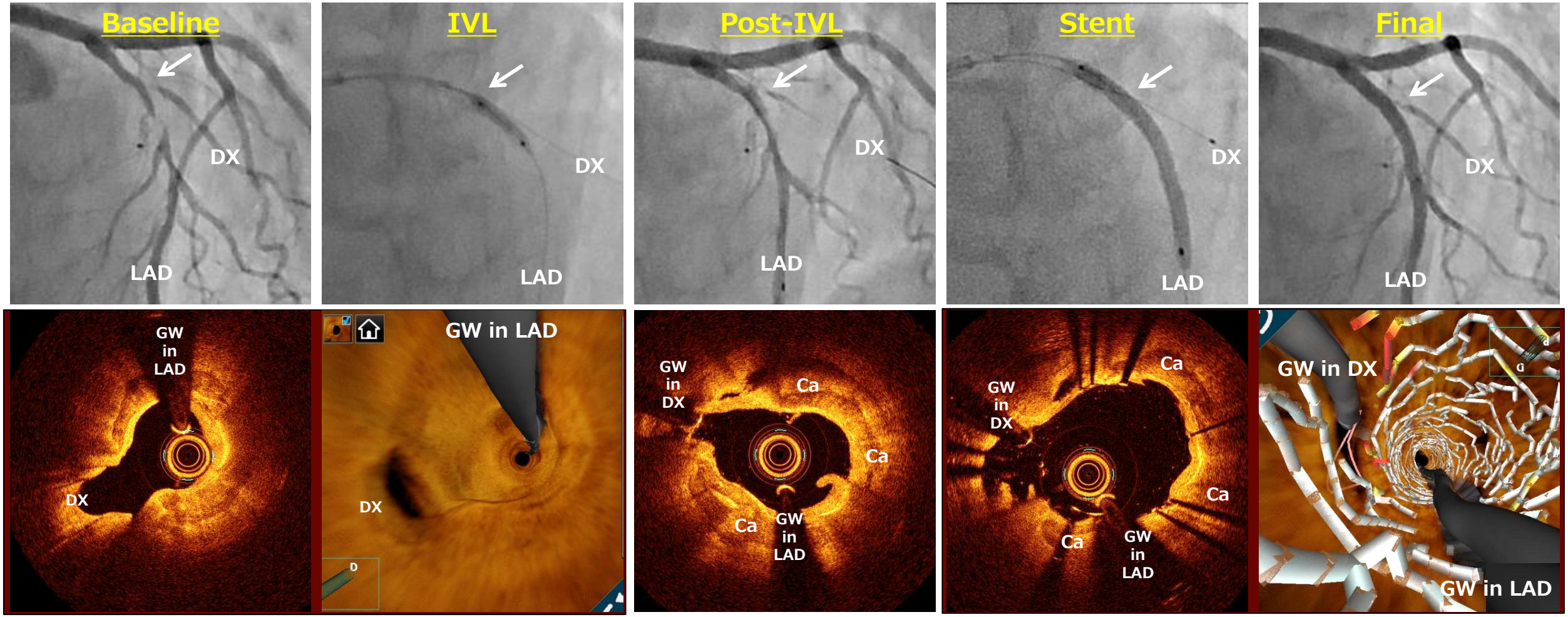






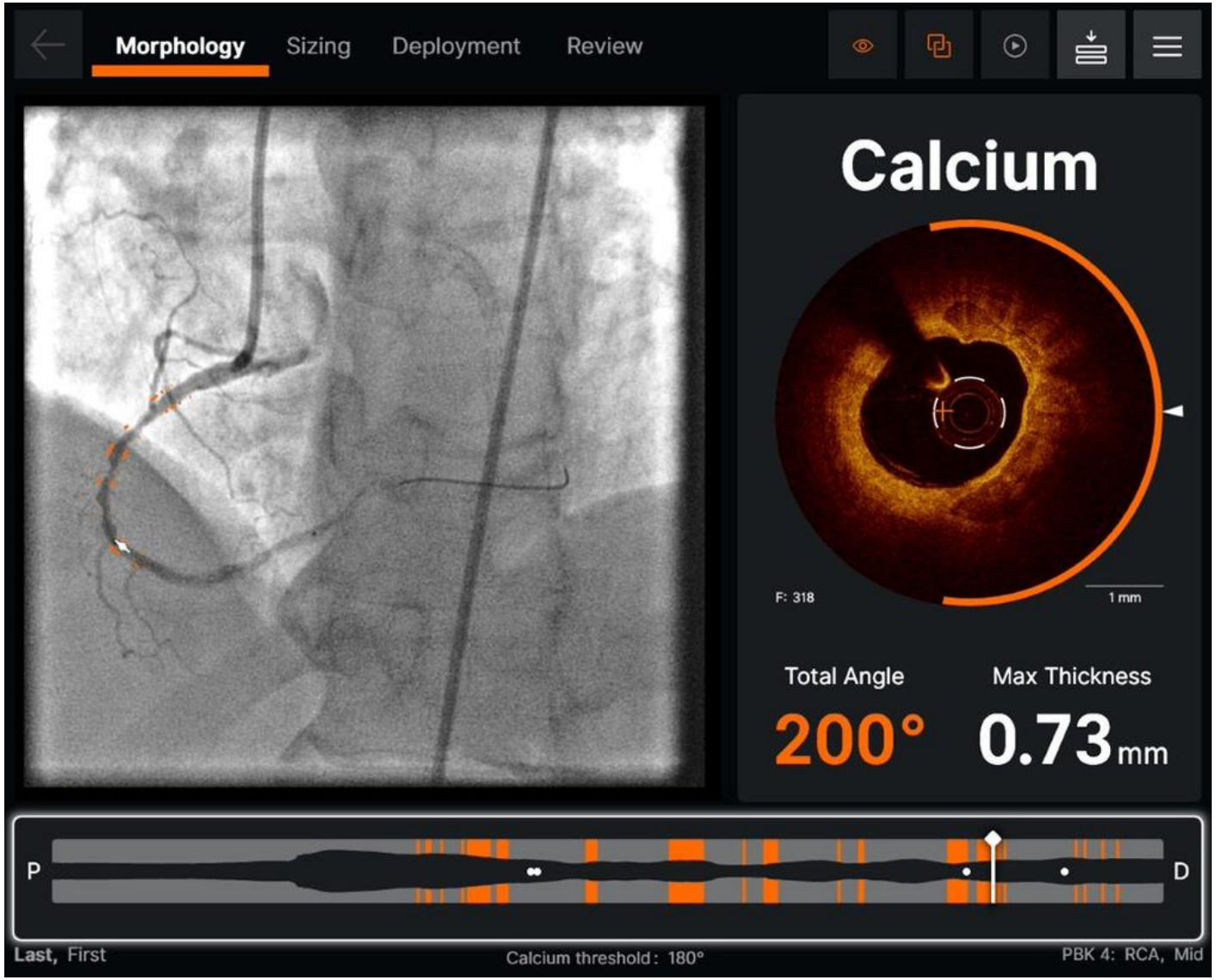


IVL (shock wave) in calcified bifurcation lesion



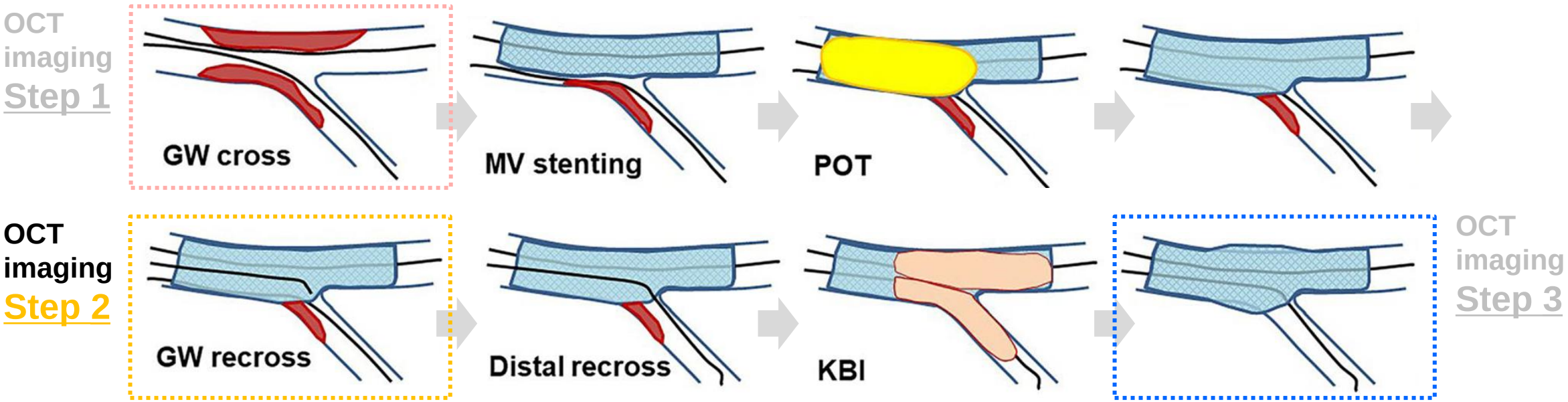
A 67-year-old woman underwent PCI for a bifurcation lesion between the LAD and DX. OCT showed circumferential calcification in the LAD. IVL 2.5x12mm was performed to the LAD while protecting the DX with a guidewire. The DX ostium was dilated with a balloon 1.5x10mm, followed by placement of an Osiro 2.75x40mm in the LAD. OCT showed that the bifurcation lesion was well dilated by the stent in the LAD without occlusion of the DX.

Calcium auto-detection by machine learning, AI



- **Calcium is indicated in orange**
- **Orange arc around the cross-sectional view indicates calcium in the current frame**
  - Arc is calculated from the lumen center
  - Arc is displayed when calcium angle is at or above 60 degrees of circumferential calcium
- **Maximum thickness of calcium in the current frame indicated by white triangle**
- Total angle of calcium highlighted when value exceeds user-defined calcium threshold (in physician preferences)
- Lumen profile highlights frames with total calcium angle that exceeds user-defined threshold
- **Angiography co-registration view allows user to visualize calcium on angiography still-frame**

Flow of OCT-guided bifurcation stenting



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3D-OCT image after MV stenting

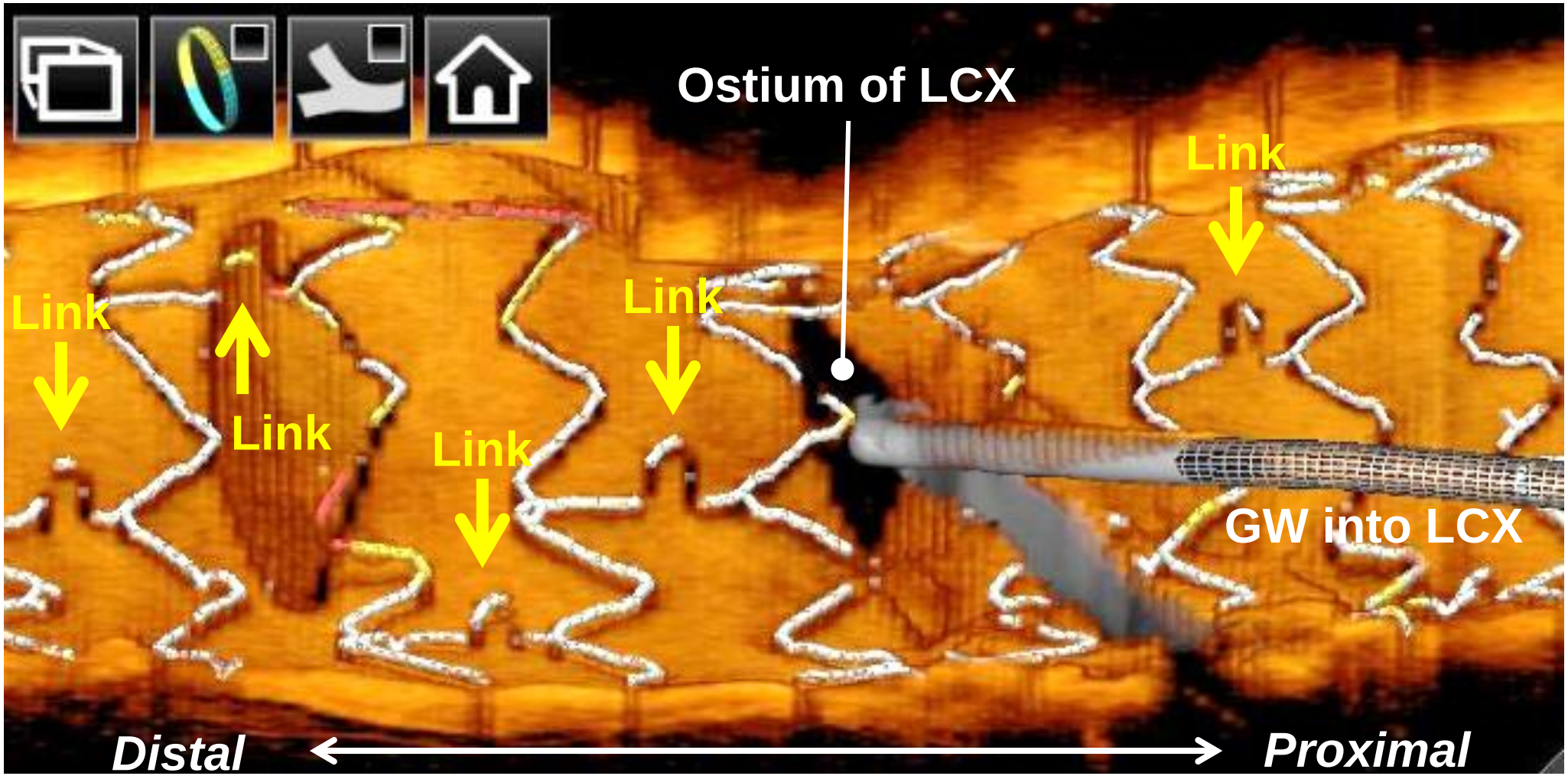
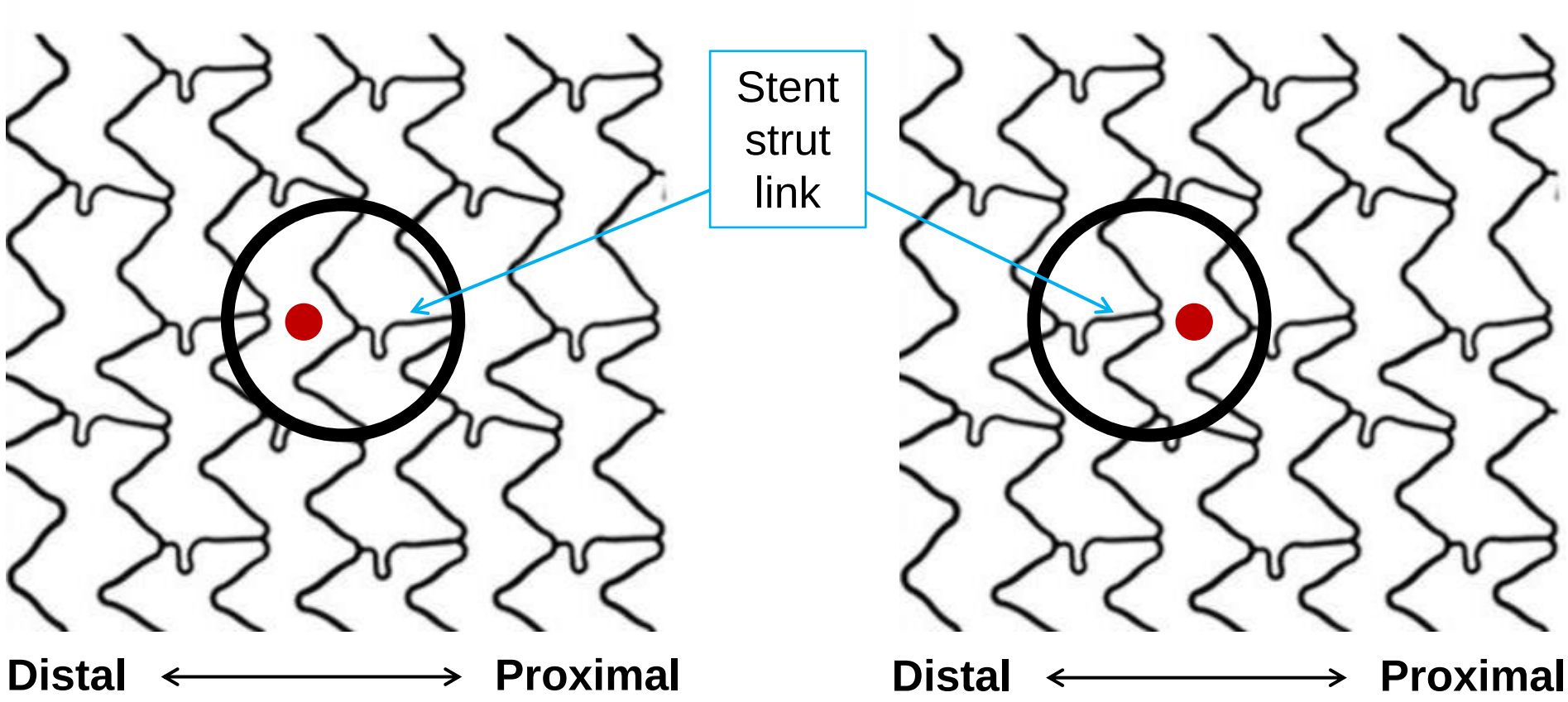


Fig 1. The side branch guidewire crossed through the center of the cell of the main branch stent over the ostium of the side branch.

Optimal stent cell rewiring for KBT

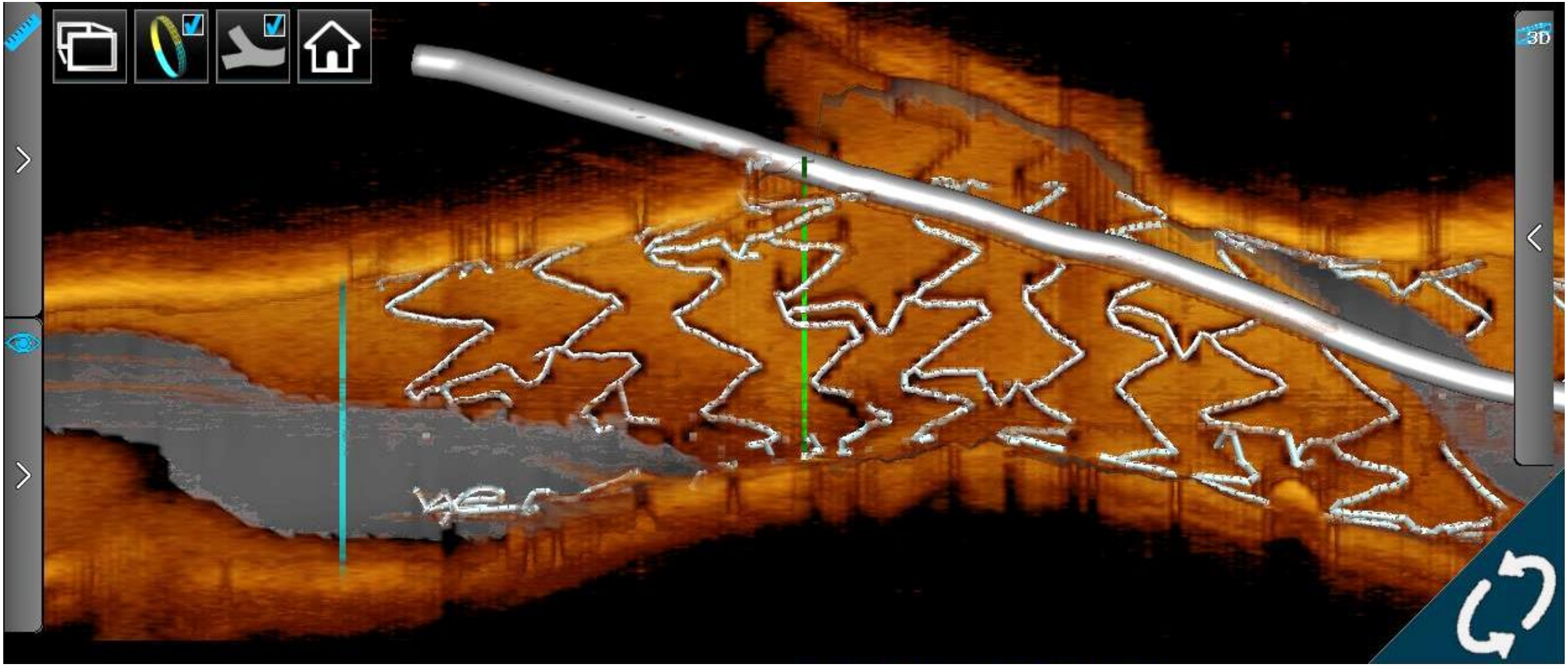
Distal crossing is optimal

Proximal crossing is optimal



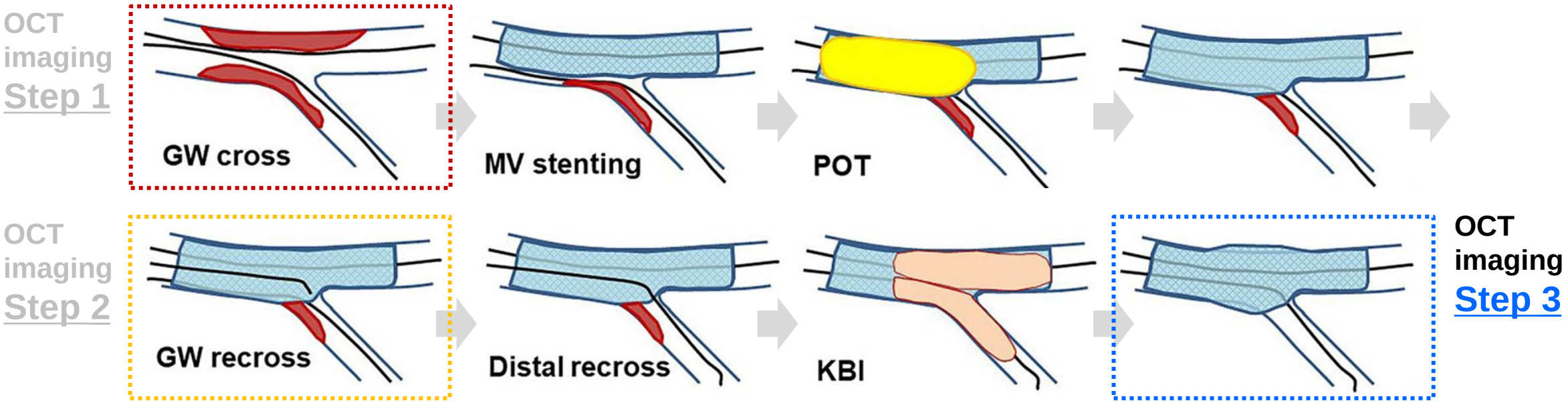
Distal wire crossing (●) is optimal if stent strut link is located at proximal site of side branch ostium (○), whereas proximal wire crossing (●) is optimal if stent strut link is located at distal site of side branch ostium (○).

3D-OCT of wire enhancement



Recent 3D-OCT software has improved the visualization of guidewire into side branch.

Flow of OCT-guided bifurcation stenting



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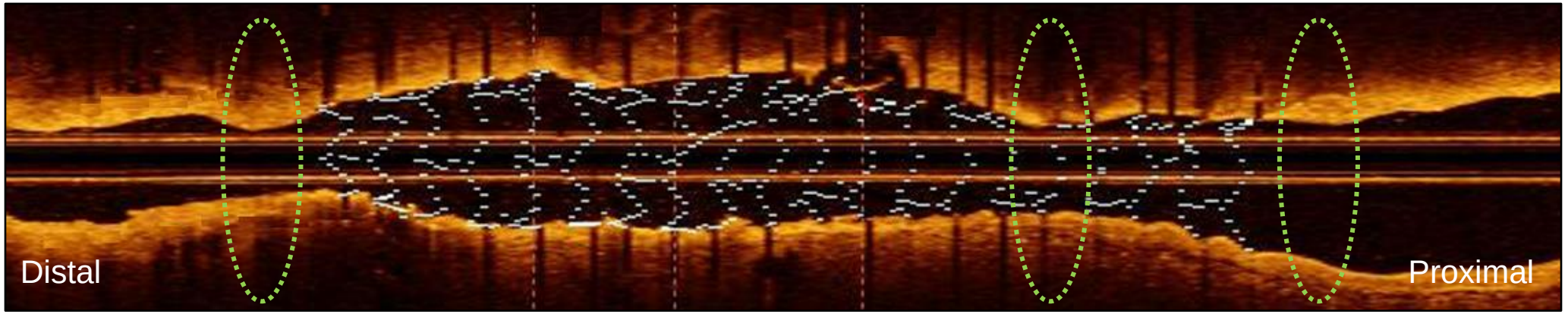
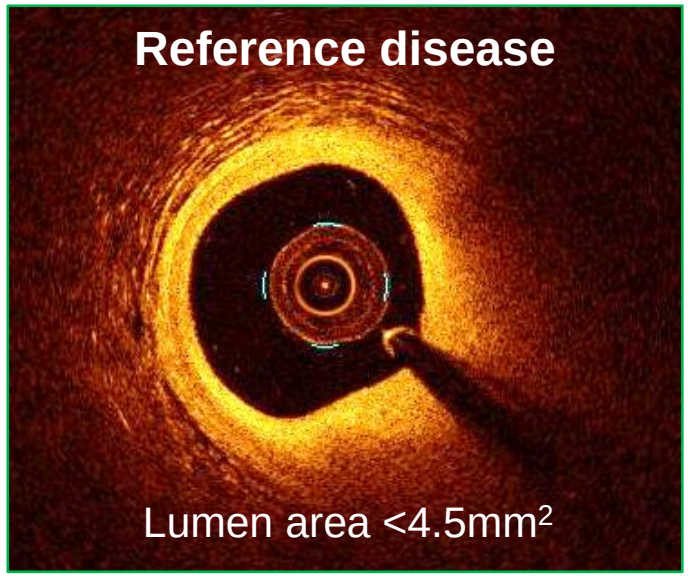
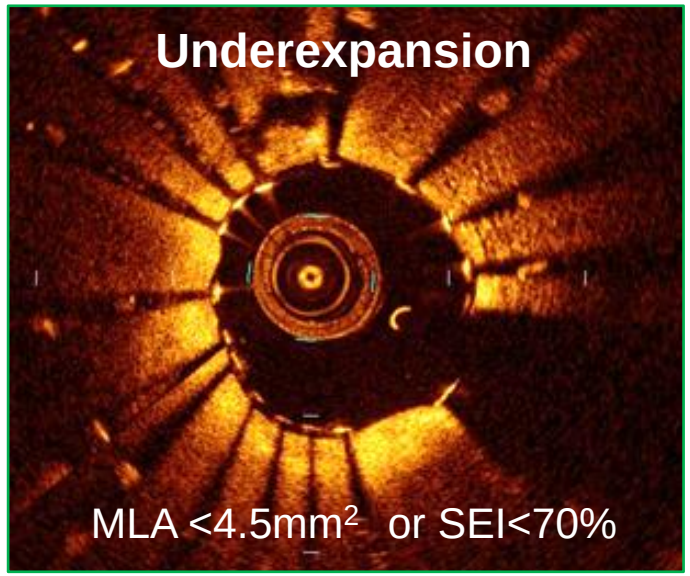
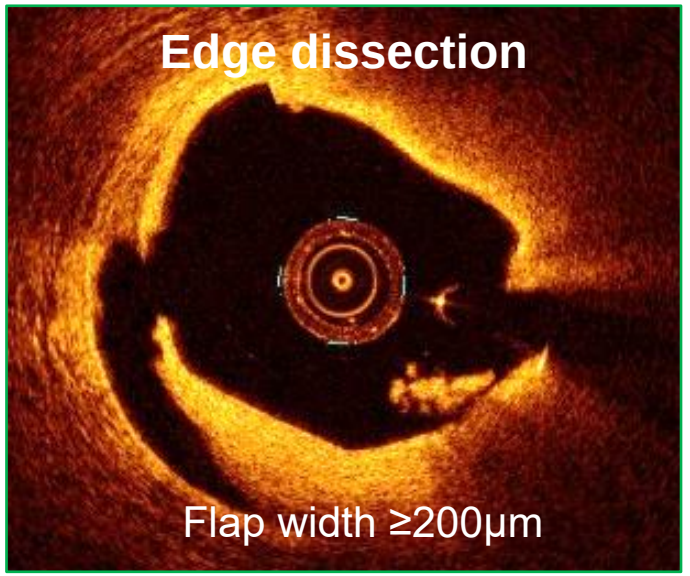
OCT criteria of suboptimal stent implantation



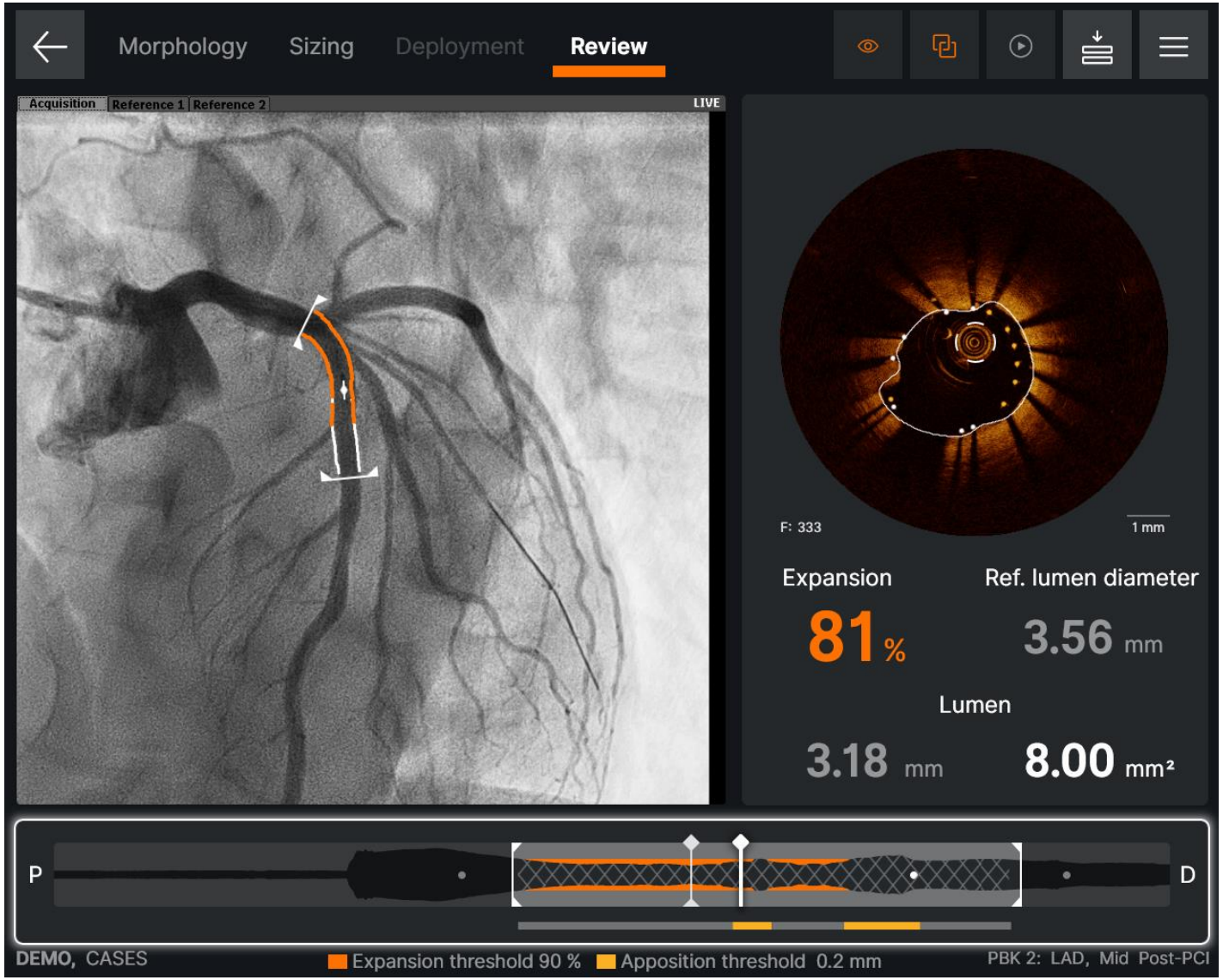






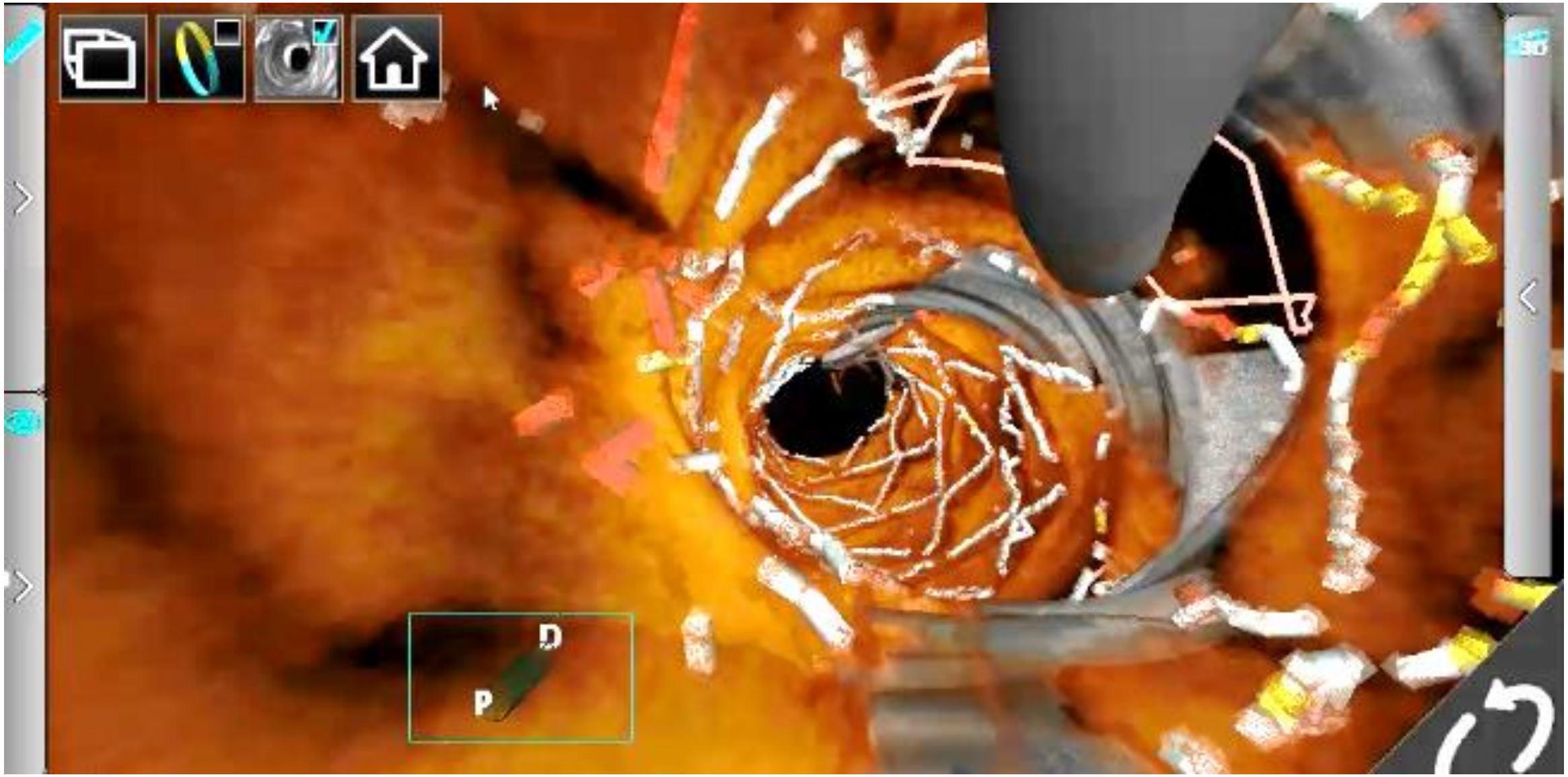
In-stent MLA <4.5mm^2, reference lumen narrowing with lumen area <4.5mm^2, stent edge dissection with a width ≥200μm were associated with worse long-term (7.5 years) PCI outcomes. *(Prati F, et al Euroint 2022)*

Apposition auto-detection by new OCT software



- **Software automatically detects malapposition**
  - Malapposition distance is automatically measured at each stent struts.
  - **Significant malapposed struts are indicated in orange color.**
- Common Practice
  - Dilate with semi-compliant balloon at low pressure
- **Angiography co-registration view allows user to visualize malapposition on angiography still-frame**

3D-OCT image after kissing balloon angioplasty



3D-OCT image after kissing balloon angioplasty

Conclusion

During bifurcation PCI, the use of OCT should be considered for pre-procedure lesion assessment, procedure guidance, and stent optimization.