

**Erasmus MC**

Universitair Medisch Centrum Rotterdam



*The latest update: Invasive Imaging*

# Imaging-Guidance for Bioresorbable Scaffold Implantation



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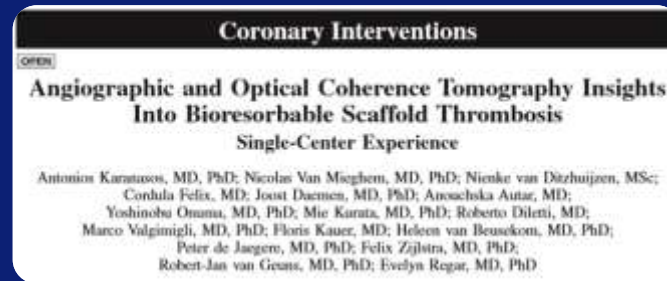
## Disclosure

- The institution Erasmus MC receives research support from St. Jude Medical and consultancy fees from Boston Scientific.

# Imaging Guidance for BVS Implantation Update – What's New in 2016?

## Device Failure

## BVS Thrombosis



## Main Pathomechanisms

- **Incomplete lesion coverage**
- **Underexpansion &**
- **Malapposition**

## Operator Failure

**Seems to be triggered by implantation technique and thus, potentially avoidable**

# Imaging Guidance for BVS Implantation Update – What's New in 2016?

## Device Failure

## BVS Thrombosis

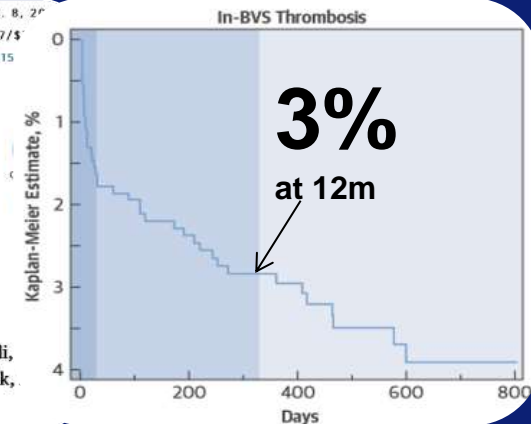
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### Bioresorbable Coronary Scaffold Thrombosis

Multicenter Comprehensive Analysis of Clinical Presentation, Mechanisms, and Predictors

Serban Puricel, MD,<sup>a</sup> Florim Cuculi, MD,<sup>b</sup> Melissa Weissner, MTA,<sup>c</sup> Axel Schermund, MD,<sup>d</sup> Peiman Jamshidi, Tobias Nyffenegger, MD,<sup>b</sup> Harald Binder, PhD,<sup>e</sup> Holger Eggebrecht, MD,<sup>d</sup> Thomas Münzel, MD,<sup>c</sup> Stephane Cook, Tommaso Gori, DOTT MED CHIR, PhD<sup>c</sup>



Multi-center, all comer registry, n=1305 pts

## Operator Failure

“can be reduced by  $\approx 70\%$  using a specific implantation technique”

# Imaging Guidance for BVS Implantation Update – What's New in 2016?

## Emphasis on implantation technique:

**Scaffold diameter must not be too SMALL**

**Scaffold diameter must not be too LARGE**

**Scaffold expansion must not be OPTIMAL**

# If BVS Diameter Is Selected Too SMALL: Struts Can Break!

Key issue with the ABSORB scaffold

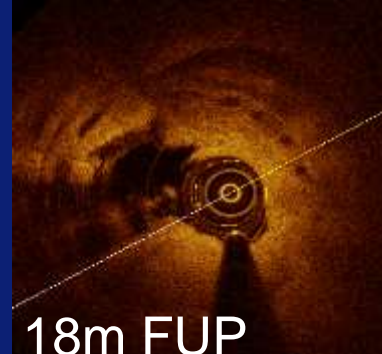
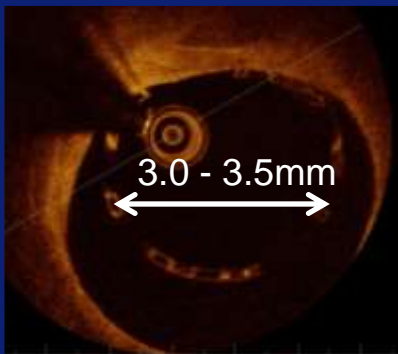
Limited range of expansion

2.5 mm scaffold → up to 3.0mm

3.0 mm scaffold → up to 3.5mm

3.5 mm scaffold → up to 4.0mm

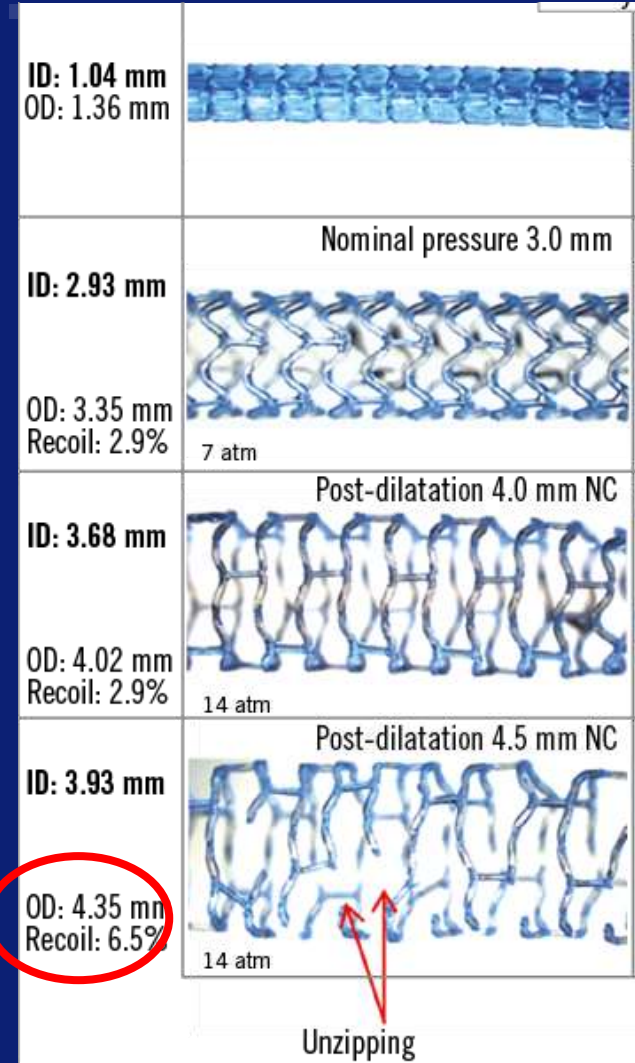
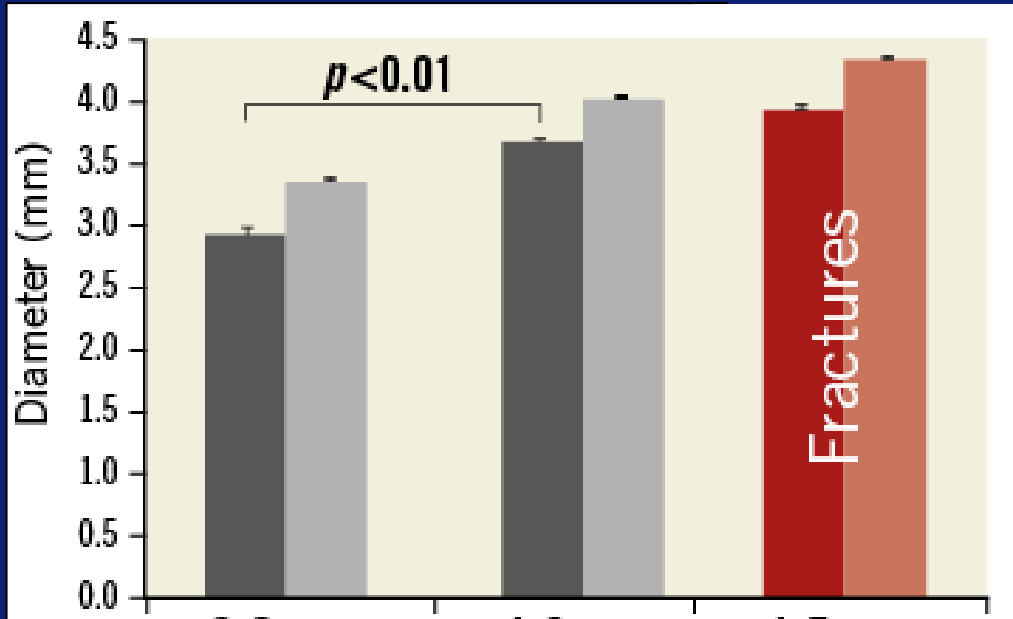
Beyond that range, struts can break when postdilated.



# If BVS Diameter Is Selected Too SMALL: Struts Can Break!

BVS overexpansion:  
in vitro post-expansion experiments

## BVS 3.0 Post-dilatation



Diameter 3.0                      4.0                      4.5mm

# BVS Diameter Is Selected Too LARGE

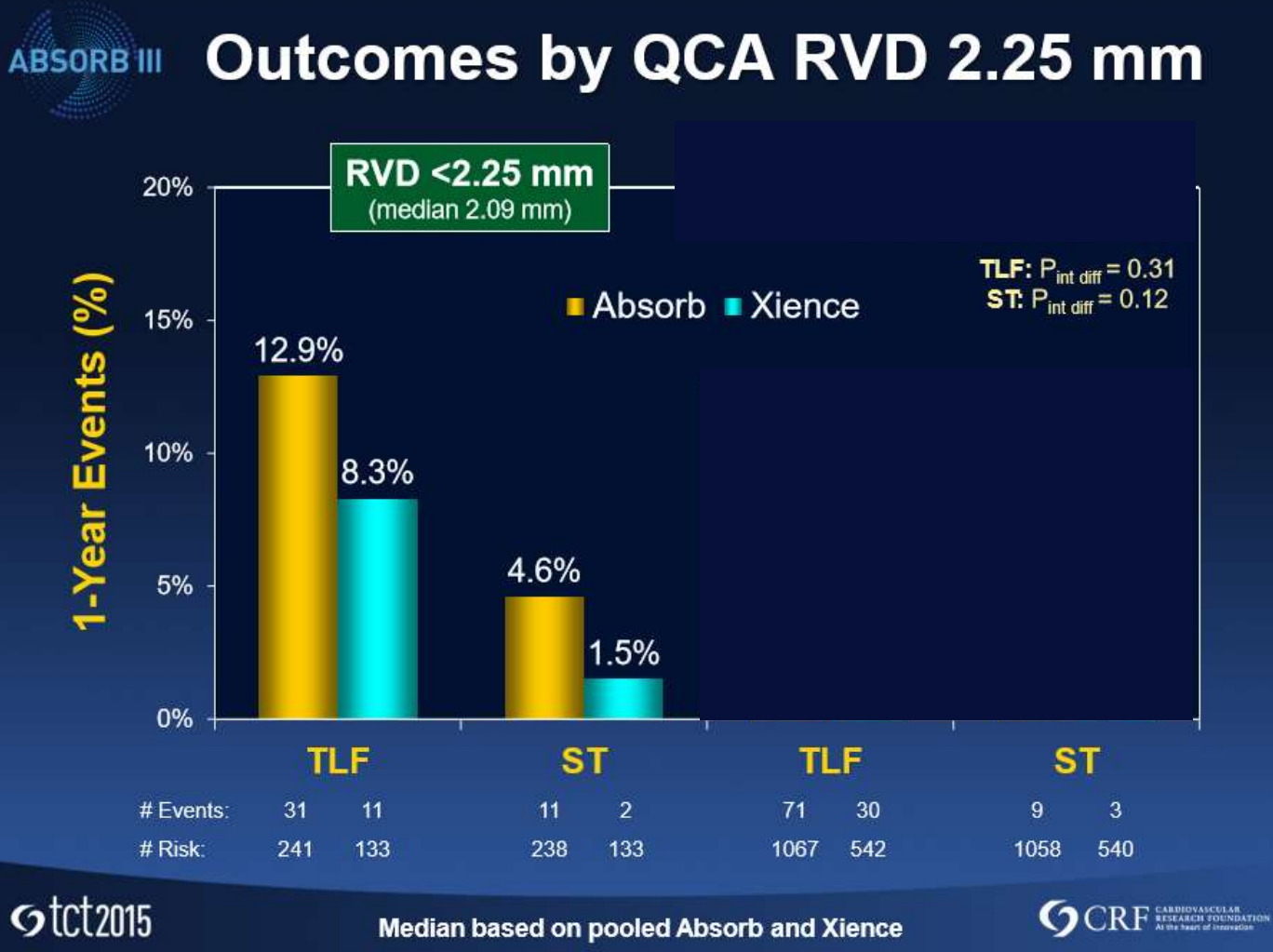


# BVS Diameter Is Selected Too LARGE For The Target Vessel: Not An Uncommon Finding

## ABSORB III Baseline Lesion Characteristics (QCA)

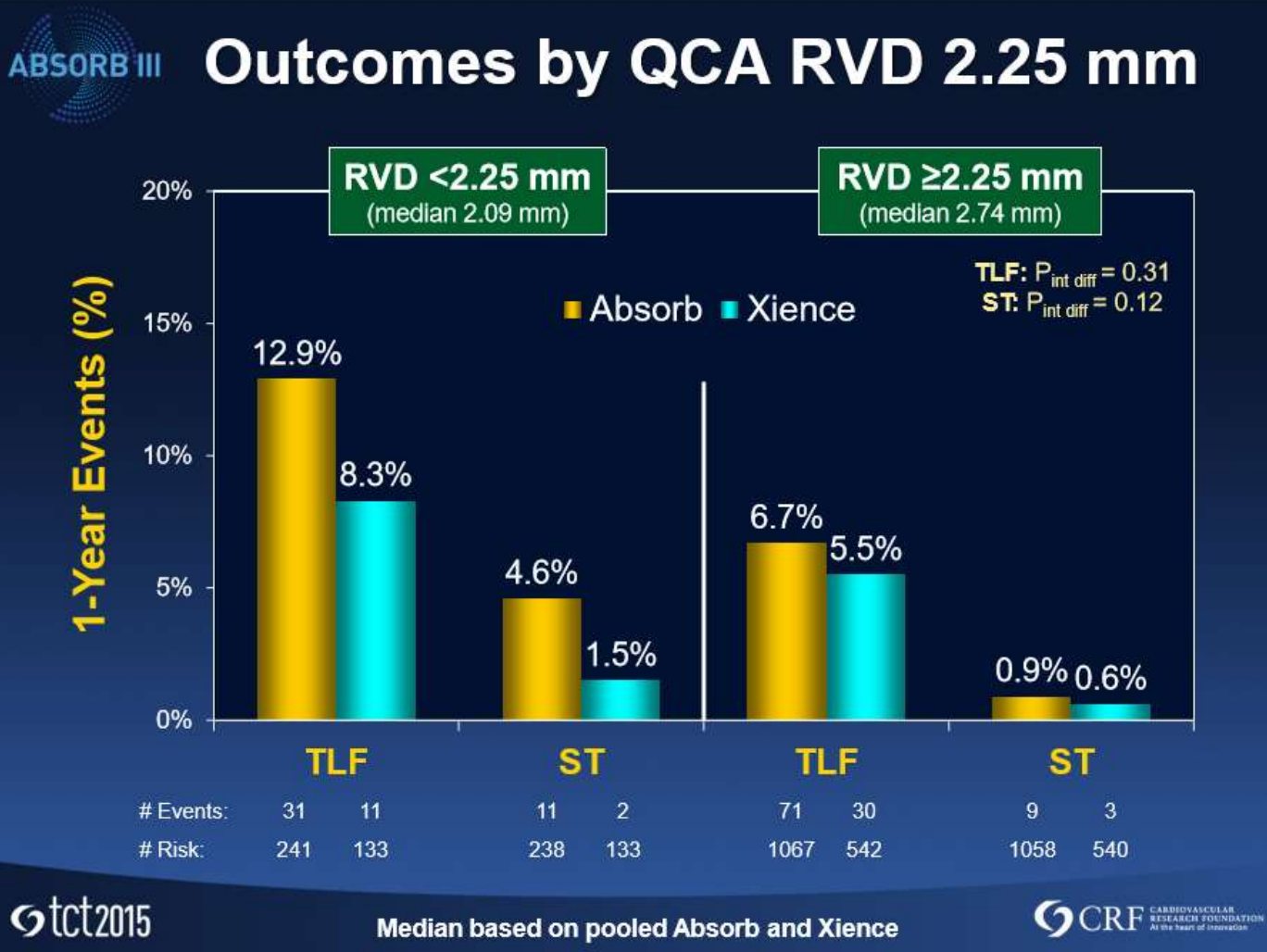
Characteristic	Absorb (N=1322) (L=1385)	Xience (N=686) (L=713)	p-value
ACC/AHA lesion class B2/C	68.7%	72.5%	0.08
# of target lesions treated	1.0 ± 0.2	1.0 ± 0.2	0.38
One	95.1%	96.1%	0.32
Two	4.8%	3.9%	0.36
Target lesion			
LAD	44.5%	42.2%	0.31
RCA	29.2%	27.2%	0.35
Circumflex	26.2%	30.6%	0.03
Lesion length, mm	12.60 ± 5.41	13.12 ± 5.82	0.05
RVD < 2.25mm	18%	19%	0.39
RVD ≥ 2.25mm	82%	81%	0.11
%DS	65.3 ± 12.5	65.9 ± 11.7	0.24

# BVS Diameter Is Selected Too LARGE For The Target Vessel: Impact on TLF & ST



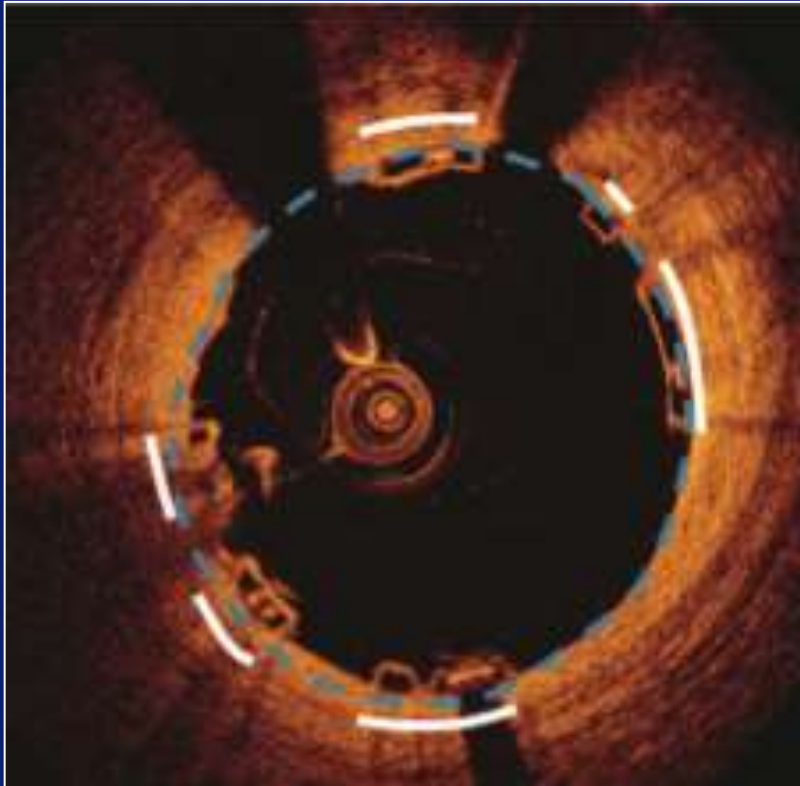
TLF: Target Lesion Failure  
ST: Scaffold Thrombosis

# BVS Diameter Is Selected Too LARGE For The Target Vessel: Impact on TLF & ST



TLF: Target Lesion Failure  
ST: Scaffold Thrombosis

# If BVS Diameter Is Selected Too LARGE: Footprint Concept



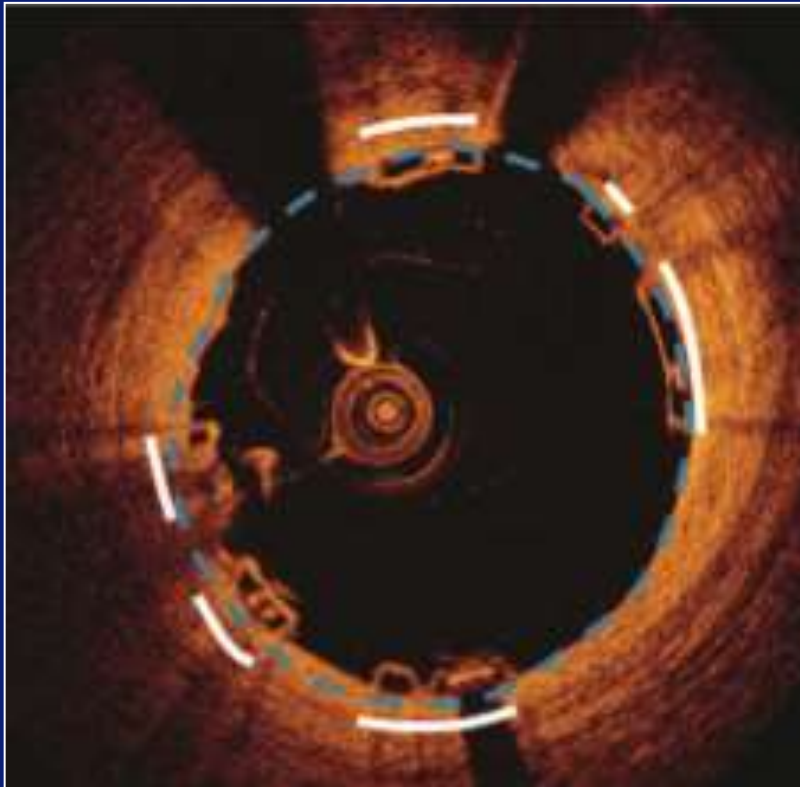
Footprint 26 %

Footprint (%) =

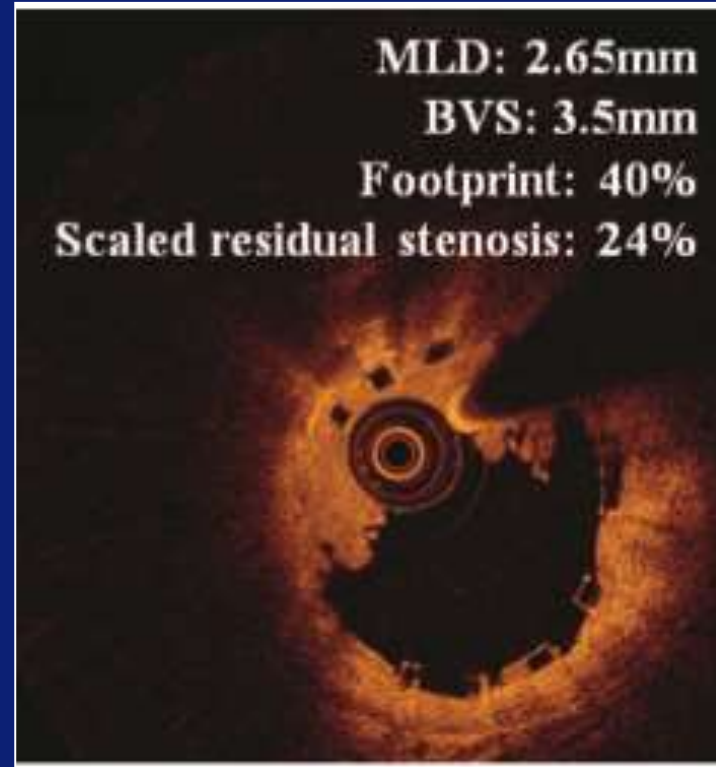
 fraction covered by struts

 lumen circumference

# If BVS Diameter Is Selected Too LARGE: Footprint Concept



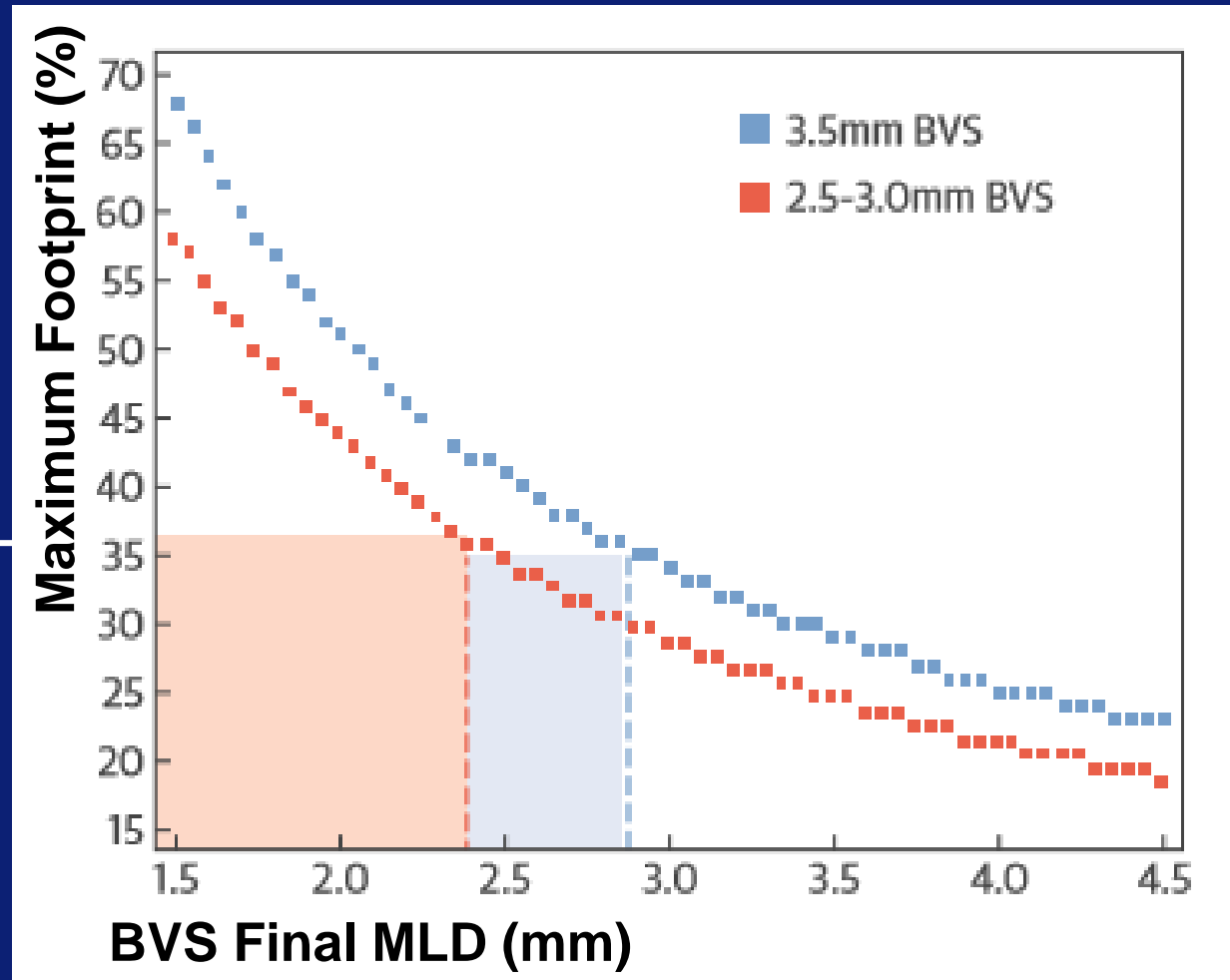
**Footprint 26 %**



**Footprint 40 %**

# If BVS Diameter Is Selected Too LARGE: Footprint Is a Function of MLD & BVS Outer Surface Area

>36% ←  
suspected  
treshold for  
increased  
thrombosis risk





## The Problem Really Is....

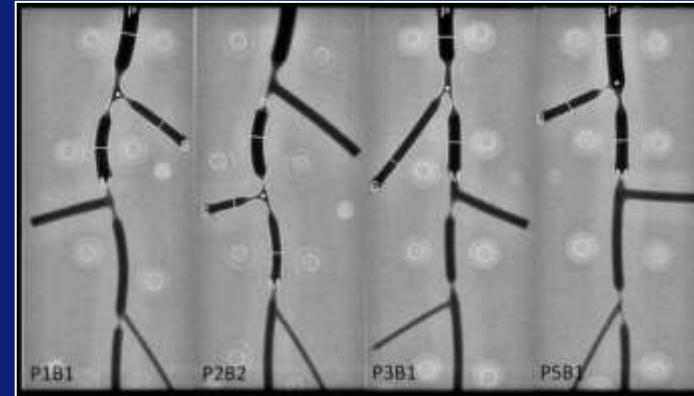


# Angiography Is A Poor Tool

# Angiography Is A Poor Tool To Visualize Coronary Dimensions

*Visual  
assessment of stenosis severity  
is poor!*

poor validity and high variability



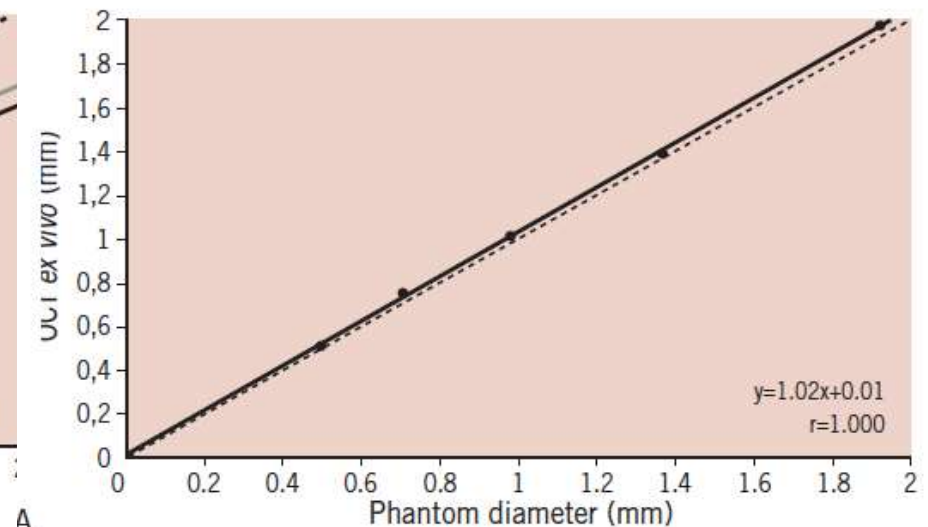
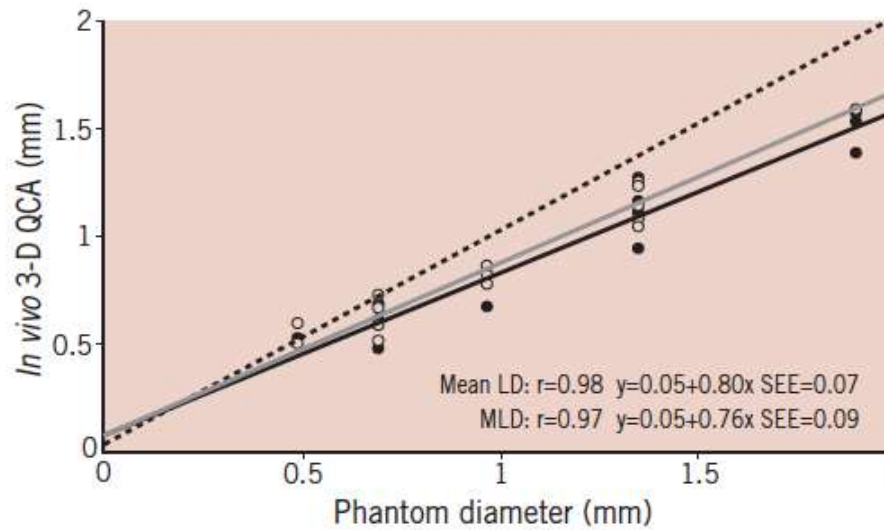
36 experts assessed % stenosis in phantom lesions

- Overestimated = 49 %
- Underestimated = 26 %
- **Exact = 25%**

# Angiography Is A Poor Tool To Visualize Coronary Dimensions

**QCA**  
underestimates  
the lumen dimension !

**OCT** provides the  
correct lumen  
dimension.



**In vivo validation of a novel three-dimensional quantitative coronary angiography system (CardiOp-B™): comparison with a conventional two-dimensional system (CAAS II™) and with special reference to optical coherence tomography**

Naohito Tsuchida, MD, PhD; Willem J. van der Giessen, MD, PhD; Mark Patterson, MRCP; Shunzo Sasamoto, MD; Hector M. Garcia-Garcia, MD, MSc; Ewgeny Bogun, MD, PhD; Jurgens M. R. Ligthart, BSc; Anne-Marie Magerman; Gio Maria Ucci; Jozsef J. Wesszel, PhD; Patrick W. Serruys, MD, PhD, FACC, FESC

Interactome, Coronary Revascularization, Rotterdam, The Netherlands

# Angiography Is A Poor Tool To Visualize Lesion Length



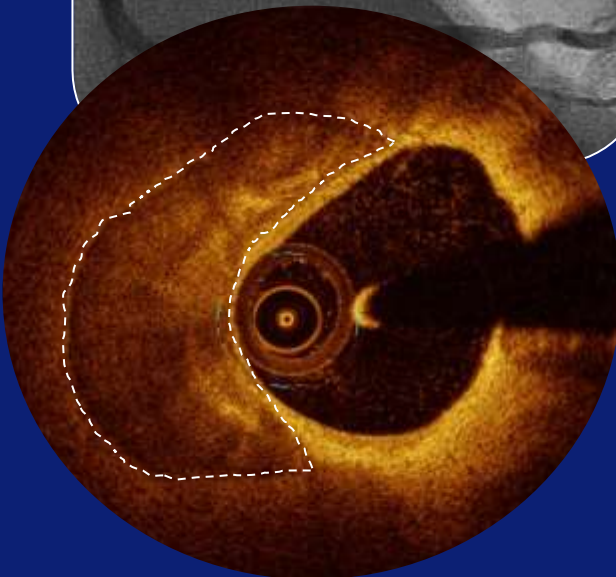
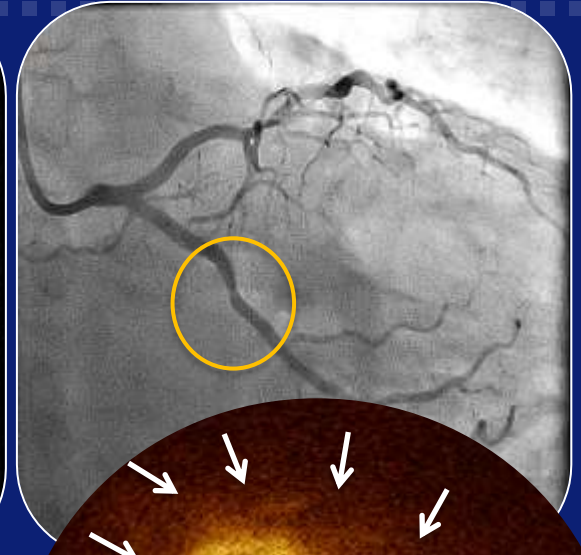
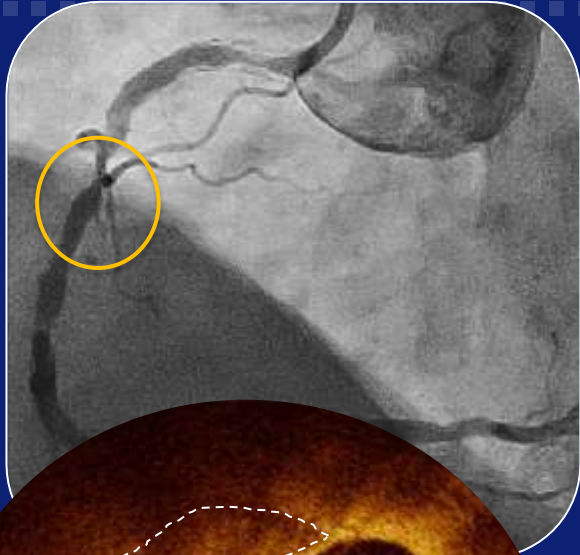
19,19 mm

21,01 mm

24,51 mm

Same vessel, different projections, different lengths.

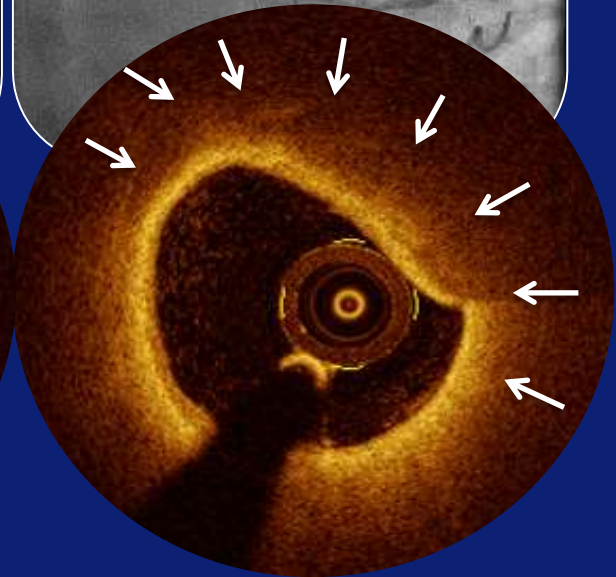
# Angiography Is A Poor Tool To Visualize Lesion Composition (Lesion Preparation?)



**Calcific**

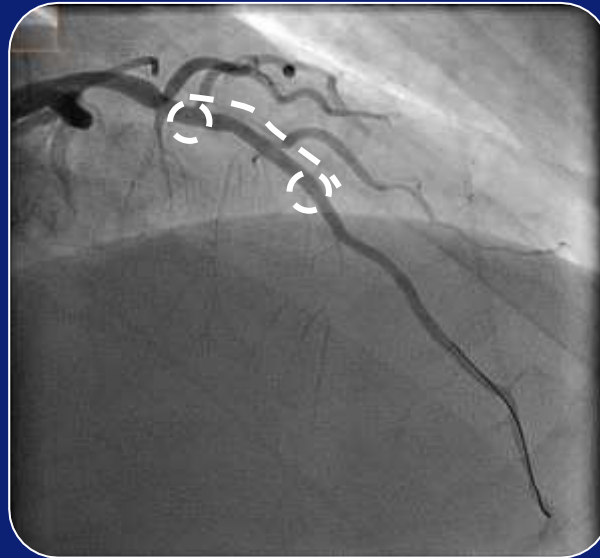
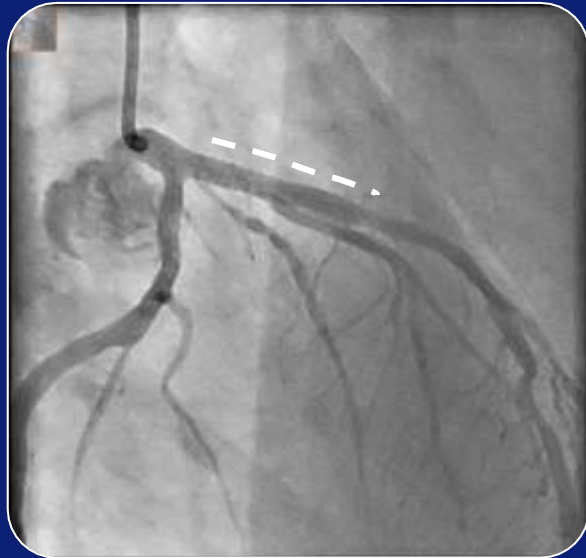


**Fibrous**



**Lipid-rich  
Fibroatheroma**

# Angiography Is A Poor Tool To Visualize Stents & Scaffolds



**Xience V™ DES**

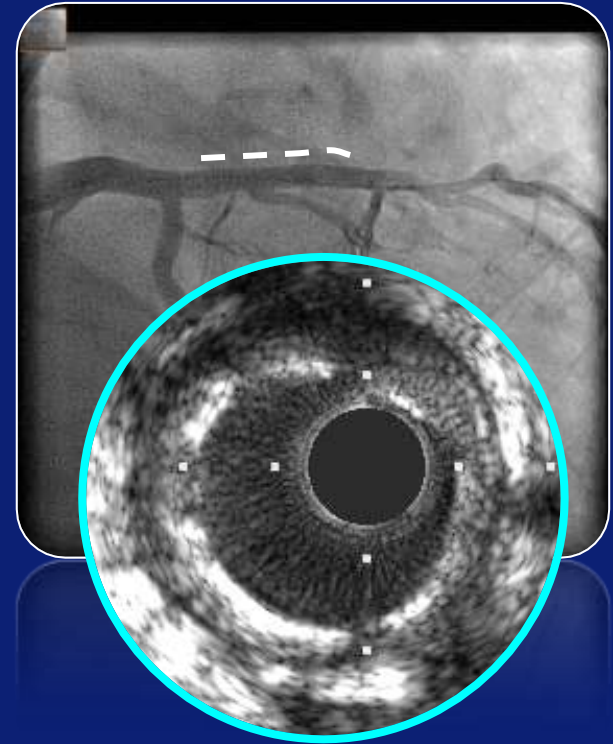
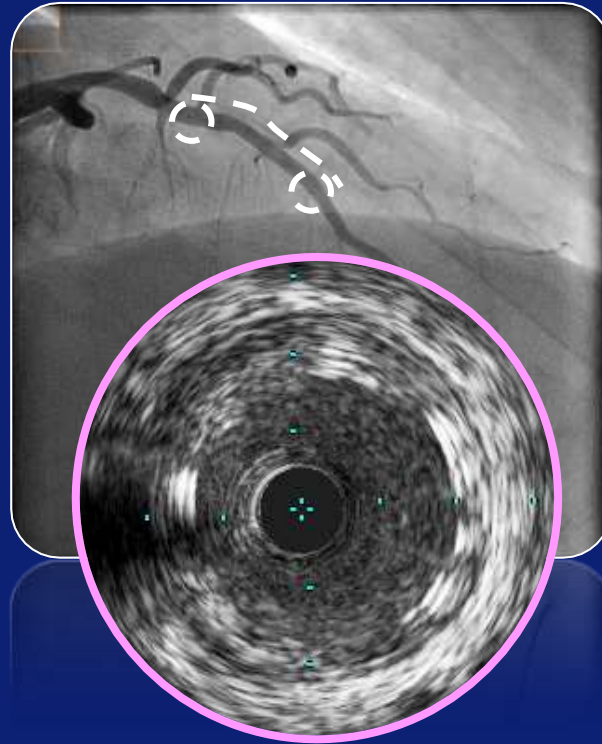


**Abbott Absorb™ BVS**



**REVA Phantom™ BVS**

# Angiography Is A Poor Tool IVUS Can Visualize Stents & Scaffolds

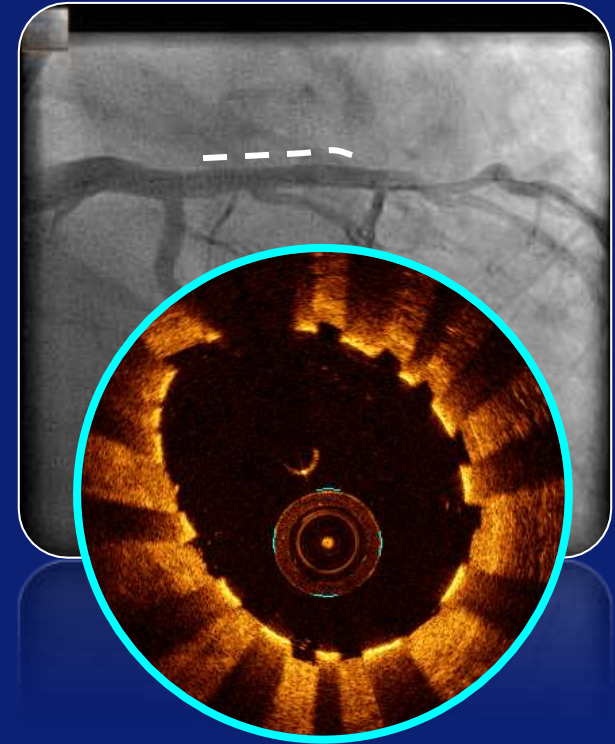
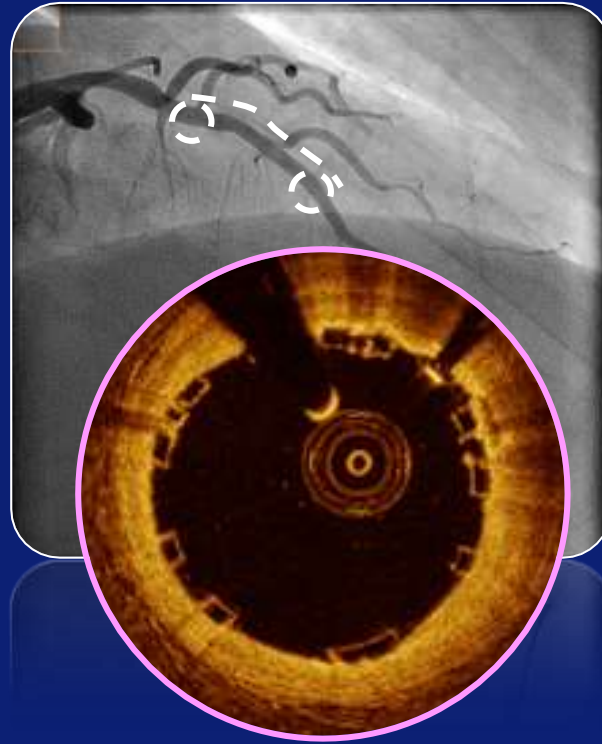


**Xience V™ DES**

**Abbott Absorb™ BVS**

**REVA Phantom™ BVS**

# Angiography Is A Poor Tool OCT Can Visualize Stents & Scaffolds



**Xience V™ DES**

**Abbott Absorb™ BVS**

**REVA Phantom™ BVS**



# A Solution....

**To use the gold standard**

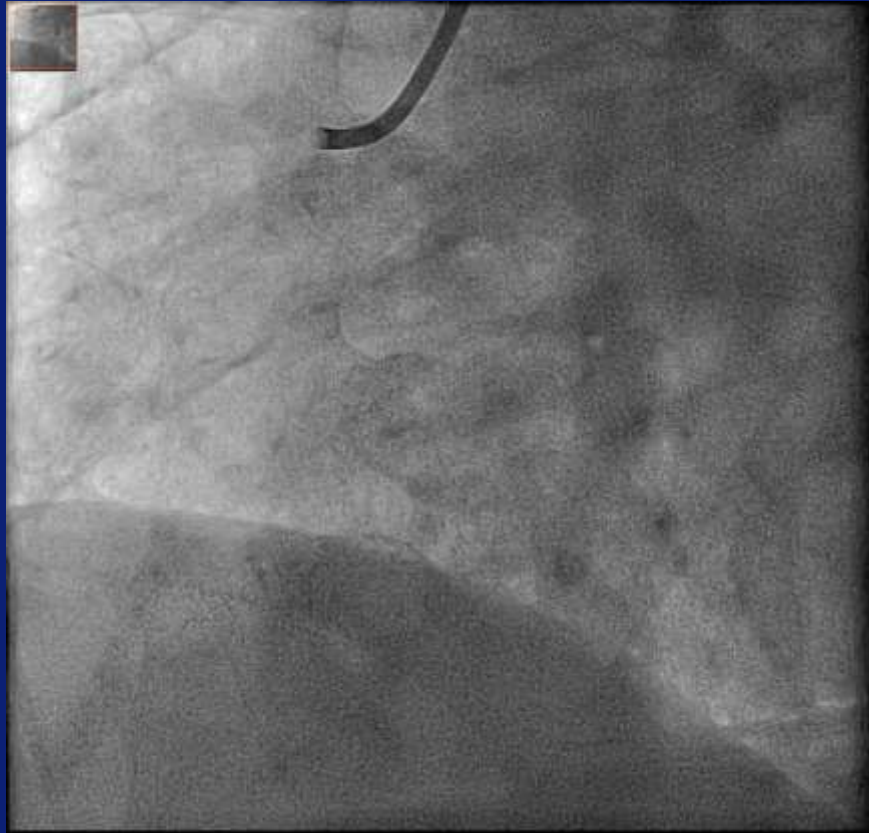
**for the assessment of vascular dimensions  
for the visualization of BVS**

**Invasive coronary imaging: IVUS & OCT**

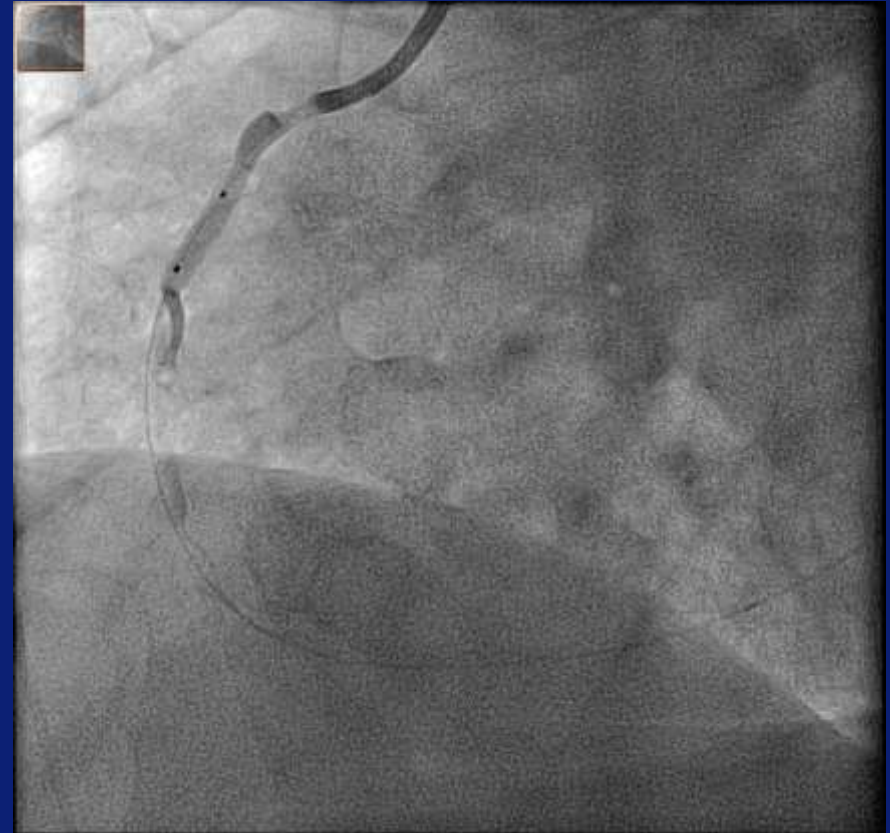
# OCT To Guide BVS Implantation

## Case Example

*NSTEMI; 62 year old male, active smoker, medical history: CVA*

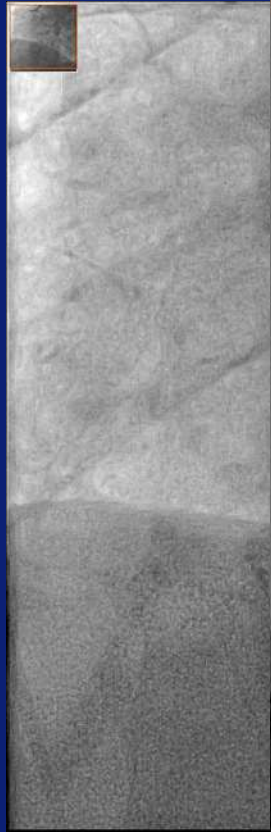


*Pre-interventional*

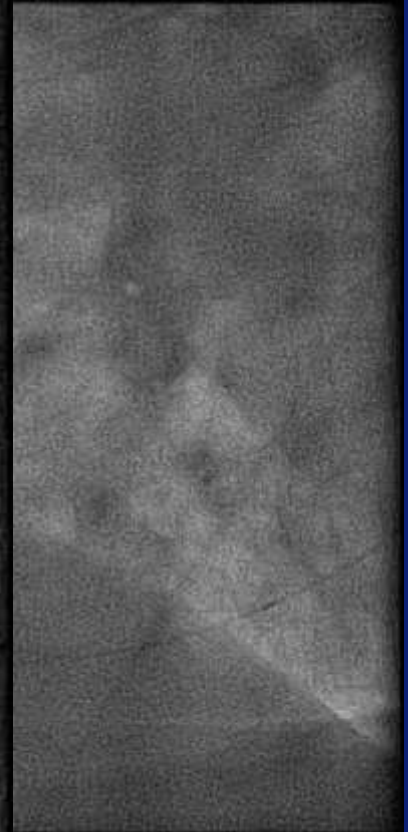
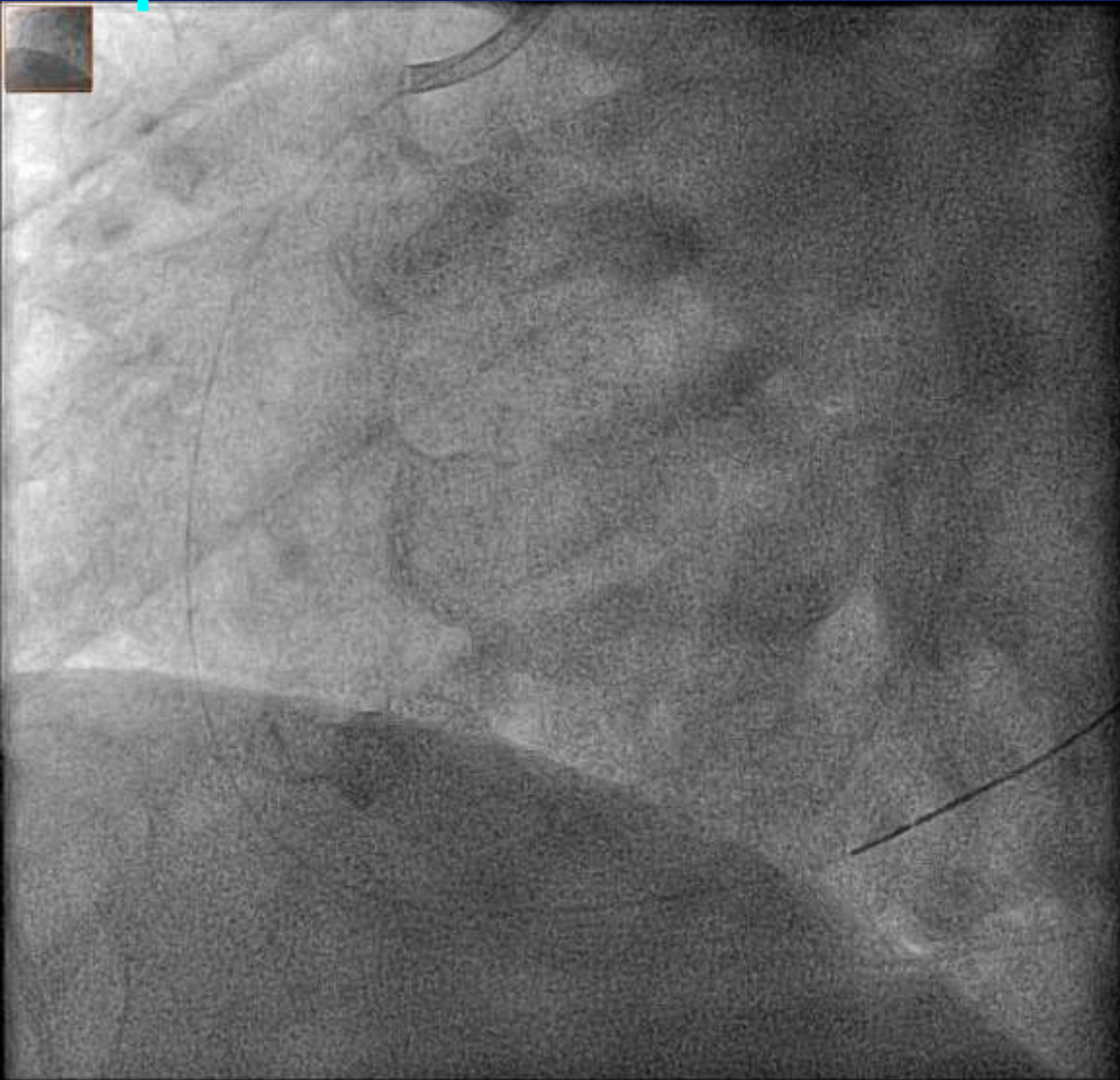


*Predilation with Sprinter  
2.5x10 mm balloon*

# OCT To Guide BVS Implantation Case Example



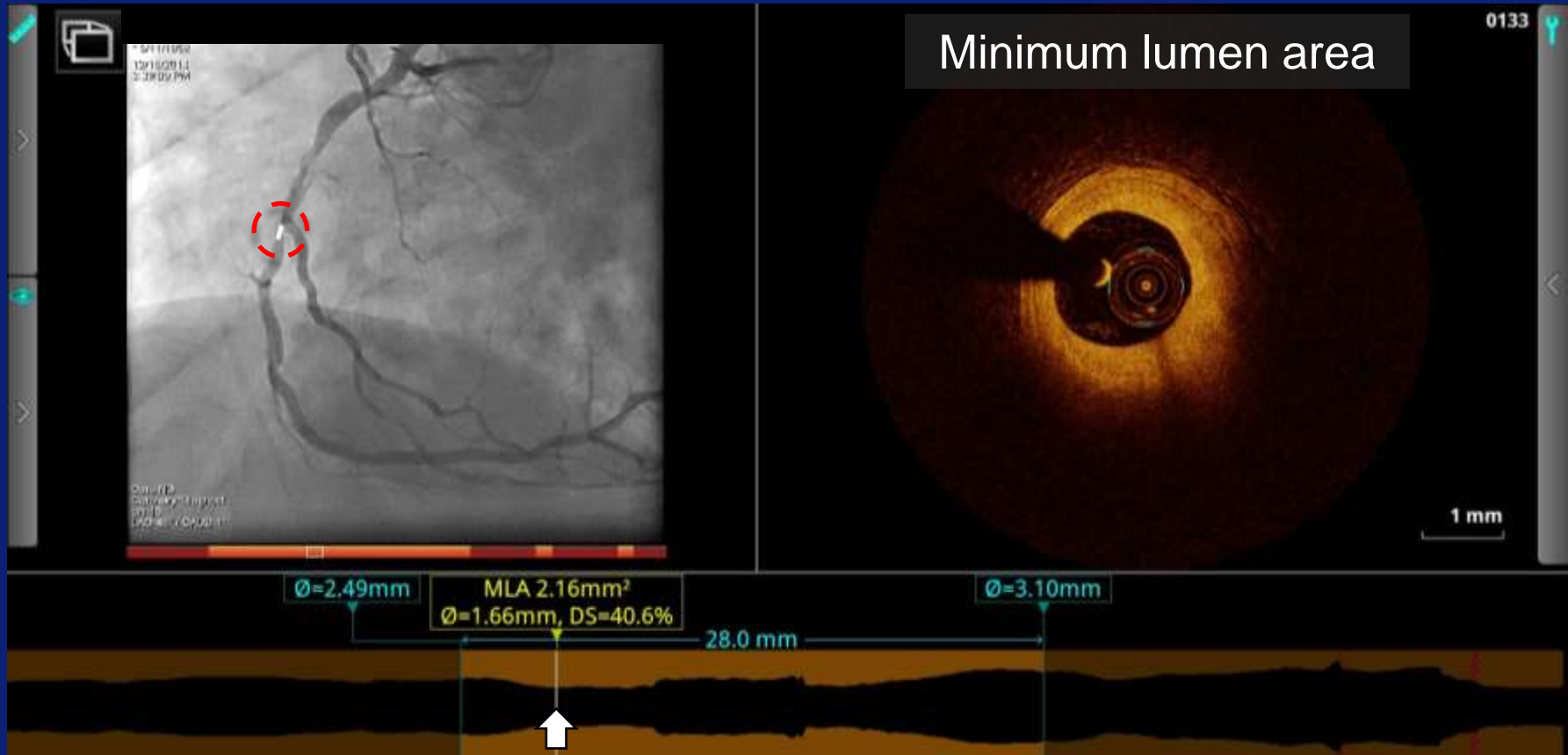
*Pre-intervention*



*Post-intervention*

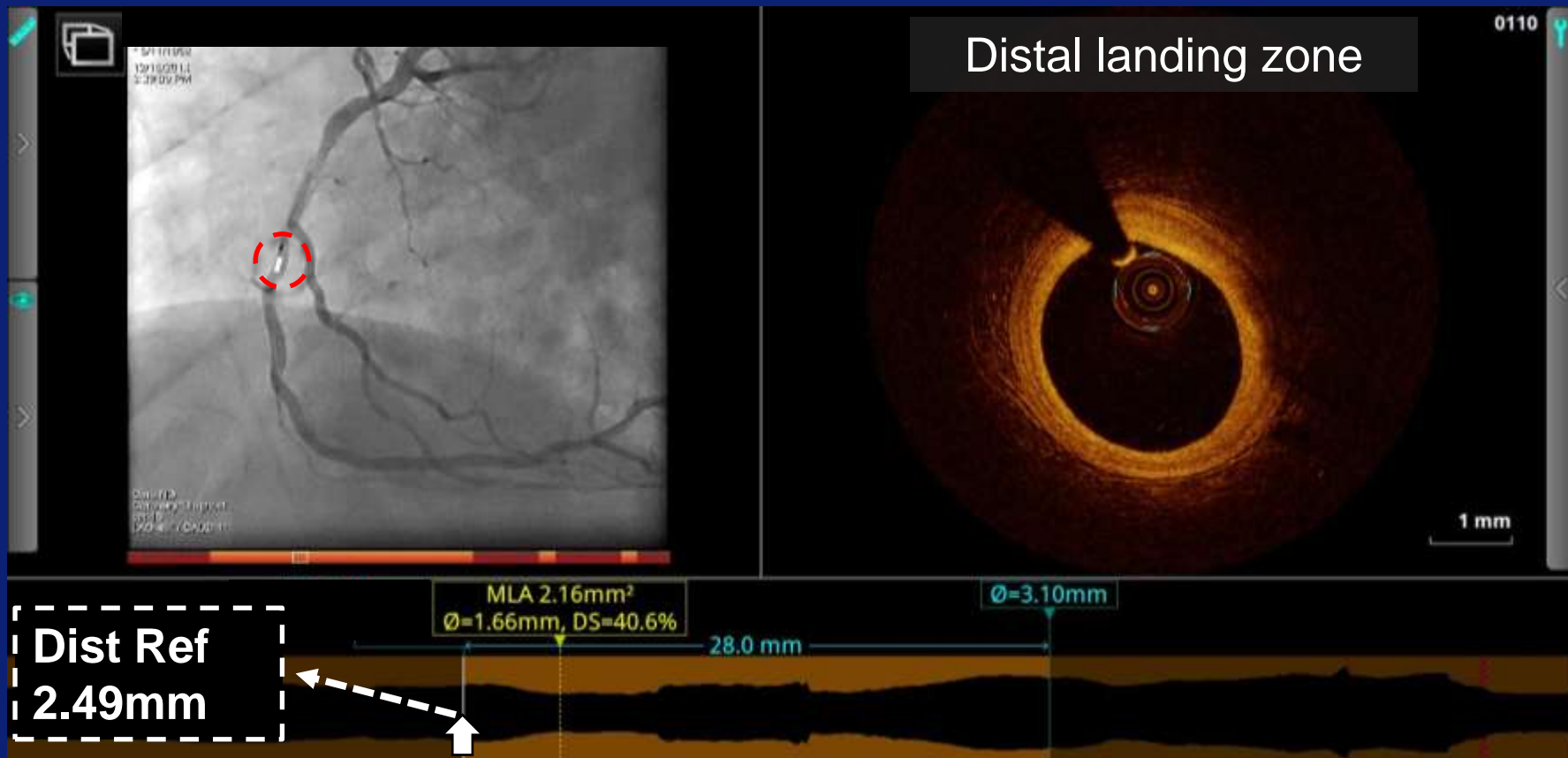
# OCT To Guide BVS Implantation

## Case Example

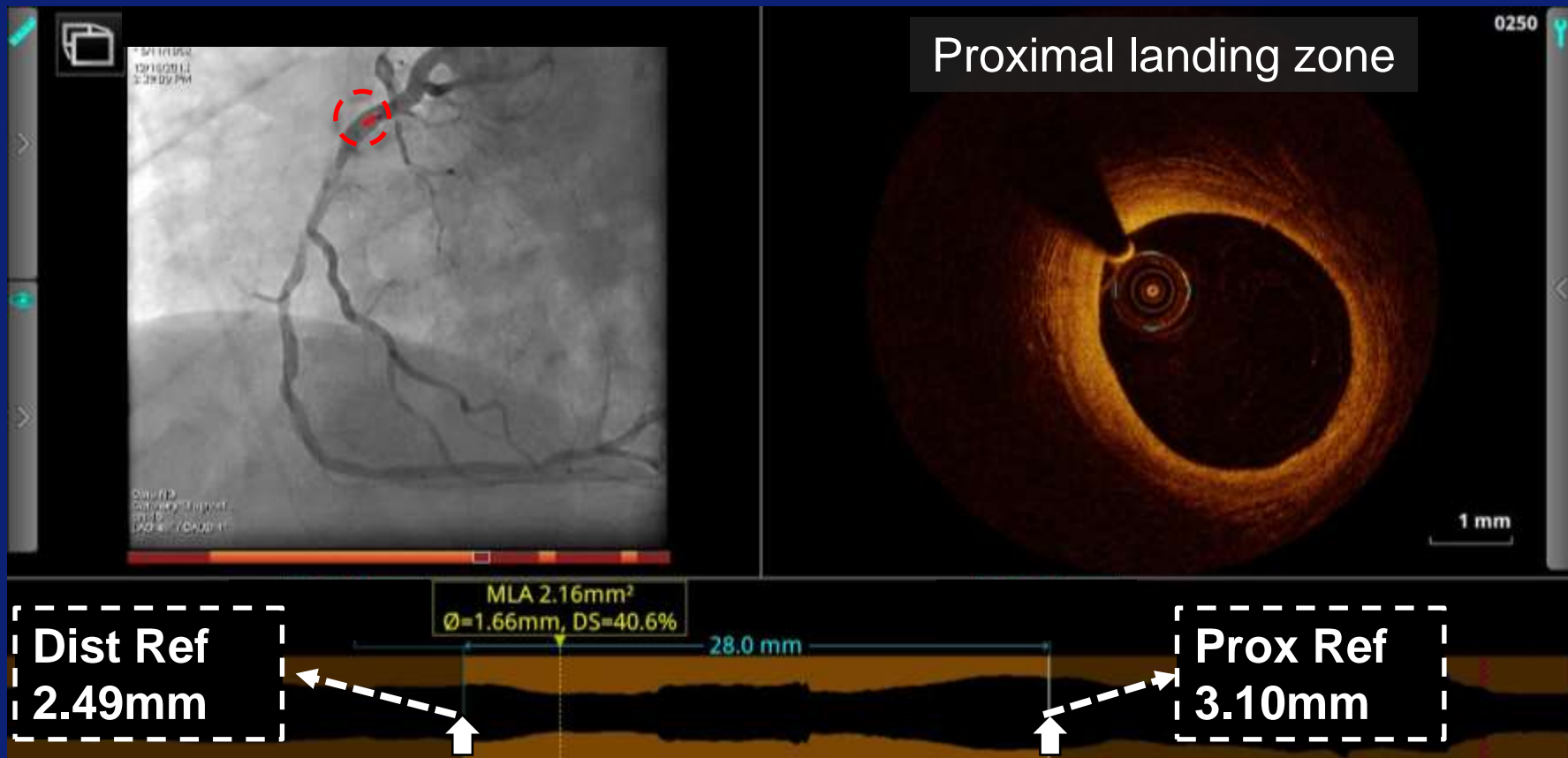


Representation of the true lumen dimensions based on automated rendering of the lumen in every cross section

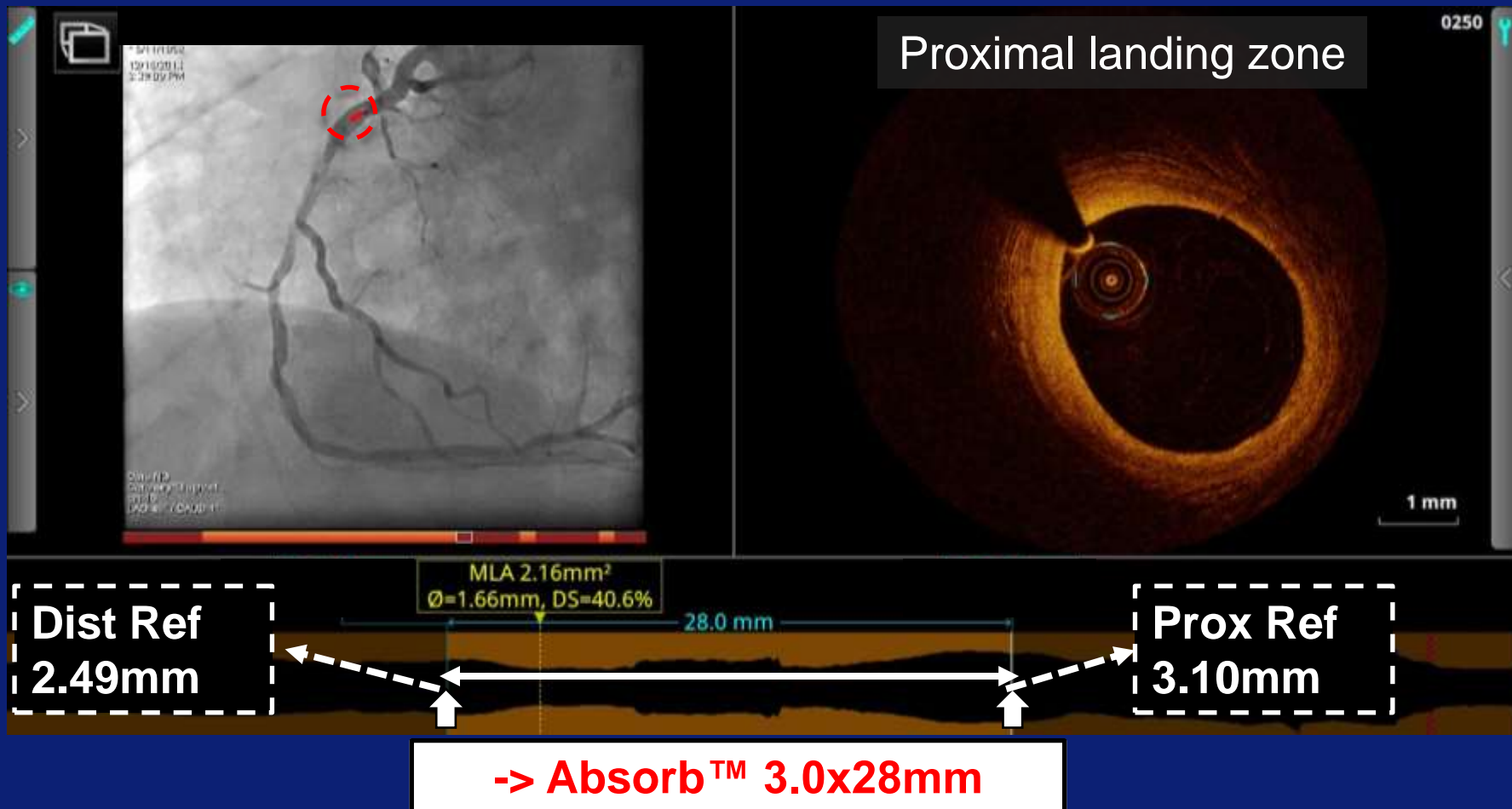
# OCT To Guide BVS Implantation Case Example



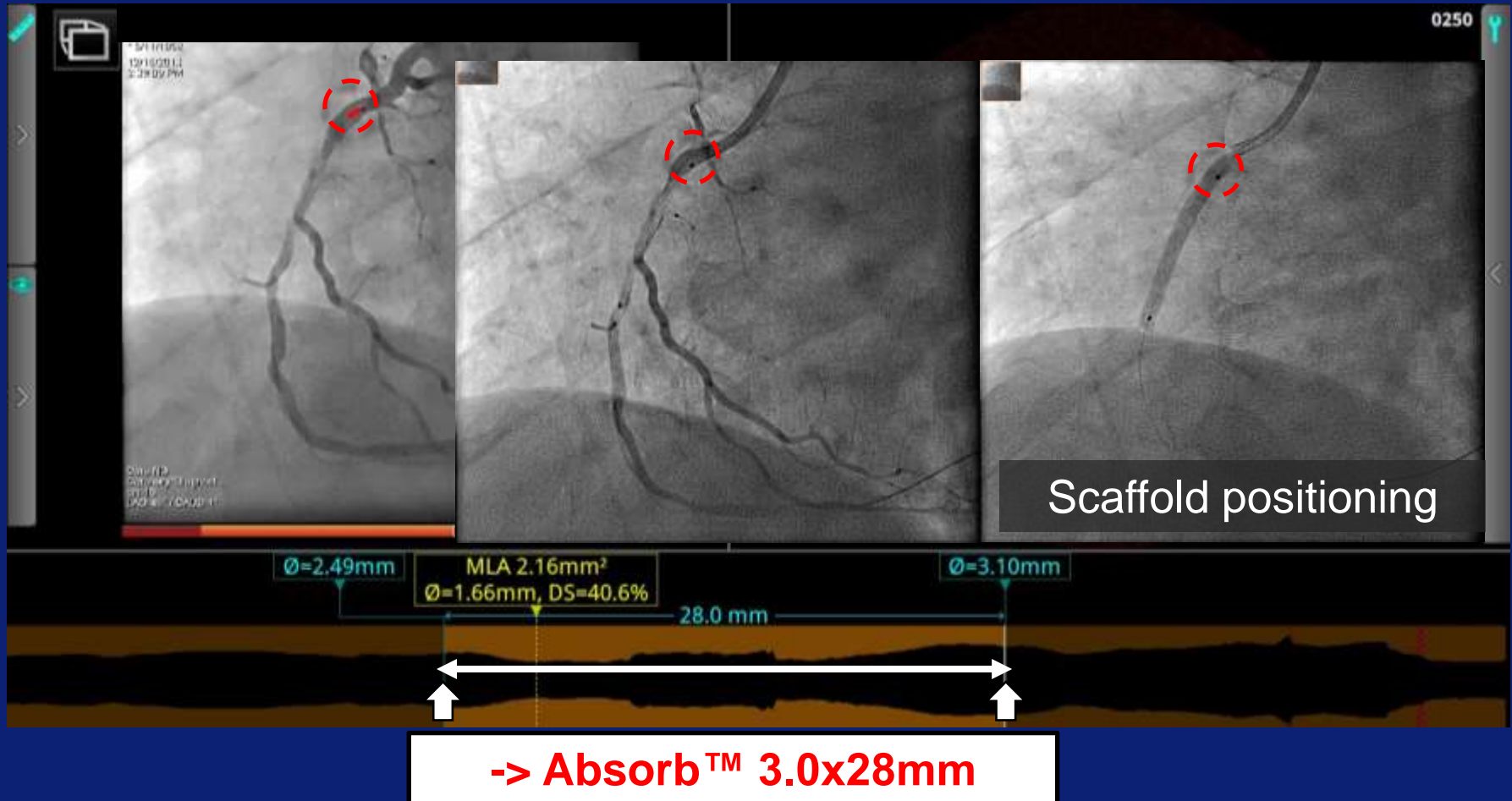
# OCT To Guide BVS Implantation Case Example



# OCT To Guide BVS Implantation Case Example

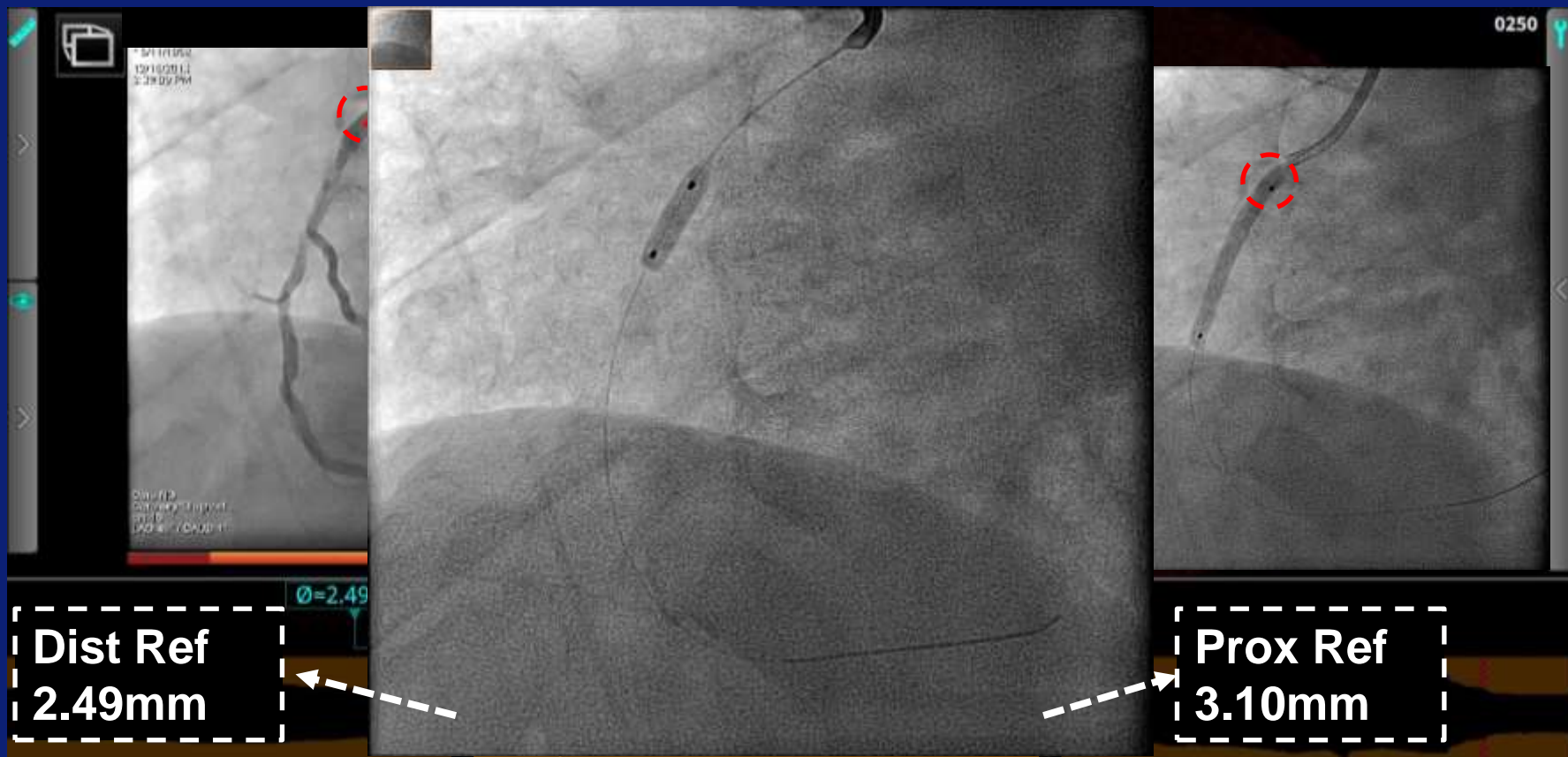


# OCT To Guide BVS Implantation Case Example





# OCT To Guide BVS Implantation Case Example



**Tapering**





## Allows

- ✓ to overcome intrinsic limitations of angiography.
- ✓ for optimal selection of BVS diameter, length & position.
- ✓ for rationale decision making regarding the need for lesion preparation & post dilatation.
- ✓ to achieve acute results that are comparable to DES.

# Thank you for your attention!

## PhD Students & Guest Researchers



### **Interventional Cardiology**

J. Ligthart  
 K. Witberg  
**R.J. van Geuns (BVS)**  
 P. de Jaegere  
 N. van Mieghem  
 M. Valgimigli  
 R. Diletti  
 F. Zijlstra

### **Experimental Cardiology**

H. van Beusekom

### **Hemodynamics Laboratory**

J. Wentzel  
 F. Gijsen

### **Bioengineering**

G. van Soest  
 A.F.W. van der Steen

### **Imaging Group**

N. Bruining  
 K. Sihan