

How Do We Use the OCT to Evaluate DES Endothelialization?

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Pathological Correlates of Late Drug-Eluting Stent Thrombosis

Strut Coverage as a Marker of Endothelialization

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The most powerful histological predictor of stent thrombosis was endothelial coverage.

The best morphometric predictor of LST was the ratio of uncovered to total stent struts.



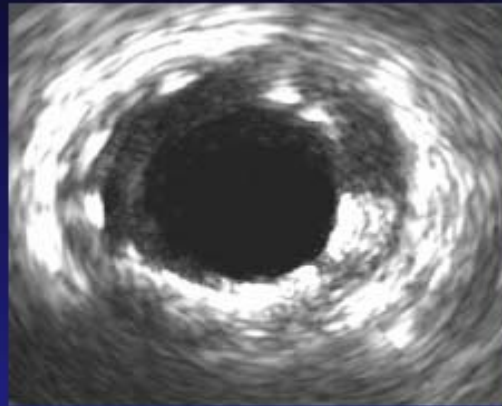
Endothelial Cell Recovery Between Comparator Polymer-Based Drug-Eluting Stents

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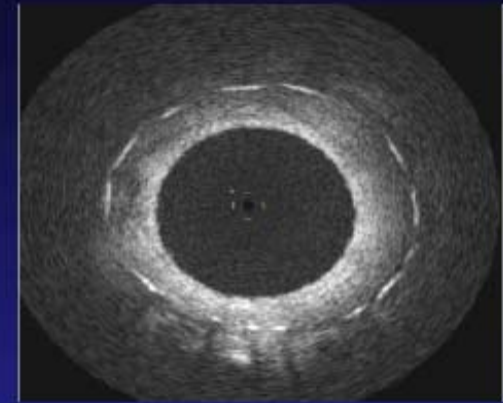
*Munich, Germany; Gaithersburg, Maryland; Atlanta, Georgia; Santa Clara, California; Boston, Massachusetts;
and Orangeburg, New York*

endothelial coverage over stent struts. The restoration of endothelial function within the stent may be further impaired because of an underlying dysfunctional endothelium in symptomatic plaques. Moving beyond the exuberance of curing restenosis, attention should focus on stent strut coverage rather than late loss alone because the persistent lack of coverage as reported in recent clinical (47) and autopsy (3) studies may serve as a nidus for thrombosis.

IVUS vs. OCT



IVUS



OCT

Resolution	Axial 100-150 μm Lateral 150-300 μm	15-20 μm 25-40 μm
Size of imaging core	0.8 mm	0.4 mm
Dynamic range	40-60 dB	90-110 dB
Frame rate	30 frame/s	15 frame/s



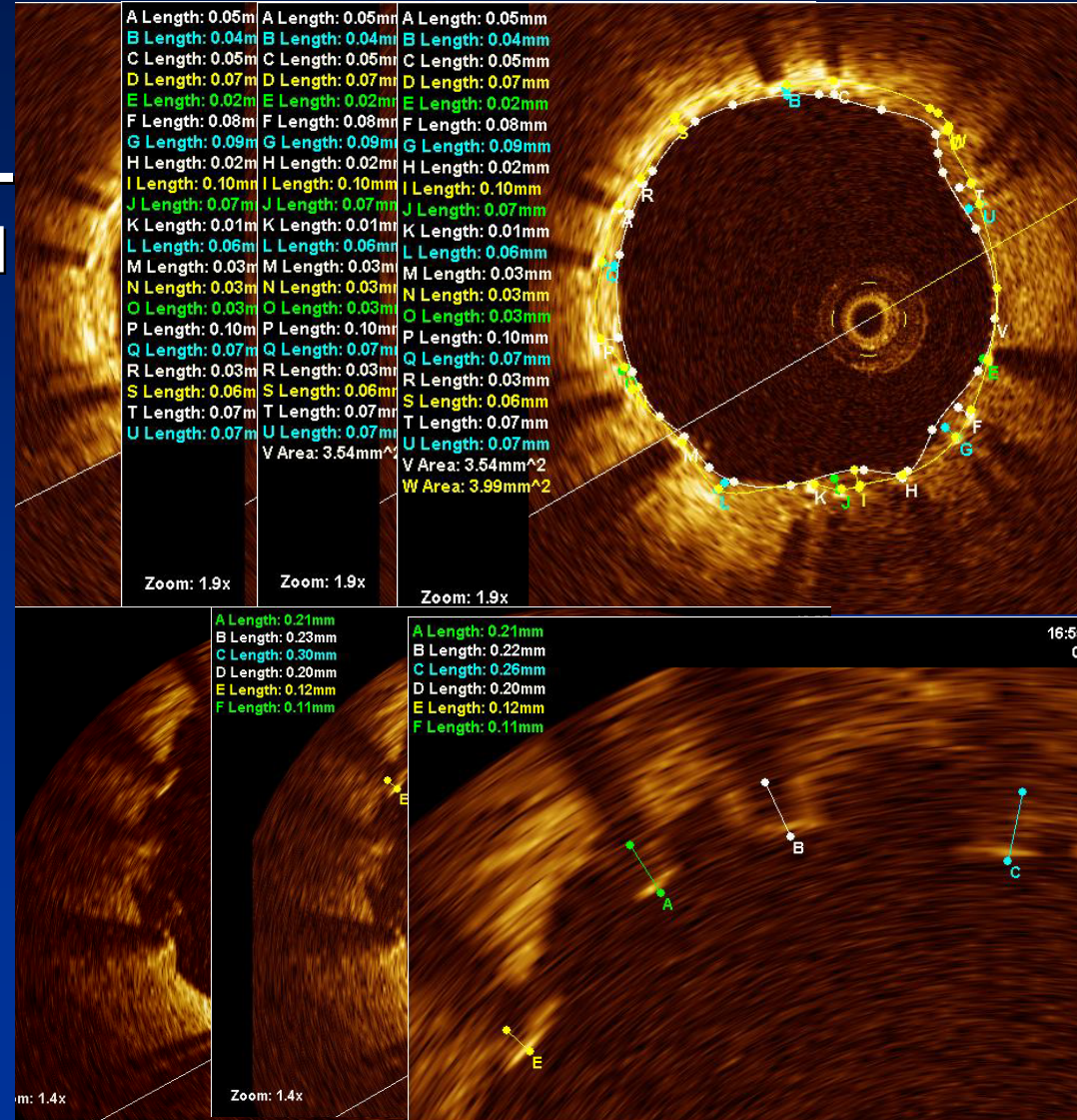
Optical Coherence Tomography Image Analysis

1. Neointimal thickness

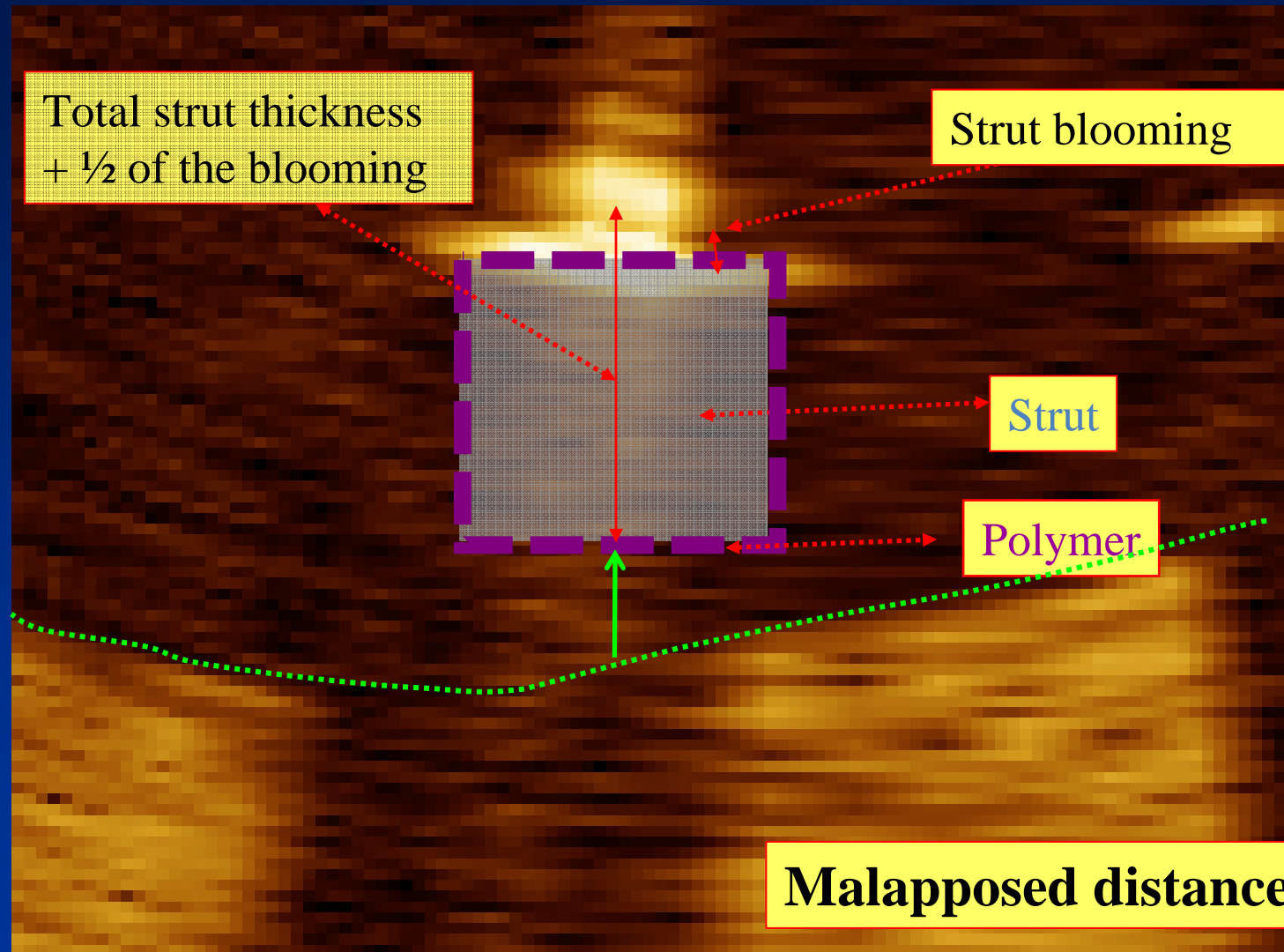
The distances between the endoluminal surface of neointimal and the strut reflection

2. Stent apposition

The distances between the endoluminal surface of the strut reflection and the vessel wall



Strut Level Analysis: Malapposition



Optical Coherence Tomography Image Analysis

1. Covered strut

Covered strut defined as stent strut with detectable neointima by OCT

Takano M, et al. *Am J Cardiol* 2007;99:1033-1038

2. Malapposition

Stent malappositions were defined as struts with detachment from the vessel wall $\geq 160 \mu\text{m}$ for SES, $\geq 130 \mu\text{m}$ for PES, $\geq 110 \mu\text{m}$ for ZES and $\geq 100 \mu\text{m}$ for EES

Tanigawa J, et al. *EuroInterv* 2007; 3:127-136

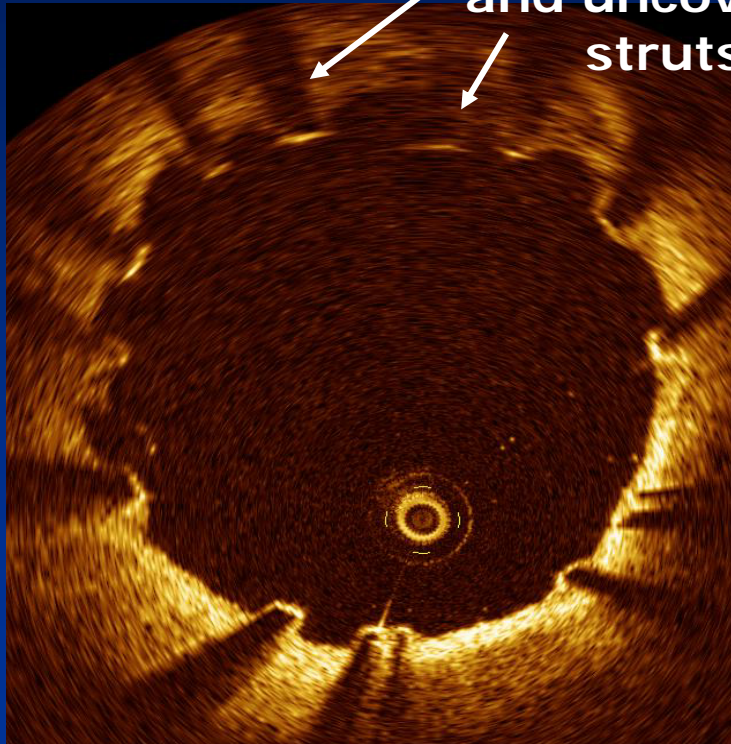


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9 Month Follow-Up OCT finding

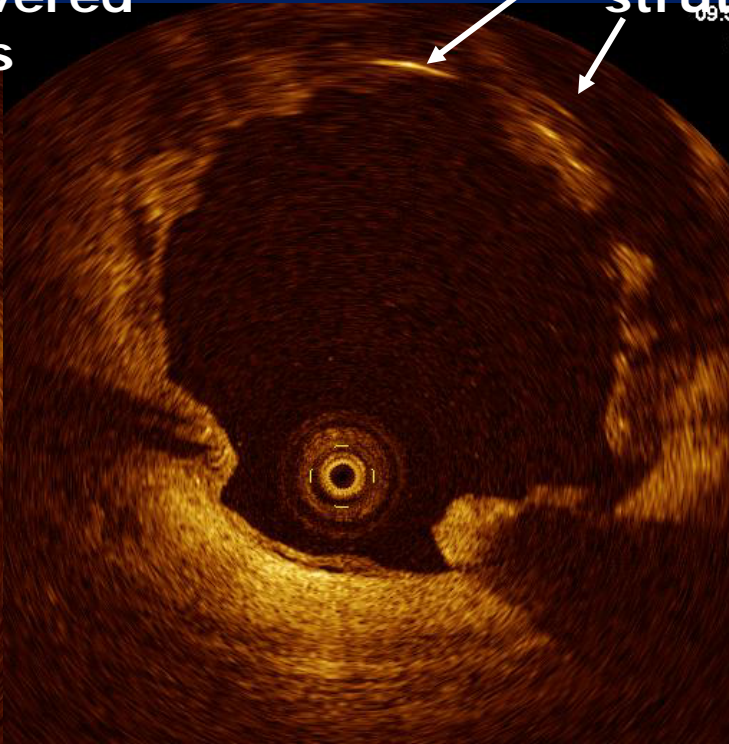
Cypher Stent

Malapposed
and uncovered
struts

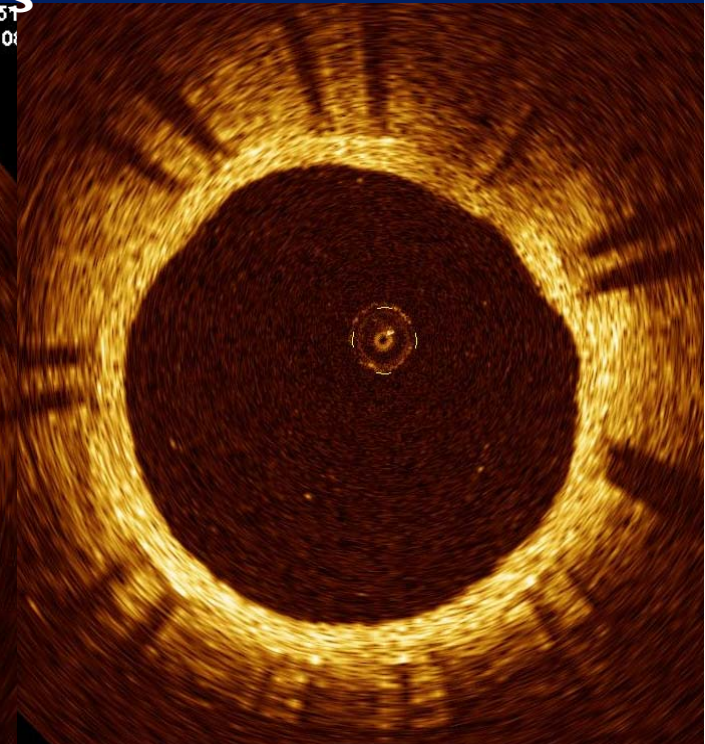


Taxus Stent

Malapposed
struts



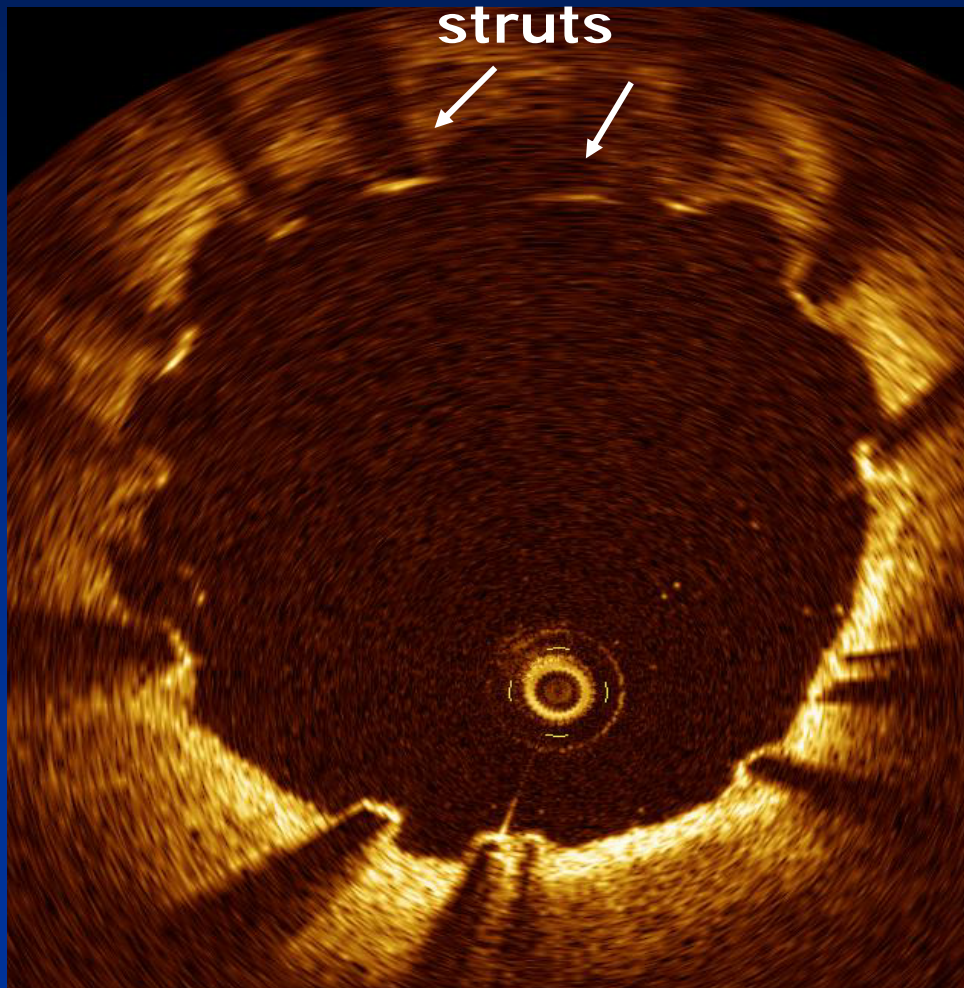
Endeavor Stent



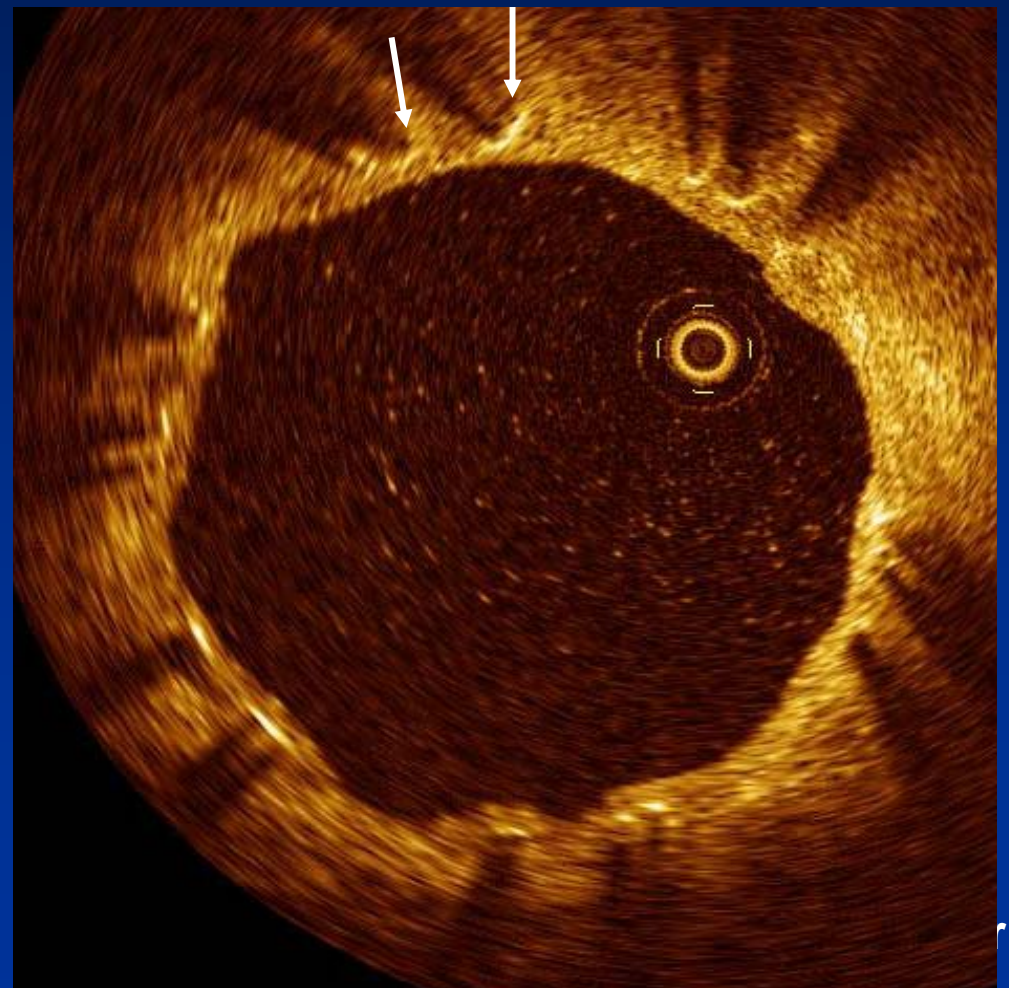
9 Month Follow-Up OCT finding

Cypher Stent

Malapposed and uncovered struts



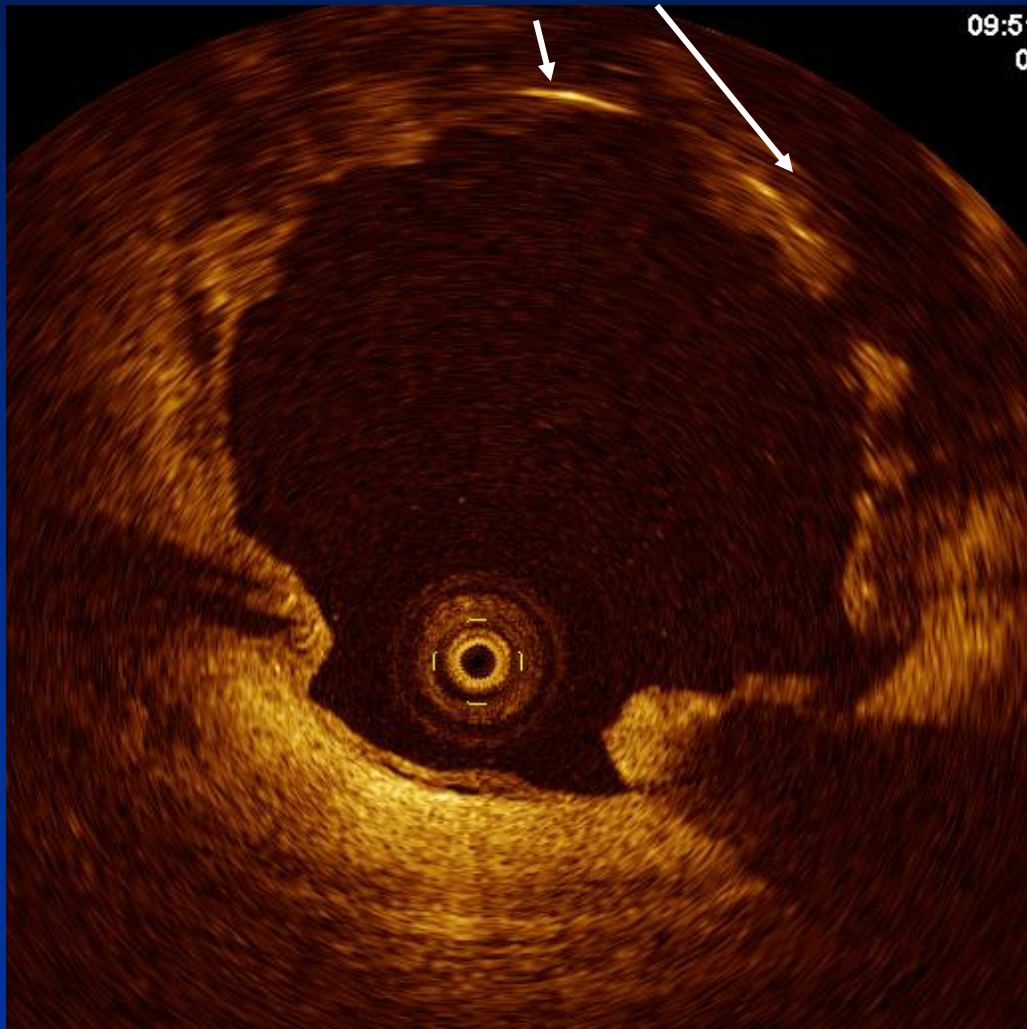
Covered struts with neointima



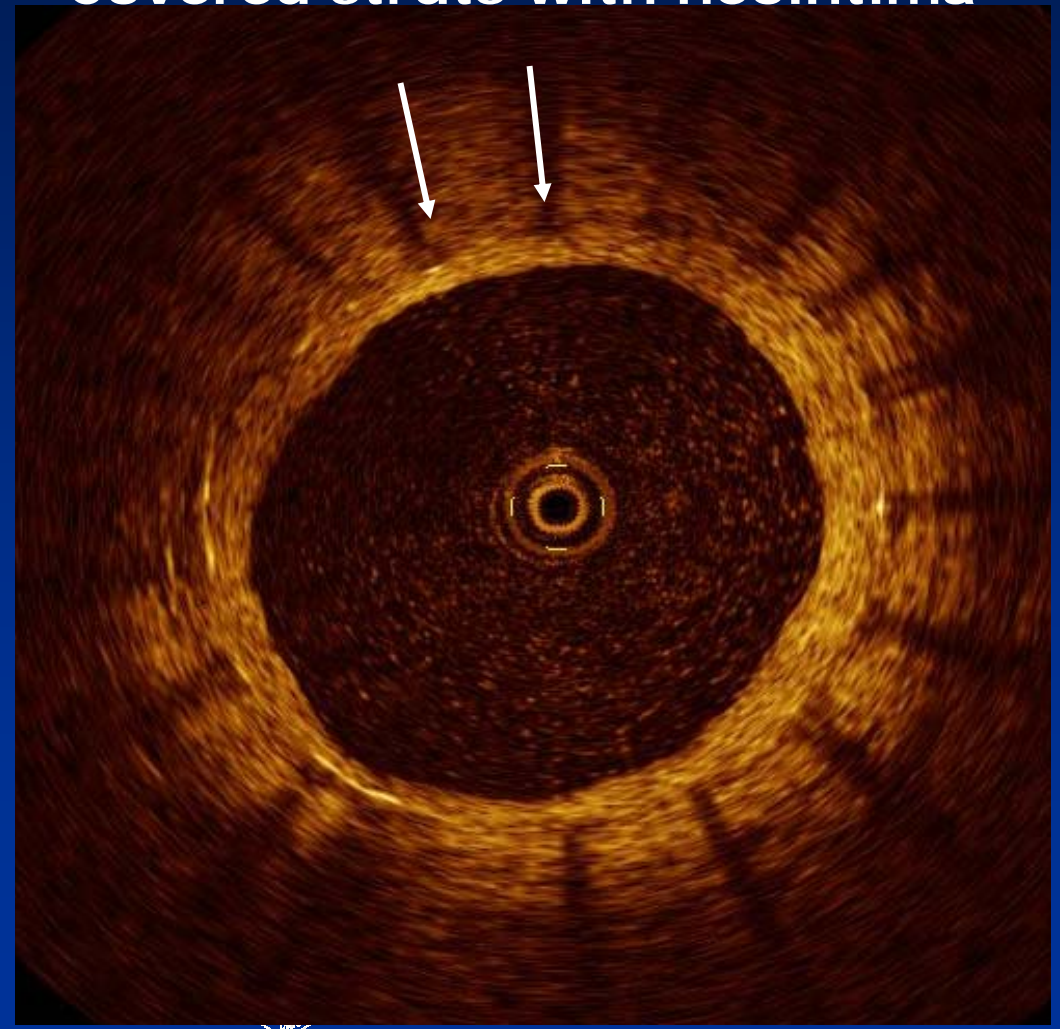
9 Month Follow-Up OCT finding

Taxus Stent

Malapposed struts

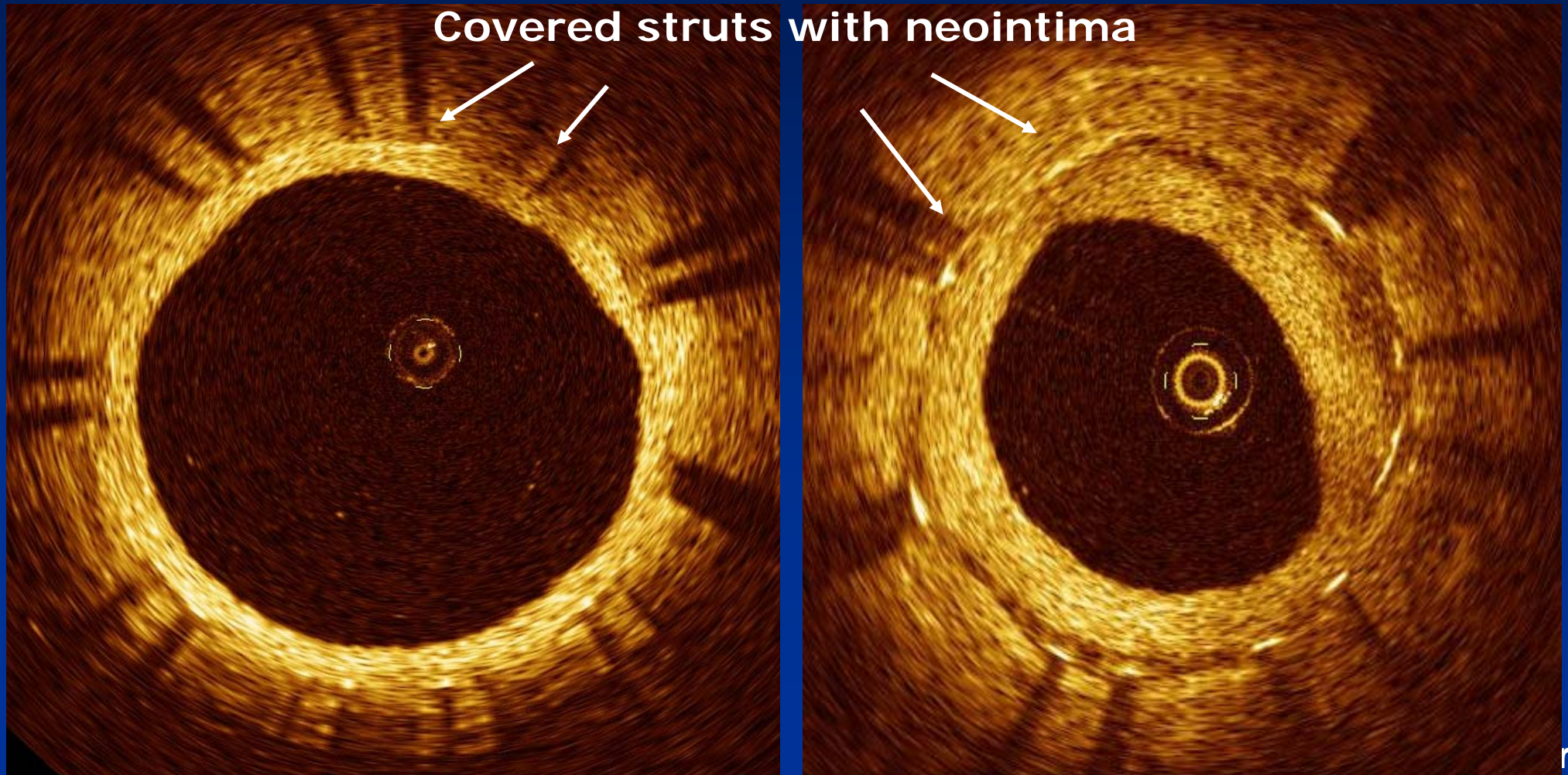


Covered struts with neointima



9 Month Follow-Up OCT finding

Endeavor Stent



Limitation of OCT for Neointima

- Tissue characterization of newly covered tissue over the stent strut is not well defined yet (need histologic comparison).
- One layer endothelium (about 600 nm) could not be detected using current OCT technology.
- The detected neointima does not fully reflect an intact functioning endothelium.
- There were no data on clinical implications of neointimal coverage detected by OCT.



YONSEI OCT Registry

From Aug, 2007 to April, 2009

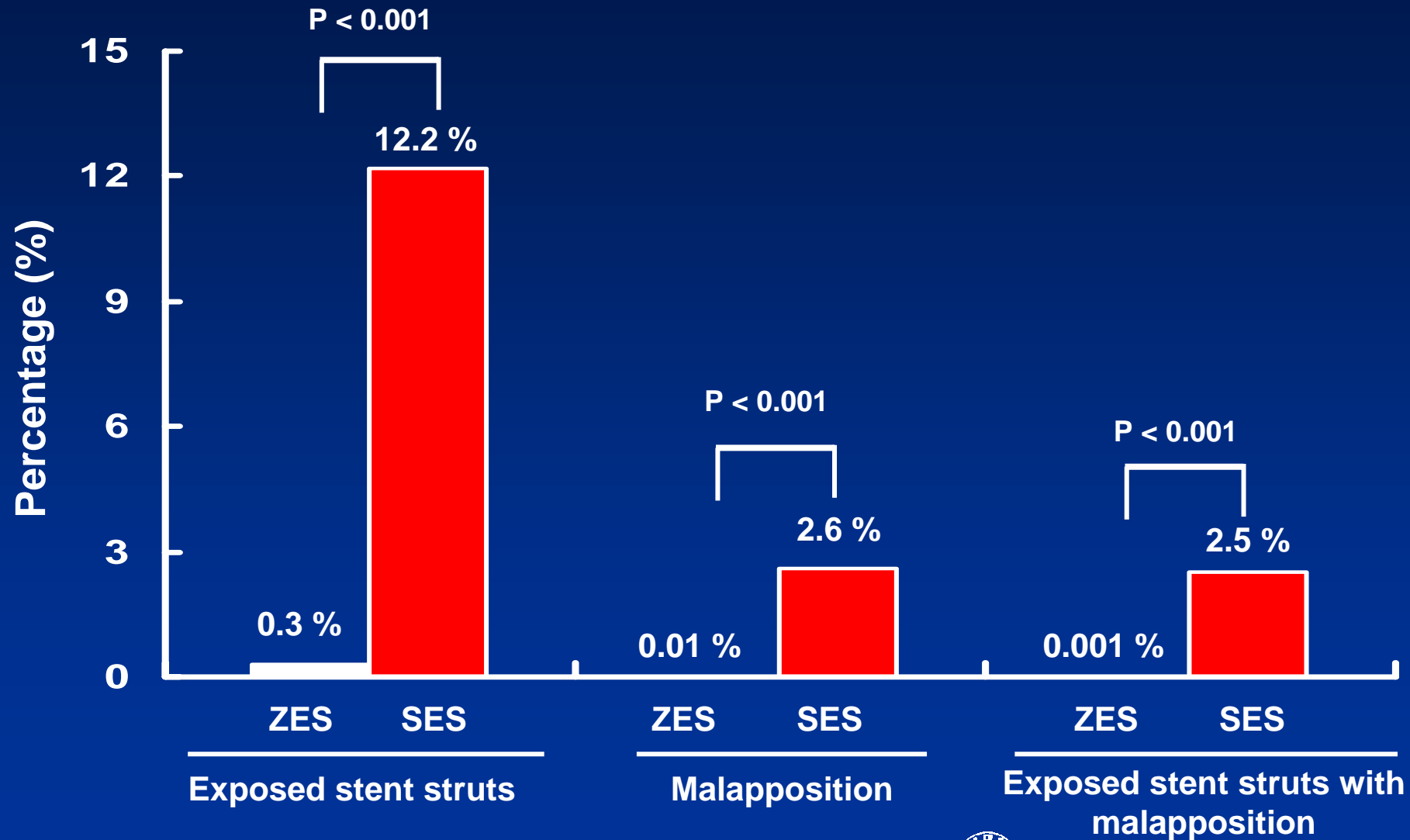
350 stents in 290 patients

were enrolled and evaluated



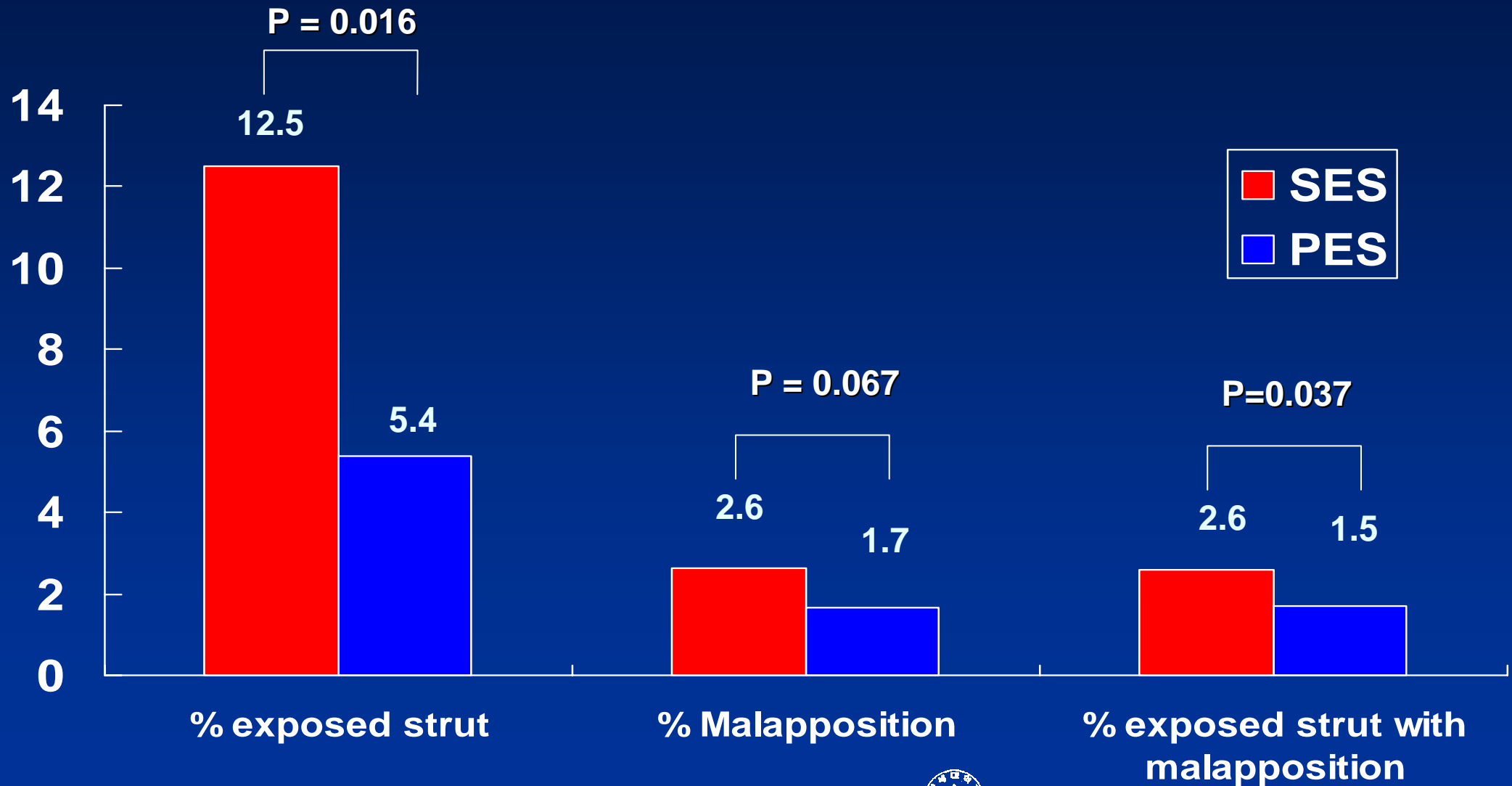
OCT findings 68 patients (36 SES and 32 ZES)

1535 mm in stent length including 16,563 struts



OCT findings 68 patients (33 SES and 24 PES)

1379 mm in stent length including 11,837 struts



TCT 2008



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Evaluation in 3 months Duration of neointima coverage after zotarolimus-eluting stent implantation by Optical Coherence Tomography (ENDEAVOR OCT)

Patients with Endeavor implantation in CAD

IVUS and OCT after stent implantation and at 3 months

Stable angina (n = 15)

ACS (n = 15)

Primary end-point: Percent neointima coverage at 3 months

Secondary end-point: percent of malapposition and thrombus at follow-up OCT

P.I: Yangsoo Jang



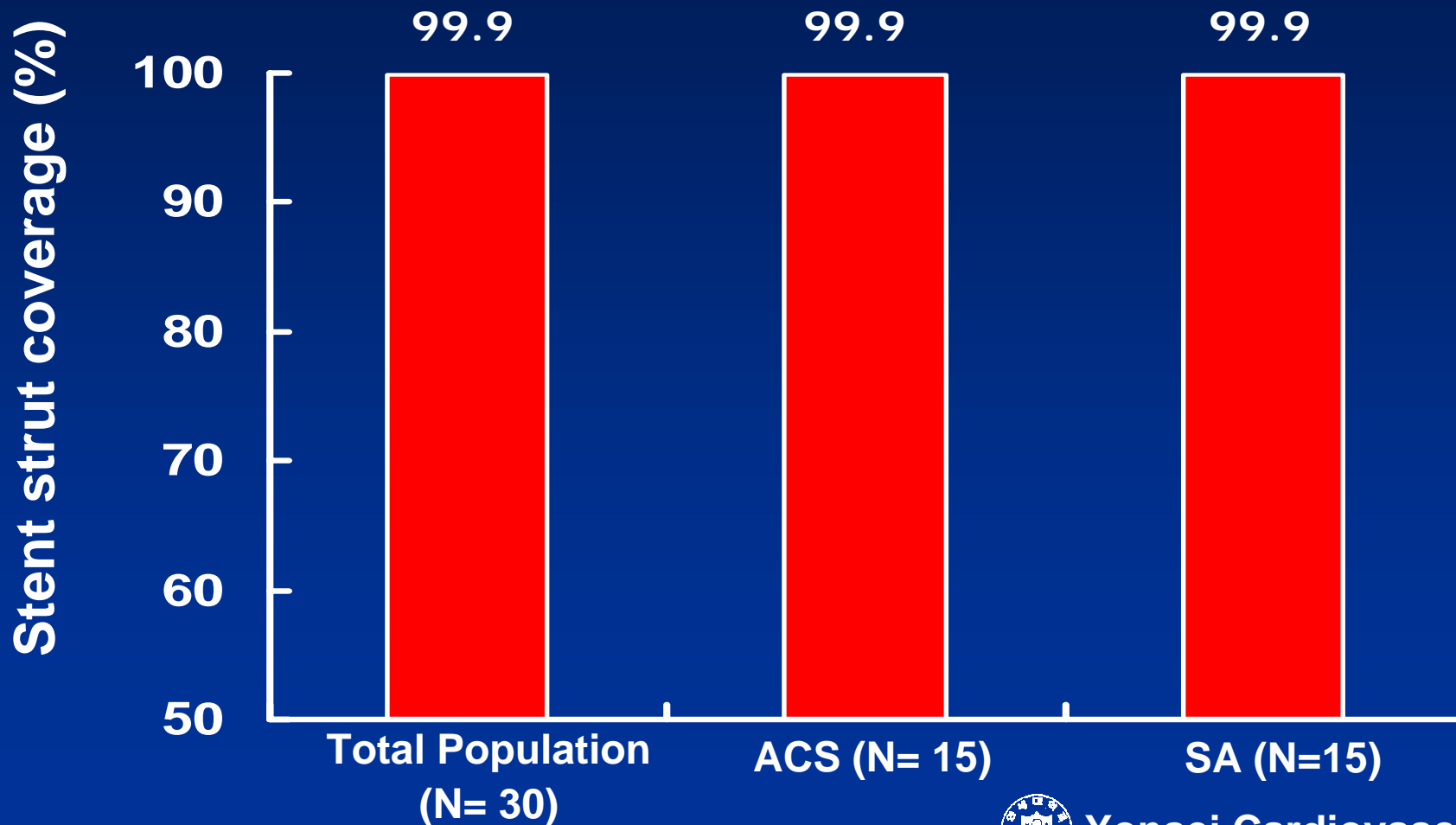
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OCT findings

Measured at every 0.5 mm

30 patients (16 stents in 15 ACS and 15 stents in 15 SA)

683 mm in stent length including 12074 struts



ENDEAVOR OCT (unpublished data)



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Limitation

- Small population, but considerable struts were evaluated in current study.
- One layer endothelium (about 600 nm) could not be detected using current OCT technology.
- The detected neointima does not fully reflect an intact functioning endothelium.
- There were no data on clinical implications of neointimal coverage detected by OCT.

