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Application of Bioabsorbable Vascular Scaffold (BVS) in CTO-PCI

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Independent predictors of DES failure

Registries

- Rotterdam (Circulation 2004)
  - In-stent restenosis lesion
  - Ostial lesion
  - DM
  - Vessel size
  - LAD
- Munich (Circulation 2006)
  - Vessel size
  - Final diameter stenosis
  - DES type
- Seoul (Am J Cardiol. 2006)
  - DES type
  - Final MLD
  - Lesion lenght
- Washington (ACC 2007)
  - Age
  - Hypertension
  - Procedural lenght
  - Lack of IVUS guidance
  - Total stented lenght
- Milan (AHA 2006)
  - DM
  - Unstable angina
  - Reference vessel diameter
  - Number of stents per lesion

Modified from Mehran R, TCT 2012

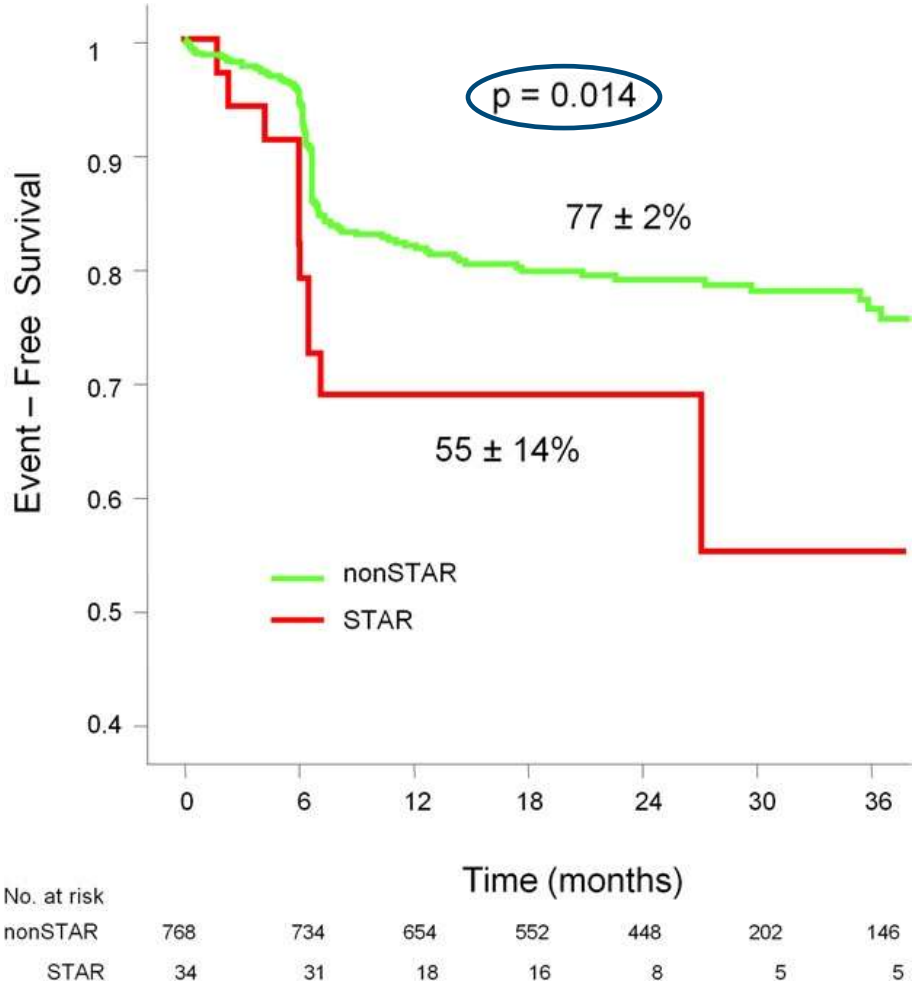
FMJ in CTO: an indipendent predictor of adverse events

• Lee CW et al, Cath. Cardiov. Inter. 2013;doi:10.1002/ccd.25228			p
• Cardiac death/MI	Stent lenght > 80 mm	OR = 2.15 (1.17 – 3.93)	0.014
• Cardiac death/MI/TLR	Stent lenght > 80 mm	OR = 2.45 (1.16 – 5.19)	0.019
• Isaaz K et al, J. Invasive Cardiol. 2013;25:323-9			
• Restenosis	Longer total stent lenght	HR = 1.017 (1.00 – 1.03)	0.045
• Galassi AR et al, J. Interv. Cardiol. 2011;24:426-36			
• Restenosis	Total stent lenght	OR = 4.7 (1.28 – 107.1)	0.02
• Restenosis	Number of stent implanted	OR = 5.8 (1.39 – 23.55)	0.01
• Reocclusion	Number of stent overlapping	OR = 7.1 (2.30 – 221.1)	0.007

Sub-intimal stenting: a predictor of adverse events

Sub-intimal stenting infleuence clinical and angiographic outcome

Clinical Outcome	HR	95% CI	p Value
Cardiac death			
Age >75 yrs	4.64	2.19–9.83	<0.001
LVEF <40%	7.25	2.77–19	<0.001
LAD-CTO	2.39	1.13–4.33	0.020
Completeness of revascularization	0.48	0.24–0.95	0.037
MACE			
Age >75 yrs	1.64	1.17–2.31	0.004
STAR technique	2.26	1.21–4.22	0.010
LVEF <40%	1.47	1.06–2.06	0.023
LAD-CTO	1.42	1.02–2.01	0.046
Angiographic Outcome	**OR**		
Reocclusion			
STAR technique	29.50	11.9–73.2	<0.001
EES	0.22	0.09–0.54	0.001
Nonocclusive restenosis			
RCA-CTO	1.64	1.02–2.62	0.040

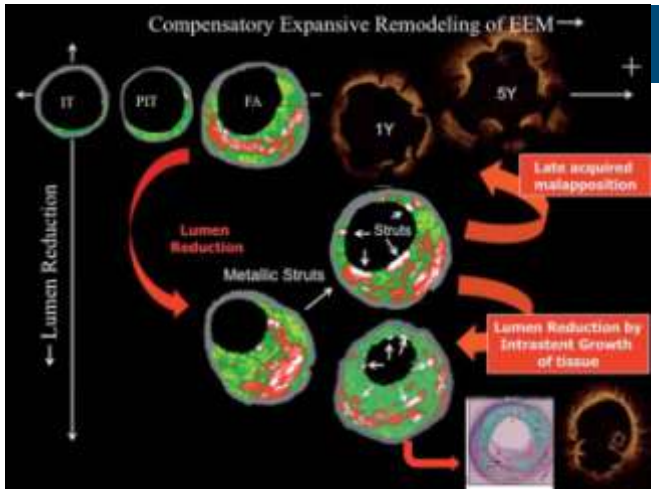


Valenti R et al, JACC 2013;61:545-50

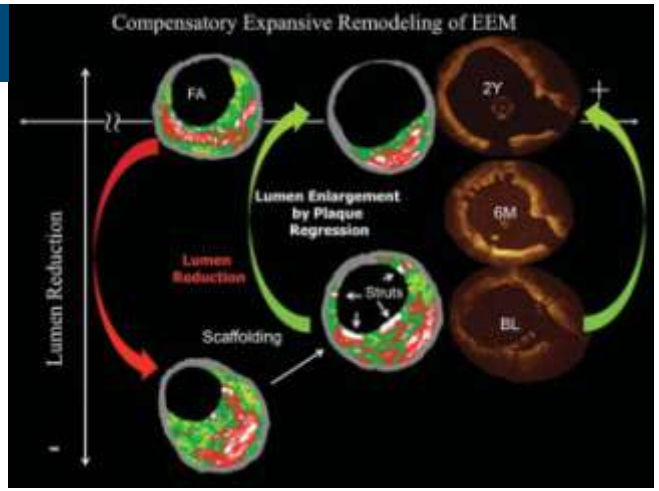
BVS: a tool for a complete healing of the vessel

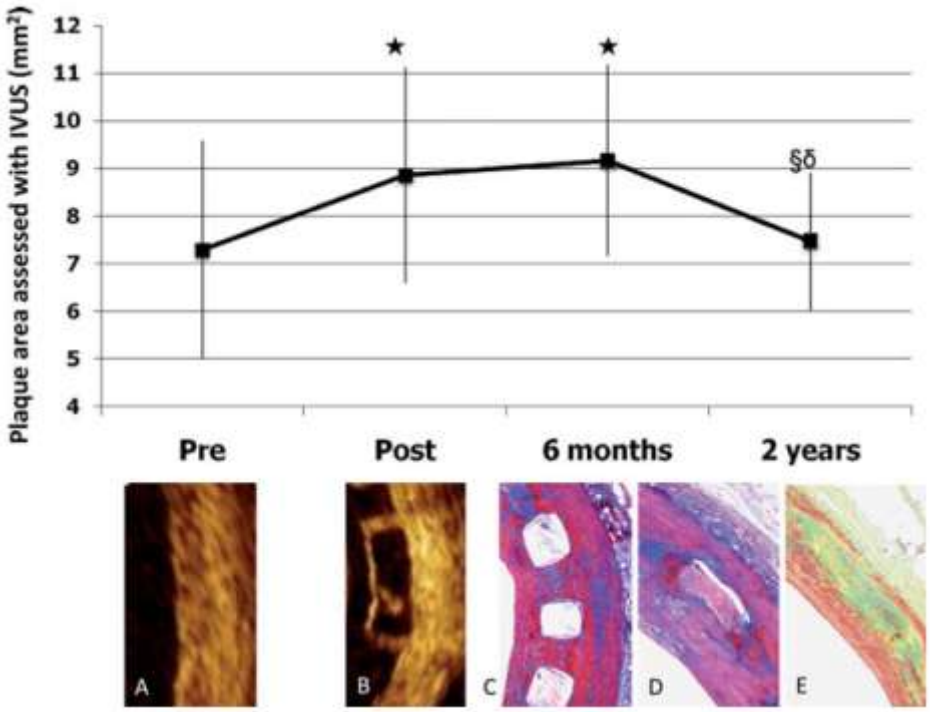
Long-term vessel wall modifications: DES vs BVS

DES



BVS

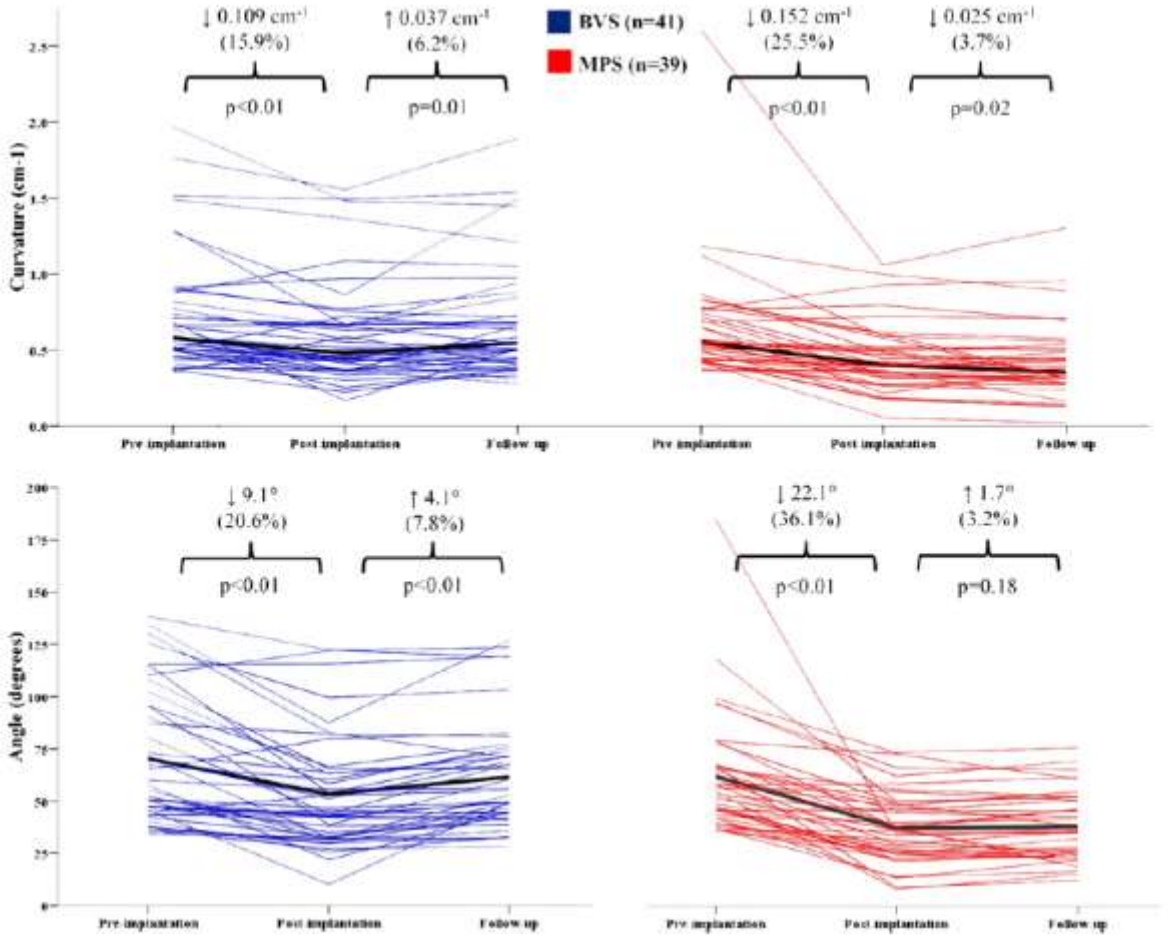




Serruys PW et al, Eur Heart J 2012;33:16-25b

BVS: a tool for a complete healing of the vessel

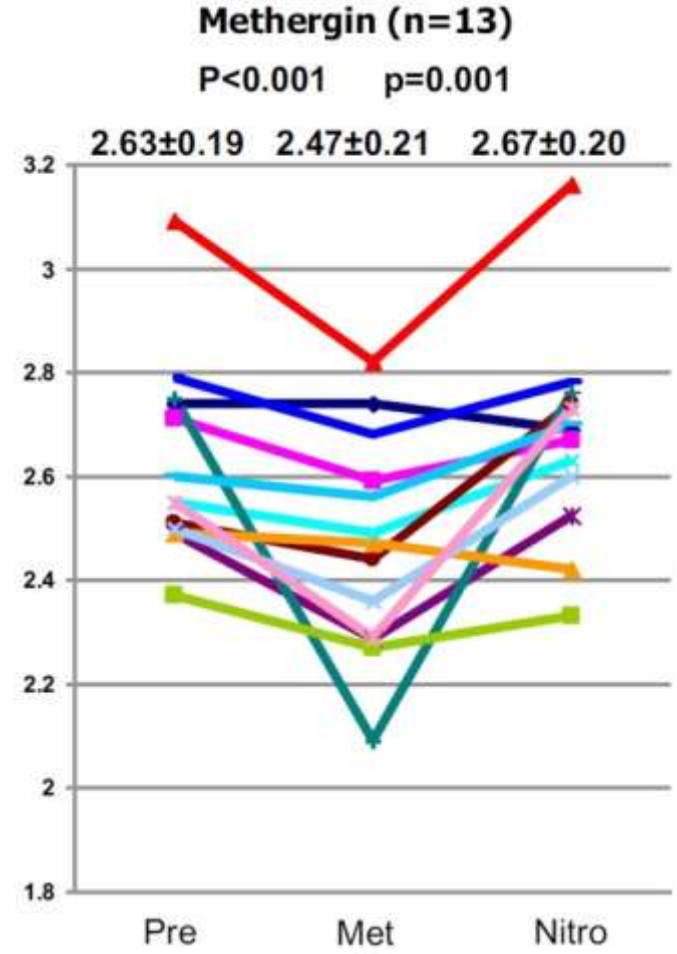
Curvature and angle changes after PCI in bending vessels: DES vs BVS

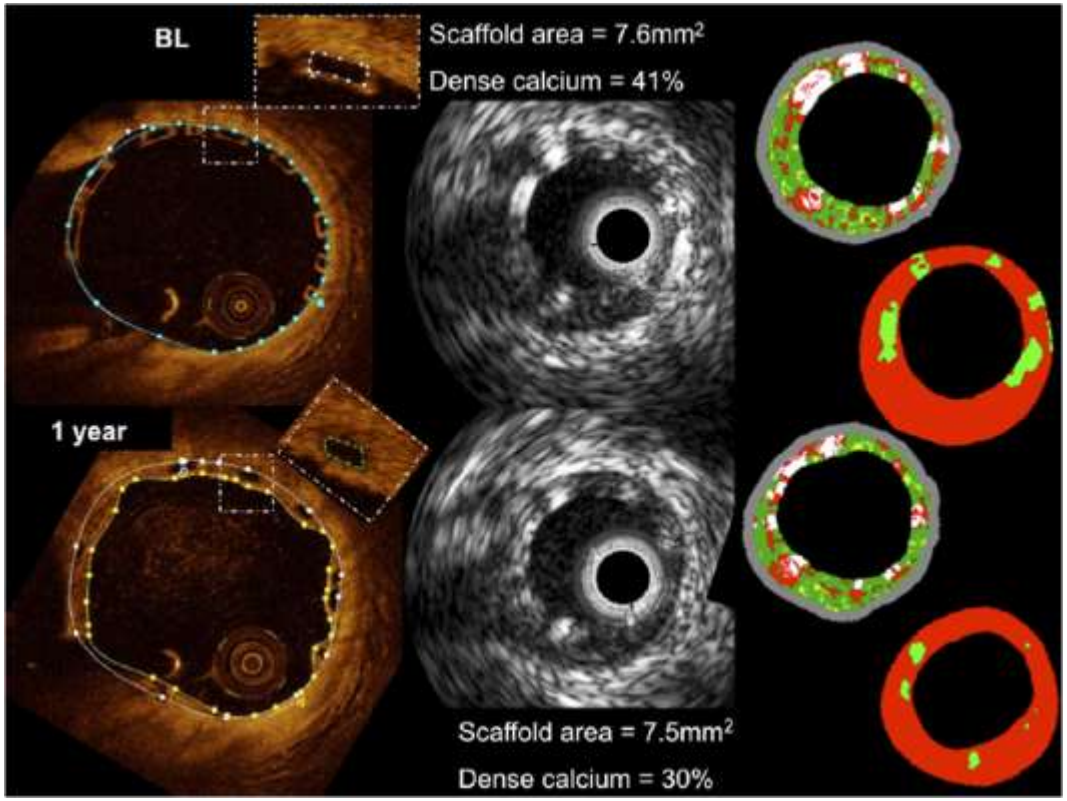


Gomez-Lara J et al, JACC Cardiovasc Interv. 2011;4:789-99

BVS: a tool for a complete healing of the vessel

Modifications of vasomotion and plaque composition after BVS implantation





Serruys PW et al, JACC 2011;58:1578-88

Techinical challanges

CTO-PCI

- Complex plaque morphology
- Long and sometimes very long occluded segments in bending coronary arteries
- Often subintimal neo-lumen reconstructed
- Intravascular imaging is warranted
- Cannulation of both coronary arteries with big lumen catheters (7 and 8 French)
- Good back-up, if necessary with extradevices

PCI with BVS

- Preferably guide catheter with large lumen
- Pre-dilatation as better as possible (stent-like)
- Importance of a accurate scaffold sizing
- When possible, post-dilatation with NC balloons at high pressure
- Use of imaging is mandatory for every step

CARDIOVASCULAR FLASHLIGHT

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Successful retrograde recanalization of chronic total coronary occlusion with multiple bioresorbable vascular scaffolds ('full polymer jacket'): initial experience and rationale

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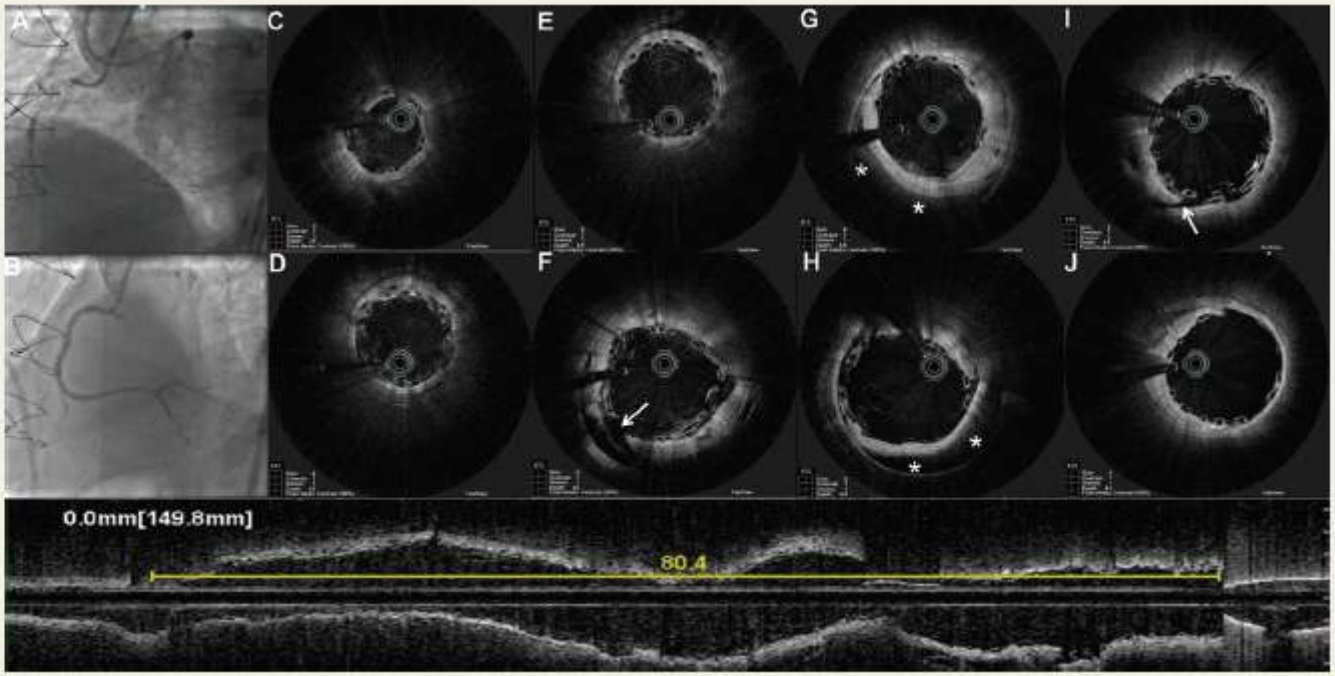
We report a successful retrograde recanalization of a chronic total occlusion (CTO) in the right coronary artery (*Panel A*) of a 58-year-old male and the implantation of four everolimus-eluting bioresorbable vascular scaffolds (BVS, Absorb, Abbot Vascular, Santa Clara, CA, USA), which we named 'full polymer jacket'. Excellent angiographic (*Panel B*) and optical coherence tomography (OCT, LUNAWAVE, Terumo Corp., Tokyo, Japan) results (longitudinal view, *Panels C–J*) were



GHOST-CTO registry

Technical and Procedural Success of BVS for CTO

- Systematic use of BVSs in 30 CTO-PCI between May 2013 and April 2014. Mean F-U 5 months, No events
- Techinical success:
  - CTO recanalization and BVS Implantation
  - Post-procedural residual stenosis <30% and TIMI 3 flow
- Procedural success:
  - No in-hospital MACE
- Optical Coherence Tomography analysis:
  - Scaffolded segments were analysed at each 1 mm interval
  - Overlap were analyzed frame by frame
  - Proximal and distal edge (5 mm) were analysed at each 1 mm interval

GHOST-CTO registry

QCA assessment

• J-CTO score	1.65±1.02	• Total number of BVSs implanted	82
• Length of occlusion	37.2±23.7 mm	• Number of BVSs for patient	2.73±1.361
• Antegrade Werner class	0.94±0.78	• Mean scaffold lenght	50.37±40.63 mm
• Retrograde Werner class	1.16±0.91	• Patients with «Hybrid percutaneous revascularization»	23% (7/30)
• Antegrade approach	93% (28/30)	• Delivery failure	3% (1/30)
• Switch to retrograde approach	7% (2/30)	• Residual stenosis > 30%	3% (1/30)
• Patients treated with at least one BVS	100%	• Technical success	93% (28/30)

GHOST-CTO registry

OCT analysis

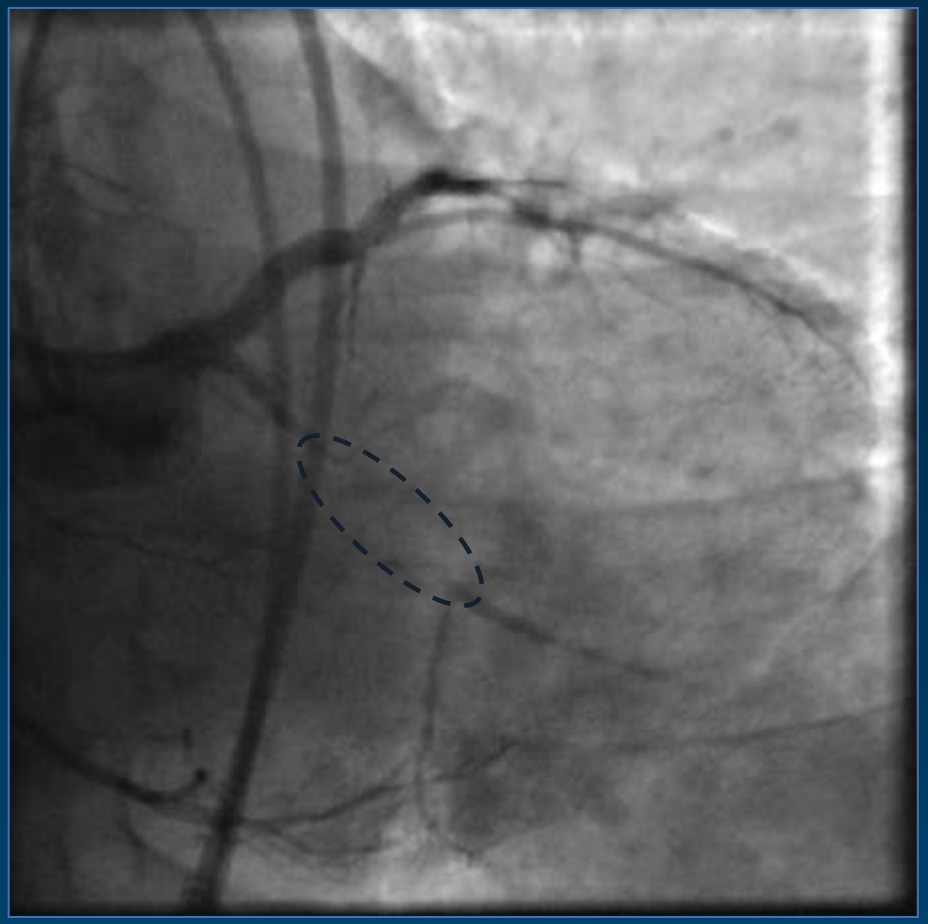
Non overlapping segments		Overlapping segments	
• Total frames analyzed	1234	• Scaffold area	11.22±1.73 mm²
• Scaffold area	9.45 ± 1.38 mm²	• Scaffold diameter	3.78±0.31 mm
• Scaffold diameter	3.13 ± 0.29 mm	• Percentage of frames with scaffold area < 5 mm²	0% (0/397)
• Percentage of frames with scaffold area < 5 mm²	4% (47/1234)	• Scaffold eccentricity index	85.67 ± 6.87
• Scaffold eccentricity index	89.47 ± 7.09	• Total overlapping lenght	79.4 mm
• Mean malapposition distance	14 μm	• Mean malapposition distance	10 μm
• Sub-media edge dissection	8% (2/26)	• Mean inner scaffold malpposed distance	10 μm

CTO clinical case - Clinical features

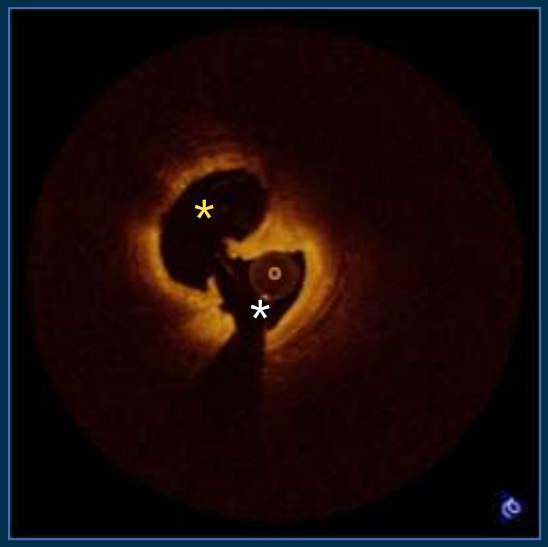
- 62 years old, Caucasian Male
- Hypertension
- Former smoker
- Prior PCI in 2010 on LAD and RCA with DES
- March 2013: stable angina (CCS 3); CTO LCX-OM
- LVEF 52% - MR 12% ischemia in lateral

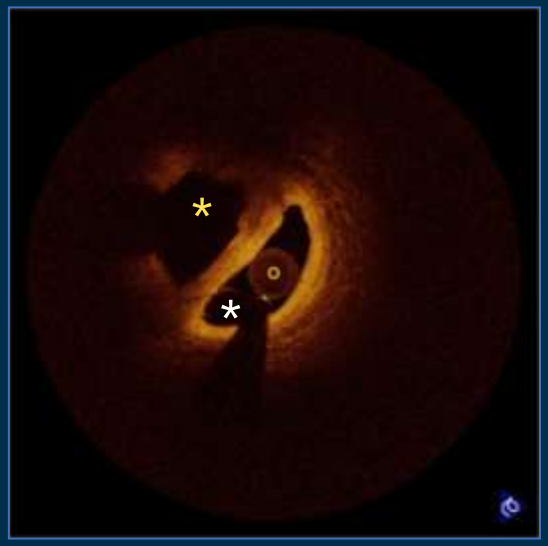
CTO clinical case

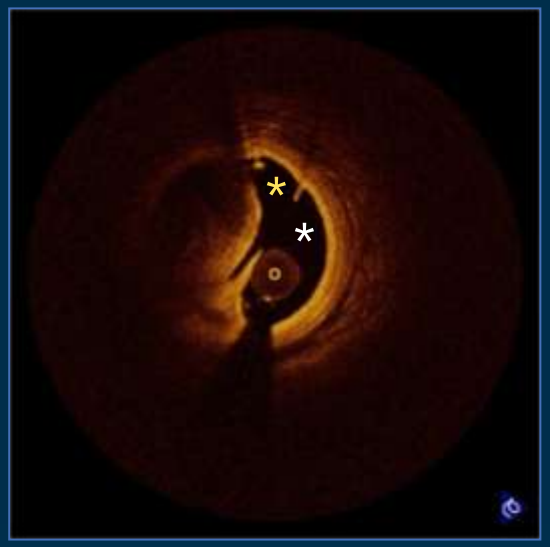
J-CTO score 2

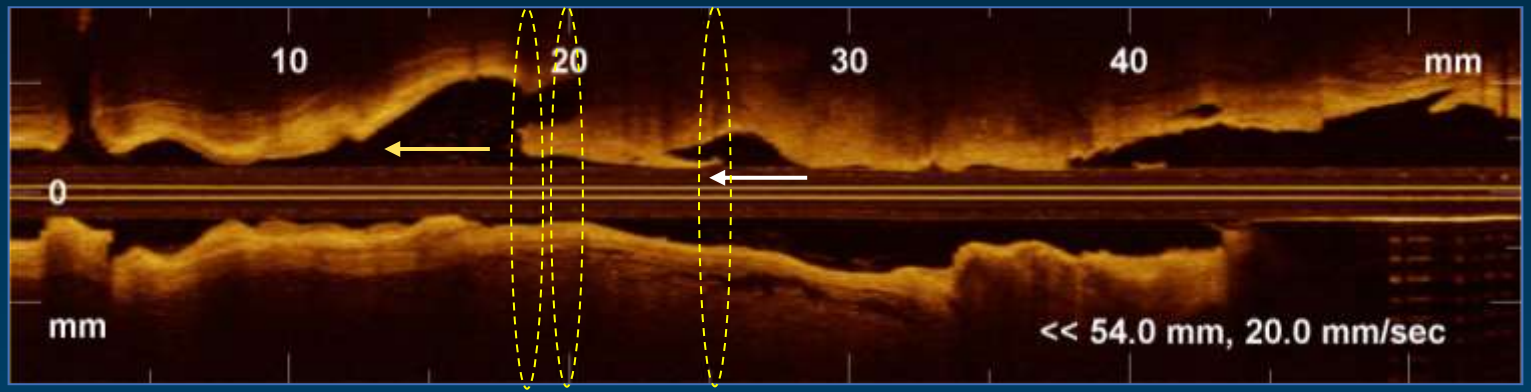


CTO clinical case



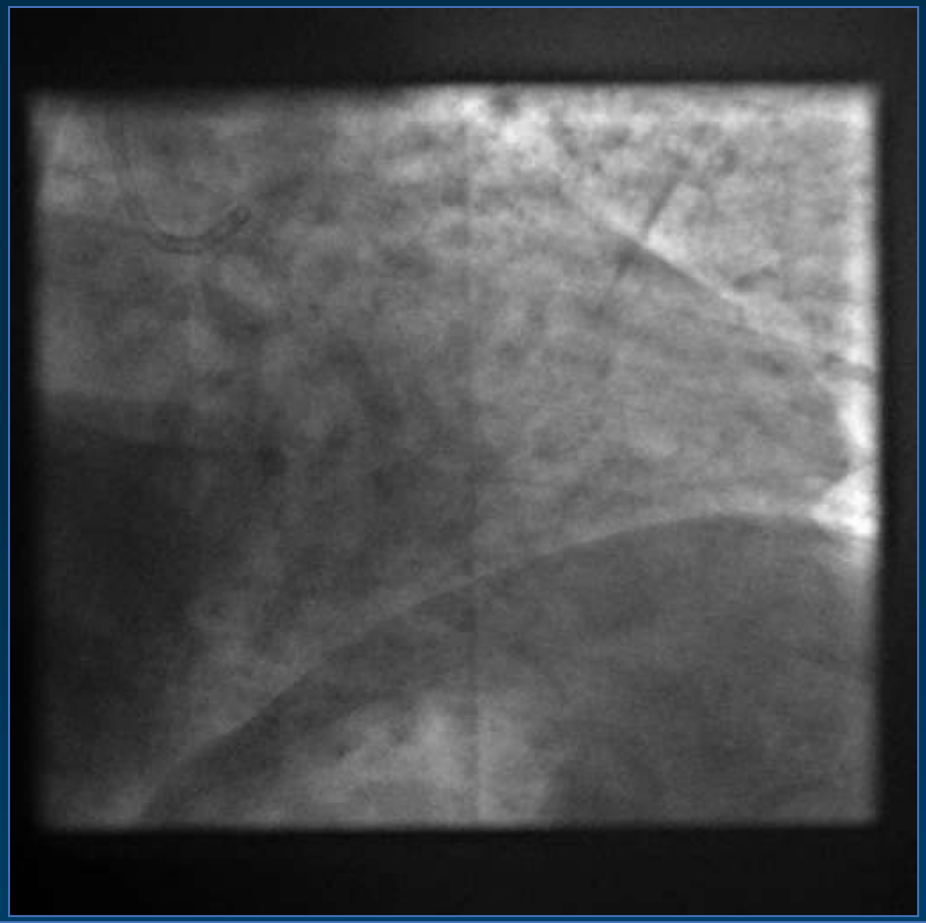






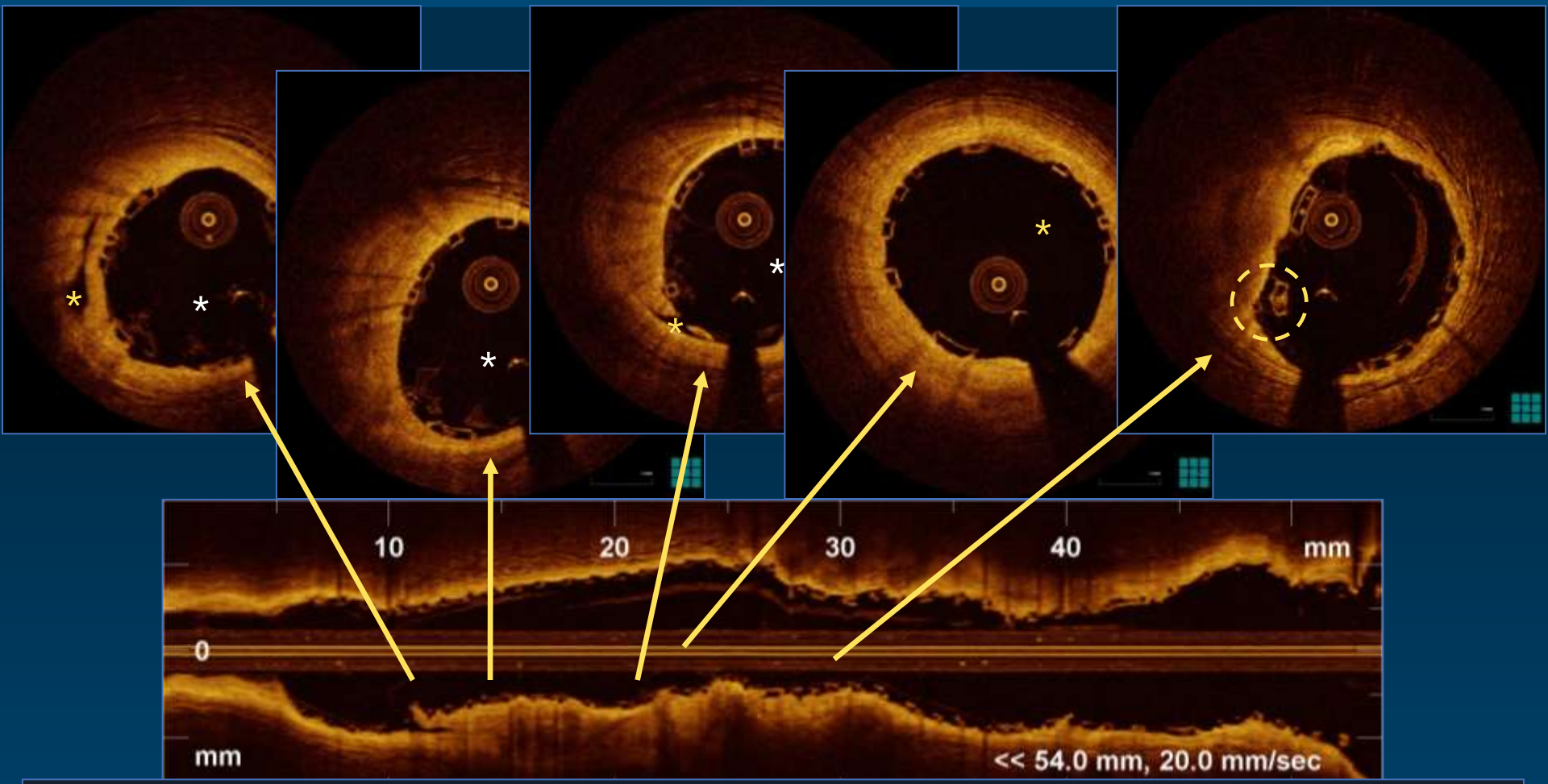
- OCT Long-view – exit (white arrow) and re-entry point (yellow arrow) of true lumen
- OCT cross-sections – false lumen (white asterisks) and true one (yellow asterisks)

CTO clinical case



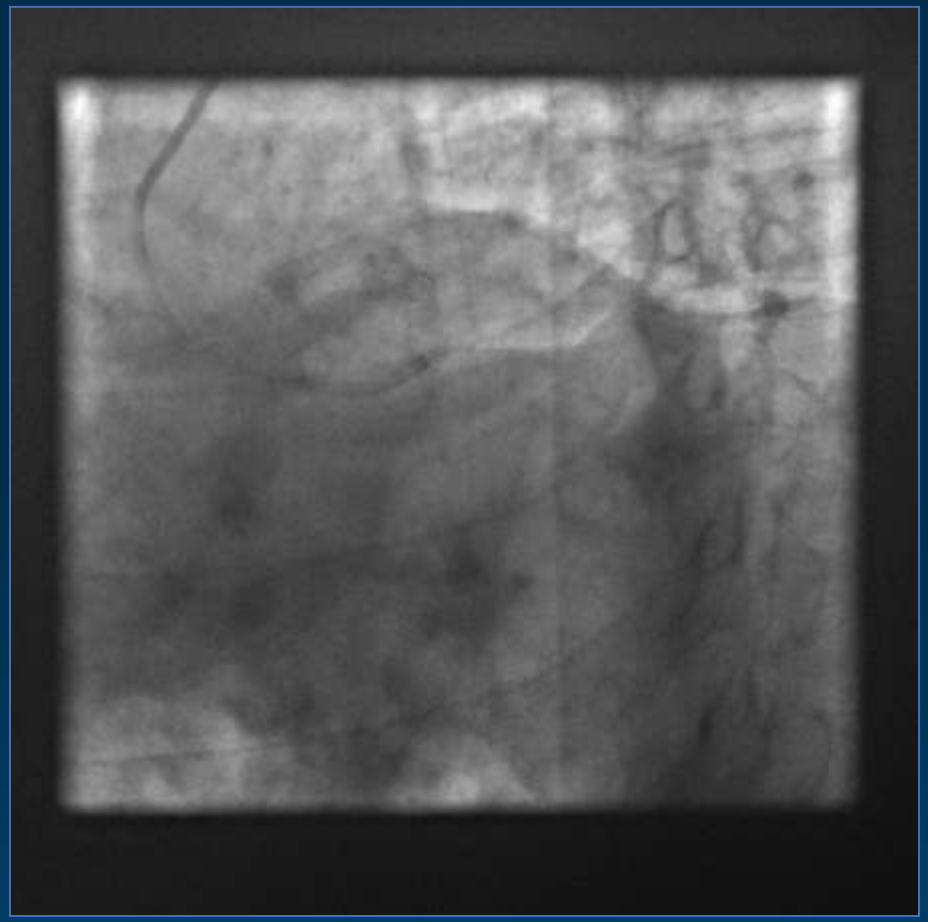
FINAL

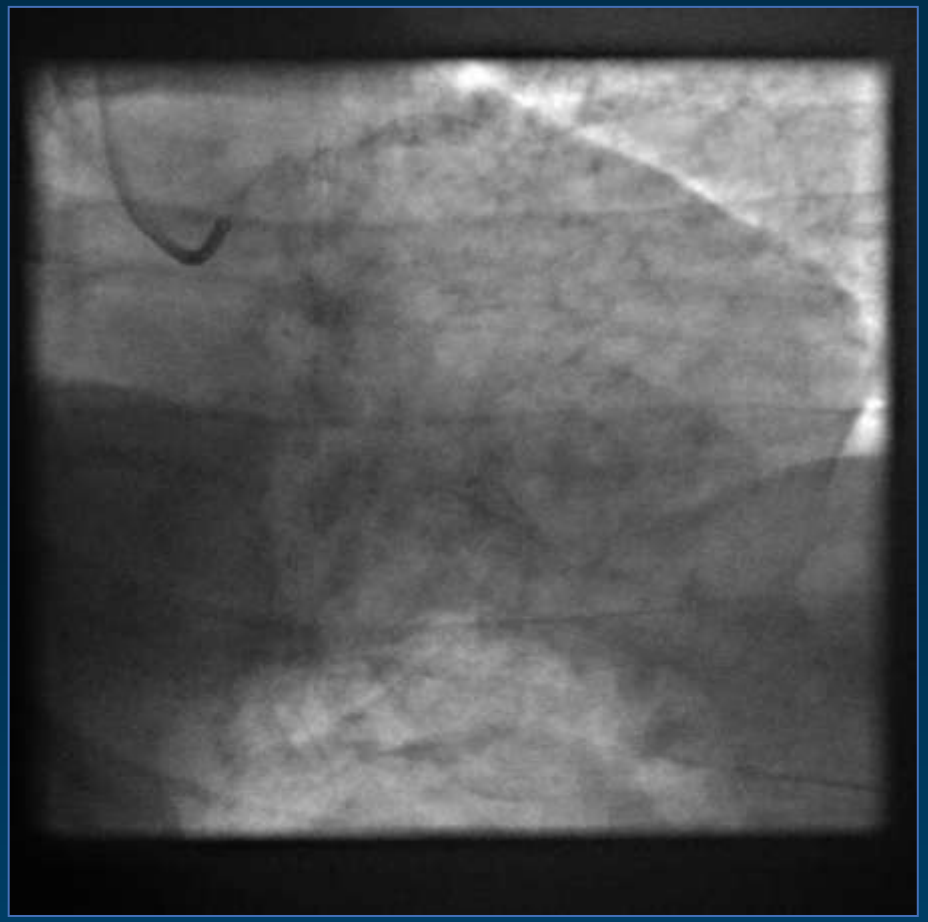
CTO clinical case



- Visible both the false lumen (white asterisks) and the true one (yellow asterisks)
- Minimum incomplete apposition between scaffolds in overlapping region (23 μm)

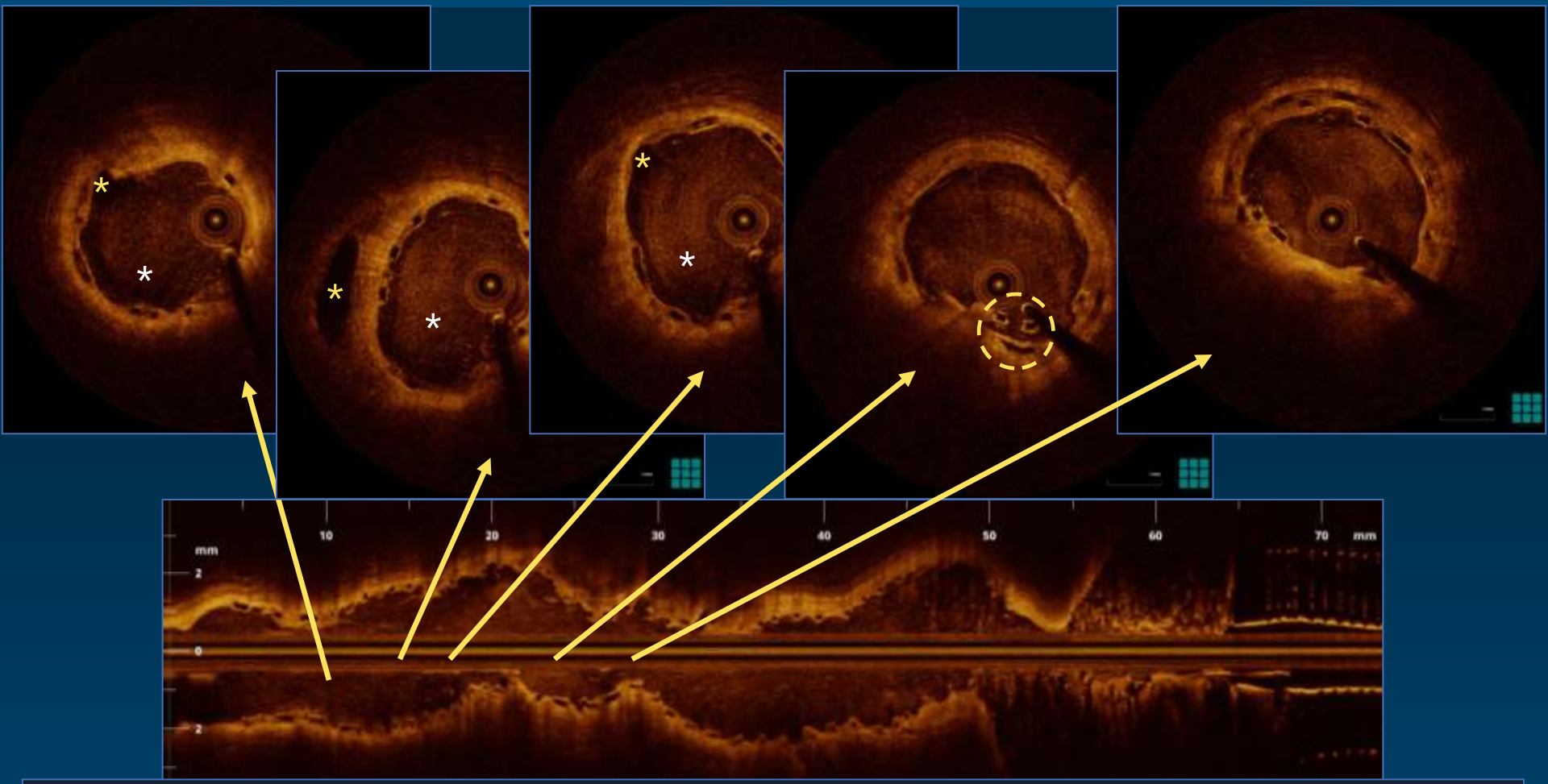
CTO clinical case – 11 m Follow-up





- Coronary angiography – good result of previous PCI on LCX-OM, TIMI 3 flow
- Coronary angiography – distal part of LCx still partly visible

CTO clinical case – 11 m Follow-up



- False lumen (white asterisks) and true one (yellow asterisks)
- In overlap, minimum incomplete apposition between scaffolds depicted (23 μm)

Conclusions

- After adequate lesion preparation («STENT-LIKE»), BVS implantation is feasible, even in challenging lesion subsets, as CTOs
- Imaging is crucial for BVS implantation in CTO
- In the long-term, results of BVS in CTO can improve avoiding malapposition and promoting vascular restoration
- Long-Term F-U is warranted