20th CARDIOVASCULAR SUMMIT
TCTAP 2015

Insight from Clinical and Imaging Studies

Y. Onuma, MD, PhD
Yuki Ishibashi, MD
Robert-Jan van Geuns, MD, PhD
Thorax Centre, Erasmus MC, the Netherlands

Patrick W. Serruys, MD, PhD
International Centre for Circulatory Health, NHLI, Imperial College London, UK

On behalf of the ABSORB A, B, Extend and II investigtors

17:16-24

Overview of the presentation

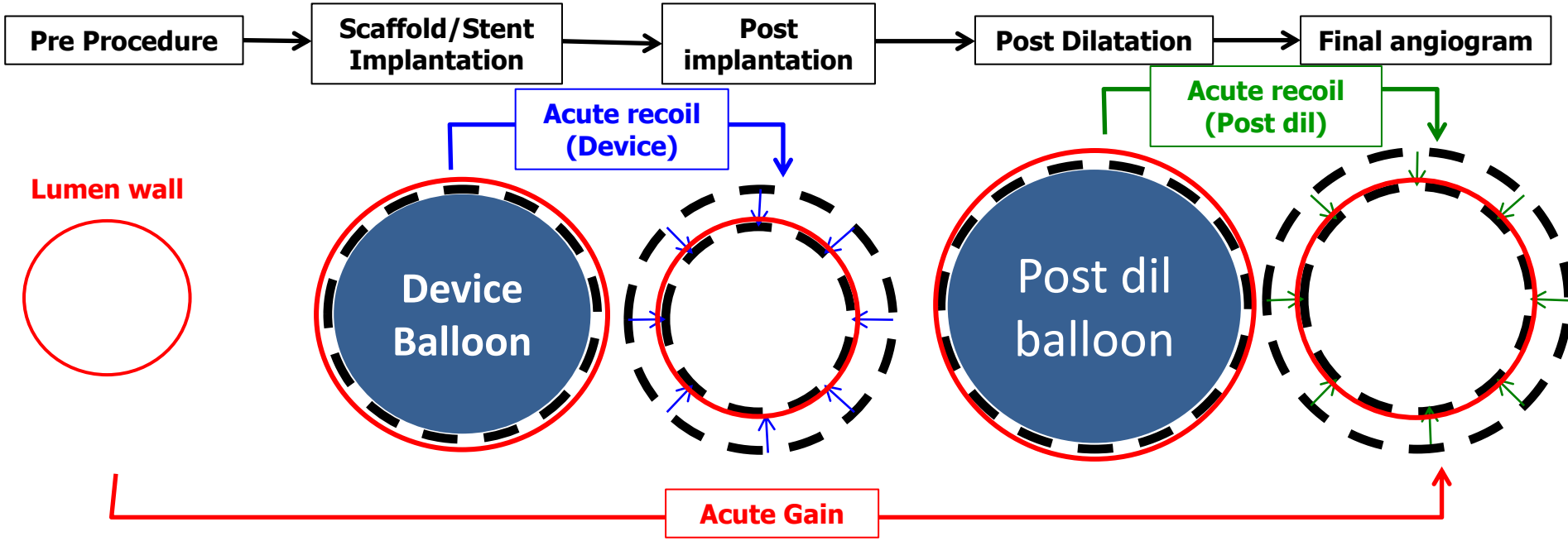
1. **Insights from ABSORB II (Absorb vs. Xience)**
   - **Acute Gain**
   - **Sidebranch Occlusion and angiographic complication**
   - **Size mismatch and clinical outcomes**

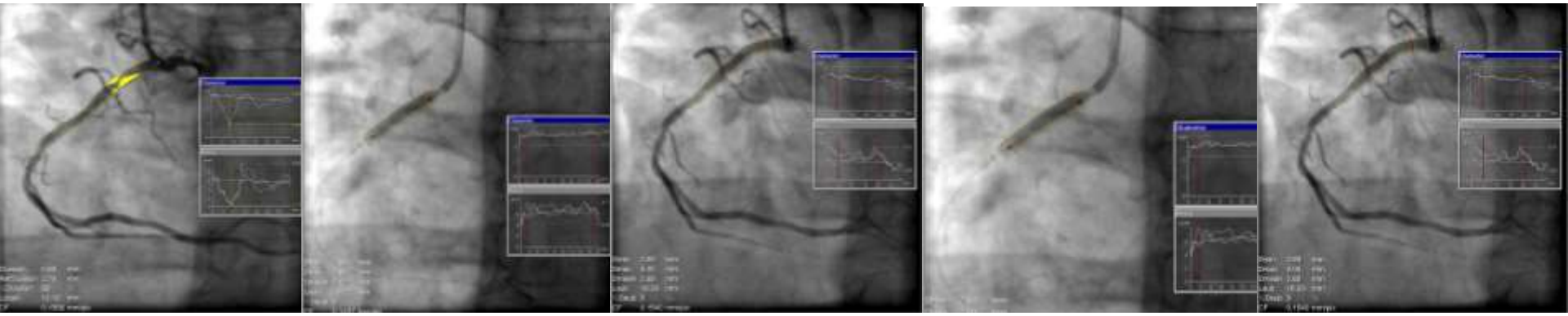
2. **Insights from ABSORB A and B trials**
   - **IVUS, VH and echogenicity**
   - **Vasomotion**
   - **OCT and light attenuation**
   - **MSCT (at 18 and 60 months)**

Angiography Assessment Pre and Post Procedure

		Absorb 364 Lesions		Xience 182 Lesions	*p* value
Lesion length obstruction	mm	13.8 ± 6.5		13.8 ± 6.6	1.00
Total device length	mm	21.1 ± 8.8		20.9 ± 7.4	0.74
Pre-procedure RVD	mm	2.59 ± 0.4		2.63 ± 0.4	0.36
Post- procedure RVD	mm	2.64 ± 0.4	<	2.80 ± 0.3	<0.001
Pre-procedure MLD	mm	1.07 ± 0.3		1.05 ± 0.3	0.44
Post-procedure in-device MLD	mm	2.22 ± 0.3	<	2.50 ± 0.3	<0.001
Acute gain in-device	mm	1.15 ± 0.4	<	1.46 ± 0.4	<0.001
Pre-procedure %DS	%	59 ± 11		60 ± 12	0.30
Post-procedure in-device DS	%	16 ± 7	>	10 ± 5	<0.001
Post-procedural curvature	cm^{-1}	0.29 ± 0.2	>	0.24 ± 0.2	0.02

#1. Acute performance: Acute gain was smaller in Absorb than Xience on QCA and IVUS. What are the contributing factors?



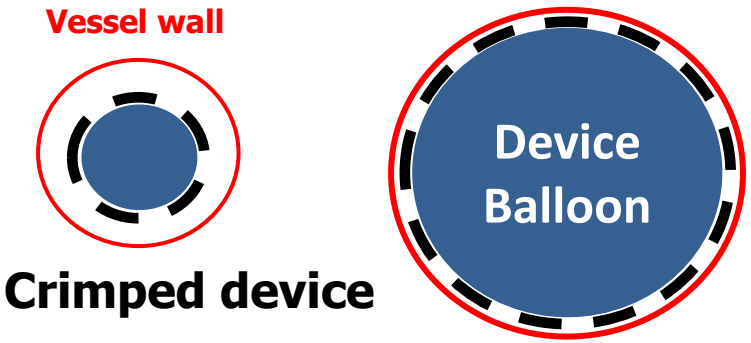


#1. Acute performance: Acute gain was smaller in Absorb than Xience on QCA and IVUS. What are the contributing factors?

Pre Procedure → Scaffold/Stent Implantation → Post implantation

Post Dilatation

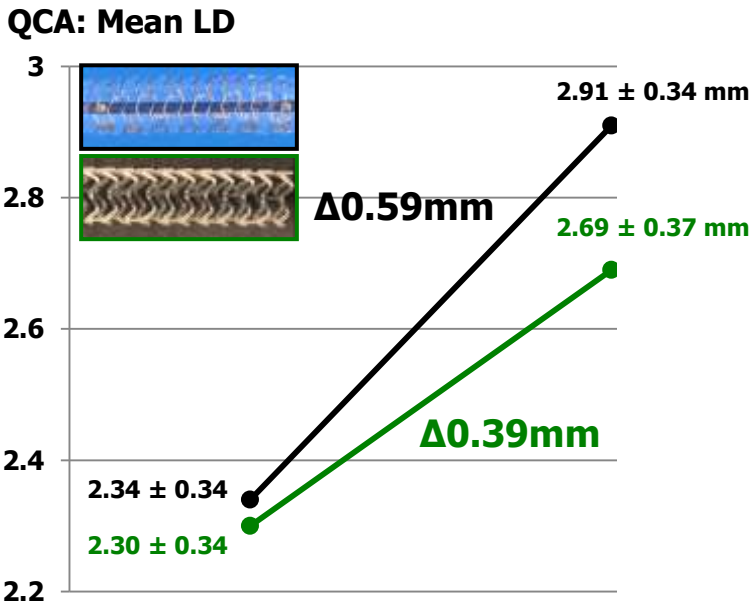
Final angiogram



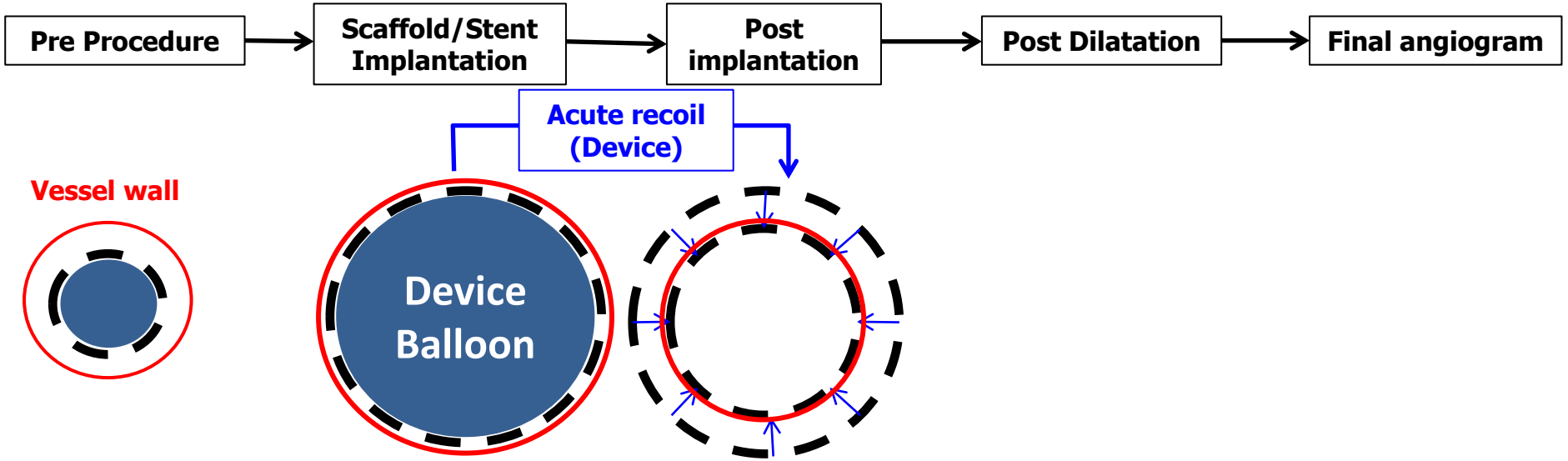
1. Less gain at implantation

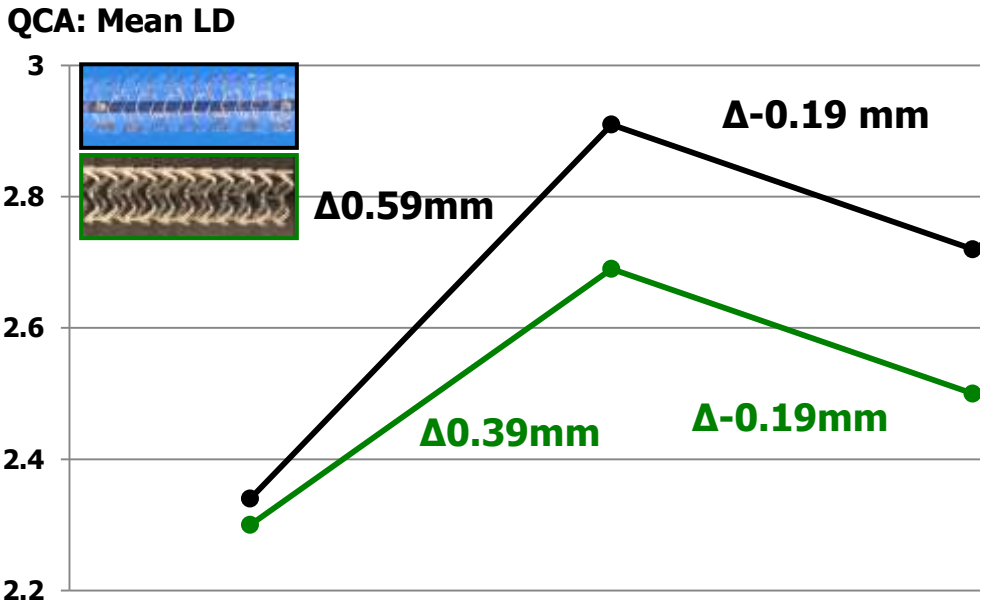
Xience : 13.8 ± 2.5 atm

Absorb : 13.1 ± 2.7 atm



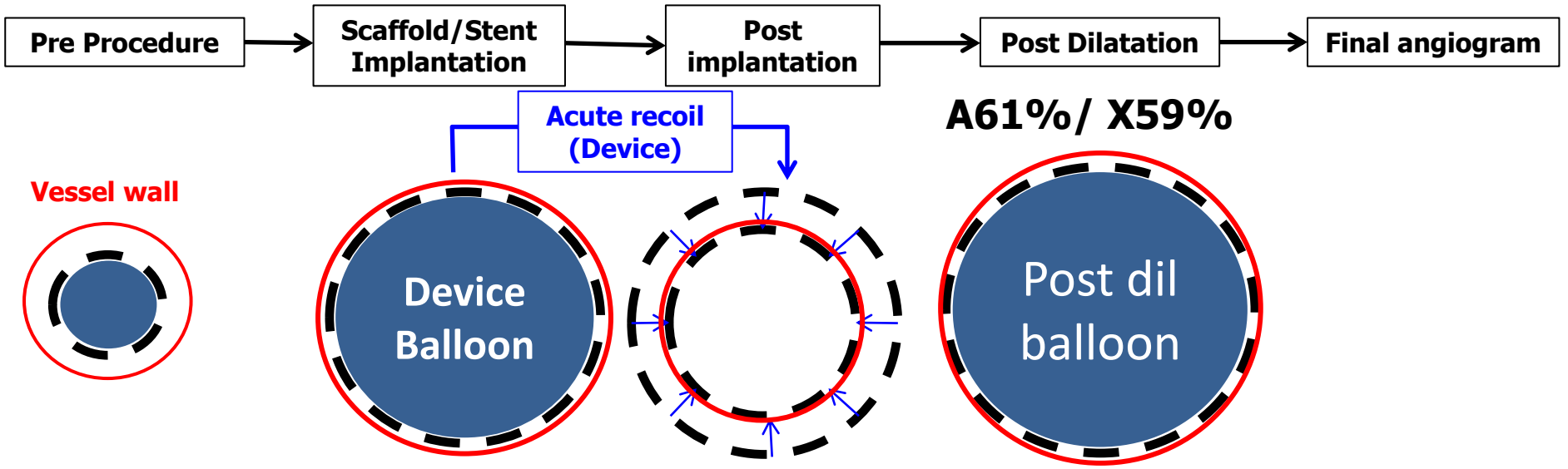
#1. Acute performance: Acute gain was smaller in Absorb than Xience on QCA and IVUS. What are the contributing factors?

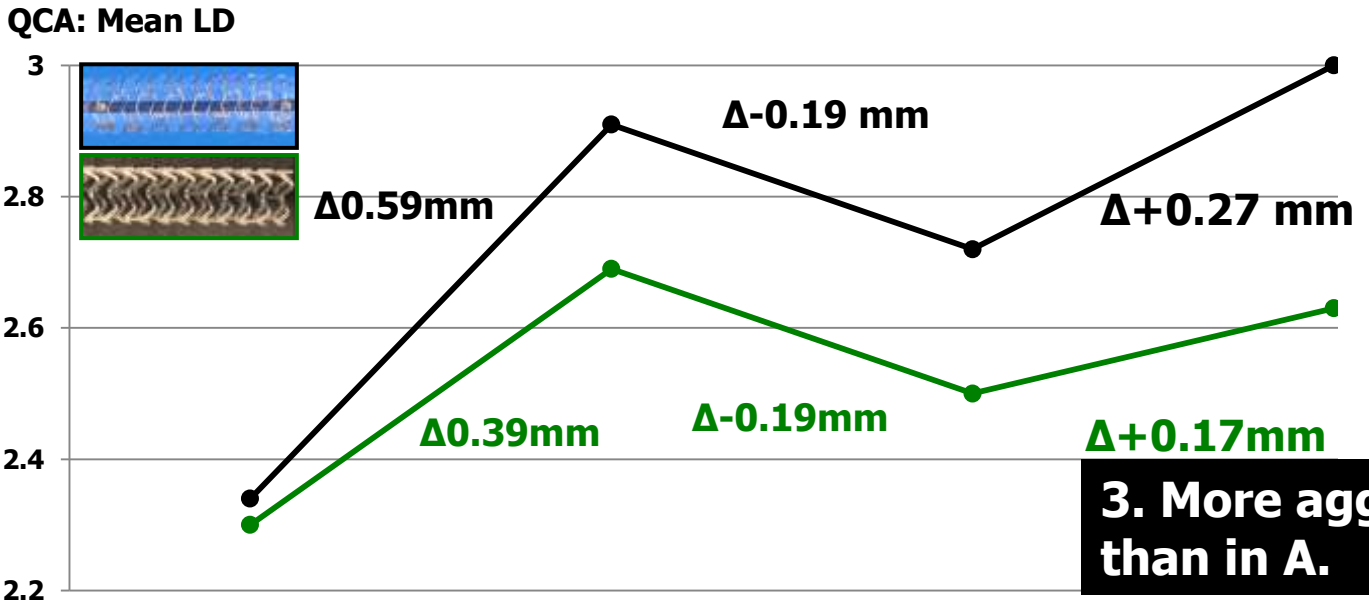




2. Acute Recoil of two devices is identical

#1. Acute performance: Acute gain was smaller in Absorb than Xience on QCA and IVUS. What are the contributing factors?

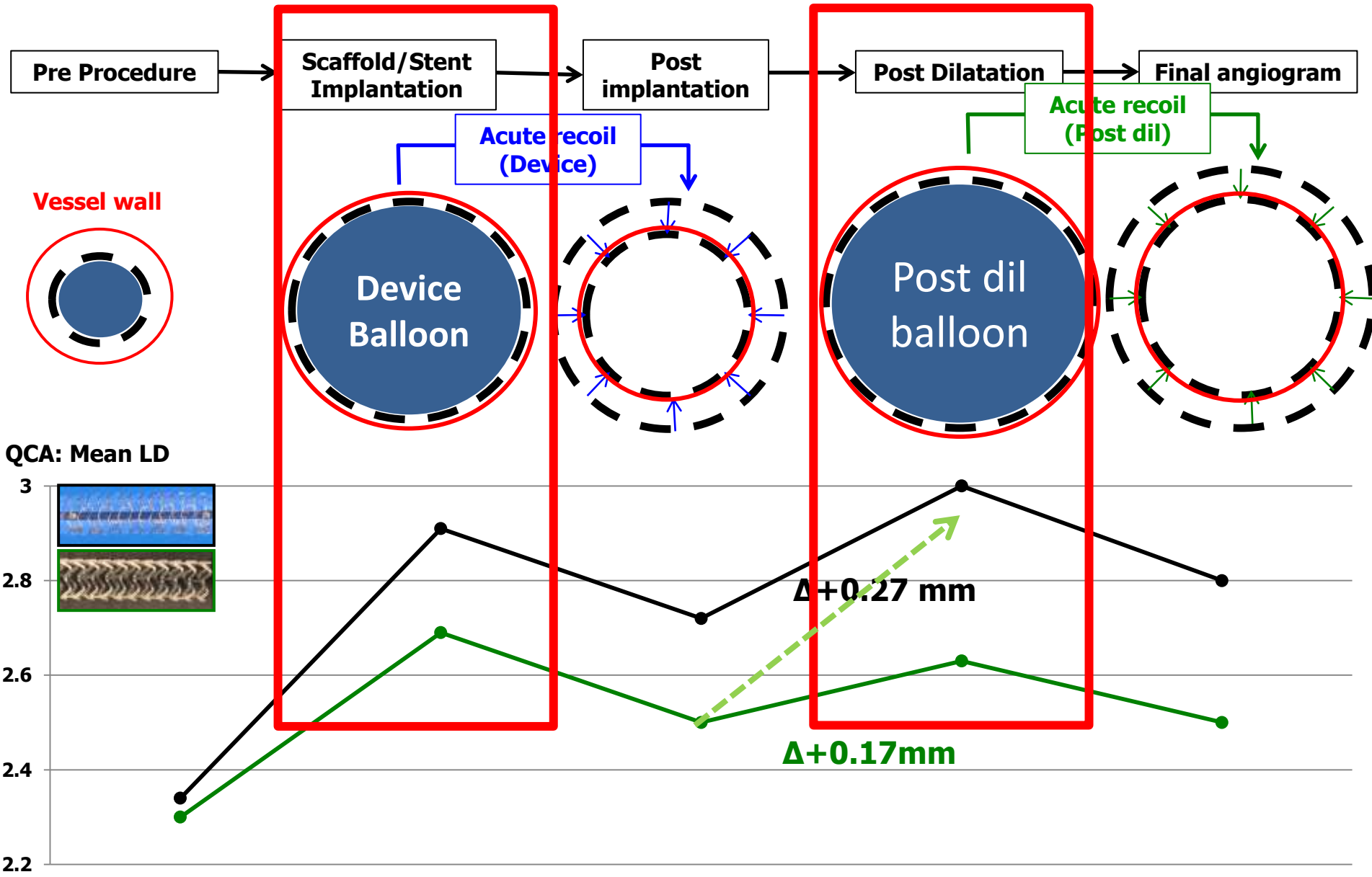




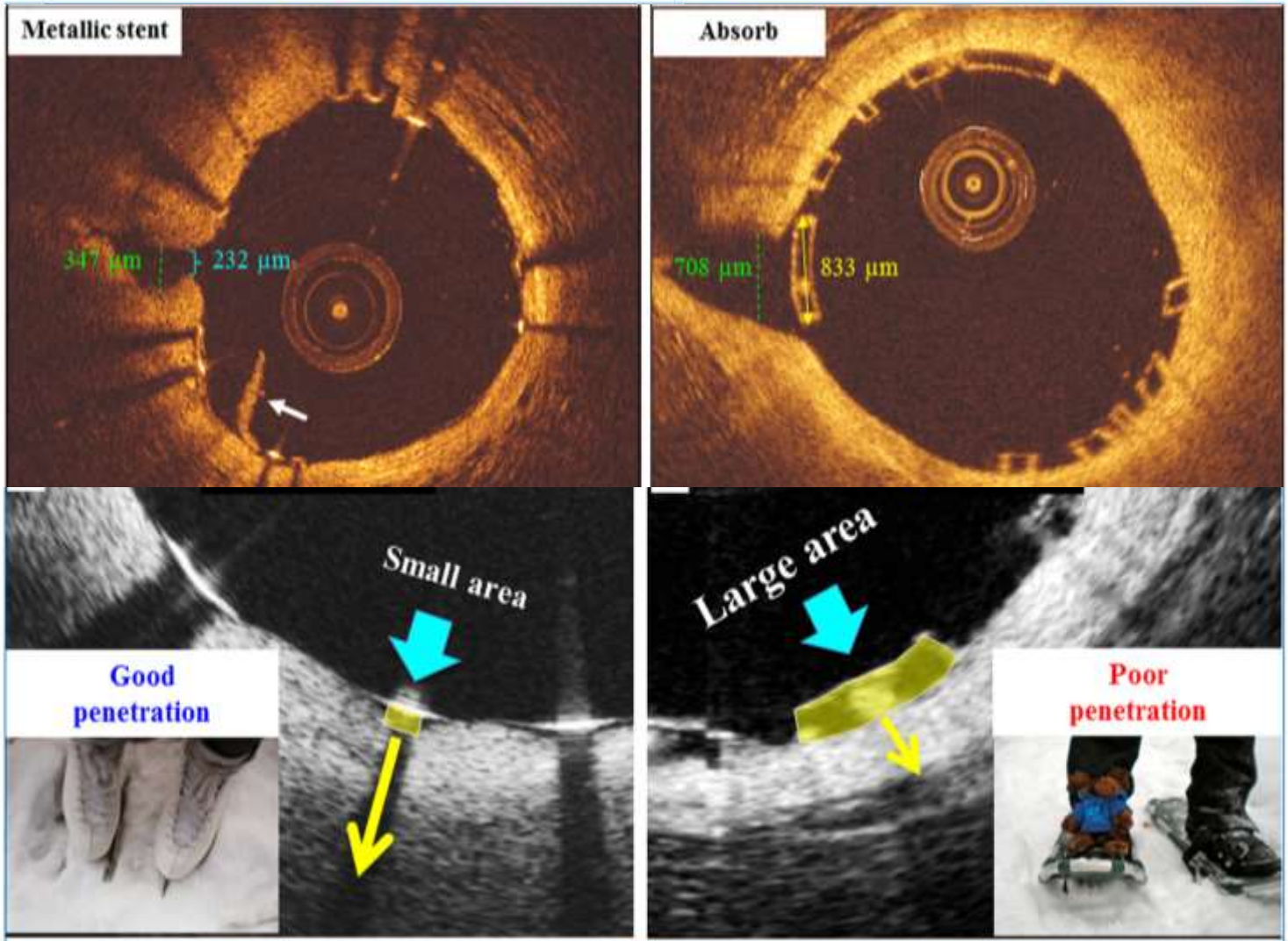
Post Dil
X: 16.8 atm
Expected Diameter:3.40±0.39 mm
A: 15.2 atm
Expected Diameter: 3.26±0.35mm

3. More aggressive posdil in X than in A.

#1. Acute performance: Acute gain was smaller in Absorb than Xience on QCA and IVUS. What are the contributing factors?



#1. Acute performance: Acute gain was smaller in Absorb than Xience on QCA and IVUS. What are the contributing factors?



#1. Acute performance: OCT guidance could improve the acute results

ABSORB Biodegradable Stents Versus Second-Generation Metal Stents

A Comparison Study of 100 Complex Lesions Treated Under OCT Guidance

Mattesini et al. JACC 2014

Table 4. Optical Coherence Tomography Findings (N = 124)

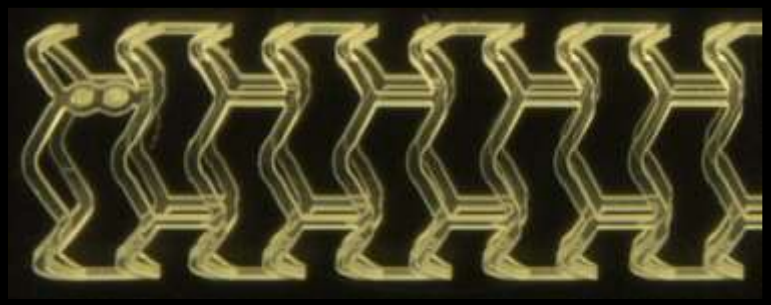
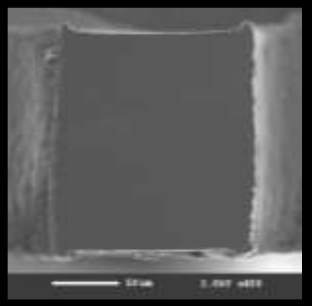
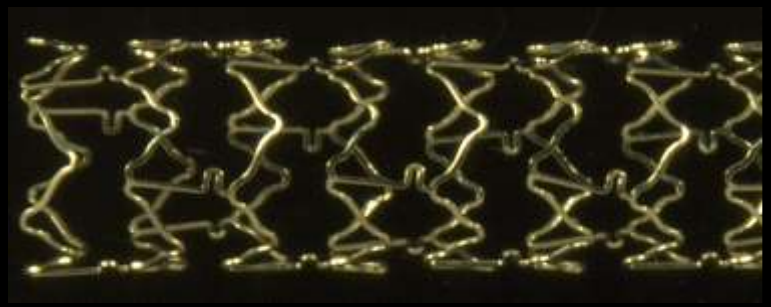
	BVS (n = 63)		DES (n = 61)	p Value
Mean stent area, mm^2	7.3 (2.3)		7.5 (1.6)	0.51
Minimal stent area, mm^2	5.9 (1.9)	=	5.8 (1.5)	0.67
Mean lumen area, mm^2	7.2 (2.2)	=	7.4 (1.6)	0.40
Minimal lumen area, mm^2*	5.8 (1.9)		5.8 (1.5)	0.97
Median stent diameter, mm	2.9 (0.5)		3.1 (0.3)	0.33
Minimal stent diameter, mm	2.7 (0.4)		2.8 (0.5)	0.46
Maximal stent diameter, mm	3.2 (0.5)		3.3 (0.4)	0.52
Percentage RAS	20.2 (7.5)	=	21.7 (9.9)	0.32

Overview of the presentation

1. Insights from ABSORB II
   - Acute Gain
   - Sidebranch Occlusion and angiographic complication
   - Size mismatch and clinical outcomes

2. Insights from ABSORB A and B trials
   - IVUS, VH and echogenicity
   - Vasomotion
   - OCT and light attenuation
   - MSCT (at 18 and 60 months)

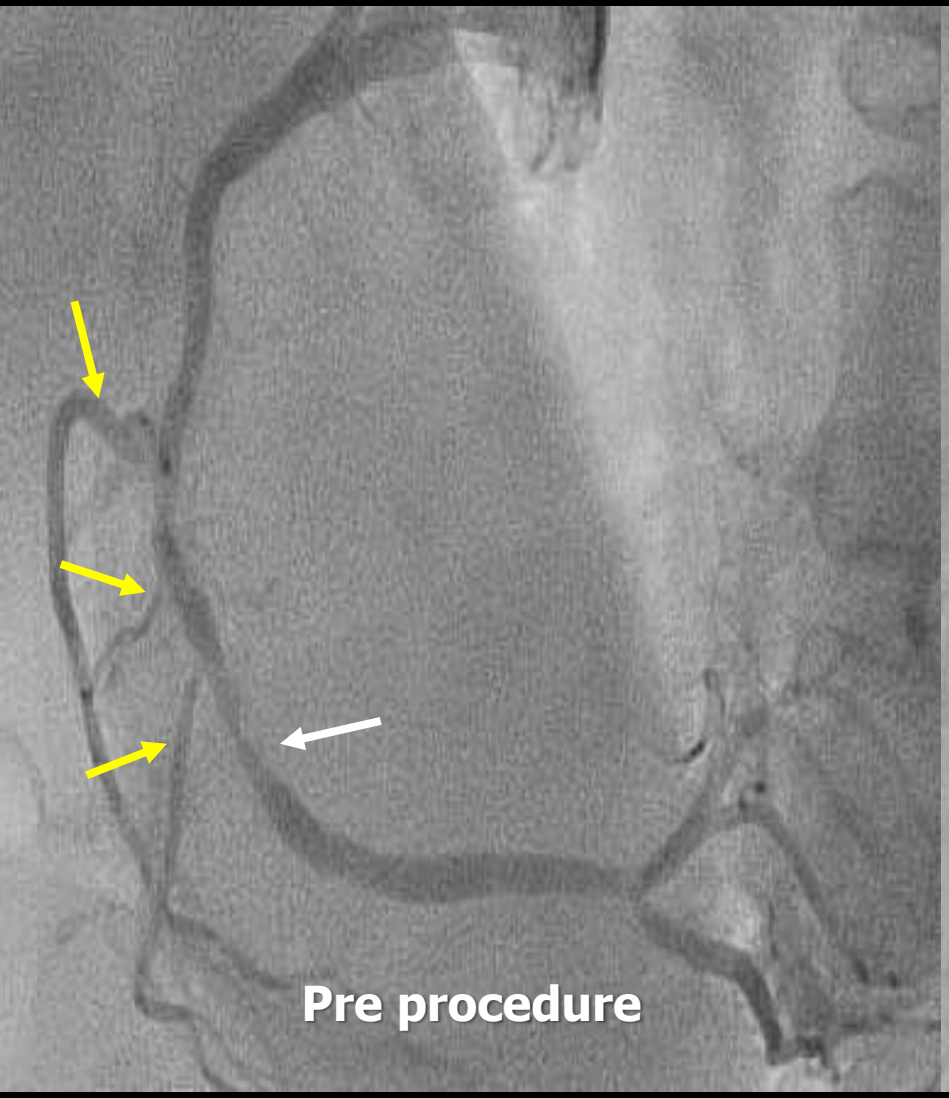
Sidebranch Occlusion: Does the larger device Footprint matter?

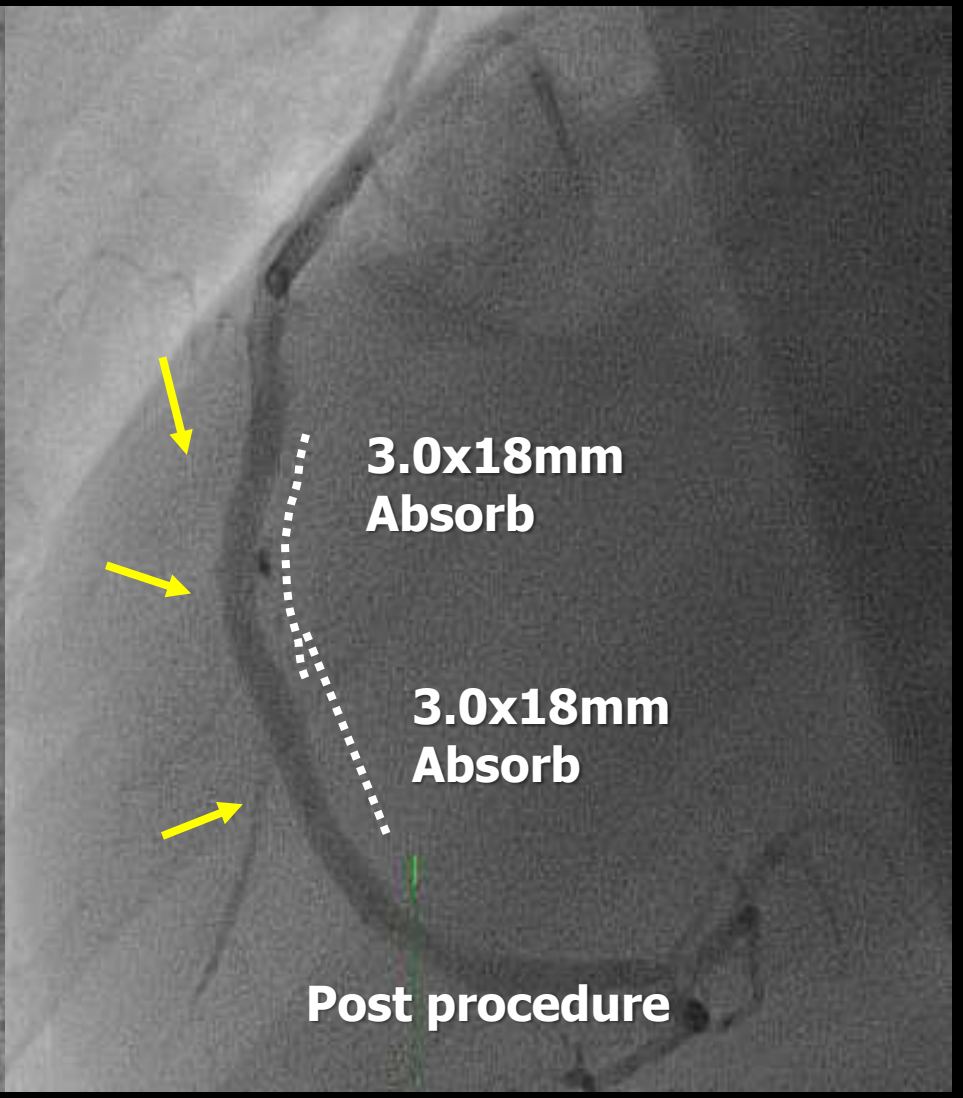
	Macroscopic appearance	Material	Cross-section	Strut thickness
Absorb scaffold		PLLA + PDLLA		157 µm
Xience V		Co-Cr + durable fluoropolymer		89 µm

Covered vessel wall area (footprint):
26% (Absorb scaffold) vs. 12% (Xience V)

Given the increased strut width (foot print) of the Absorb, a potential concern exists that the scaffold implantation might result in more frequent side branch occlusion and a higher incidence of peri-procedural myocardial injury and myocardial infarction compared to newer-generations of DES.

Sidebranch Occlusion: Does the high device Footprint matter?





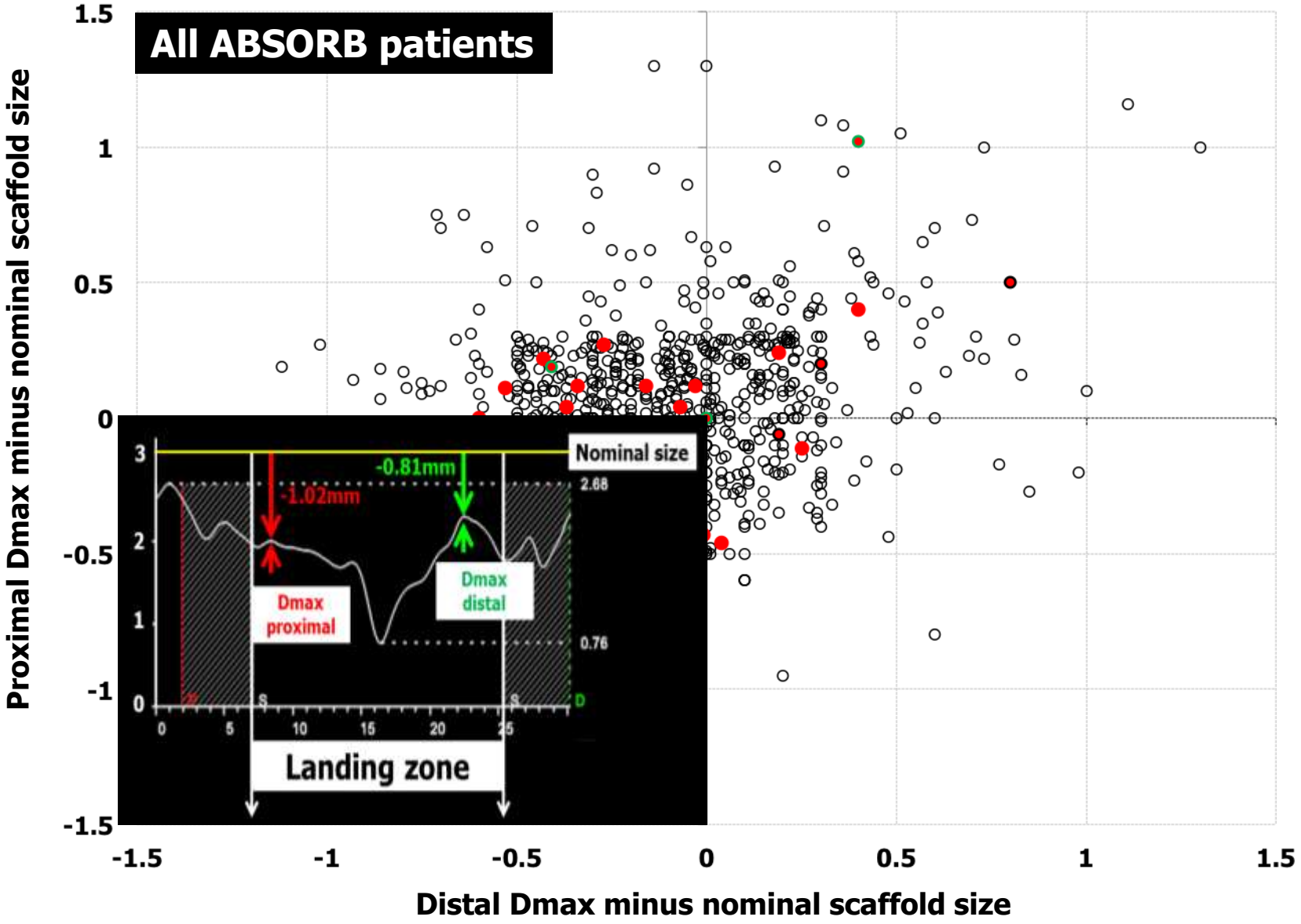
Type 1: Side Branch Occlusion

Sidebranch Occlusion: Does the high device Footprint matter?

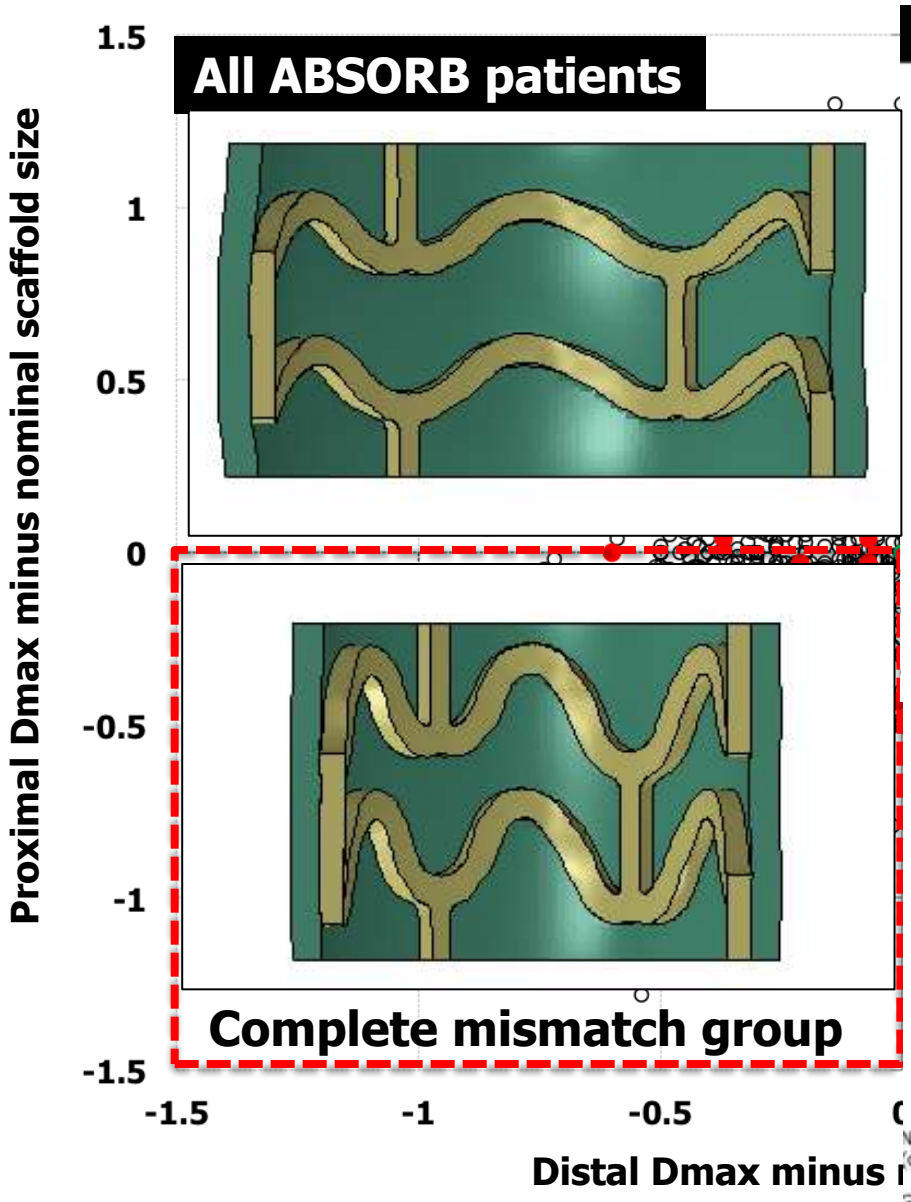
Anatomic complication assessed by angiography

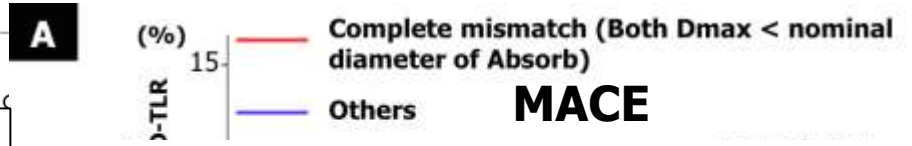
Per patient analysis	Absorb (N=335 pts)	EES (N=166 pts)	p value
Type1 anatomic complication assessed by angiography			
Side Branch Occlusion, % (N)	**12.5%**	**15.7%**	**0.41**
Any anatomic complications assessed by angiography	**16.4%**	**19.9%**	**0.39**

Distribution of Dmax Prox and Dmax Distal related to the nominal device size in the ABSORB II, Extend and B (n=1248)

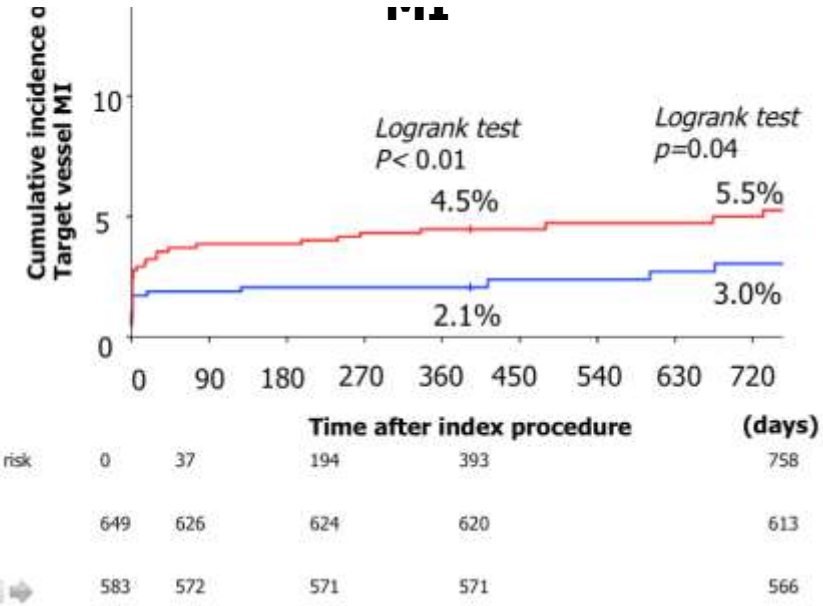


Distribution of Dmax Prox and Dmax Distal related to the nominal device size in the ABSORB II, Extend and B (n=1248)





The implantation of a "large" Absorb scaffold in a relatively small vessel had a higher risk of MACE at 1year. The selection of nominal scaffold size below the diameter of both proximal and distal Dmax might lead to a denser polymer surface pattern, which could be associated with MI after procedure.



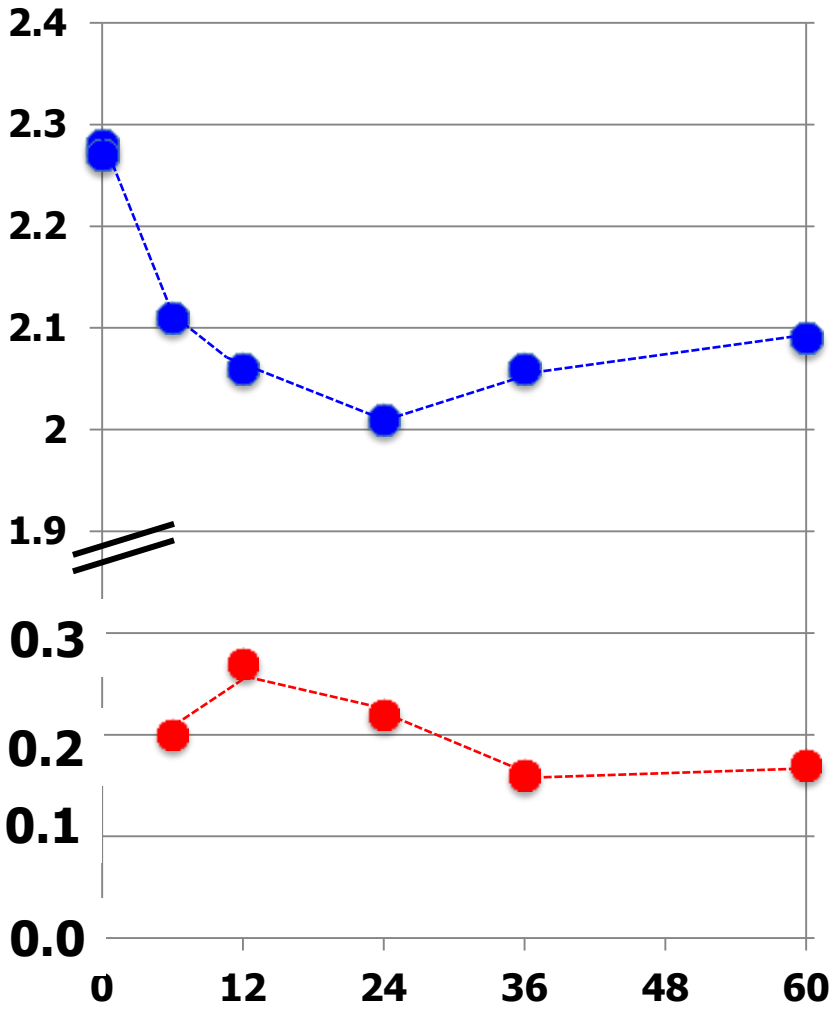
Overview of the presentation

1. Insights from porcine model (1-5 years)
   - IVUS and echogenicity, pulsatility and vasomotion
   - OCT and light intensity
   - Histology

2. Insights from human investigation (1-5 years)
   - IVUS, VH and echogenicity
   - Vasomotion
   - OCT and light attenuation
   - MSCT (at 18 and 60 months)

A

Serial QCA without TLR cases

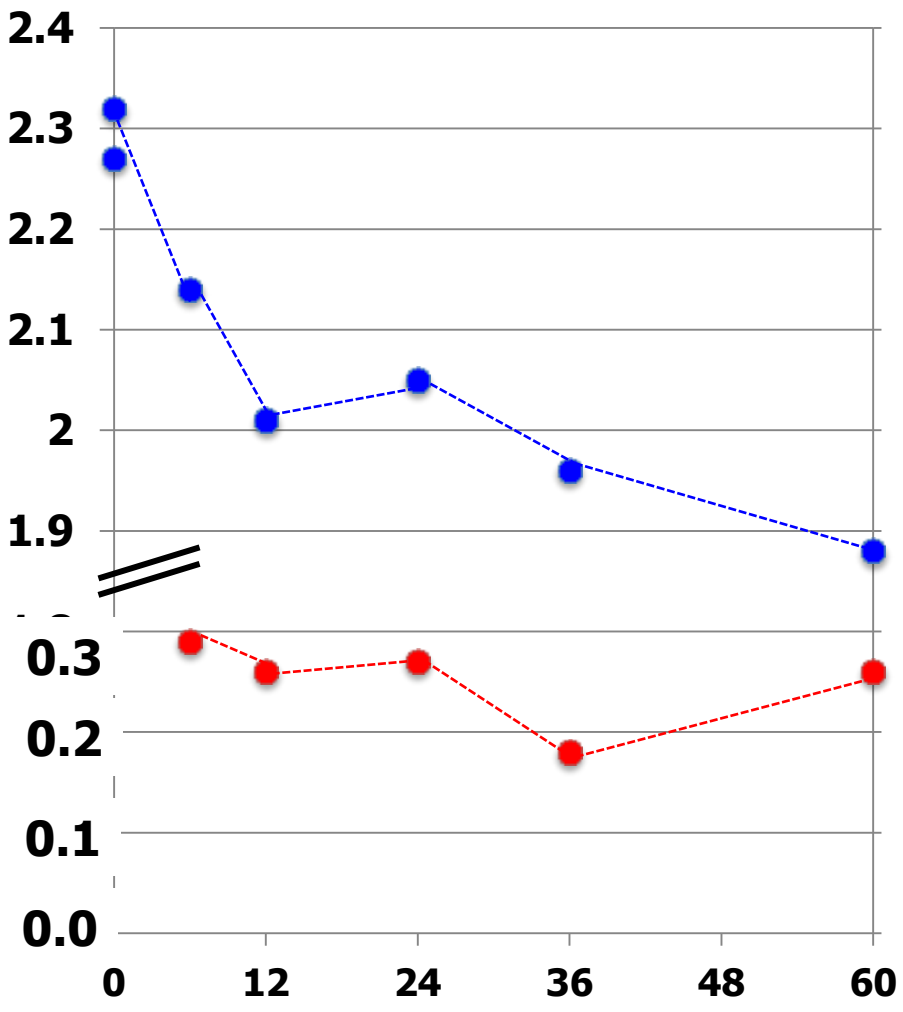


5 year LL: 0.17±0.31mm

- Minimum lumen diameter in cohort B1
- Minimum lumen diameter in cohort B2
- Late loss in cohort B1
- Late loss in cohort B2

B

Serial QCA with TLR cases



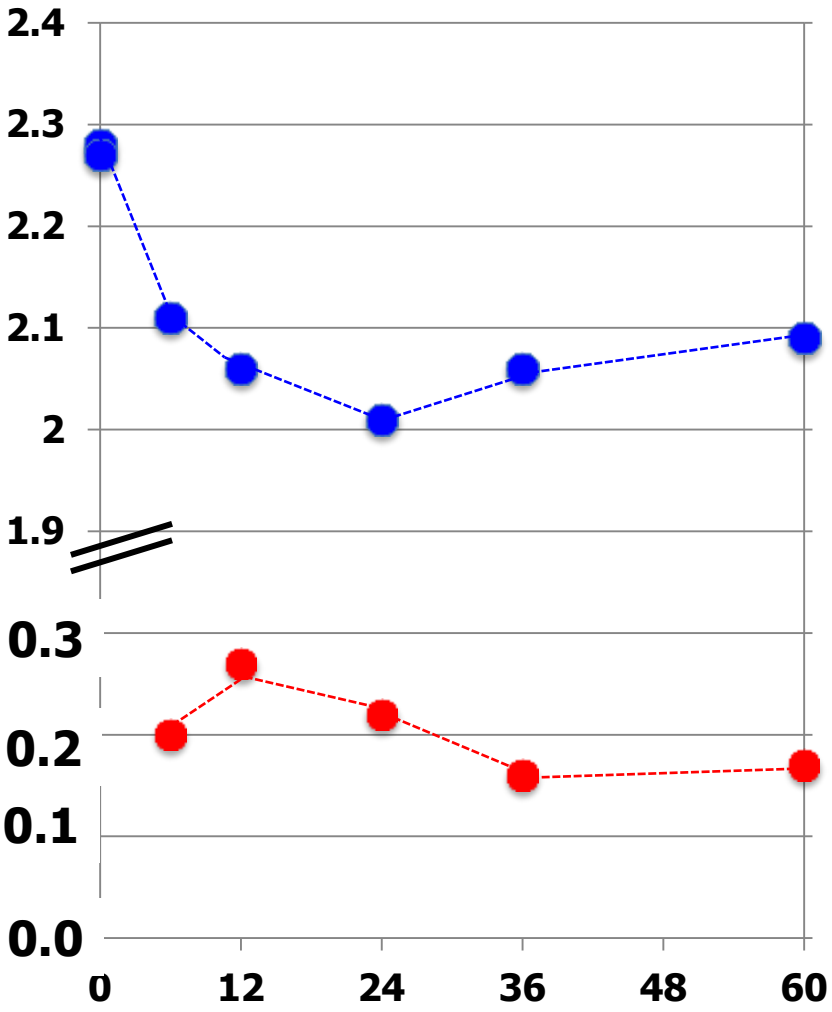
5 year LL: 0.26±0.42mm

- Minimum lumen diameter in cohort B1
- Minimum lumen diameter in cohort B2
- Late loss in cohort B1
- Late loss in cohort B2

De Bruyne et al. TCT 2014

A

Serial QCA without TLR cases

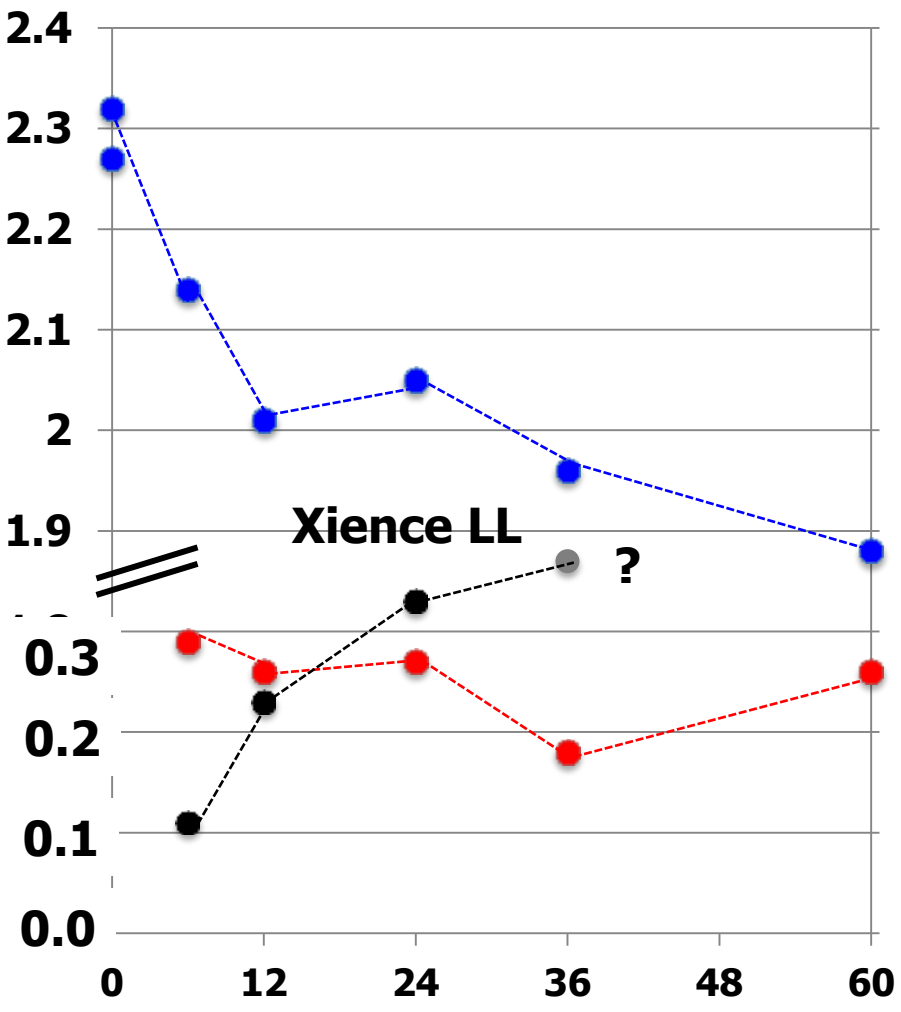


5 year LL: 0.17±0.31mm

- Minimum lumen diameter in cohort B1
- Minimum lumen diameter in cohort B2
- Late loss in cohort B1
- Late loss in cohort B2

B

Serial QCA with TLR cases



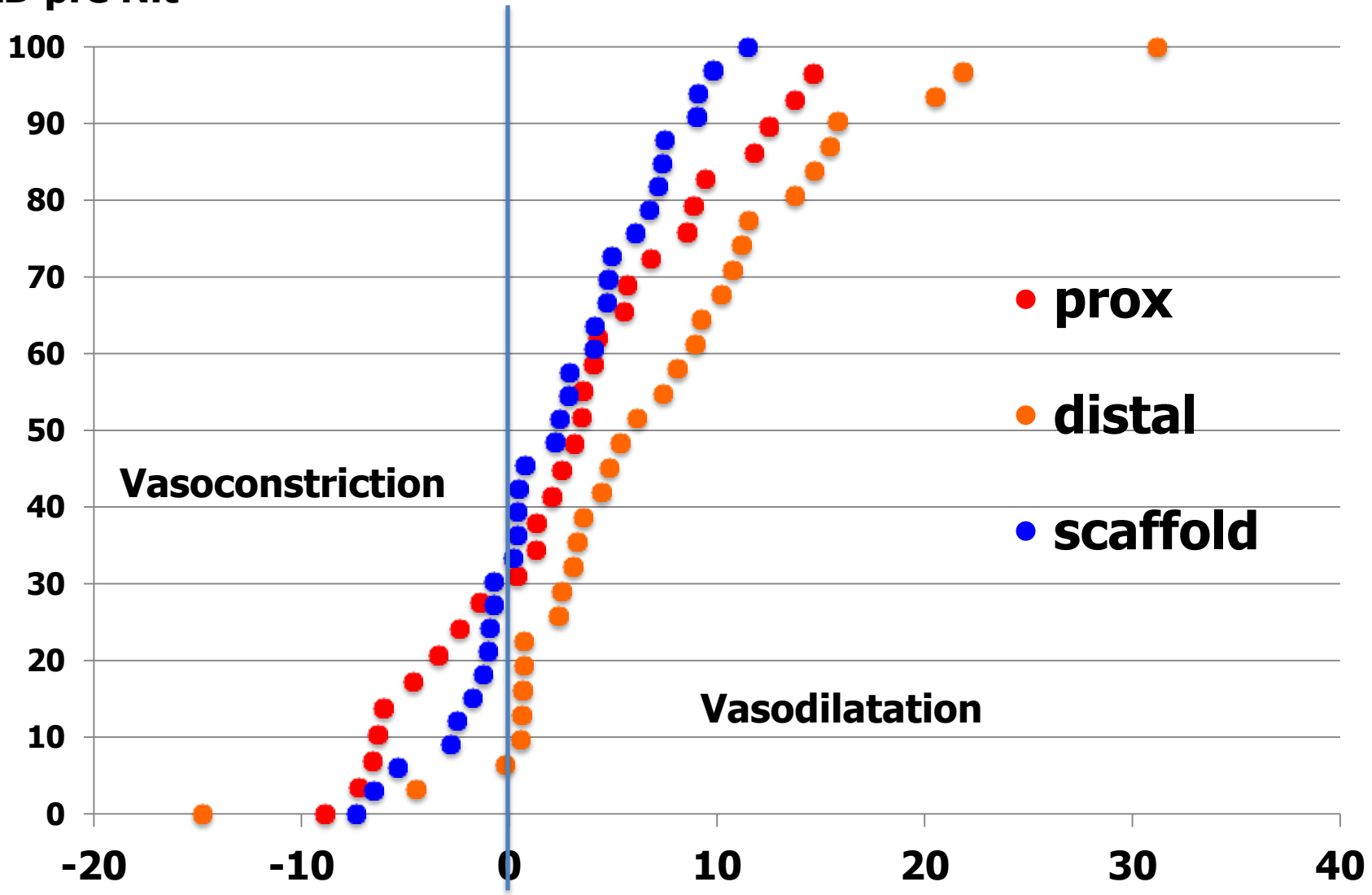
5 year LL: 0.26±0.42mm

- Minimum lumen diameter in cohort B1
- Minimum lumen diameter in cohort B2
- Late loss in cohort B1
- Late loss in cohort B2

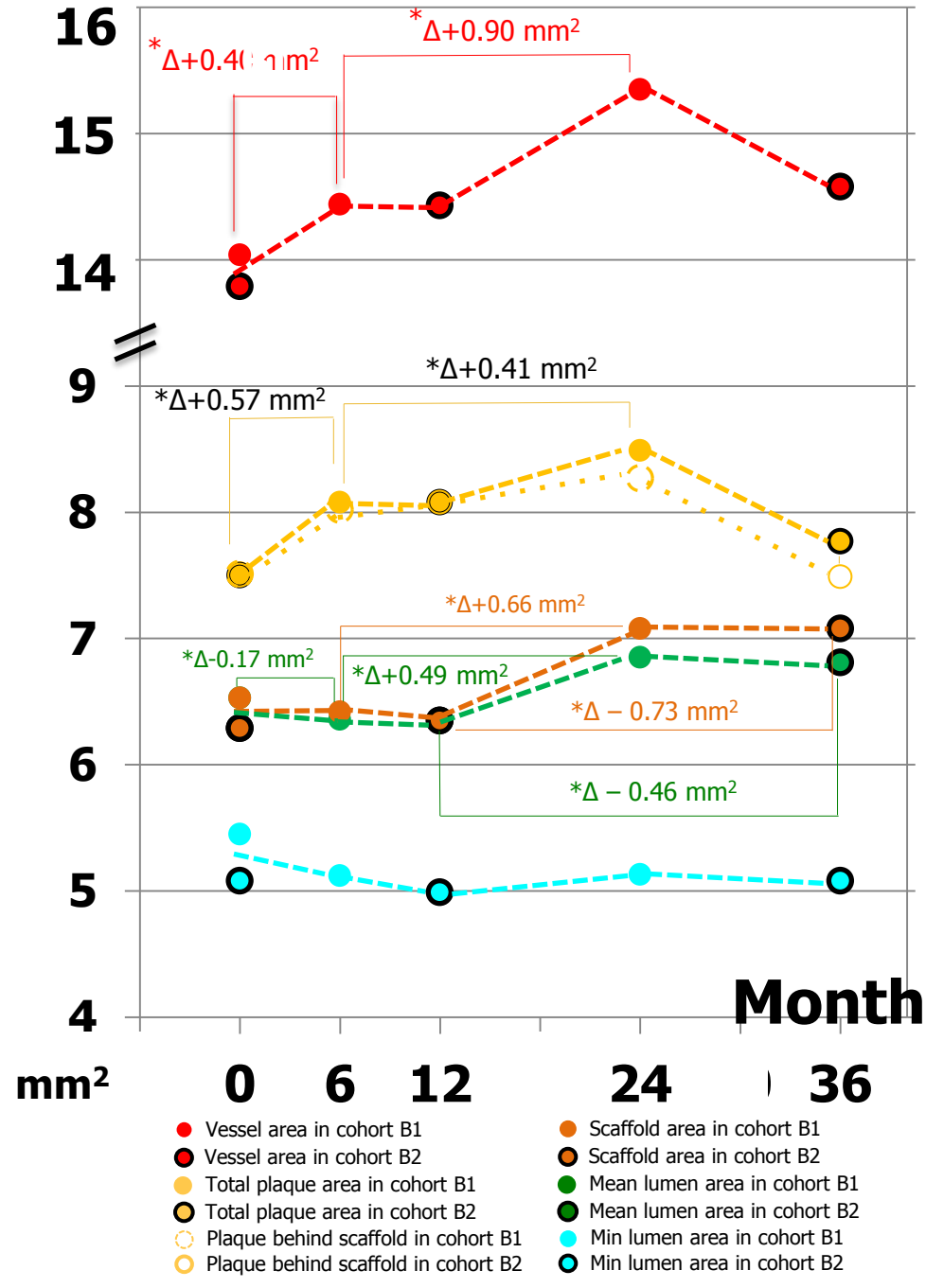
De Bruyne et al. TCT 2014

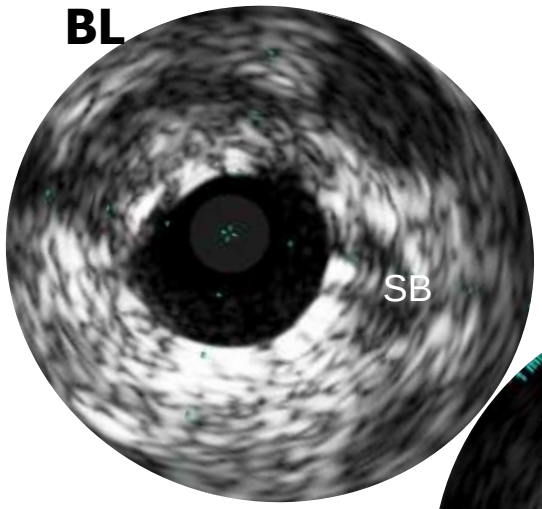
Vasomotion test at 3 years: Mean LD before and after nitrate

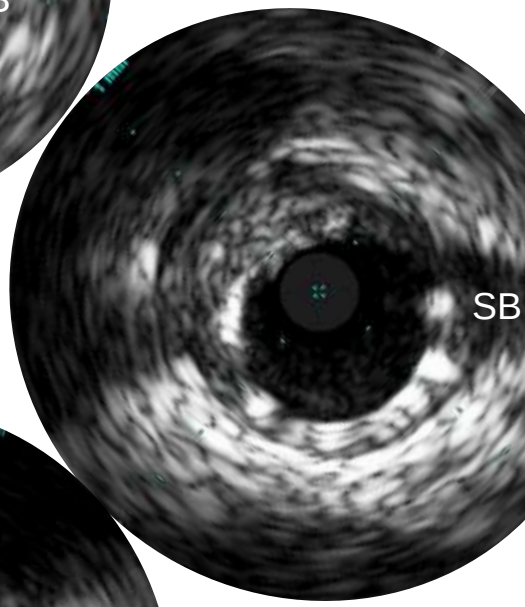
Relative change = 100 x (mean LD post Nit – Mean LD pre Nit) / Mean LD pre Nit

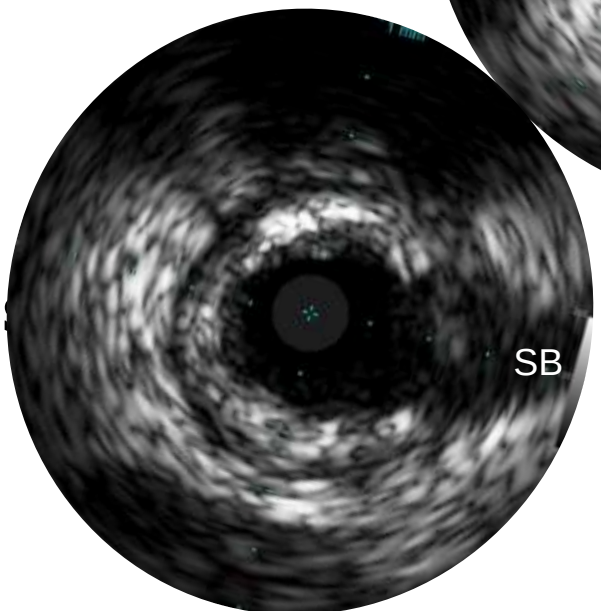


Serial IVUS

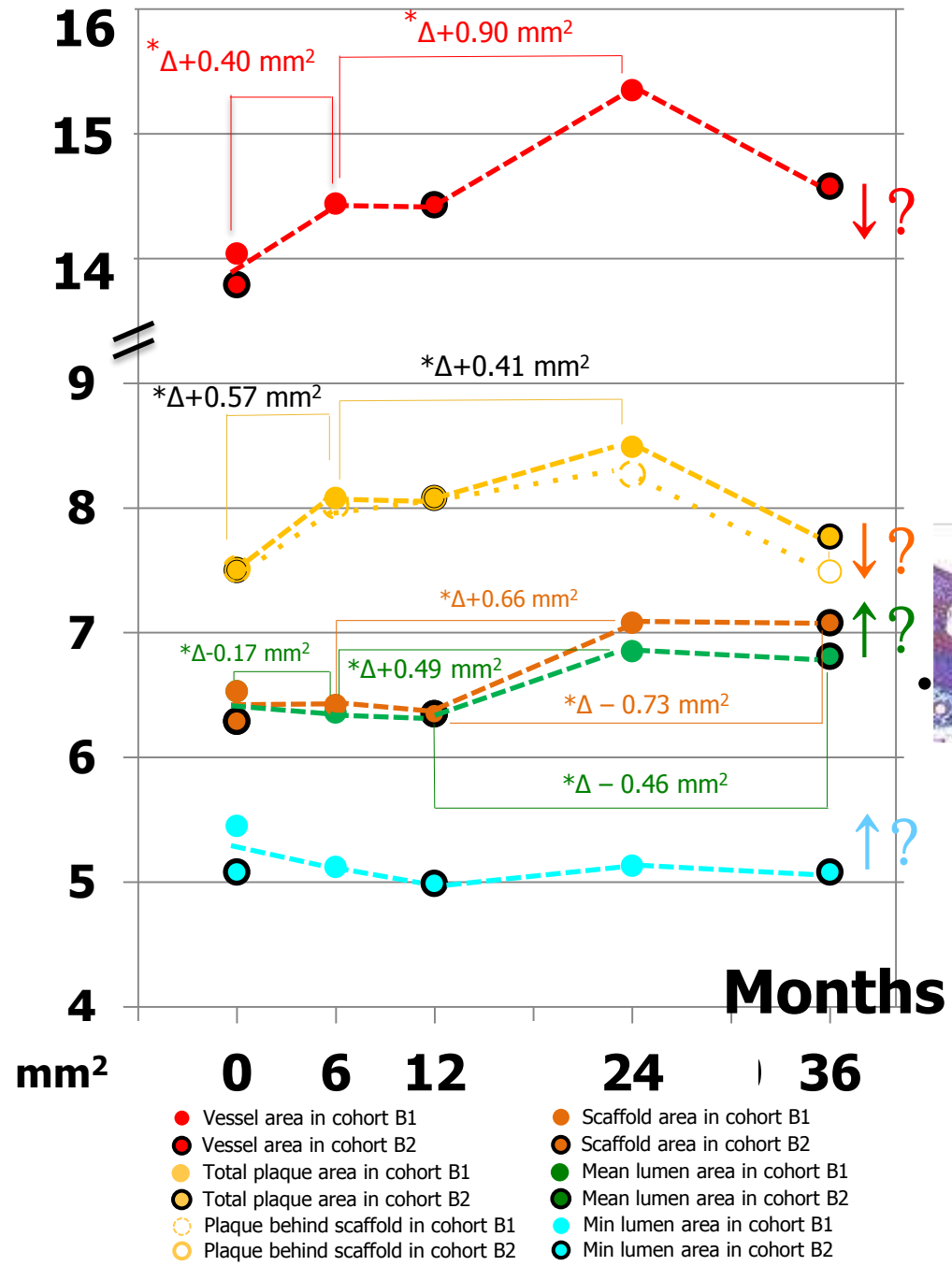

16
15
14
9
8
7
6
5
4
*Δ+0.90 mm²
*Δ+0.41 mm²
*Δ+0.57 mm²
*Δ+0.66 mm²
*Δ-0.17 mm²
*Δ+0.49 mm²
*Δ – 0.73 mm²
*Δ – 0.46 mm²
Month
mm²
0
6
12
24
36
Vessel area in cohort B1
Vessel area in cohort B2
Total plaque area in cohort B1
Total plaque area in cohort B2
Plaque behind scaffold in cohort B1
Plaque behind scaffold in cohort B2
Scaffold area in cohort B1
Scaffold area in cohort B2
Mean lumen area in cohort B1
Mean lumen area in cohort B2
Min lumen area in cohort B1
Min lumen area in cohort B2


BL
SB

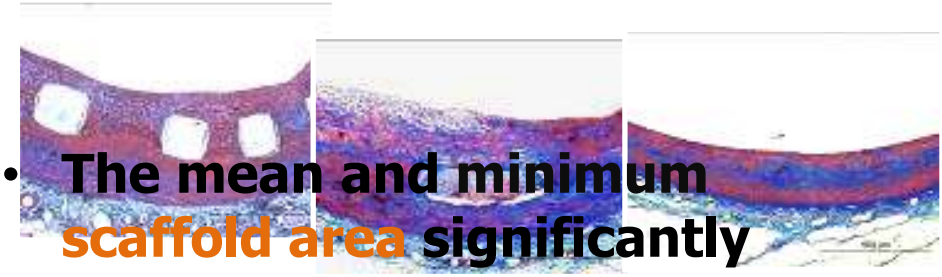

6M
SB


2Y
SB

Serial IVUS

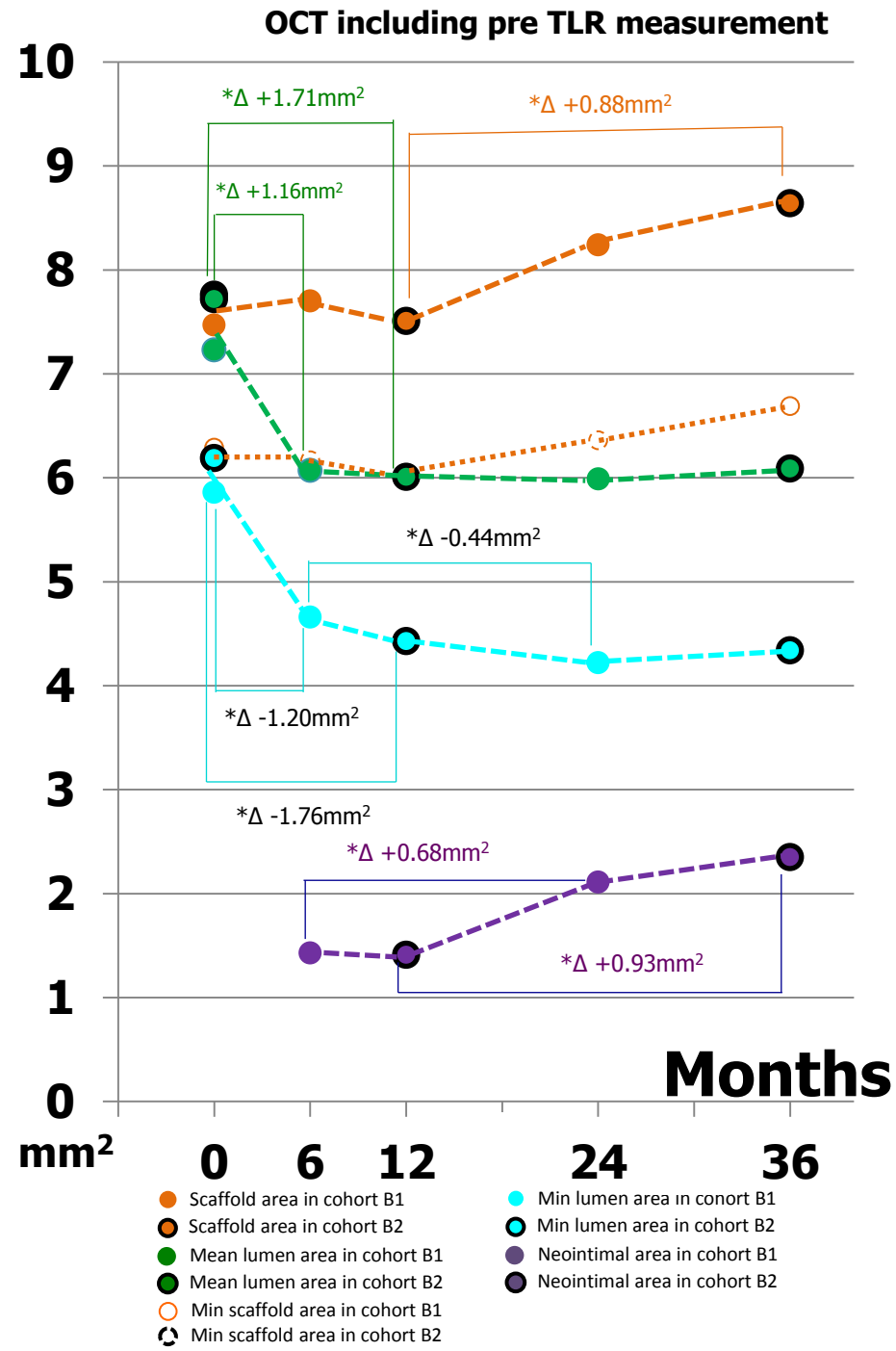


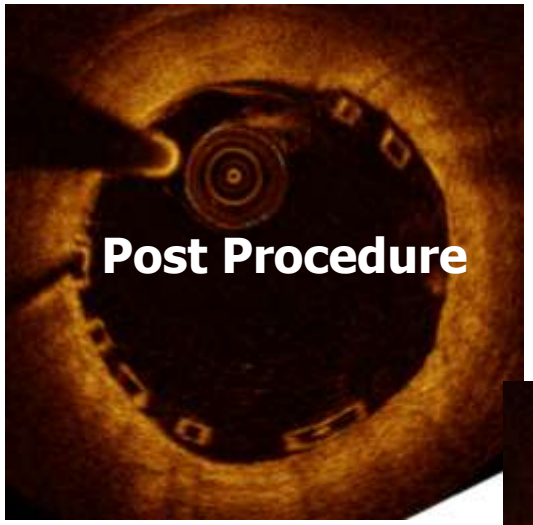
- **The Vessel area and total plaque area show a biphasic change with an increase between the first and second year. A plaque reduction occurs between the second and third year follow-up.**

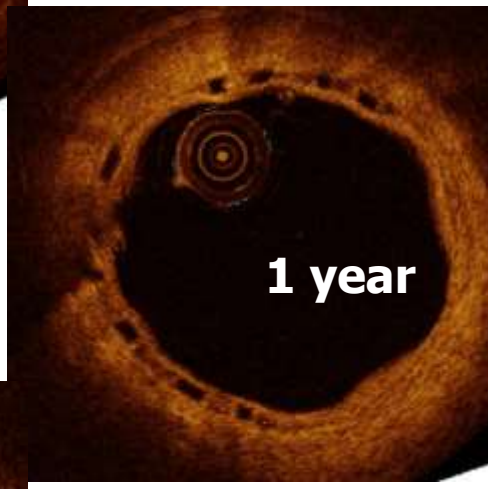


- **The mean and minimum scaffold area significantly increase and compensate for the increase in neointimal hyperplasia, resulting in an increase of mean lumen area from 1 to 3 years with an unchanged minimal lumen area from 1 year to 3 years.**

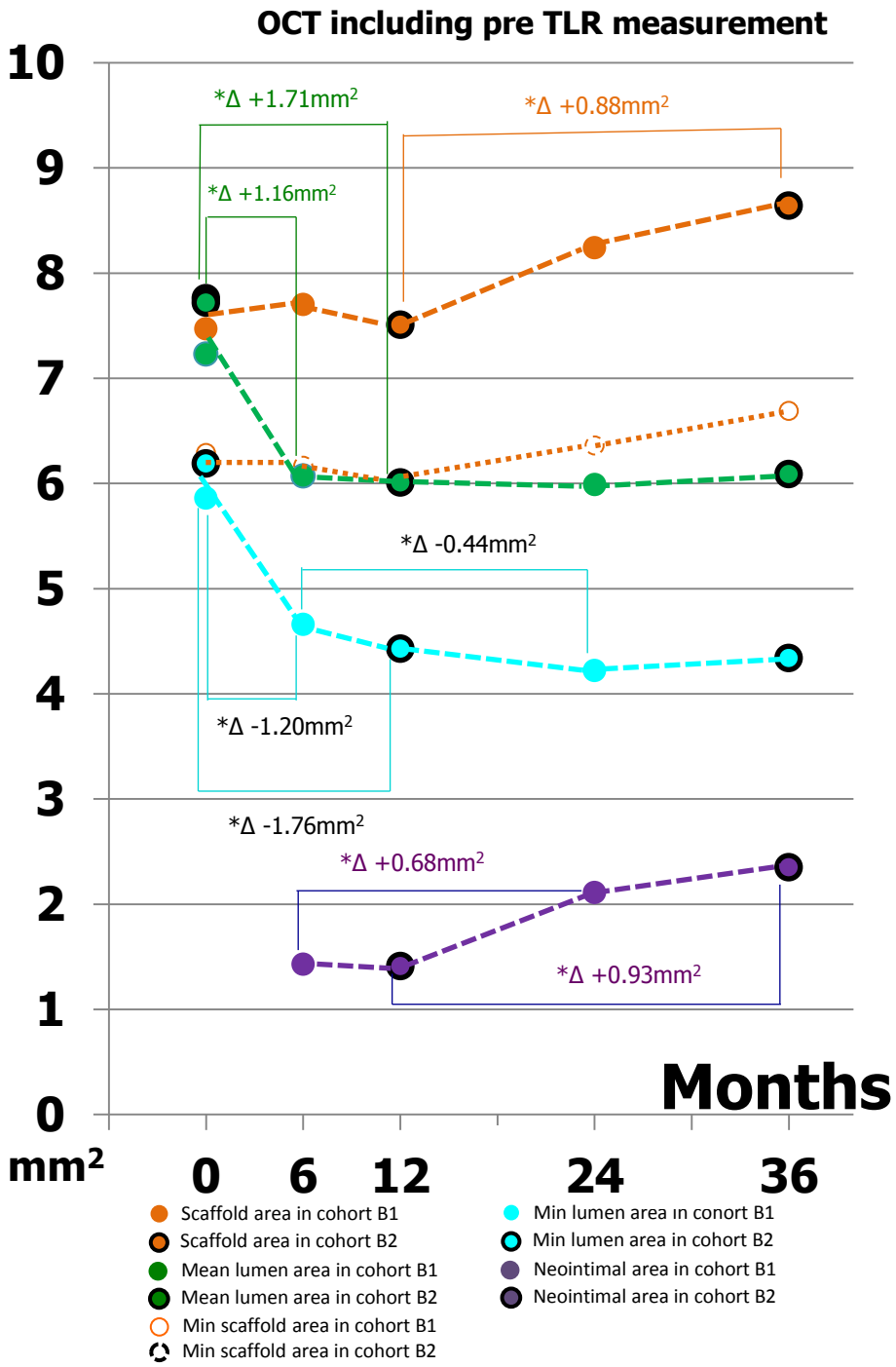
Serial OCT


OCT including pre TLR measurement
10
9
8
7
6
5
4
3
2
1
0
mm²
*Δ +1.71mm²
*Δ +0.88mm²
*Δ +1.16mm²
*Δ -0.44mm²
*Δ -1.20mm²
*Δ -1.76mm²
*Δ +0.68mm²
*Δ +0.93mm²
Months
0
6
12
24
36
Scaffold area in cohort B1
Scaffold area in cohort B2
Mean lumen area in cohort B1
Mean lumen area in cohort B2
Min scaffold area in cohort B1
Min scaffold area in cohort B2
Min lumen area in conort B1
Min lumen area in cohort B2
Neointimal area in cohort B1
Neointimal area in cohort B2


Post Procedure


1 year

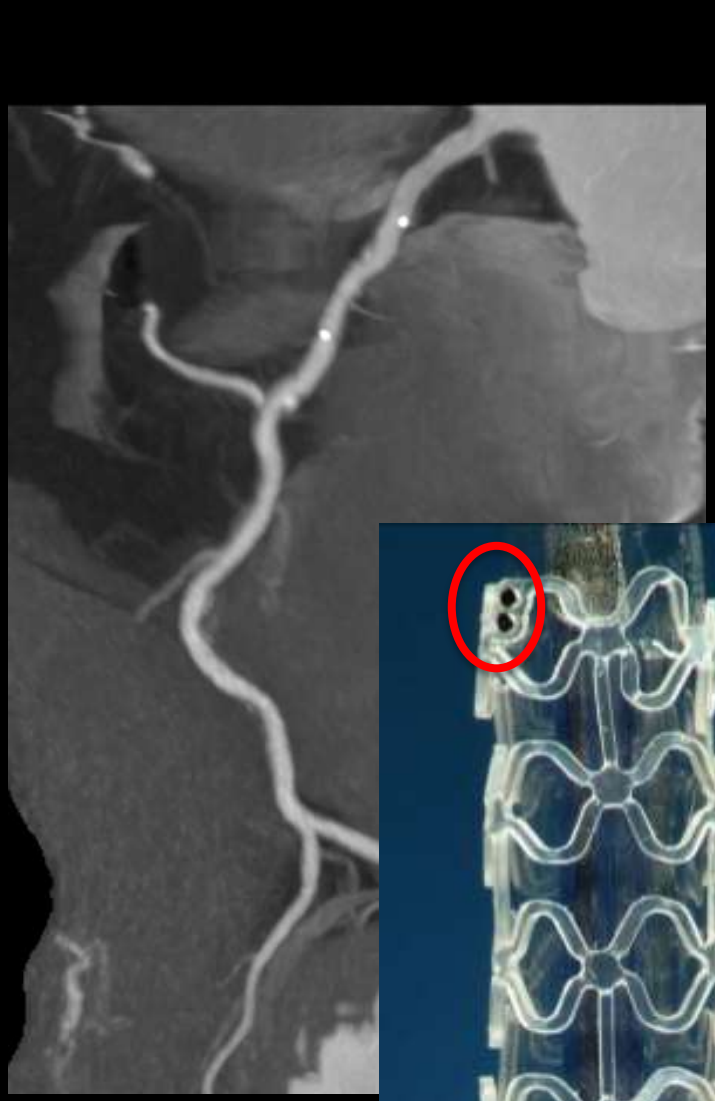

3 year

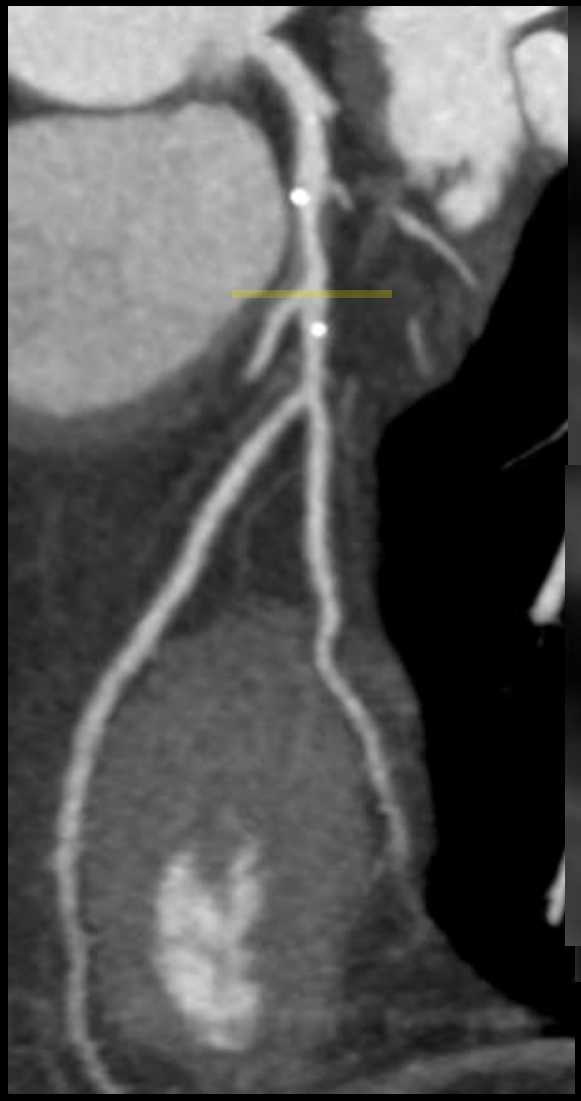


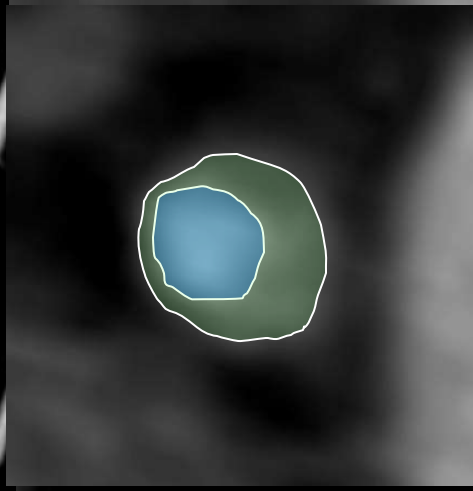
Serial OCT

- **OCT confirms the IVUS findings regarding the increase in the scaffold area and neointimal area from 1 to 3 years.**
- **The mean and minimum scaffold area significantly increase and compensate for the increase in neointimal hyperplasia. As a consequence, mean lumen area and minimal lumen area were unchanged from 1 year to 3 years.**

Quantitative Assessment of MSCT

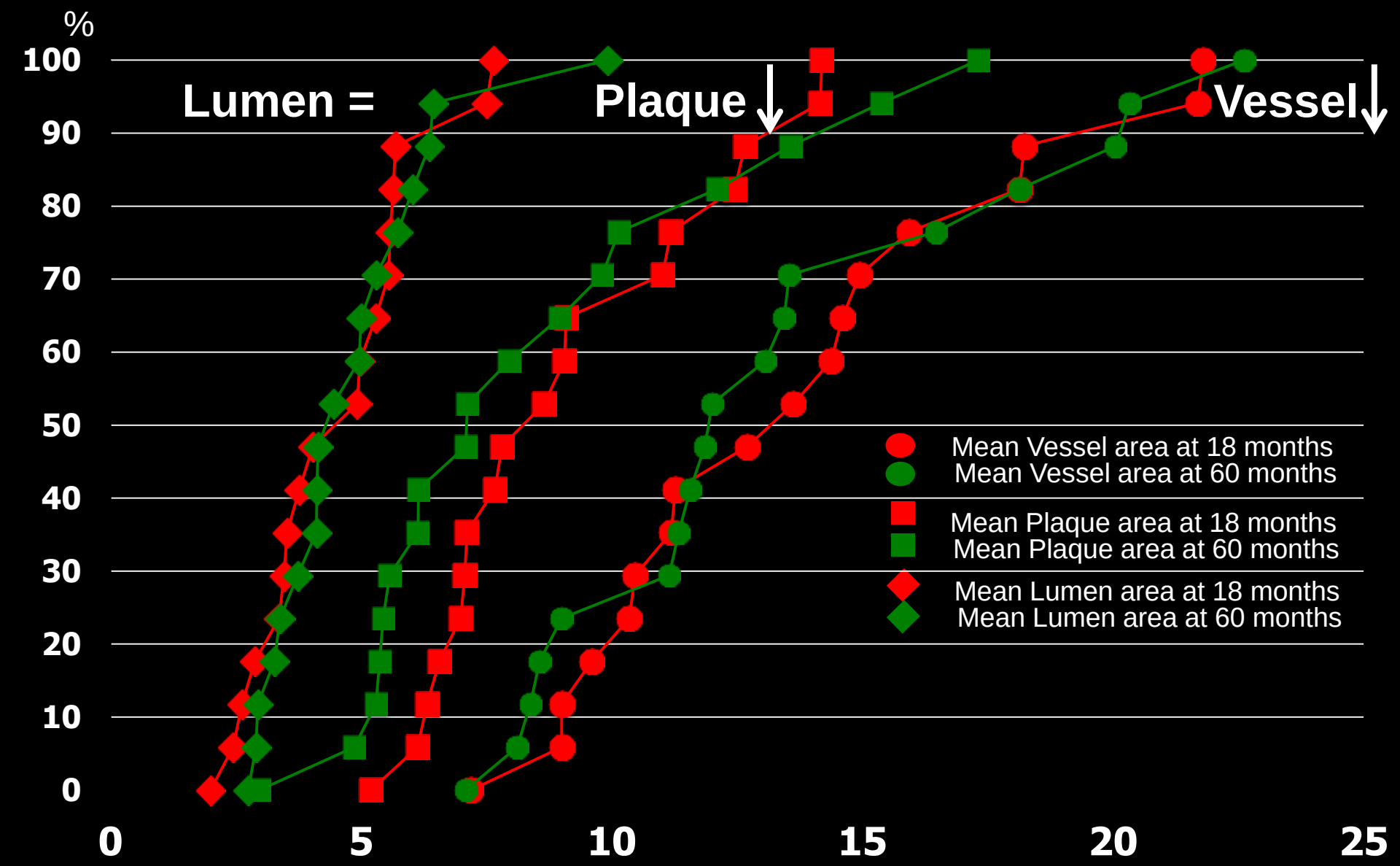






Erasmus MC
University Medical Center Rotterdam

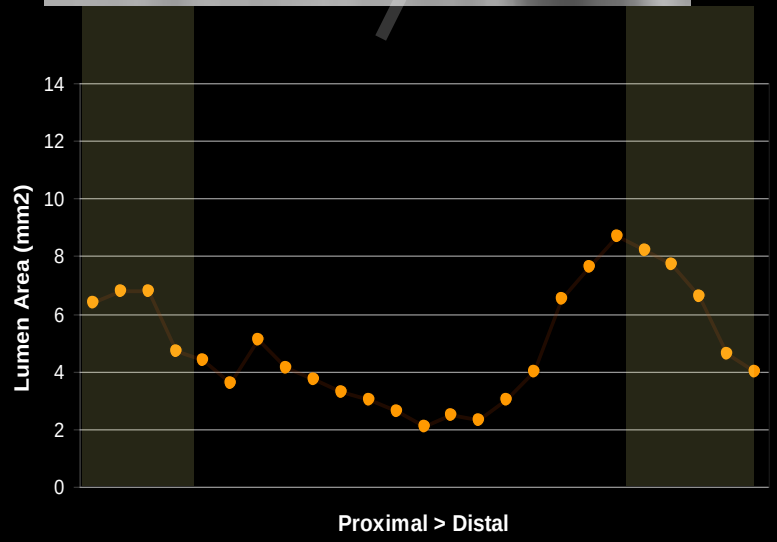
Cumulative frequency distribution curves of vessel area, plaque area and lumen area on MSCT at 18 months and 60 months



Onuma et al. JACC interv 2013

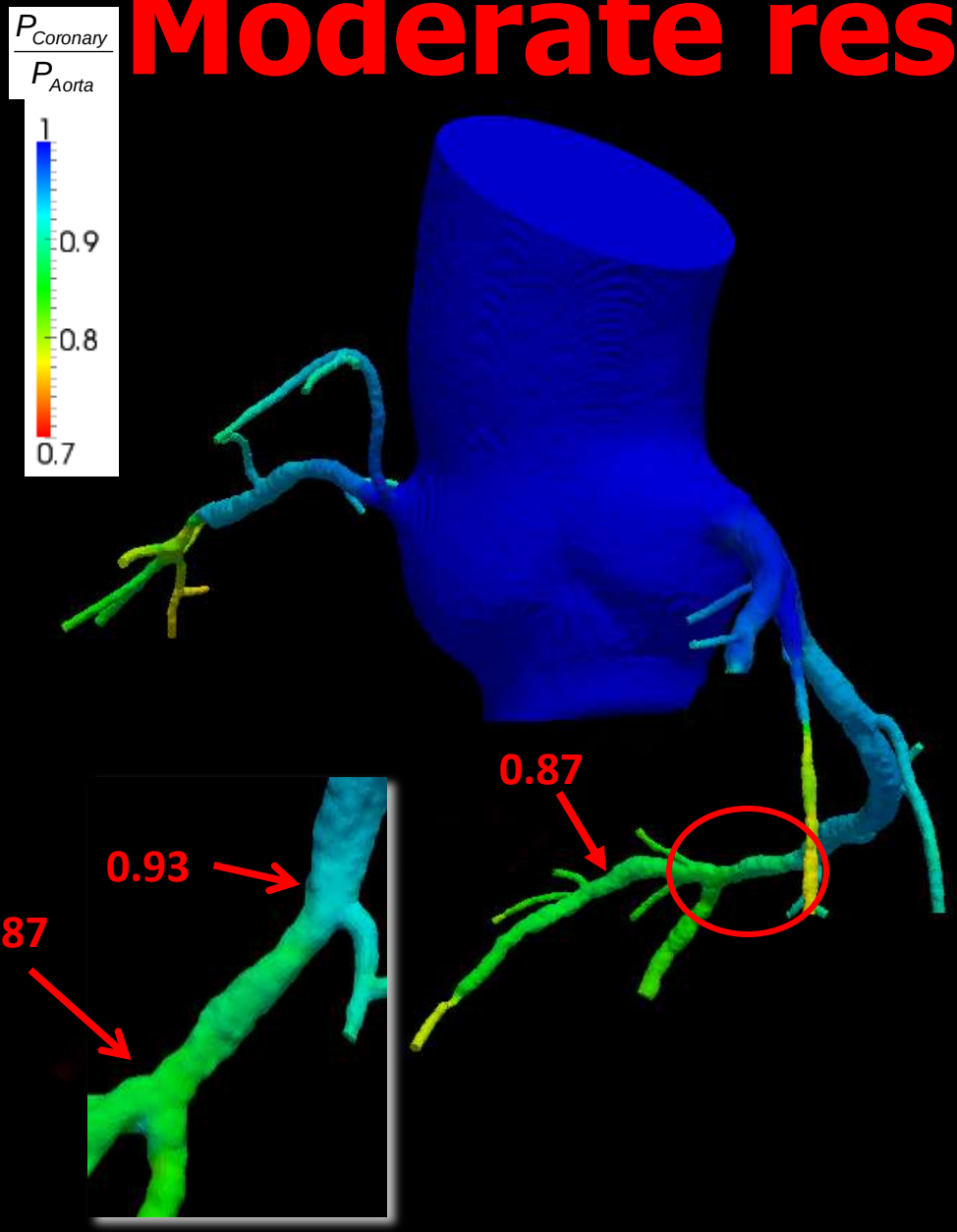
Moderate restenosis

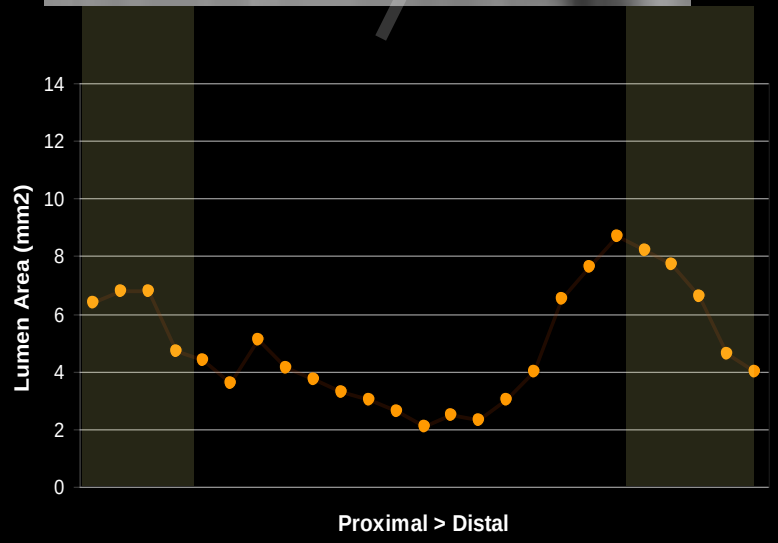
Onuma et al. JACC interv 2013



Moderate restenosis

Onuma et al. JACC interv 2013





Conclusion

Absorb II trial showed:

- The acute gain is smaller with Absorb (A) than with Xience (X), which is derived from less aggressive implantation/postdilatation with A than X.
- Appropriate postdilatation with OCT guidance may achieve better acute gain
- Sidebranch occlusion and other angiographic complications are not different
- The implantation of a "large" Absorb scaffold in a relatively small vessel had a higher risk of MACE at 1year.

ABSORB A and B trials showed:

- Stable Late lumen loss
- Late lumen enlargement
- Feasibility of non-invasive imaging at FUP by MSCT with a possibility of functional assessment