OCT for Guiding Complex PCI: Wisdom from Experience

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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.

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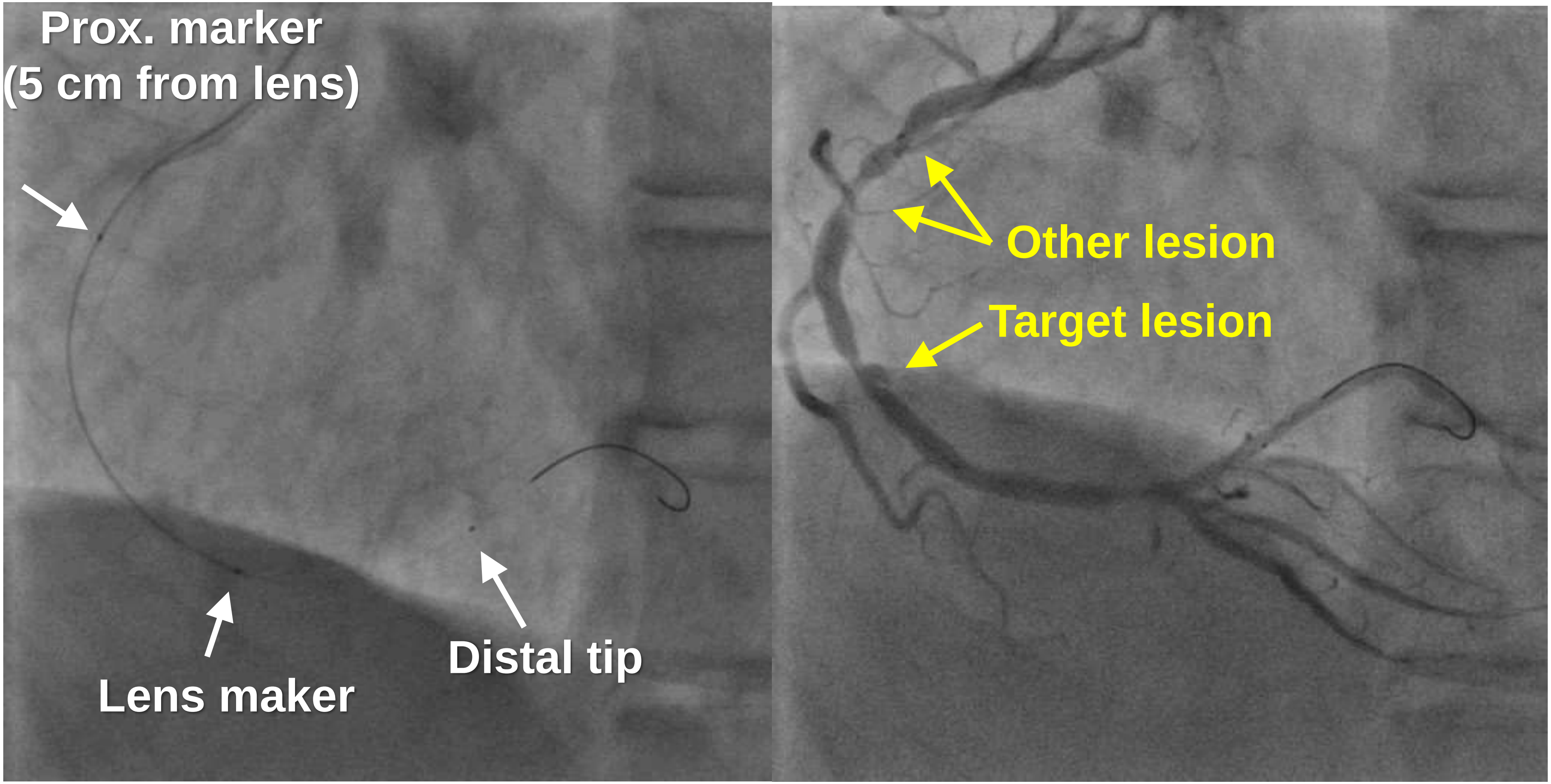
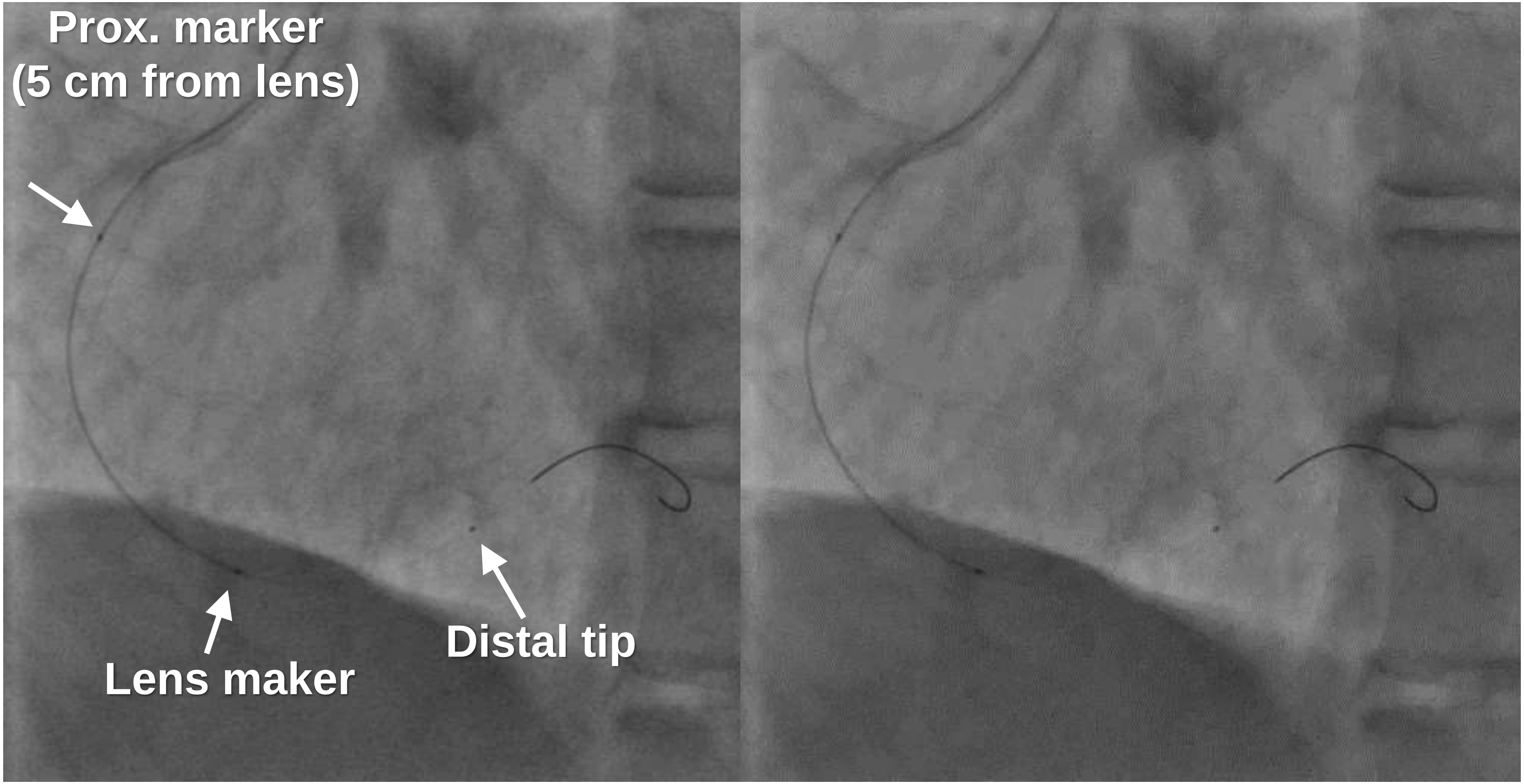
  Nipro Inc.
  Terumo Inc.

- Consulting Fees/Honoraria : Abbott Vascular Japan
  Daiichi-Sankyo Pharmaceutical Inc.
  Nipro Inc.
  Terumo Inc.

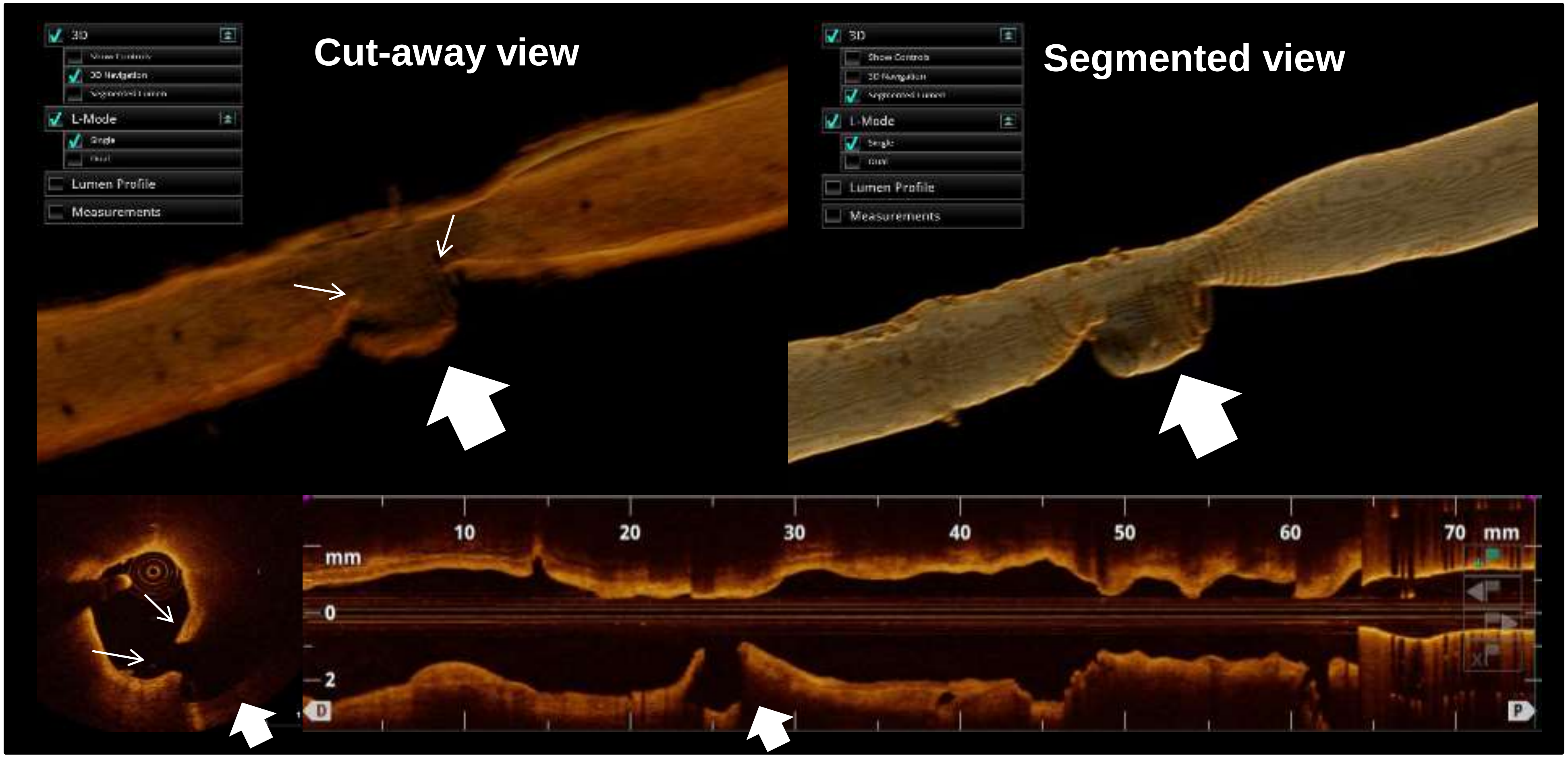
Positioning of OCT Catheter



Positioning of OCT Catheter



Advantages of Newly developed FD-OCT system (ILUMIEN OPTIS ™)



Demonstration of various causes in ACS

Plaque rupture

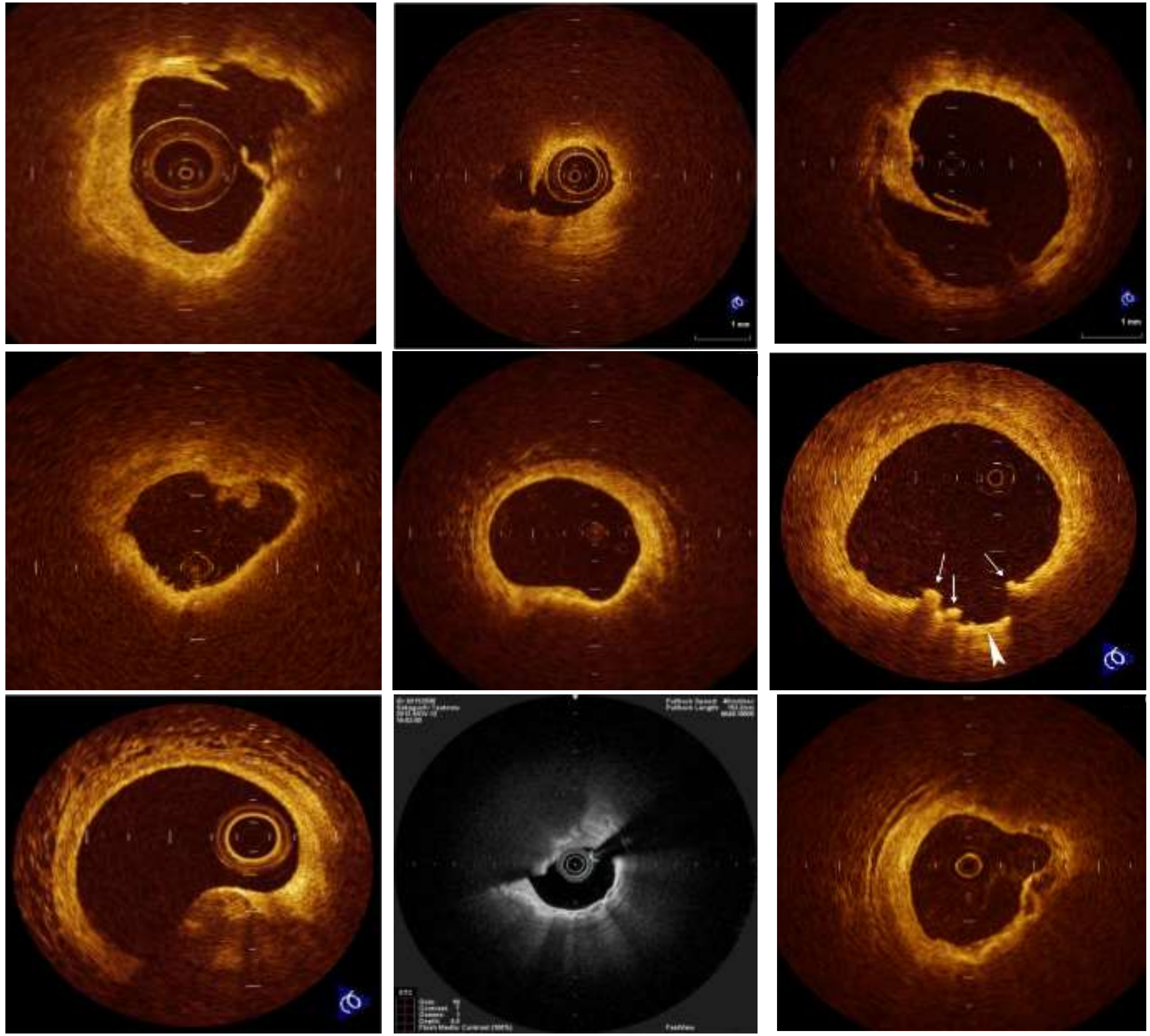
60 – 70 %

Plaque erosion

20 – 30 %

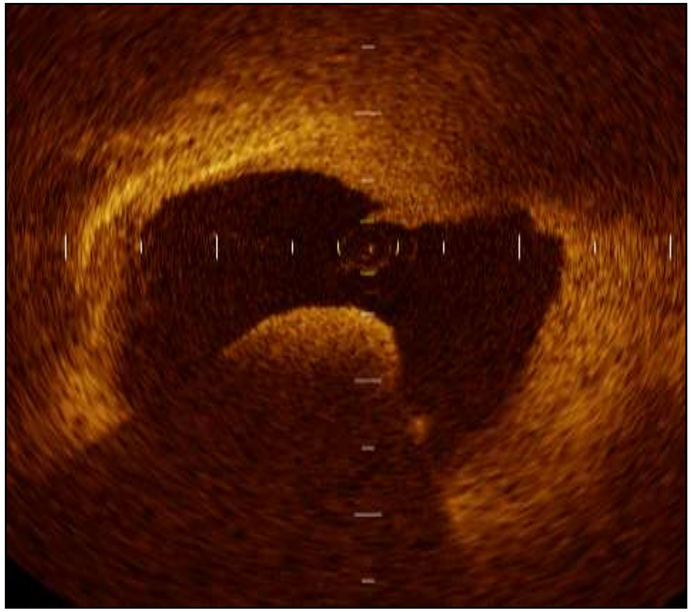
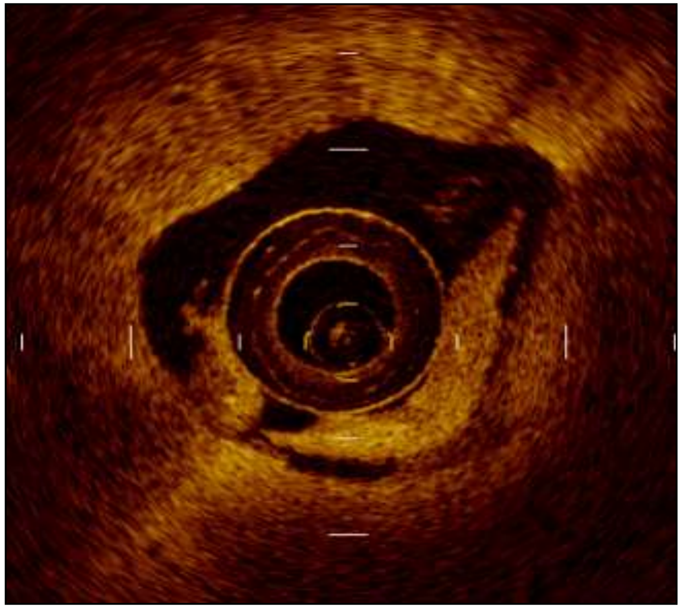
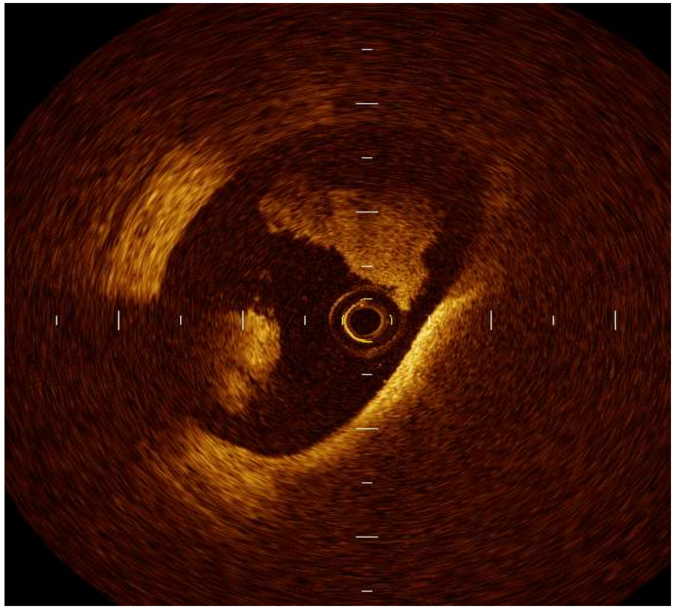
Calcified nodule

5 – 6 %



Kubo T, Akasaka T, et al. (J Am Coll Cardiol 50:933-939,2007)

Red & white thrombus

Red thrombus	White thrombus	Mixed thrombus
		
Protrusion mass with shadow	Protrusion mass without shadow	Protrusion mass with & without shadow

Kume T, Akasaka T, et al. (Am J Cardiol 97:1713-1717, 2006)
Kubo T, Akasaka T, et al. (J Am Coll Cardiol 50:933-939,2007)

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doi:10.1016/j.jacc.2011.09.079

MINI-FOCUS ISSUE: OPTICAL COHERENCE TOMOGRAPHY

Clinical Research

Consensus Sta… Acquisition, M… Intravascular O…

A Report From th… Optical Coherence…

Guillermo J. Tearney, M…
Evelyn Regar, MD, PhD,…

Objectives The pu… Cohere… nities, t… with at…

Background Intrava… lution o… detail. I… using t… by the … tion of …

Methods The IW… States, … interna…

Results Knowle… ate this… pated i…

Conclusions This document may be broadly used … modality, intended for researchers a… 2012;59:1058–72) © 2012 by the A…

European Heart Journal (2010) **31**, 401–415
doi:10.1093/eurheartj/ehp433

REVIEW

Imaging of atheroscle…

Expert revie… terminolog… coherence t… methodolog… application … and atheros…

Francesco Prati[1*], E… Ik-Kyung Jang[6], Tak… Eberhard Grube[10], … Expert's OCT Revie…

[1]Interventional Cardiology, San Giovanni H… [3]Washington Hospital Center, Washingto… [6]Massachusetts General Hospital, Boston, … Italy; [10]Heart Center Siegburg, Siegburg, G…

Received 10 December 2008; revised 30 Apr…

European Heart Journal (2012) **33**, 2513–2522
doi:10.1093/eurheartj/ehs095

CURRENT OPINION

Expert review document part 2: methodology, terminology and clinical applications of optical coherence tomography for the assessment of interventional procedures

Francesco Prati[1,2*], Giulio Guagliumi[3], Gary S. Mintz[4], Marco Costa[5], Evelyn Regar[6,7], Takashi Akasaka[8], Peter Barlis[9], Guillermo J. Tearney[10,11], Ik-Kyung Jang[12], Elosia Arbustini[13], Hiram G. Bezerra[5], Yukio Ozaki[14], Nico Bruining[6,7], Darius Dudek[15], Maria Radu[6,7], Andrejs Erglis[16], Pascale Motreff[17], Fernando Alfonso[18], Kostas Toutouzas[19], Nieves Gonzalo[20], Corrado Tamburino[21], Tom Adriaenssens[22], Fausto Pinto[23], Patrick W.J. Serruys[6,7], and Carlo Di Mario[24,25], for the Expert's OCT Review Document

[1]San Giovanni Hospital, Rome, Italy; [2]CLI Foundation, Rome, Italy; [3]Ospedali Riuniti, Bergamo, Italy; [4]Cardiovascular Research Foundation, New York, NY, USA; [5]University Hospitals at Case Medical Center, Cleveland, OH, USA; [6]The Thoraxcenter, University Hospital Rotterdam, Rotterdam, Netherlands; [7]Rigshospitalet, Copenhagen University Hospital, Copenhagen, Denmark; [8]Wakayama Medical University, Wakayama, Japan; [9]The Northern Hospital, University of Melbourne, Melbourne, Australia; [10]Wellman Center for Photomedicine, Massachusetts General Hospital, Boston, MA, USA; [11]Pathology Department, Massachusetts General Hospital, Boston, MA, USA; [12]Massachusetts General Hospital, Boston, MA, USA; [13]IRCCS Foundation, Policlinico San Matteo, Pavia, Italy; [14]Fujita Health University, Toyoake, Aichi, Japan; [15]Institute of Cardiology, Jagiellonian University Medical College, University Hospital, Krakow, Poland; [16]Pauls Stradins Clinical University Hospital, Riga, Latvia; [17]Cardiologie et maladies vasculaires, Hôpital G. Montpied, Cedex, France; [18]Interventional Cardiologie, Cardiovascular Institute, San Carlos University Hospital, Madrid, Spain; [19]1st Department of Propaedeutic Surgery, Surgical Intensive Care Unit, University of Athens, Athens Medical School, Hippocration Hospital, Athens, Greece; [20]Interventional Cardiology, Hospital Clinico Universitario San Carlos, Madrid, Spain; [21]Cardiology Department, University of Catania, Catania, Italy; [22]Cardiology Department, Campus Gasthuisberg, Leuven, Belgium; [23]University of Lisbon, Lisbon, Portugal; [24]Royal Brompton Hospital, London, UK; and [25]Imperial College, London, UK

Received 4 February 2011; revised 10 November 2011; accepted 21 December 2011; online publish-ahead-of-print 31 May 2012

OCT- vs. angio-guided PCI with DES or BMS

The retrospective Centro per la Lotta contro l'Infarto-Optimisation of Percutaneous Coronary Intervention (CLI-OPCI) study

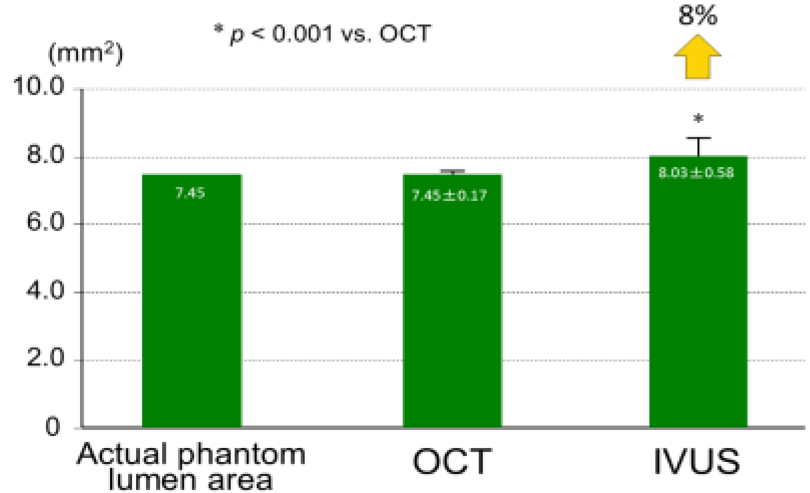
Events at 1-year follow-up	Angiographic guidance group (n=335)	Angiographic plus OCT guidance group (n=335)	*p*-value
Death	23 (6.9%)	11 (3.3%)	0.035
Cardiac death	15 (4.5%)	4 (1.2%)	0.010
Myocardial infarction	29 (8.7%)	18 (5.4%)	0.096
Target lesion repeat revascularisation	11 (3.3%)	11 (3.3%)	1.0
Definite stent thrombosis	2 (0.6%)	1 (0.3%)	1.0
Cardiac death or myocardial infarction	43 (13.0%)	22 (6.6%)	0.006
Cardiac death, myocardial infarction, or repeat revascularisation	50 (15.1%)	32 (9.6%)	0.034

The use of OCT can improve clinical outcomes of patients undergoing PCI.

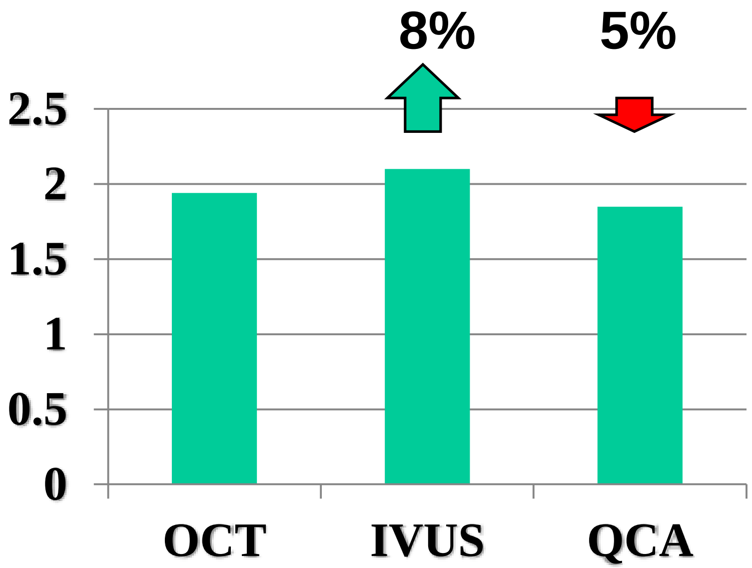
Prati F, et al., EuroIntervention 2012;8:823-829

Comparison of measurements (OCT, IVUS & QCA)

(OPUS-CLASS study)

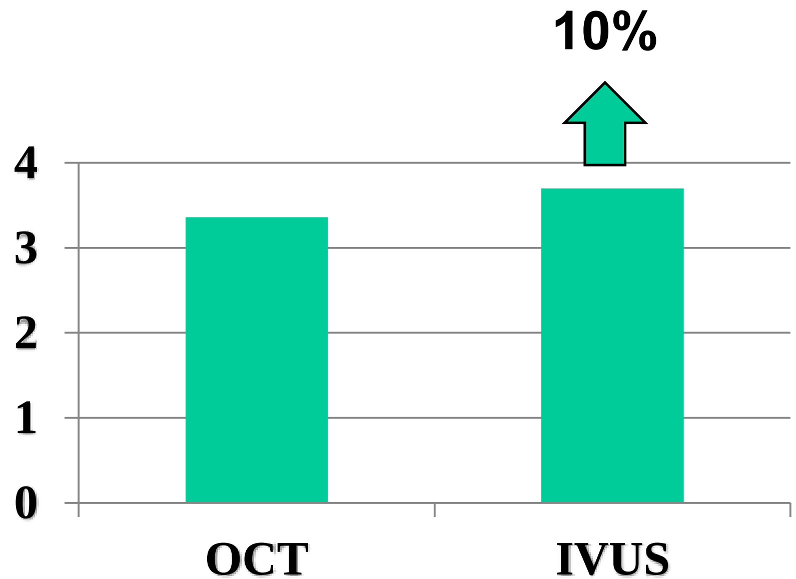


MLD



1.94±0.70 mm   2.10±0.59 mm   1.85±0.77 mm

MLA



$3.36 \pm 2.28 mm^2$ $3.70 \pm 2.04 mm^2$

Kubo T, Akasaka T, et al. JACC Cardiovasc Img. 2013;6:1095-1104

European Heart Journal - Cardiovascular Imaging Advance Access published September 15, 2015

EUROPEAN SOCIETY OF CARDIOLOGY®

European Heart Journal – Cardiovascular Imaging
doi:10.1093/ehjci/jev229

Multi-laboratory inter-institute reproducibility study of IVOCT and IVUS assessments using published consensus document definitions

Edouard Gerbaud[1], Giora Weisz[2,3], Atsushi Tanaka[1], Manabu Kashiwagi[1],
Take
Meli
Mire
Akik

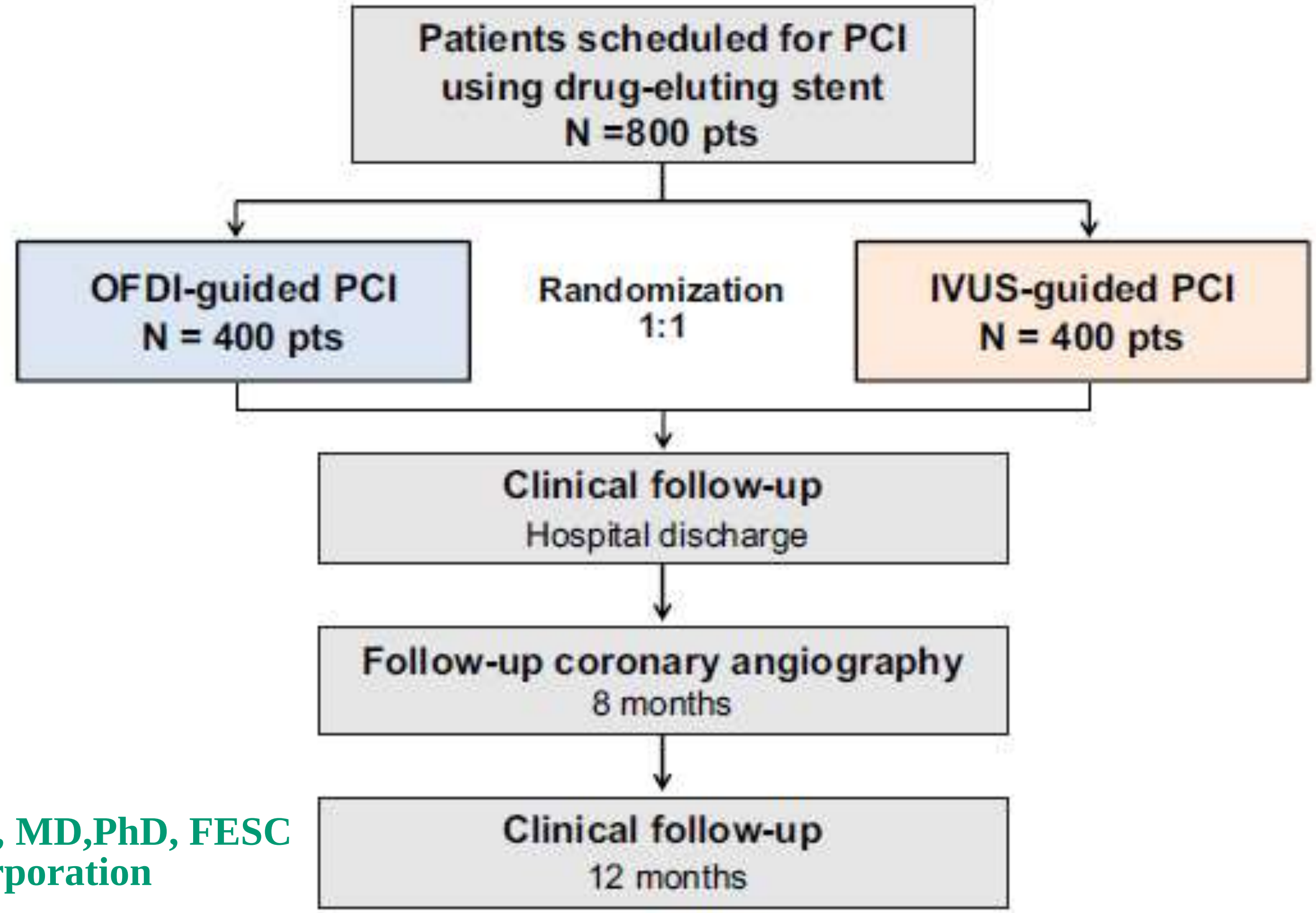
Aims The aim of this study was to investigate the reproducibility of intravascular optical coherence tomography (IVOCT) assessments, including a comparison to intravascular ultrasound (IVUS). Intra-observer and inter-observer variabilities of IVOCT have been previously described, whereas inter-institute reliability in multiple laboratories has never been systematically studied.

Methods and results In 2 independent laboratories with intravascular imaging expertise, 100 randomized matched data sets of IVOCT and IVUS images were analysed by 4 independent observers according to published consensus document definitions. Intra-observer, inter-observer, and inter-institute variabilities of IVOCT qualitative and quantitative measurements vs. IVUS measurements were assessed. Minor inter- and intra-observer variability of both imaging techniques was observed for detailed qualitative and geometric analysis, except for inter-observer mixed plaque identification on IVUS ($\kappa = 0.70$) and for inter-observer fibrous cap thickness measurement reproducibility on IVOCT (ICC = 0.48). The magnitude of inter-institute measurement differences for IVOCT was statistically significantly less than that for IVUS concerning lumen cross-sectional area (CSA), maximum and minimum lumen diameters, stent CSA, and maximum and minimum stent diameters ($P < 0.001$, $P < 0.001$, $P < 0.001$, $P = 0.02$, $P < 0.001$, and $P = 0.01$, respectively). Minor inter-institute measurement variabilities using both techniques were also found for plaque identification.

Conclusion In the measurement of lumen CSA, maximum and minimum lumen diameters, stent CSA, and maximum and minimum stent diameters by analysts from two different laboratories reproducibility of IVOCT was more consistent than that of IVUS.

The OPINION study design

Prospective, multi-center (n=42), randomized (1:1) non-inferiority trial comparing OFDI-guided PCI with IVUS-guided PCI



PI: Takashi Akasaka, MD,PhD, FESC
Sponsor: Terumo corporation

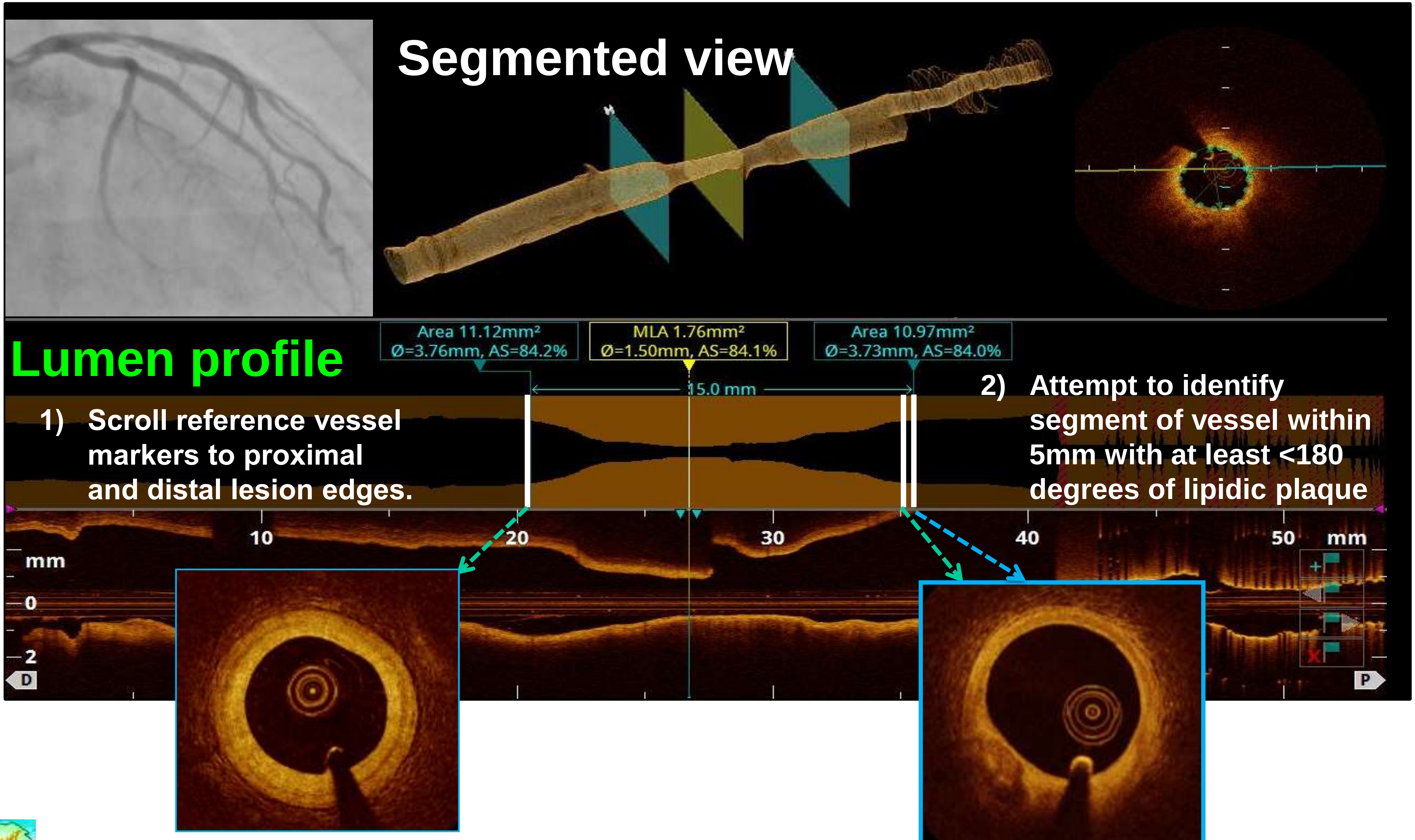
Kubo T, et al. J Cardiol 2016;68:455-460

FD-OCT and IVUS criteria of optimal stent deployment

	FD-OCT-guided PCI	IVUS-guided PCI
Reference site	• **Most normal looking** • **No lipidic plaque**	• Largest lumen • **Plaque burden < 50%**
Determination of stent diameter	• By measuring **lumen** diameter at proximal and distal reference sites	• By measuring **vessel** diameter at proximal and distal reference sites
Determination of stent length	• By measuring distance from distal to proximal reference site	
Goal of stent deployment	• **In-stent minimal lumen area ≥ 90% of the average reference lumen area** • Complete apposition of the stent over its entire length against the vessel wall • Symmetric stent expansion defined by minimum lumen diameter / maximum lumen diameter ≥ 0.7 • No plaque protrusion, thrombus, or edge dissection with potential to provoke flow disturbances	

Kubo T, et al. J Cardiol 2016;68:455-460

Pre-PCI assessment, #6 90%, (DES 4.0×15mm)



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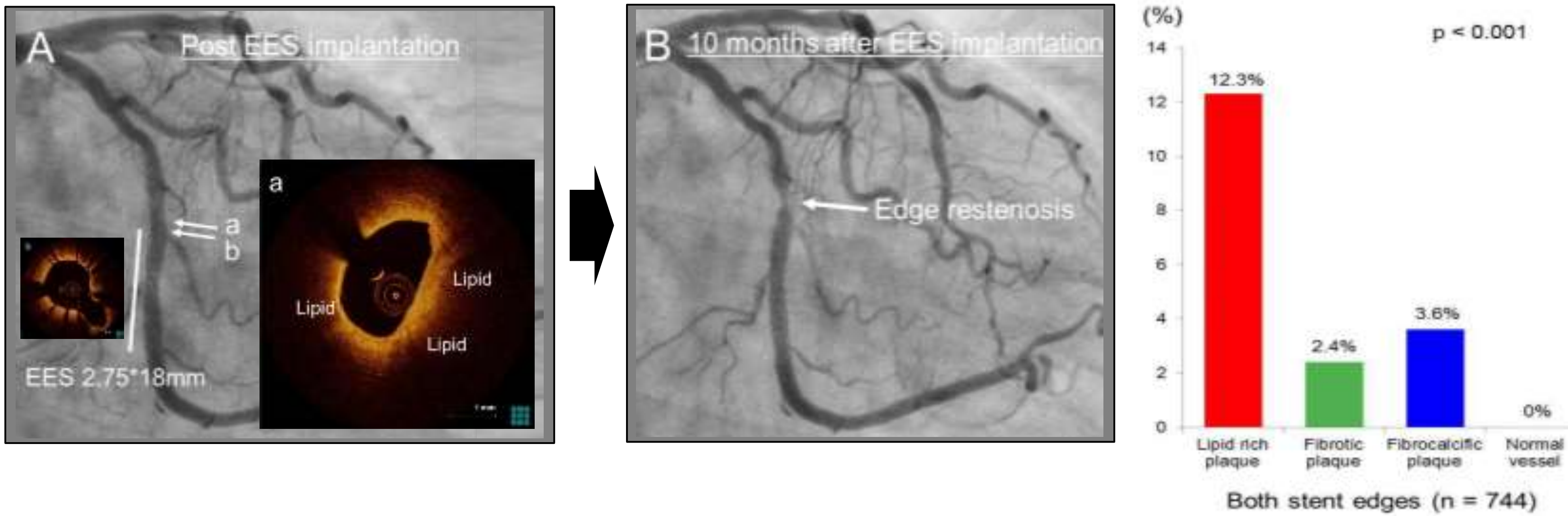
Precursor lesion of stent edge restenosis

In 744 stent (EES) edge segments, OCT was used to evaluate morphological characteristics of the coronary plaques that developed stent edge restenosis.

Post-stenting | 10 months follow-up | Stent edge restenosis

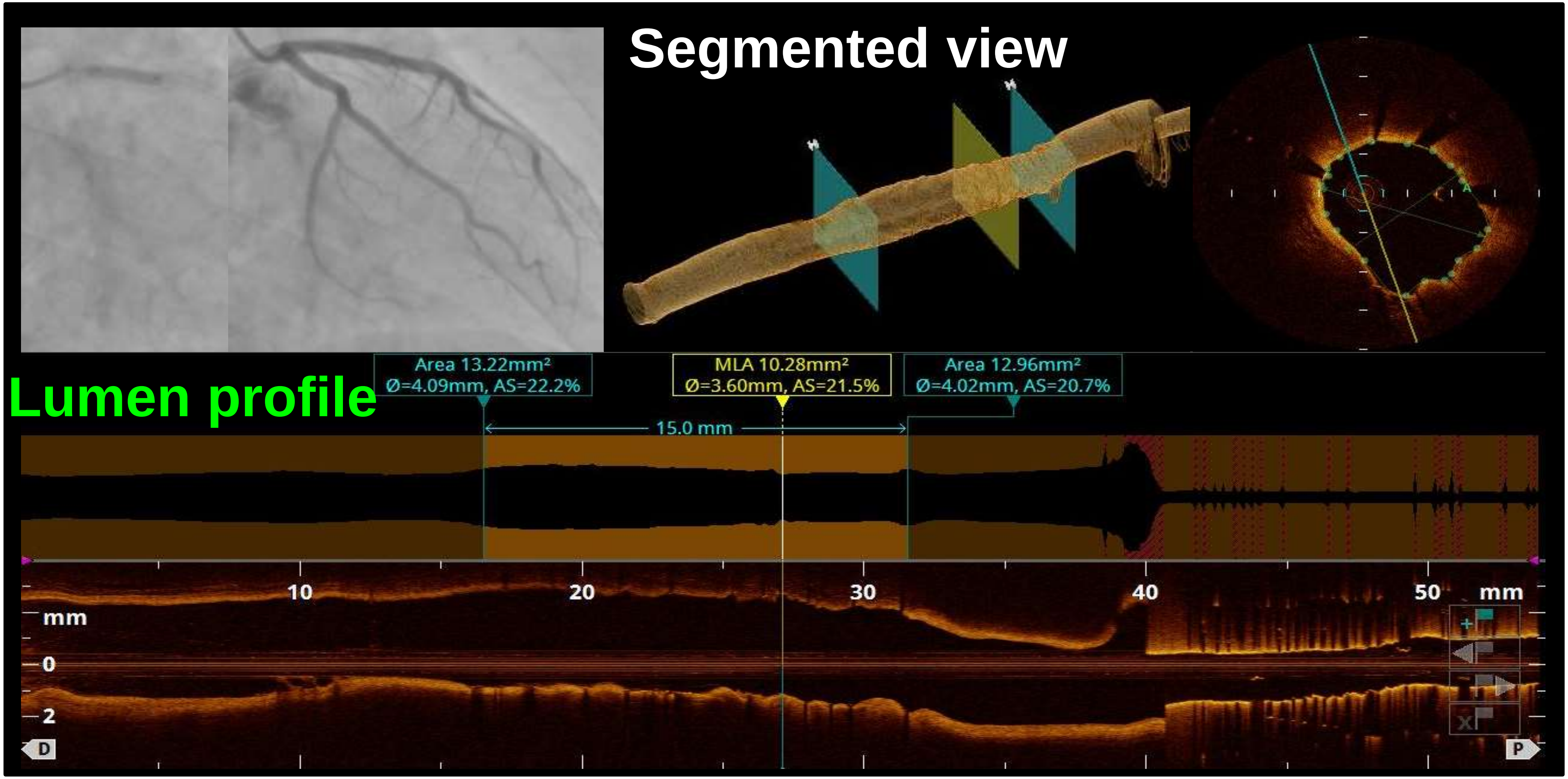


(A) Immediately after EES implantation, OCT images showed lipid rich plaque at the proximal stent edge (a, b).
(B) At 10-month follow-up, angiography demonstrated stent edge restenosis at the proximal edge of the stent.

Conclusion: Lipidic plaque in the stent edge segments at post- PCI was a predictor of late stent edge restenosis.

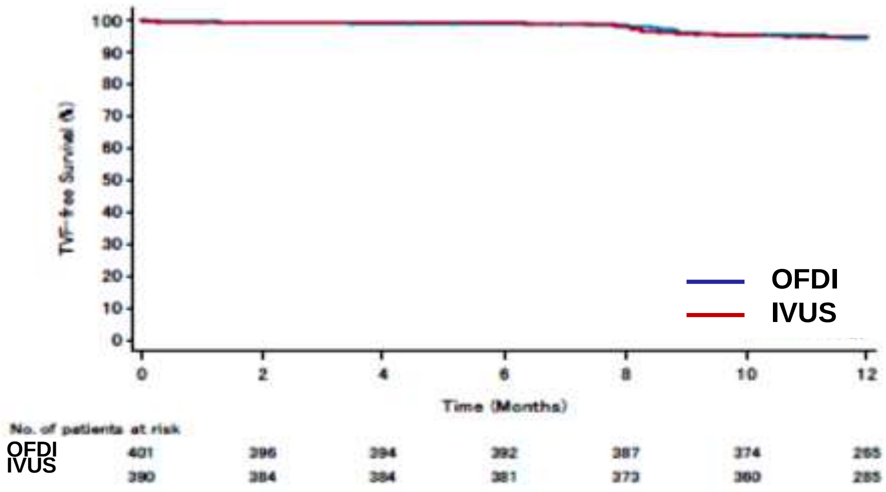
Ino Y, et al. Cric CV Interv 2016;9:e004231
DOI:10.1161/CIRCINTERVENTIONS.116.004231.

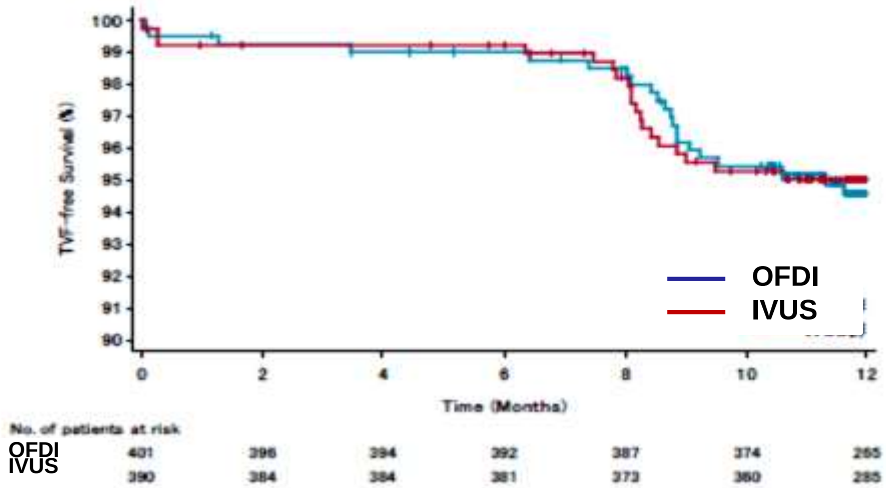
Post-PCI assessment, #6 90%, (DES 4.0 × 15mm)



MLA ≥ 90% of the average reference lumen area

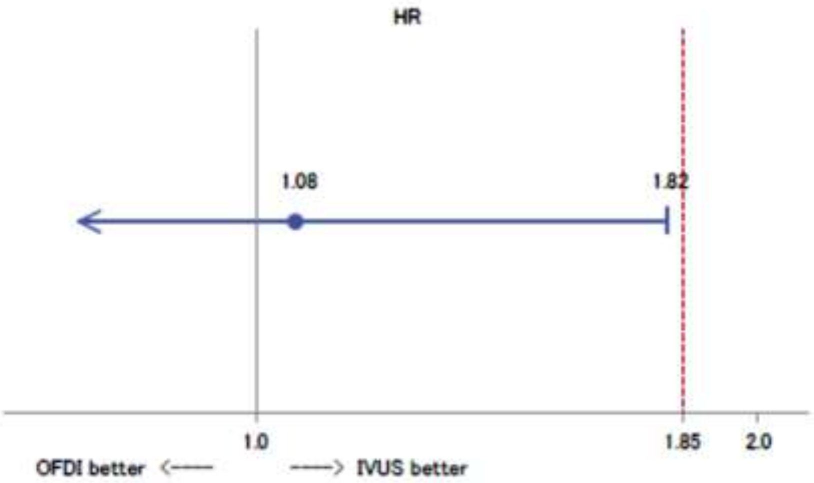
TVF





	Event number / study patient	(%)	HR	95 % CI	HR: 95 % CI	P value
						0.0446
OFDI	21/412	(5.1)	1.08	(0.58, 2.01)	1.82	
IVUS	19/405	(4.7)	1.00			

HR for upper limit of non-inferiority; 1.85



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European Heart Journal (2017) **0**, 1–9
doi:10.1093/eurheartj/ehx351

CLINICAL RESEARCH
Interventional cardiology

Optical frequency domain imaging vs. intravascular ultrasound in percutaneous coronary intervention (OPINION trial): one-year angiographic and clinical results

Takashi Kubo[1], Toshiro Shinke[2], Takayuki Okamura[3], Kiyoshi Hibi[4], Gaku Nakazawa[5], Yoshihiro Morino[6], Junya Shite[7], Tetsuya Fusazaki[6], Hiromasa Otake[2], Ken Kozuma[8], Tetsuya Ioji[9], Hideaki Kaneda[9], Takeshi Serikawa[10], Toru Kataoka[11], Hisayuki Okada[12], and Takashi Akasaka[1]*; on behalf of the OPINION Investigators†

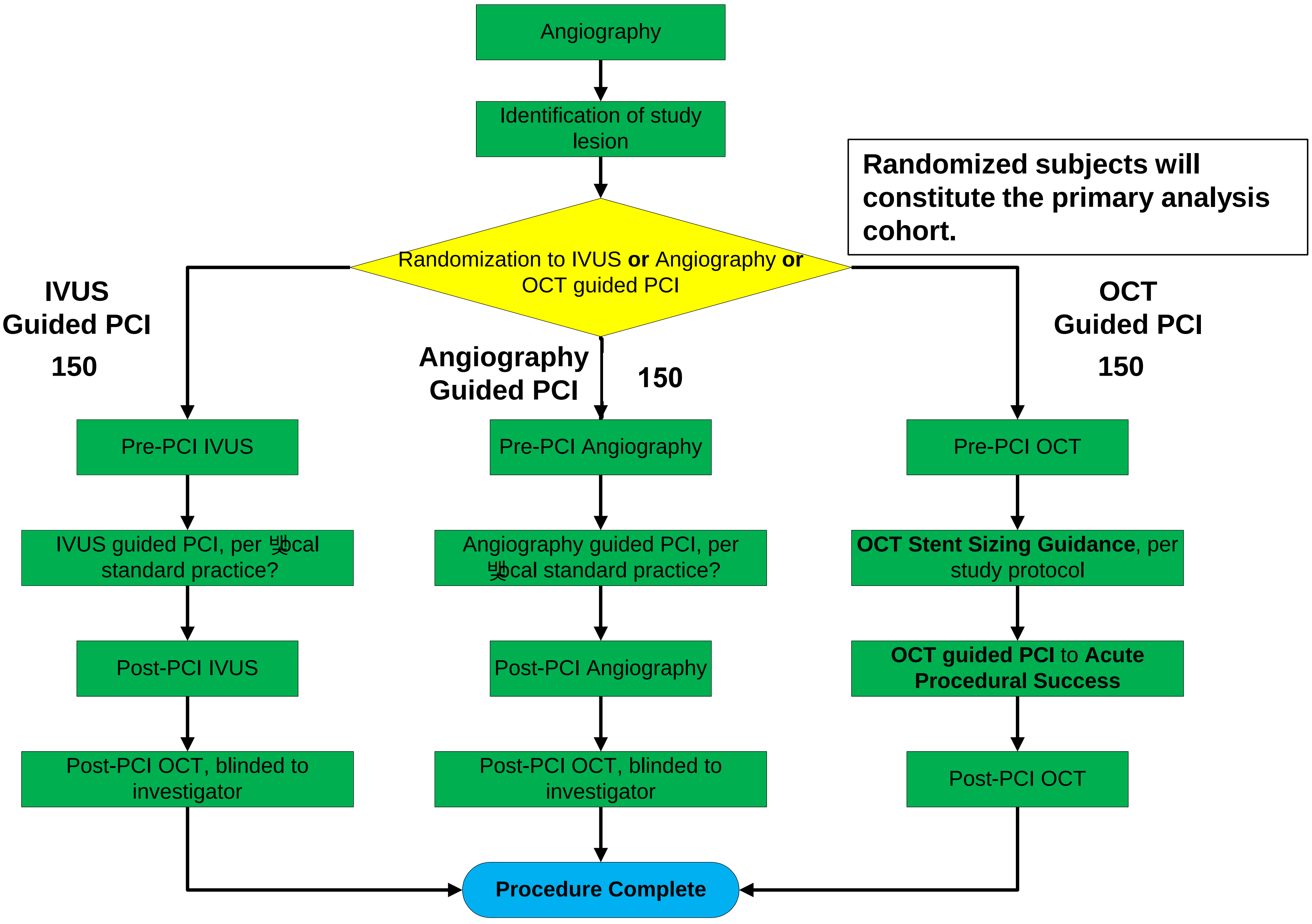
…ased, high-resolution intravascular imaging …l imaging technique for guiding percutane-…riority of OFDI-guided PCI compared with

…trolled, non-inferiority study to compare …generation drug-eluting stent. The primary … death, target-vessel related myocardial infarction, and ischaemia-driven target vessel revascularization until 12 months after the PCI. The major secondary endpoint was angiographic binary restenosis at 8 months. We randomly allocated 829 patients to receive OFDI-guided PCI ($n = 414$) or IVUS-guided PCI ($n = 415$). Target vessel failure occurred in 21 (5.2%) of 401 patients undergoing OFDI-guided PCI, and 19 (4.9%) of 390 patients undergoing IVUS-guided PCI, demonstrating non-inferiority of OFDI-guided PCI to IVUS-guided PCI (hazard ratio 1.07, upper limit of one-sided 95% confidence interval 1.80; $P_{non\text{-}inferiority} = 0.042$). With 89.8% angiographic follow-up, the rate of binary restenosis was comparable between OFDI-guided PCI and IVUS-guided PCI (in-stent: 1.6% vs. 1.6%, $P = 1.00$; and in-segment: 6.2% vs. 6.0%, $P = 1.00$).

Conclusion The 12-month clinical outcome in patients undergoing OFDI-guided PCI was non-inferior to that of patients undergoing IVUS-guided PCI. Both OFDI-guided and IVUS-guided PCI yielded excellent angiographic and clinical results, with very low rates of 8-month angiographic binary restenosis and 12-month target vessel failure.

Wakayama Medical University

ILUMIEN III : OPTIMIZE PCI (Study Protocol)



Optical coherence tomography compared with intravascular ultrasound and with angiography to guide coronary stent implantation (ILUMIEN III: OPTIMIZE PCI): a randomised controlled trial

Ziad A Ali, Akiko Maehara, Philippe Généreux, Richard A Shlofmi
Fernando Alfonso, Habib Samady, Takashi Akasaka, Eric B Carlsc
Ori Ben-Yehuda, Gregg W Stone, for the ILUMIEN III: OPTIMIZE P

Summary

Background Percutaneous coronary intervention (PCI) is most commonly guided by angiography alone. Intravascular ultrasound (IVUS) guidance has been shown to reduce major adverse cardiovascular events (MACE) after PCI, principally by resulting in a larger postprocedure lumen than with angiographic guidance. Optical coherence tomography (OCT) provides higher resolution imaging than does IVUS, although findings from some studies suggest that it might lead to smaller luminal diameters after stent implantation. We sought to establish whether or not a novel OCT-based stent sizing strategy would result in a minimum stent area similar to or better than that achieved with IVUS guidance and better than that achieved with angiography guidance alone.

Methods In this randomised controlled trial, we recruited patients aged 18 years or older undergoing PCI from 29 hospitals in eight countries. Eligible patients had one or more target lesions located in a native coronary artery with a visually estimated reference vessel diameter of 2·25–3·50 mm and a length of less than 40 mm. We excluded patients with left main or ostial right coronary artery stenoses, bypass graft stenoses, chronic total occlusions, planned two-stent bifurcations, and in-stent restenosis. Participants were randomly assigned (1:1:1; with use of an interactive web-based system in block sizes of three, stratified by site) to OCT guidance, IVUS guidance, or angiography-guided stent implantation. We did OCT-guided PCI using a specific protocol to establish stent length, diameter, and expansion according to reference segment external elastic lamina measurements. All patients underwent final OCT imaging (operators in the IVUS and angiography groups were masked to the OCT images). The primary efficacy endpoint was post-PCI minimum stent area, measured by OCT at a masked independent core laboratory at completion of enrolment, in all randomly allocated participants who had primary outcome data. The primary safety endpoint was

Interpretation OCT-guided PCI using a specific reference segment external elastic lamina-based stent optimisation strategy was safe and resulted in similar minimum stent area to that of IVUS-guided PCI. These data warrant a large-scale randomised trial to establish whether or not OCT guidance results in superior clinical outcomes to angiography guidance.

(one-sided 97·5% lower CI –0·70 mm²; p=0·001), but not superior (p=0·42). OCT guidance was also not superior to angiography guidance (p=0·12). We noted procedural MACE in four (3%) of 158 patients in the OCT group, one (1%) of 146 in the IVUS group, and one (1%) of 146 in the angiography group (OCT *vs* IVUS p=0·37; OCT *vs* angiography p=0·37).

Interpretation OCT-guided PCI using a specific reference segment external elastic lamina-based stent optimisation strategy was safe and resulted in similar minimum stent area to that of IVUS-guided PCI. These data warrant a large-scale randomised trial to establish whether or not OCT guidance results in superior clinical outcomes to angiography guidance.

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See Online/Comment
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*Investigators listed in the appendix
New York Presbyterian Hospital and Columbia University, New York, NY, USA (Z A Ali MD, A Maehara MD, T M Nazif MD, O Ben-Yehuda MD, Prof G W Stone MD); Cardiovascular Research Foundation, New York, NY, USA (Z A Ali, A Maehara, P Généreux MD, T M Nazif, M Matsumura BS, M O Ozan MS, G S Mintz MD, O Ben-Yehuda, Prof G W Stone); St Francis Hospital, Roslyn, New York, NY,
Madrid, Spain (F Alfonso MD); Emory University Hospital, Atlanta, GA, USA (Prof H Samady MD); Wakayama Medical University, Wakayama, Japan (Prof T Akasaka MD); Eastern Cardiology, Greenville, NC, USA (E B Carlson MD); and University of Alabama, Birmingham, AB, USA (Prof M A Leesar MD)

Wakayama Medical University

ESC European Society of Cardiology

European Heart Journal (2018) **00**, 1–96
doi:10.1093/eurheartj/ehy394

ESC/EACTS GUIDELINES

2018 ESC/EACTS Guidelines on myocardial revascularization

The Task Force on myocardial revascularization Society of Cardiology (ESC) and European Asso Cardio-Thoracic Surgery (EACTS)

Developed with the special contribution of the Association for Percutaneous Cardiovascular In

Authors/Task Force Members: Franz-Josef Neumann* (ESC (Germany), Miguel Sousa-Uva*[1] (EACTS Chairperson) (Po (Sweden), Fernando Alfonso (Spain), Adrian P. Banning (U (UK), Robert A. Byrne (Germany), Jean-Philippe Collet (Fr (Ger Adna Josef Dirk (Swit

Docum Co-or (Norw (Canad

Recommendations on intravascular imaging for procedural optimization

Recommendations	Class[a]	Level[b]
IVUS or OCT should be considered in selected patients to optimize stent implantation.[603,612,651–653]	IIa	B
IVUS should be considered to optimize treatment of unprotected left main lesions.[35]	IIa	B

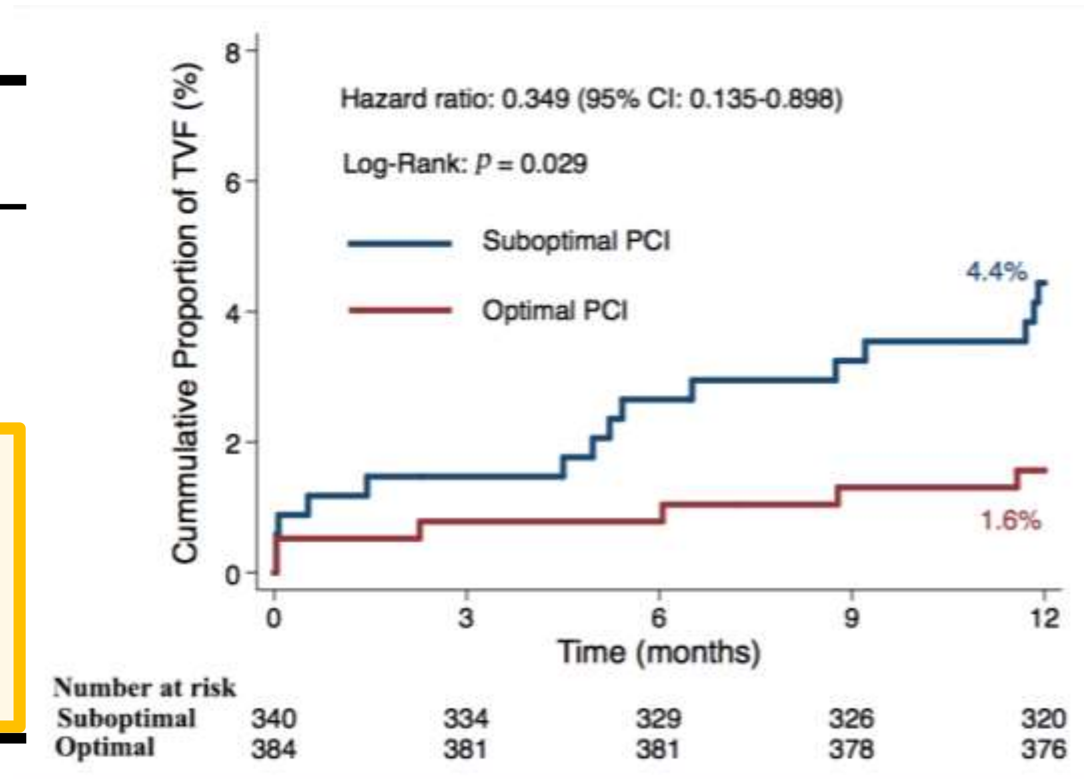
Restenosis		
DES are recommended for the treatment of in-stent restenosis of BMS or DES.[373,375,378,379]	I	A
Drug-coated balloons are recommended for the treatment of in-stent restenosis of BMS or DES.[373,375,378,379]	I	A
In patients with recurrent episodes of diffuse in-stent restenosis, CABG should be considered by the Heart Team over a new PCI attempt.	IIa	C
IVUS and/or OCT should be considered to detect stent-related mechanical problems leading to restenosis.	IIa	C

Optimal vs Suboptimal IVUS-guided PCI (ULTIMATE trial)

PCI results

	Optimal group	Suboptimal group	*P*
No. of patients n (%)	384 (53.0)	340 (47.0)	
No. of lesions n (%)	578 (60.1)	384 (39.9)	
MSA, mm^2	6.09	5.45	<0.001
Prox. edge plaque burden	37.2%	51.2%	<0.001
Dist. edge plaque burden	24.2%	35.1%	<0.001

TVF at 12 months



Zhang J, et al. J Am Coll Cardiol 2018;DOI:10.1016/j.jacc2018.09.013

Wakayama Medical University

Stent sizing

ESC European Society of Cardiology
European Heart Journal (2018) **00**, 1–20
doi:10.1093/eurheartj/ehy285

FASTTRACK CLINICAL RESEARCH
Coronary artery disease

Clinical use of intracoronary imaging. Part 1: guidance and optimization of coronary interventions. An expert consensus document of the European Association of Percutaneous Cardiovascular Interventions

Endorsed by the Chinese Society of Cardiology

Lorenz Räber[1], Gary S. Mintz[2], Konstantinos C. Koskinas[1], Thomas W. Johnson[3], Niels R. Holm[4], Yoshinubo Onuma[5], Maria D. Radu[6], Michael Joner[7,8], Bo Yu[9], Haibo Jia[9], Nicolas Meneveau[10,11], Jose M. de la Torre Hernandez[12], Javier Escaned[13], Jonathan Hill[14], Francesco Prati[15], Antonio Colombo[16], Carlo di Mario[17], Evelyn Regar[18], Davide Capodanno[19], William Wijns[20], Robert A. Byrne[21], and Giulio Guagliumi[22]*

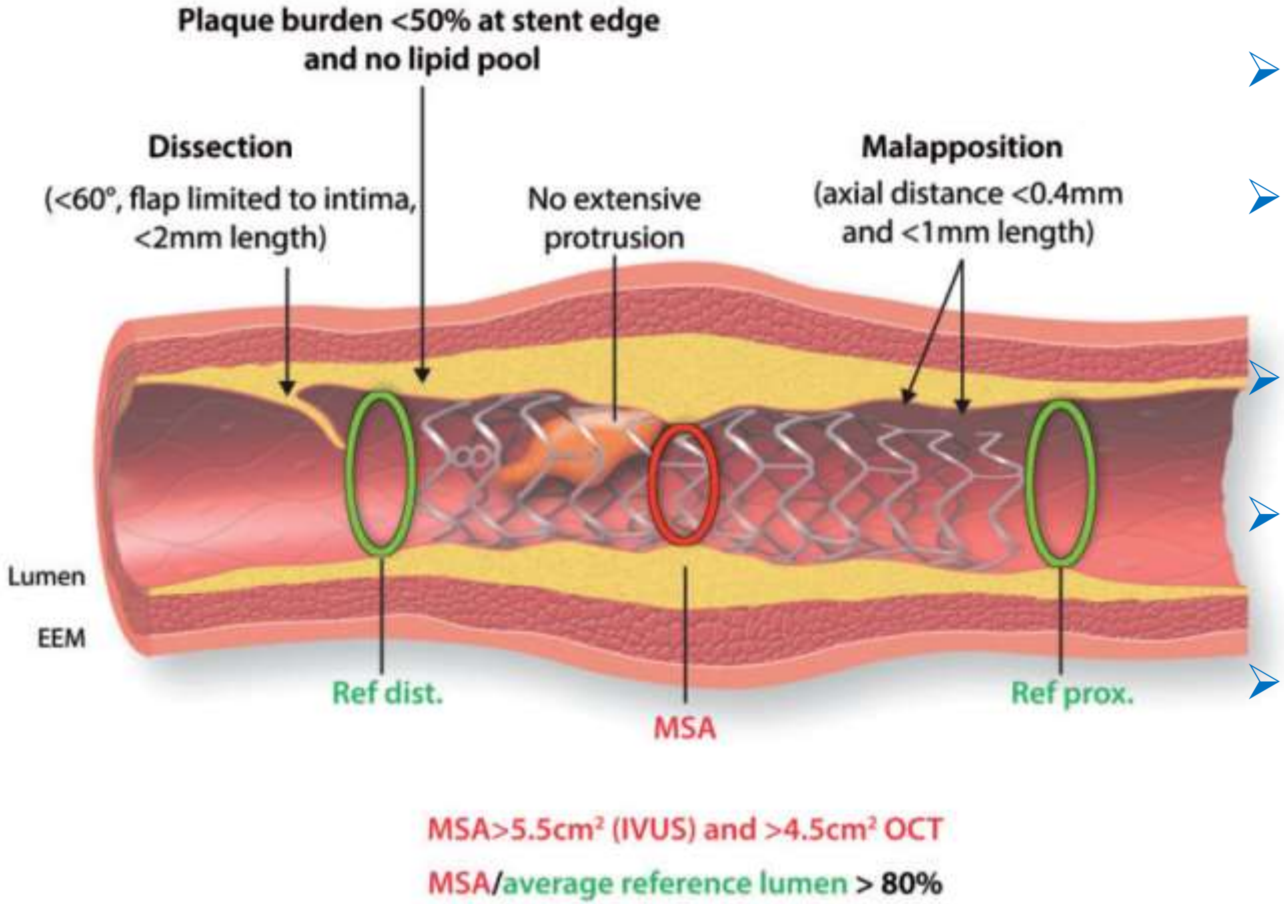
Coordinating editor: Prof Patrick W. Serruys, MD, PhD, Imperial College, London, UK

Document Reviewers: Fernando Alfonso[23], Ravinay Bhindi[24], Ziad Ali[25], Rickey Carter[26]

- The beneficial effect of imaging-guided PCI does not appear to be strictly linked to the algorithm used for stent sizing by IVUS or OCT.
- From a practical standpoint, a distal lumen reference based sizing may represent a safe and straightforward approach with subsequent optimization of the mid and proximal stent segments. Specifically, the mean distal lumen diameter with up rounding stent (0–0.25 mm) may be used (e.g. 3.76 → 4.0 mm), or the mean EEM (2 orthogonal measurements) with down rounding to the nearest 0.25 mm stent size (e.g. 3.76 → 3.5 mm).
- When using OCT, an EEM reference based sizing strategy appears feasible, although more challenging than a lumen based approach for routine clinical practice.
- Appropriate selection of the landing zone is crucial as residual plaque burden (<50%) and particularly lipid rich tissue at the stent edge is associated with subsequent restenosis.
- Co-registration of angiography and IVUS or OCT is a useful tool to determine stent length and allows for precise stent placement.

Räber L, et al. Eur Heart J 2018 May 22. doi: 10.1093/eurheartj/ehy285

Post PCI optimization



- MSA>4.5 cm^2, or > 80% of RA.
- Malaposition < 400μm distance, <1mm lenghth.
- No extensive protrusion.
- Distal landing: PB < 50%
  No lipid pool
- Distal edge dissection: <60°
  Flap: limited to intima
  < 2 mm length

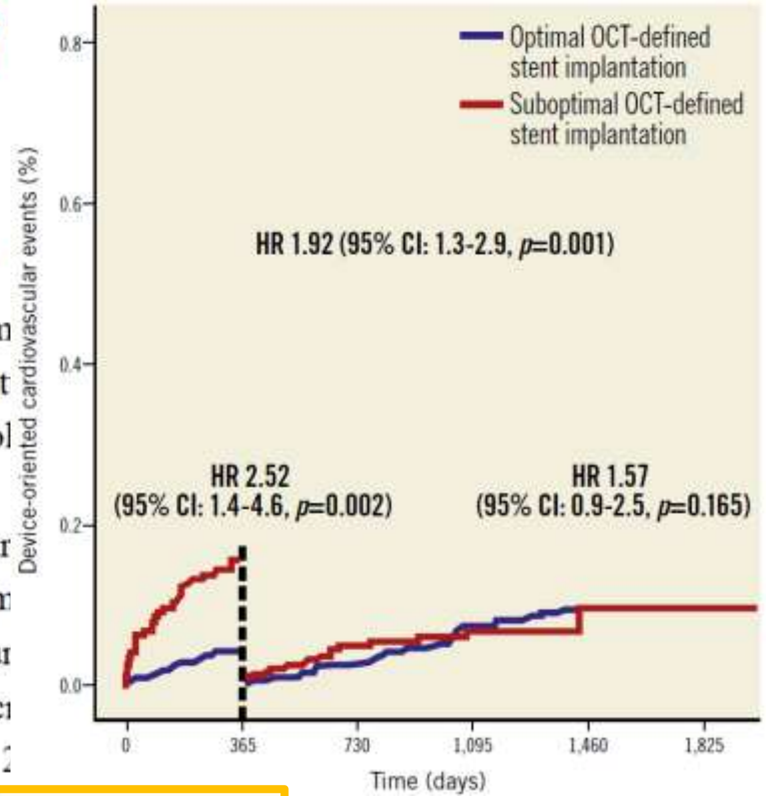
Raber L, et al. Eur Heart J 2018 May 22. doi: 10.1093/eurheartj/ehy285

Long-term consequences of optical coherence tomography findings during percutaneous coronary intervention: the Centro Per La Lotta Contro L'infarto – Optimization Of Percutaneous Coronary Intervention (CLI-OPCI) LATE study

Aims: The role of intraprocedural optical coherence tomography (OCT) on the long-term of percutaneous coronary interventions (PCI) remains undefined. The aim of the present st ate the impact of quantitative OCT-defined suboptimal stent implantation at long-term fol

Methods and results: In the context of the multicentre Centro per la Lotta contro l'Infar of Percutaneous Coronary Intervention (CLI-OPCI) registry, we compared the long-term 1,211 patients from 13 independent OCT-experienced centres according to end-procedu OCT assessment revealed suboptimal stent implantation in 30.9% of lesions, with an inc in patients experiencing device-oriented cardiovascular events (DoCE) (52.8% vs. 2 At a median follow-up of 833 (interquartile range 415-1,447) days, in-stent minimum lumen area (MLA) <4.5 mm² (HR 1.82, p<0.001), distal stent edge dissection >200 µm (HR 2.03, p=0.004), and significant reference vessel plaque and lumen area <4.5 mm² at either the distal (HR 5.22, p<0.001) or proximal (HR 5.67, p<0.001) stent edges were independent predictors of device failure. Conversely, in-stent MLA/mean reference lumen area <70%, acute stent malapposition, and intra-stent plaque/thrombus protrusion were not associated with worse outcomes. Using multivariable Cox hazard analysis, the presence of at least one of the significant criteria for suboptimal OCT stent deployment was confirmed as an independent predictor of DoCE (HR 1.92, p=0.001).

Conclusions: Suboptimal stent deployment, defined according to specific quantitative OCT criteria, was confirmed as an independent outcome predictor at long-term follow-up.



Prati F, et al. EuroInterv 2018;14: e443-e451

Long-term consequences of optical coherence tomography findings during percutaneous coronary intervention: the Centro Per La Lotta Contro L'infarto – Optimization Of Percutaneous Coronary Intervention (CLI-OPCI) LATE study

Prati F, et al. EuroInterv 2018;14: e443-e451

Francesco Prati[1,2*], MD; Enrico Romagnoli[1], MD, PhD; Alessio La Manna[3], MD;

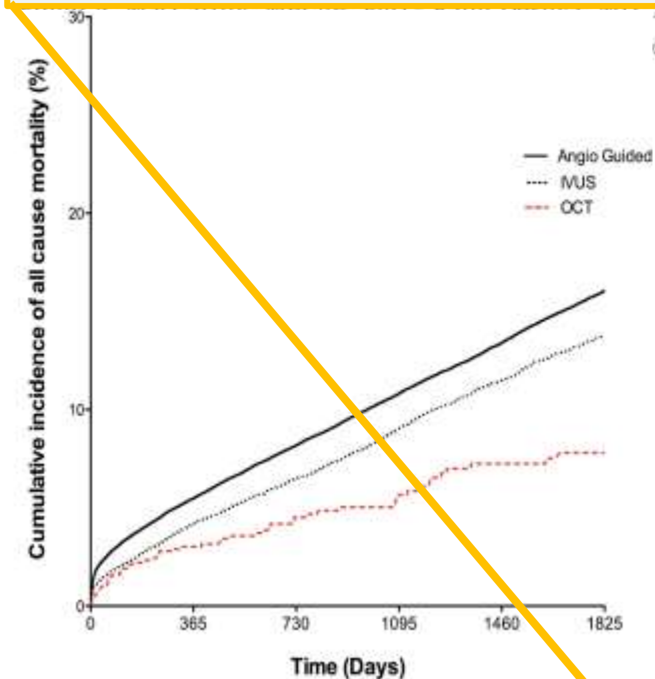
		Total population (1,211)	Patients with OCT suboptimal deployment* (375)	Patients with OCT optimal deployment* (836)	*p*-value	HR
DoCE (%)		144 (11.9)	76 (20.3)	68 (8.1)	<0.001	2.70 (1.9-3.7)
Cardiac death (%)		41 (3.4)	19 (5.1)	22 (2.6)	0.027	2.00 (1.1-3.7)
Target vessel MI (%)		103 (7.2)	56 (12.7)	47 (4.8)	<0.001	2.71 (1.8-4.0)
Periprocedural		42 (2.9)	19 (4.3)	23 (2.3)	0.046	1.86 (1.1-3.4)
During follow-up		61 (4.3)	37 (8.4)	24 (2.4)	<0.001	3.46 (2.1-5.8)
Target lesion revascularisation (%)	patient basis	102 (8.4)	61 (16.3)	41 (4.9)	<0.001	3.69 (2.5-5.5)
	lesion basis	122 (8.6)	70 (15.9)	52 (5.3)	<0.001	3.22 (2.2-4.6)
Target vessel revascularisation (%)	patient basis	124 (10.2)	64 (17.1)	60 (7.2)	<0.001	2.61 (1.8-3.7)
	lesion basis	152 (10.7)	75 (17.0)	77 (7.8)	<0.001	2.31 (1.7-3.2)
Stent thrombosis (%)	patient basis	32 (2.6)	27 (7.2)	5 (0.6)	<0.001	12.46 (4.8-32.3)
	lesion basis	34 (2.4)	29 (6.6)	5 (0.5)	<0.001	13.17 (5.1-34.0)
Days of follow-up†		833 (415-1,447)	746 (380-1,458)	881 (426-1,445)	0.160	–

*Either in-stent MLA <4.5mm², dissection >200 μ at the distal stent edges, or distal or proximal reference narrowing. † Expressed as median and interquartile range. DoCE: device-oriented cardiovascular events, i.e., hierarchical major adverse cardiac events (cardiac death, non-fatal target vessel myocardial infarction, target lesion revascularisation); MI: myocardial infarction

Angiography Alone Versus Angiography Plus Optical Coherence Tomography to Guide Percutaneous Coronary Intervention

Outcomes From the Pan-London PCI Cohort

CONCLUSIONS In this large observational study, OCT-guided PCI was associated with improved procedural outcomes, in-hospital events, and long-term survival compared with standard angiography-guided PCI. (J Am Coll Cardiol Intv 2018;11:1313–21) © 2018 by the American College of Cardiology Foundation.



Numbers at risk

Angio Only	75046	66033	56182	51030	40053	28765
IVUS	10971	8954	7838	6632	5431	4242
OCT	1149	901	789	654	561	410

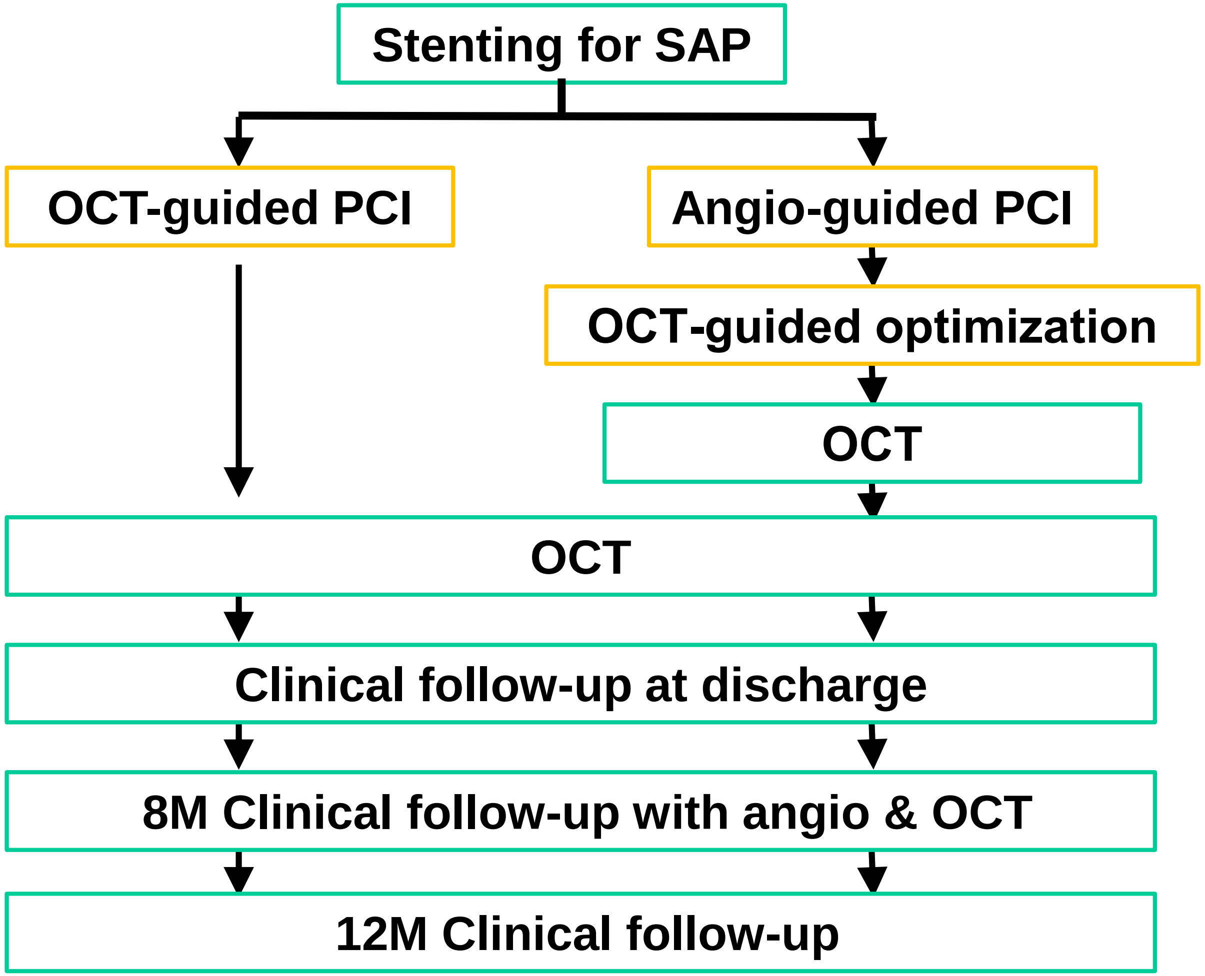
METHODS This was a cohort study based on the Pan-London (United Kingdom) PCI registry, which includes 123,764 patients who underwent PCI in National Health Service hospitals in London between 2005 and 2015. Patients undergoing primary PCI or pressure wire use were excluded leaving 87,166 patients in the study. The primary endpoint was all-cause mortality at a median of 4.8 years.

RESULTS OCT was used in 1,149 (1.3%) patients, intravascular ultrasound (IVUS) was used in 10,971 (12.6%) patients, and angiography alone in the remaining 75,046 patients. Overall OCT rates increased over time ($p < 0.0001$), with variation in rates between centers ($p = 0.002$). The mean stent length was shortest in the angiography-guided group, longer in the IVUS-guided group, and longest in the OCT-guided group. OCT-guided procedures were associated with greater procedural success rates and reduced in-hospital MACE rates. A significant difference in mortality was observed between patients who underwent OCT-guided PCI (7.7%) compared with patients who underwent either IVUS-guided (12.2%) or angiography-guided (15.7%; $p < 0.0001$) PCI, with differences seen for both elective ($p < 0.0001$) and acute coronary syndrome subgroups ($p = 0.0024$). Overall this difference persisted after multivariate Cox analysis (hazard ratio [HR]: 0.48; 95% confidence interval [CI]: 0.26 to 0.81; $p = 0.001$) and propensity matching (hazard ratio: 0.39; 95% CI: 0.21 to 0.77; $p = 0.0008$; OCT vs. angiography-alone cohort), with no difference in matched OCT and IVUS cohorts (HR: 0.88; 95% CI: 0.61 to 1.38; $p = 0.43$).

CONCLUSIONS In this large observational study, OCT-guided PCI was associated with improved procedural outcomes, in-hospital events, and long-term survival compared with standard angiography-guided PCI. (J Am Coll Cardiol Intv 2018;11:1313–21) © 2018 by the American College of Cardiology Foundation.

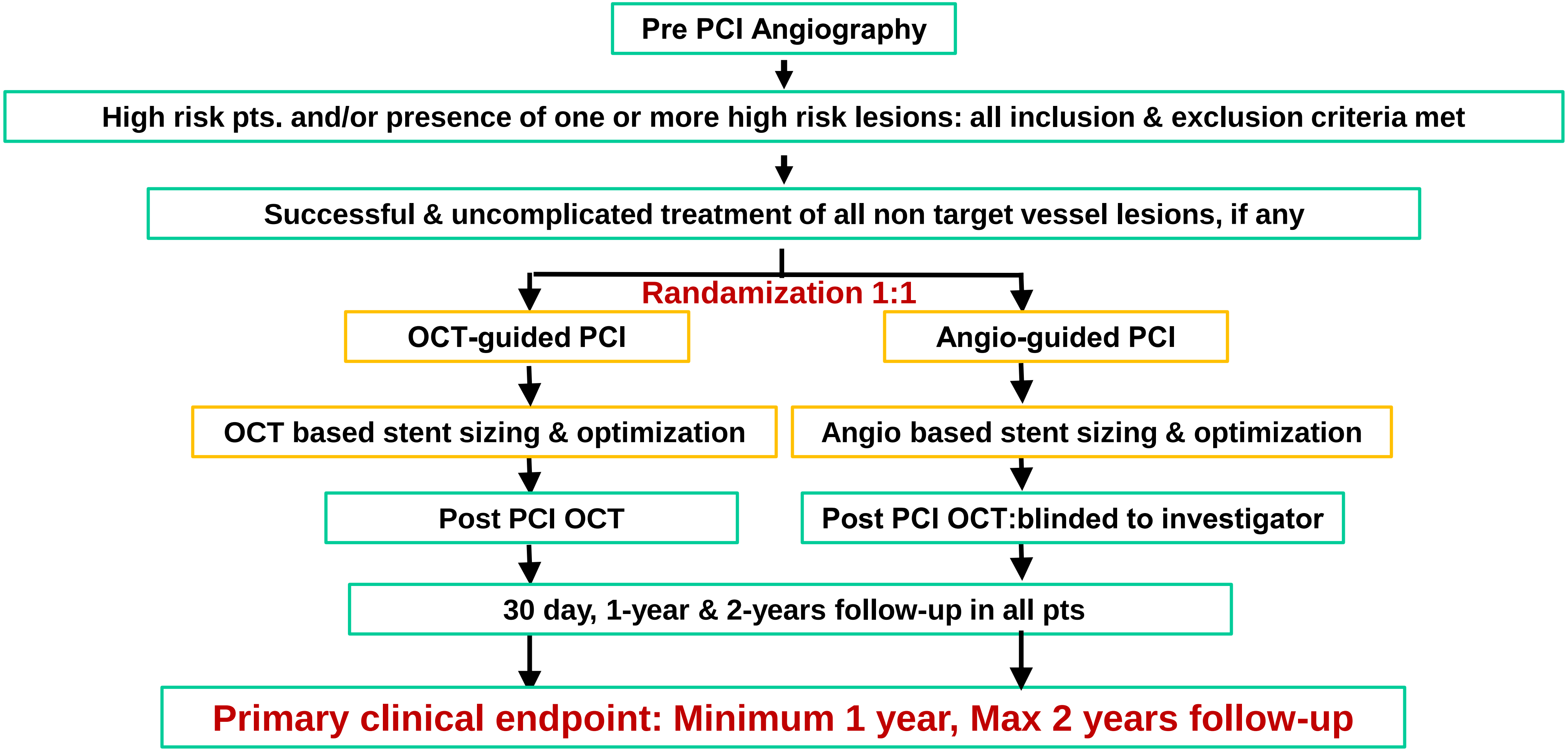
COCOA

Comparison between Optical Coherence tomography guidance and Angiography Guidance in percutaneous coronary intervention

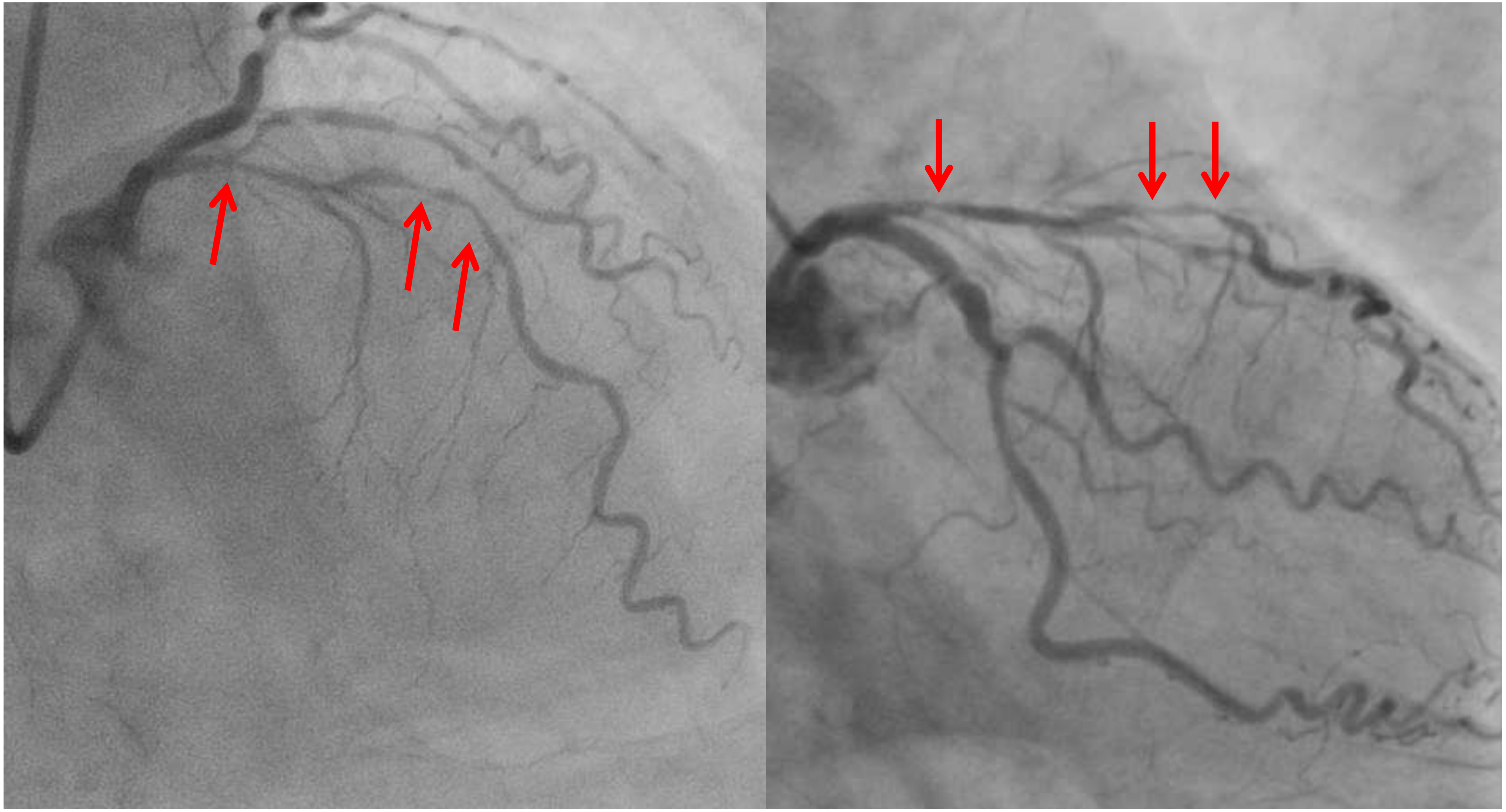


ILUMIEN IV: OPITIMAL PCI

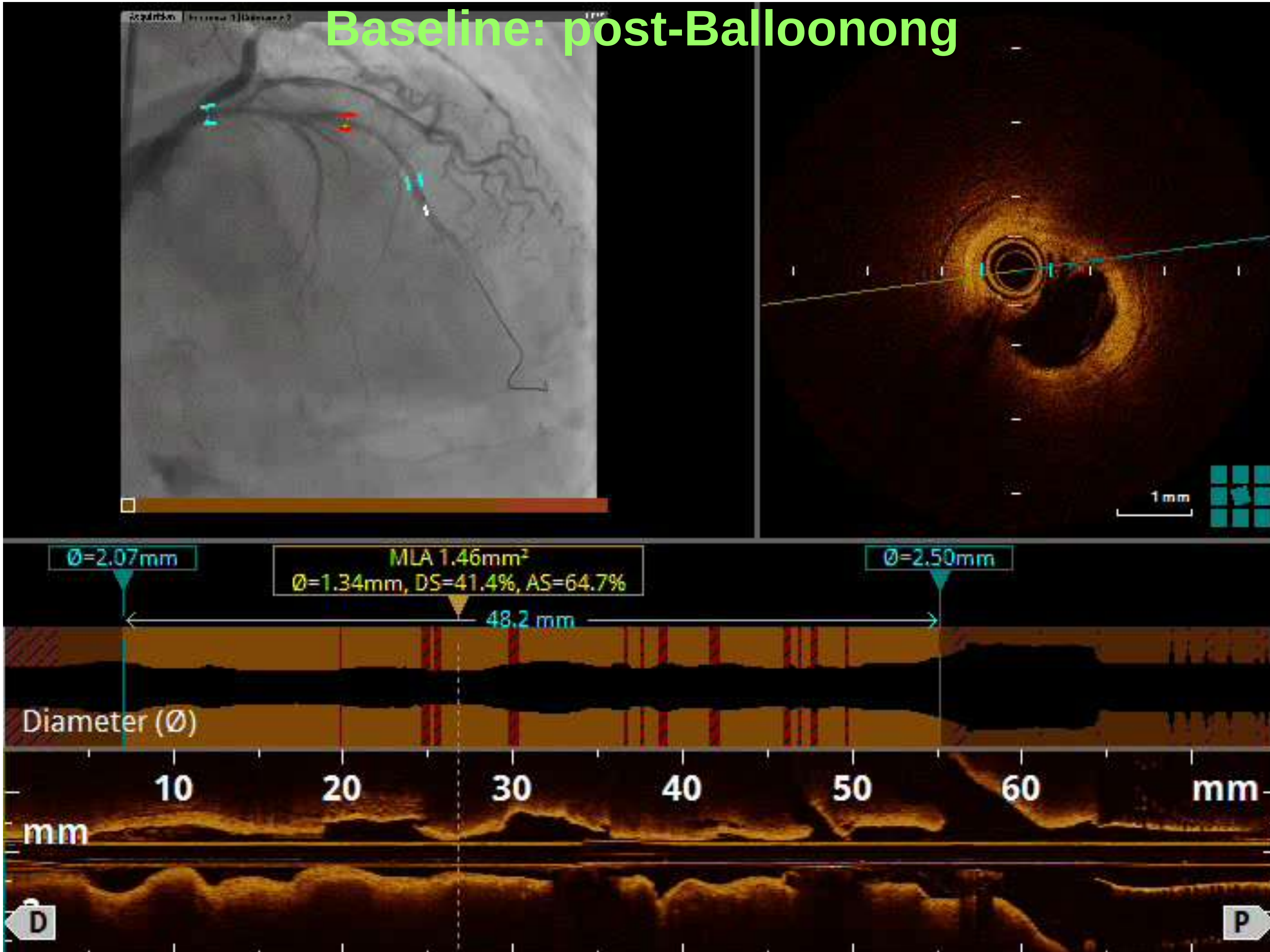
Optical Coherence Tomography guided Coronary Stent Implantation Compared to Angiography: a Multicenter Randamized Trial in PCI



Coronary angio.（Pre PCI）

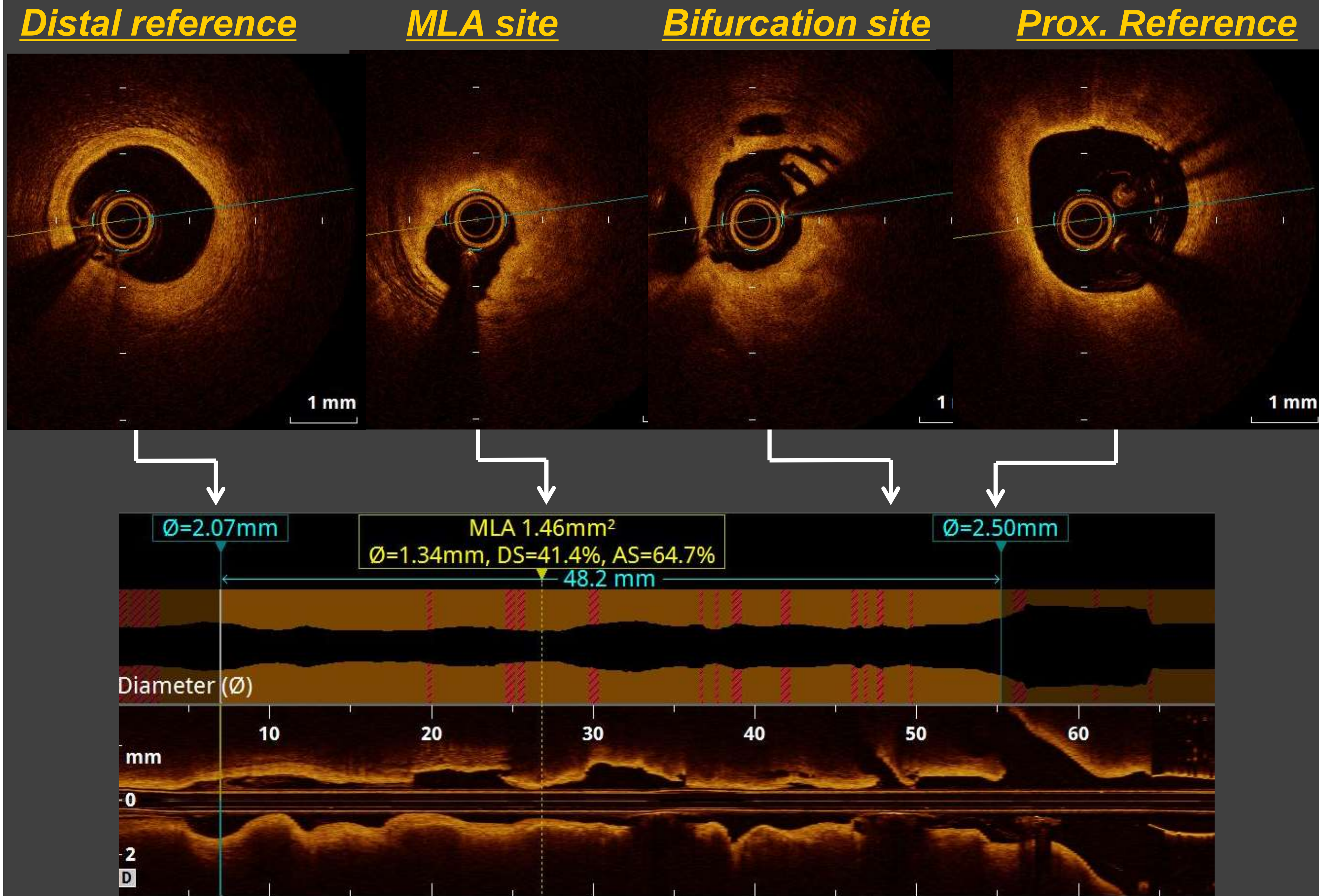


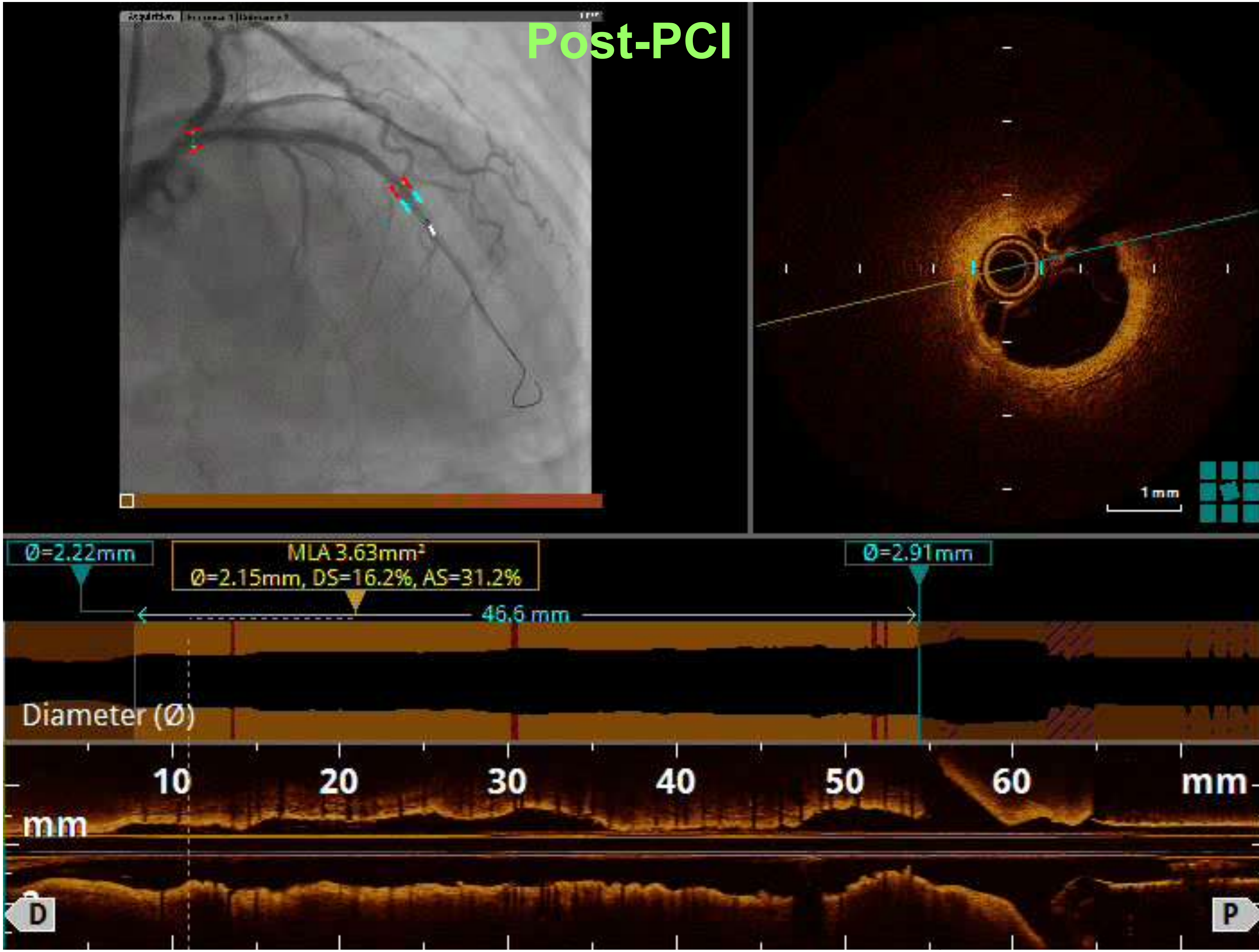
Baseline: post-Balloonong



rsity

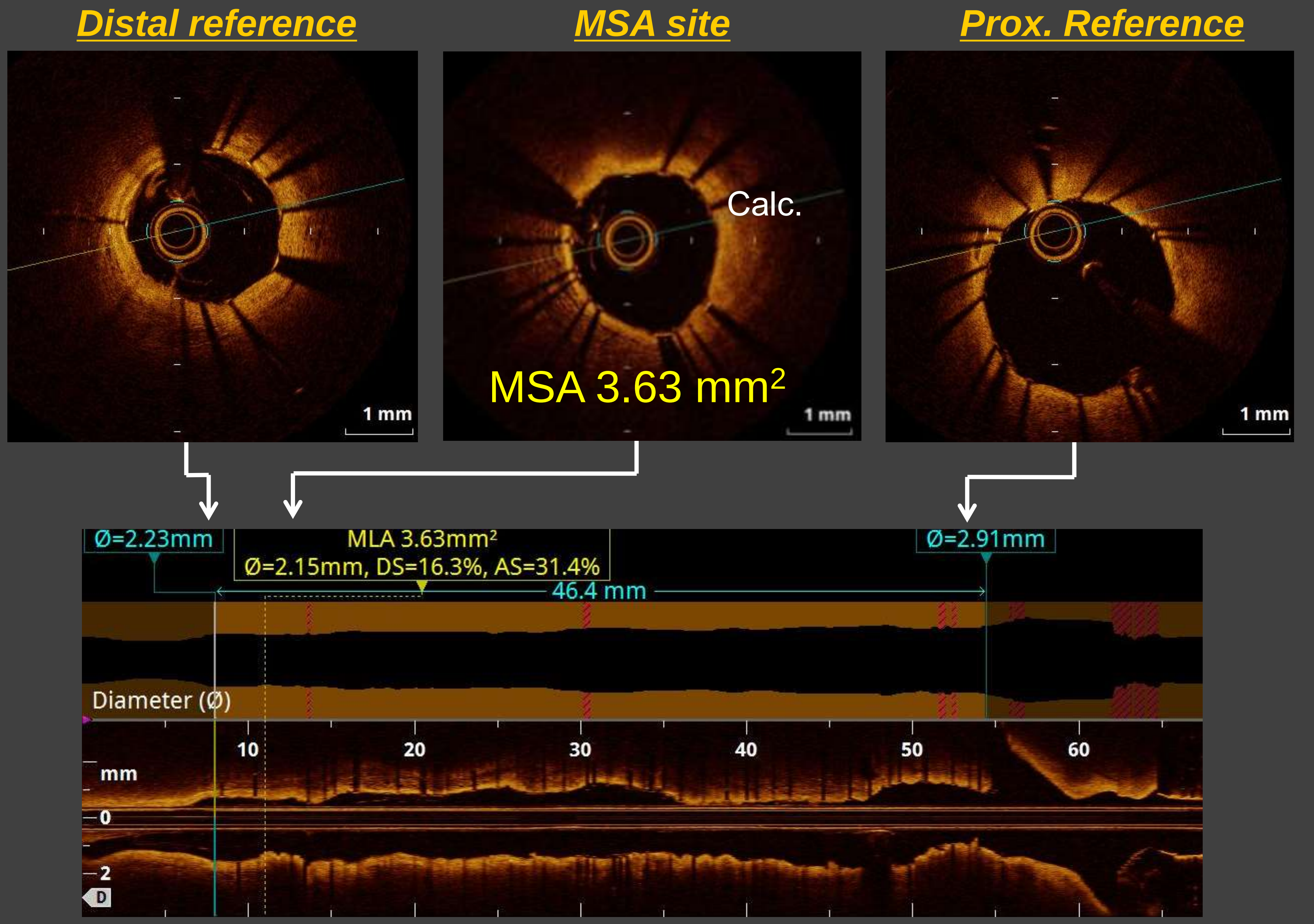
Baseline: post-Ballooning





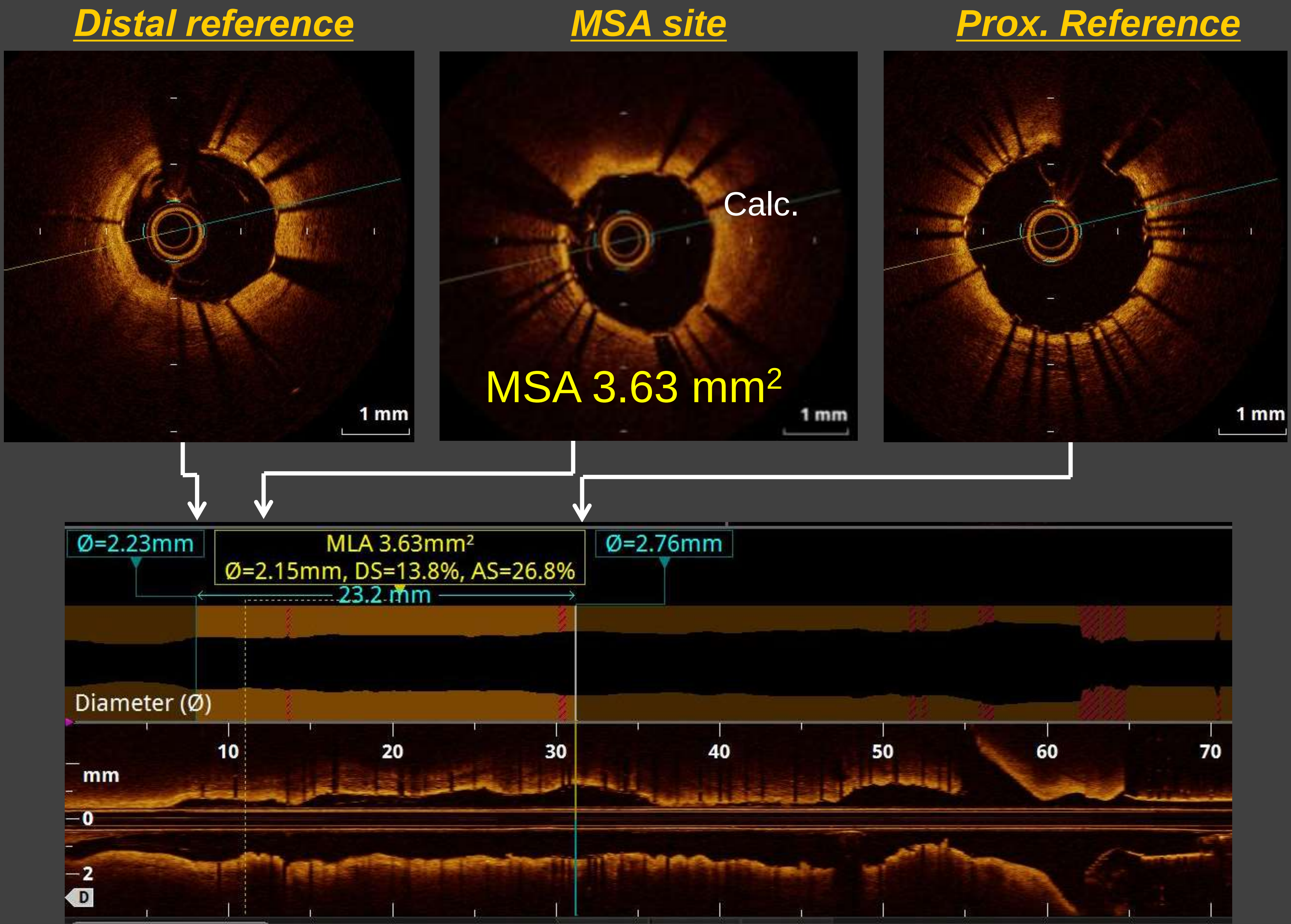
Post-PCI
1 mm
Ø=2.22mm
MLA 3.63mm²
Ø=2.15mm, DS=16.2%, AS=31.2%
Ø=2.91mm
46.6 mm
Diameter (Ø)
10
20
30
40
50
60
mm
mm
D
P

Post-PCI



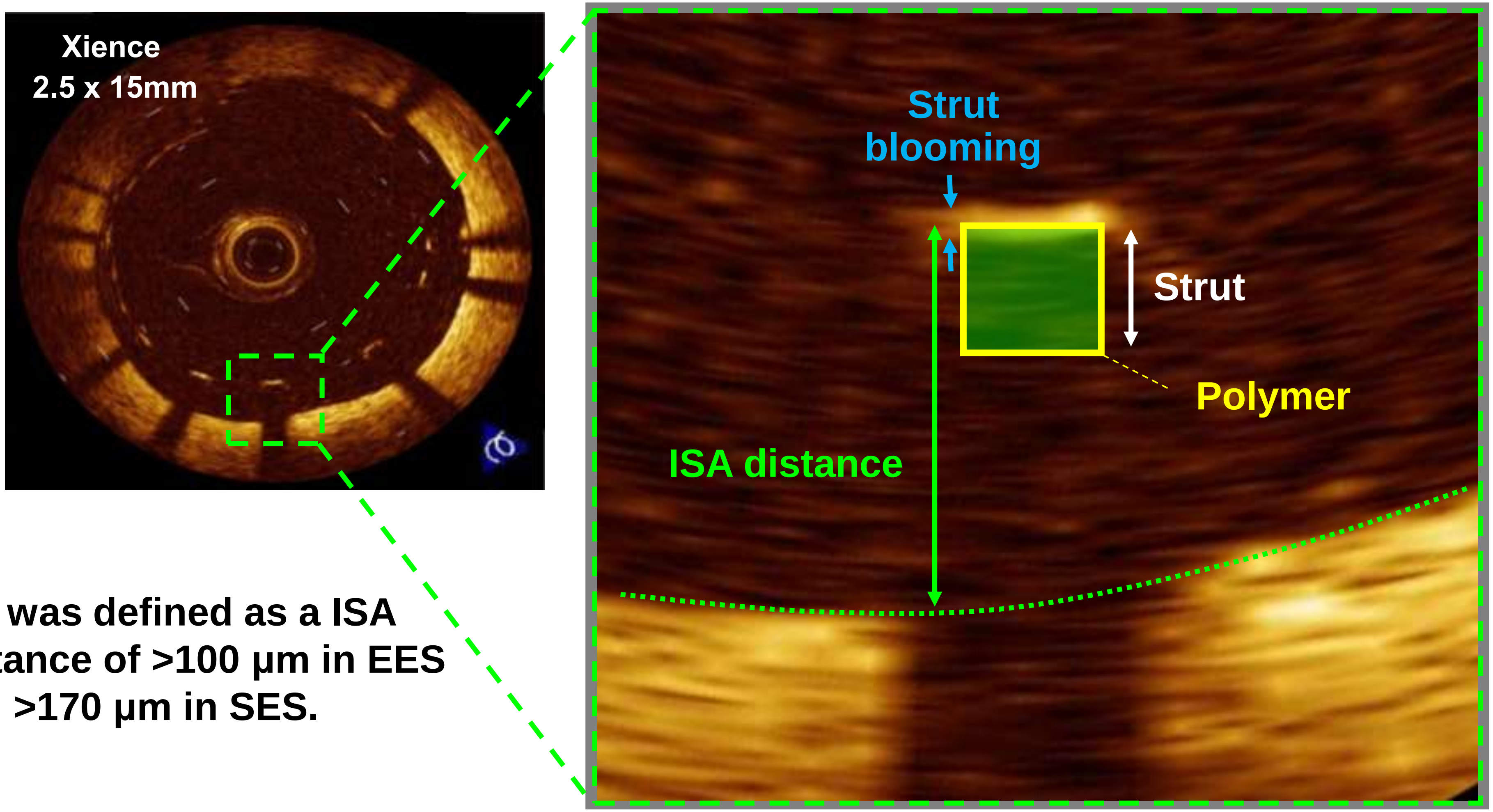
Distal reference
MSA site
Prox. Reference
1 mm
Calc.
MSA 3.63 mm²
1 mm
1 mm
Ø=2.23mm
MLA 3.63mm²
Ø=2.15mm, DS=16.3%, AS=31.4%
46.4 mm
Ø=2.91mm
Diameter (Ø)
10
20
30
40
50
60
mm
0
2
D

Post-PCI



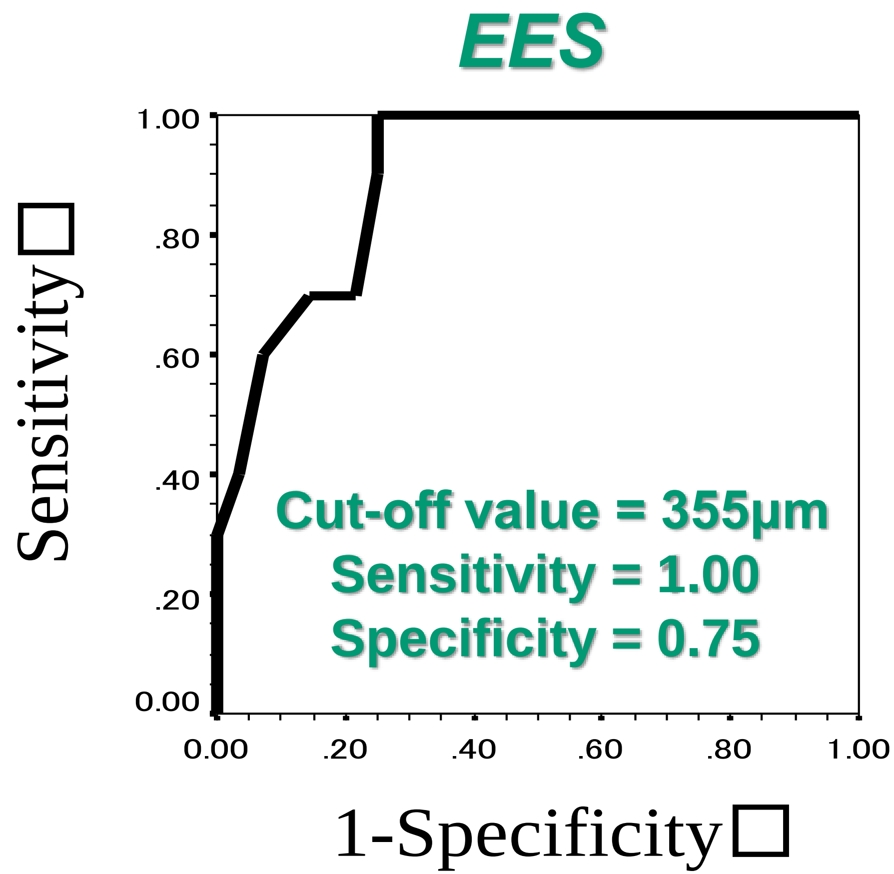
Distal reference
MSA site
Prox. Reference
1 mm
Calc.
MSA 3.63 mm²
1 mm
1 mm
Ø=2.23mm
MLA 3.63mm²
Ø=2.15mm, DS=13.8%, AS=26.8%
Ø=2.76mm
23.2 mm
Diameter (Ø)
10
20
30
40
50
60
70
mm
0
2
D

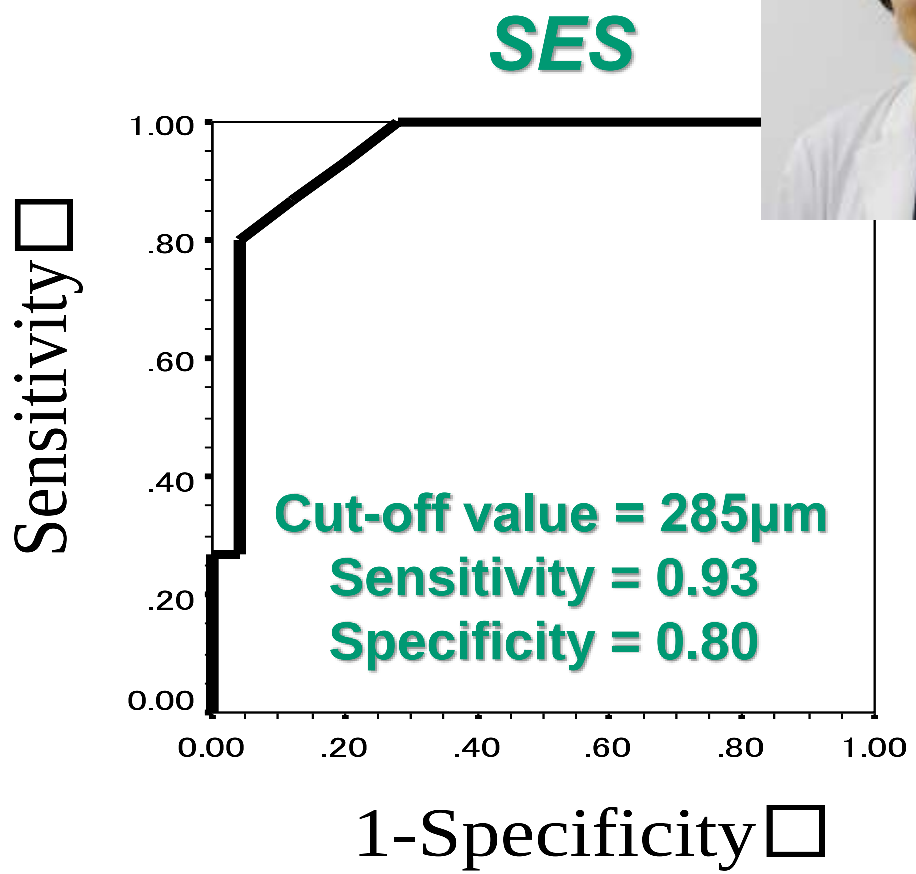
Definition of incomplete stent appostion (ISA)



ISA was defined as a ISA distance of >100 μm in EES and >170 μm in SES.

ROC curve analysis of maximum ISA distance for predicting persistent ISA (Subanalysis of RESET study)

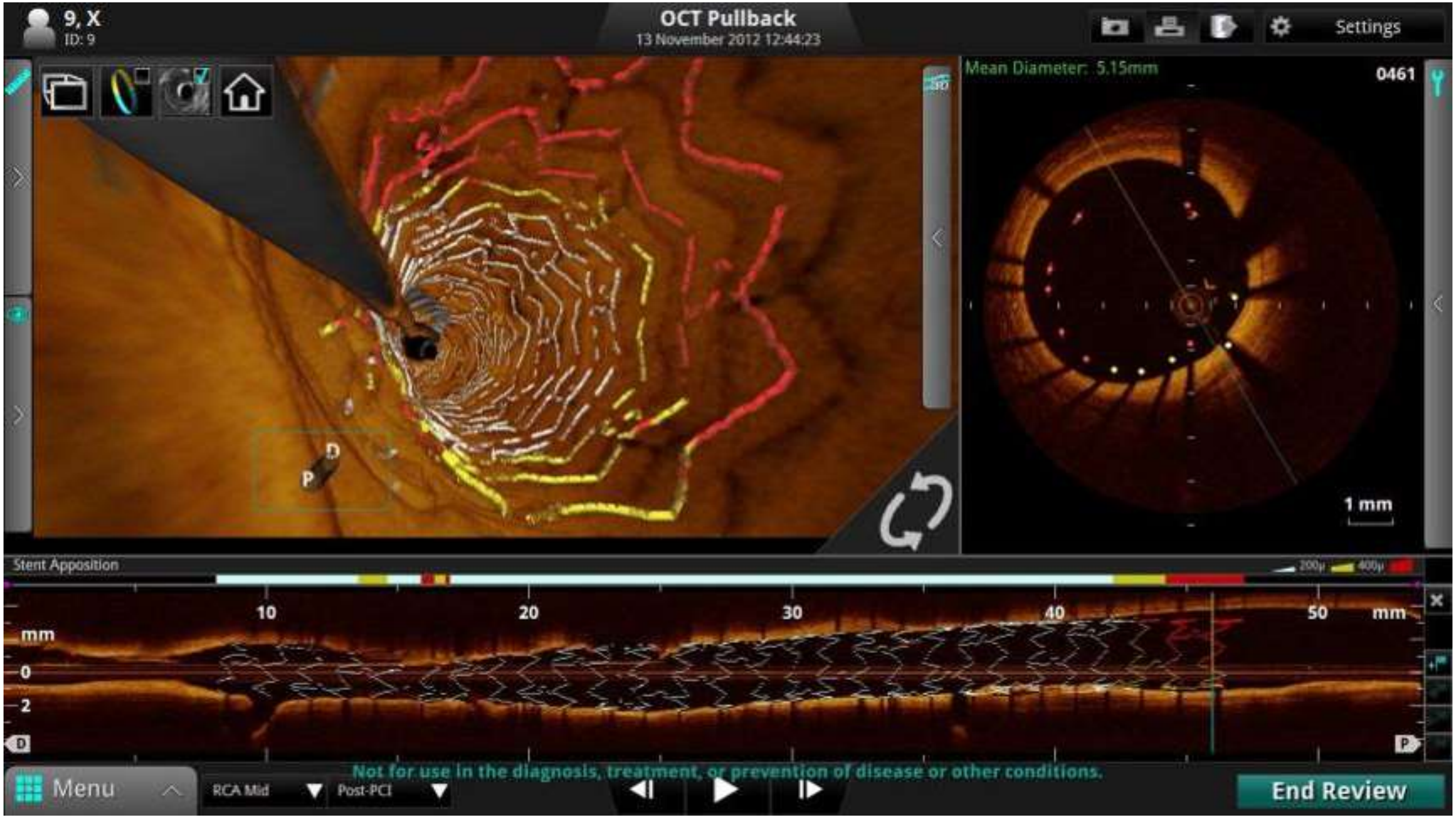




ROC curve analysis identified a maximum ISA distance of EES > 355μm with as separating persistent from resolved ISA (sensitivity 100%, specificity 75%, area under the curve = 0.905; 95%CI, 0.812 to 0.999).

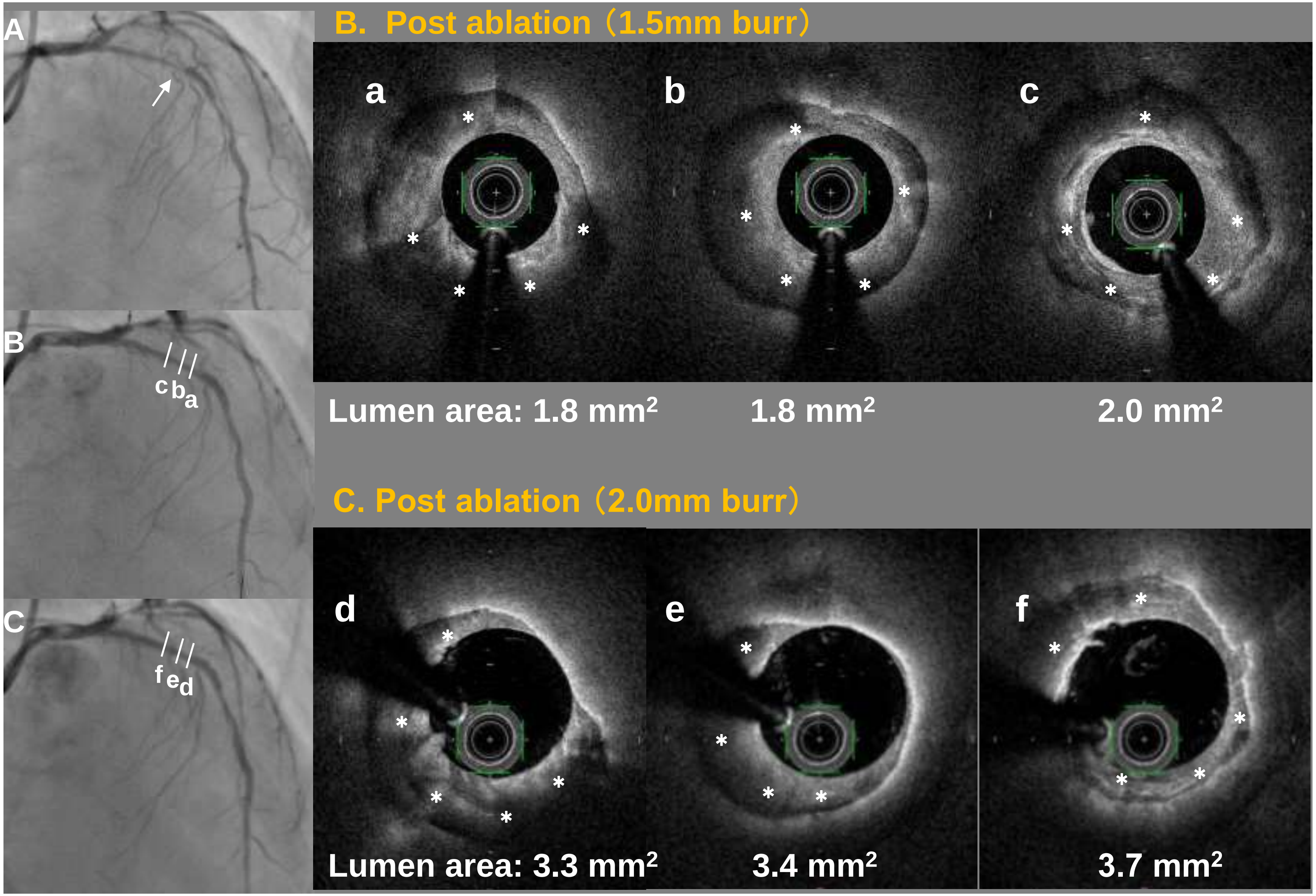
ROC curve analysis identified a maximum ISA distance of SES > 285μm with as separating persistent from resolved ISA (sensitivity 93%, specificity 80%, area under the curve = 0.947; 95%CI, 0.878 to 1.015).

New Development in OCT



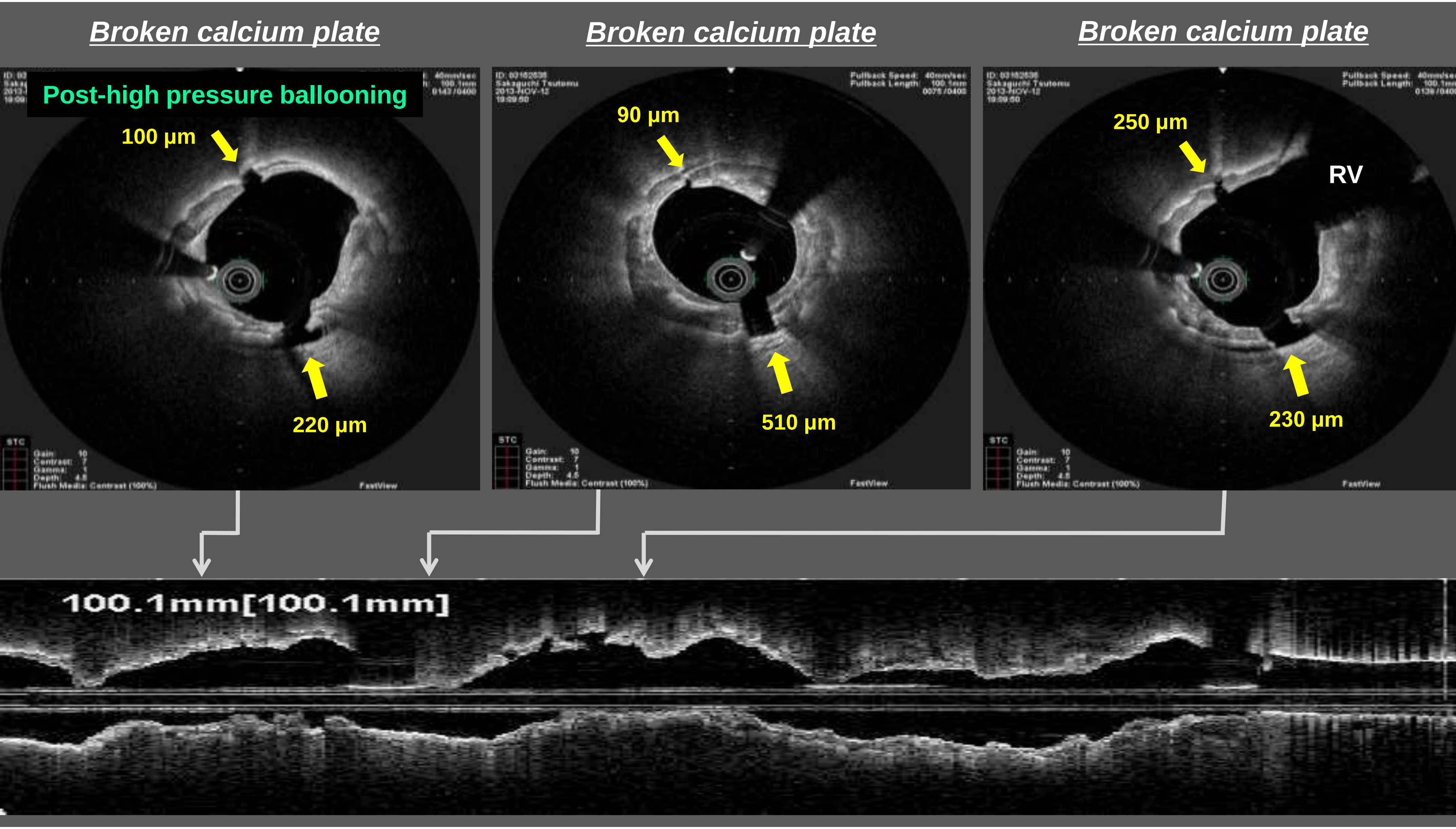
3-D reconstruction and color coded auto-detection of stent incomplete apposition can be demonstrated as fly through image by new OCT.

Step by step calcium ablation by OCT-guide

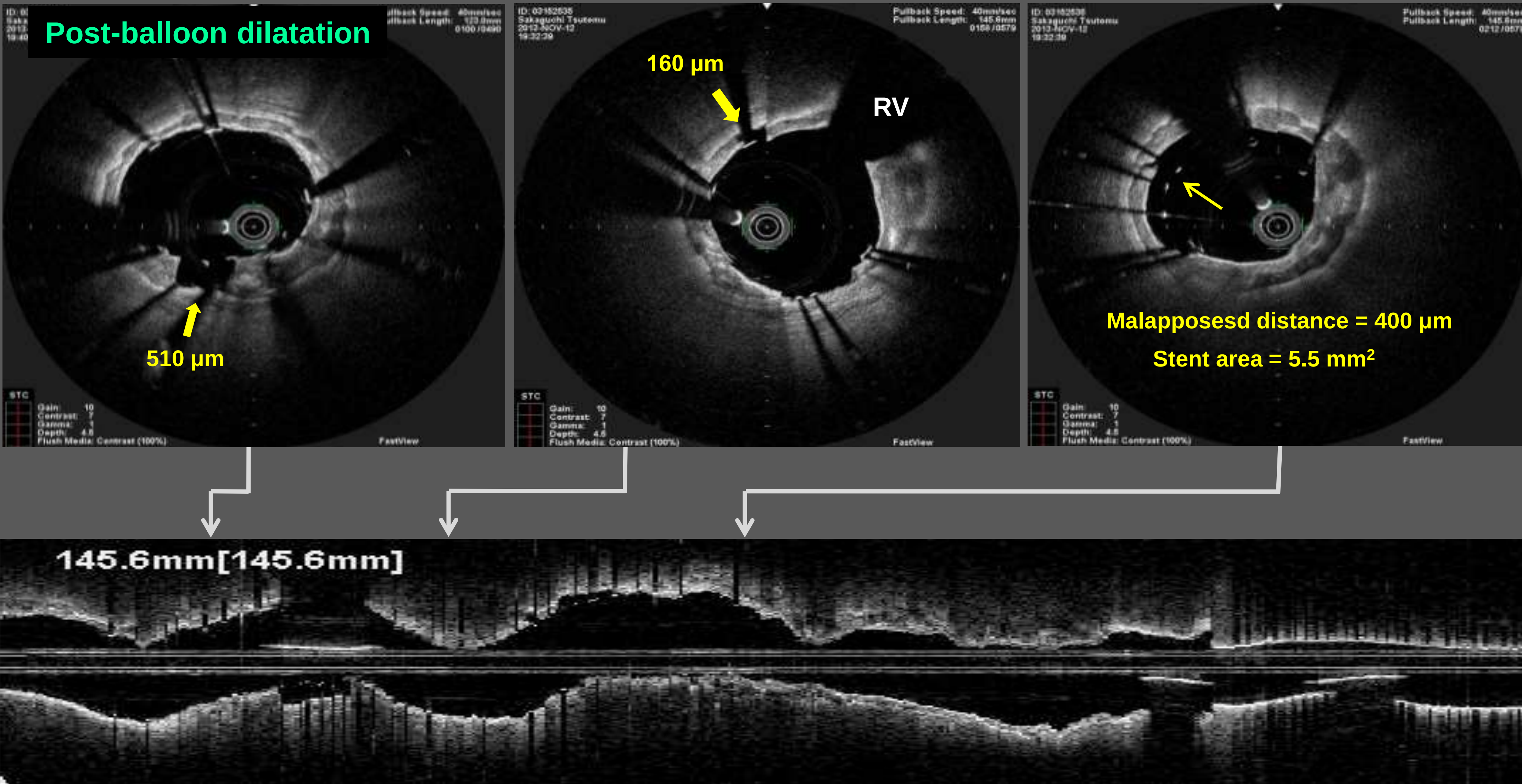


Non-stent strategy was selected because of subsequent colon cancer operation.

Making calcium fractures after rotablator by OCT-guide



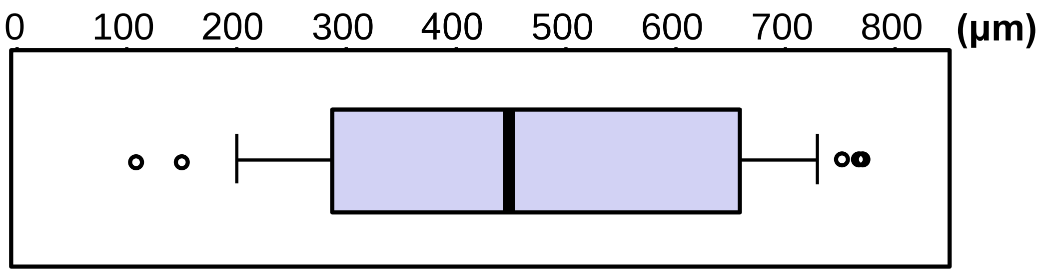
Broken calcium plate | Broken calcium plate | Stent malappsoition



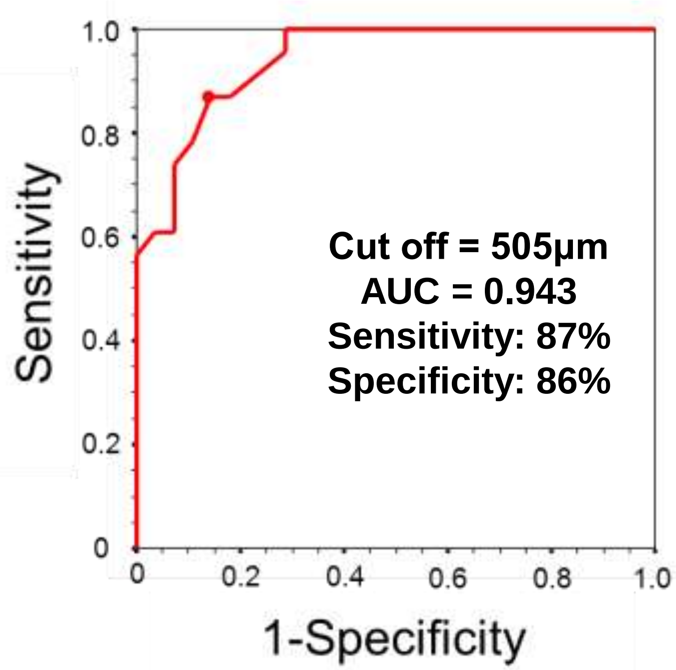
Prediction of calcium plate fracture by ballooning

OFDI was performed to assess vascular response immediately after high pressure ballooning in 61 patients with severe calcified coronary lesion.

Thickness distribution of calcium fracture



Median = 450μm; Lower quartile = 300μm; Upper quartile = 660μm; Minimum = 110μm; and Maximum = 770μm.

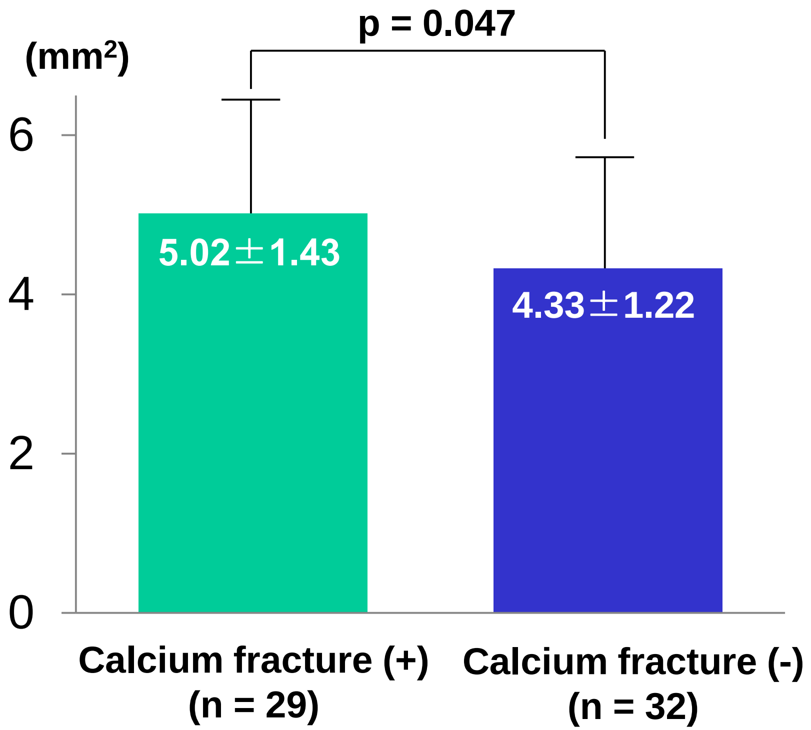


Conclusion: A calcium plate thickness < 505 μm was the corresponding cut-off value for predicting calcium plate fracture by high pressure ballooning.

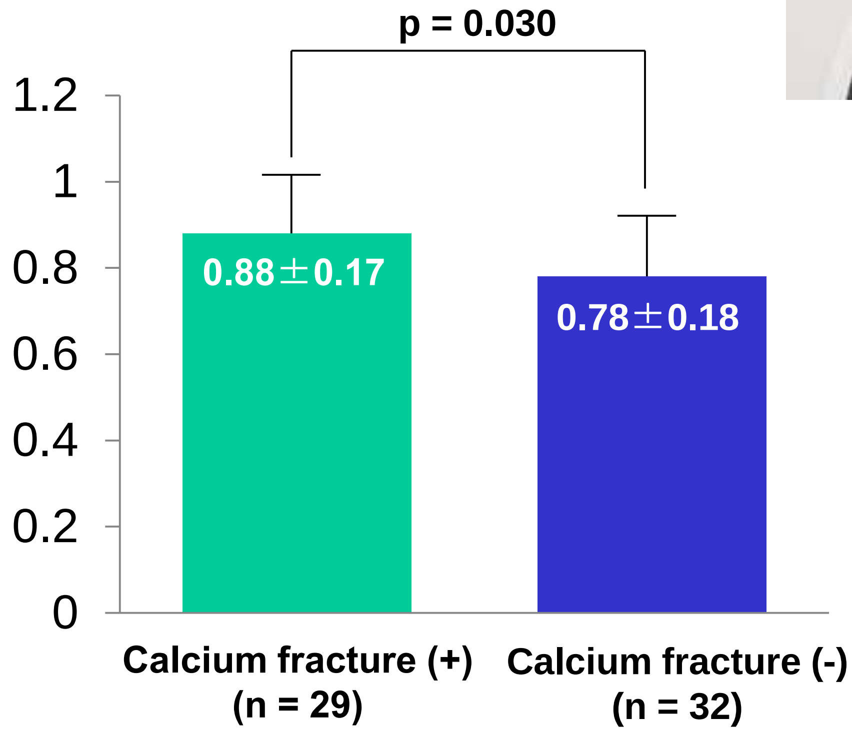
Kubo, Akasaka et al. JACC Imag 2015;8:1228-9

Stent expansion at post-PCI

Minimum stent area



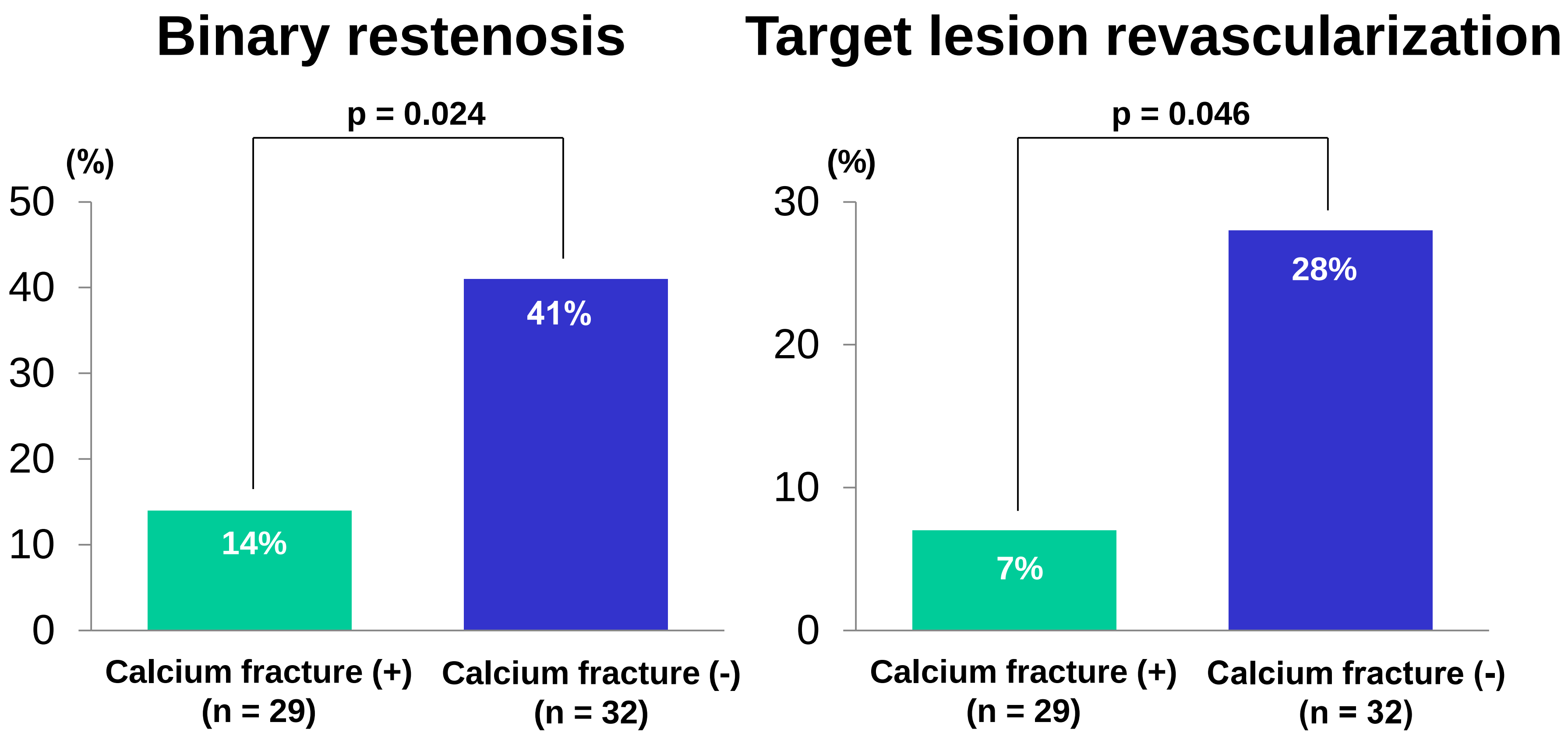
Stent expansion index



Minimum stent area and stent expansion index were significantly greater in the group with calcium fracture compared with the group without calcium fracture.

Kubo, Akasaka et al. JACC Imag 2015;8:1228-9

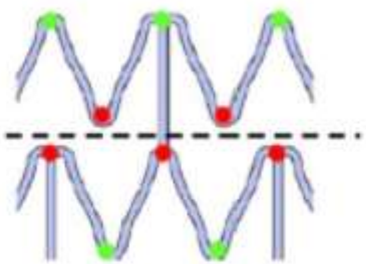
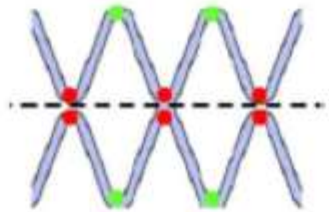
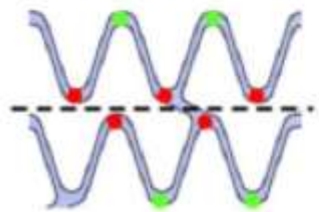
Restenosis and TLR at 10 months follow-up

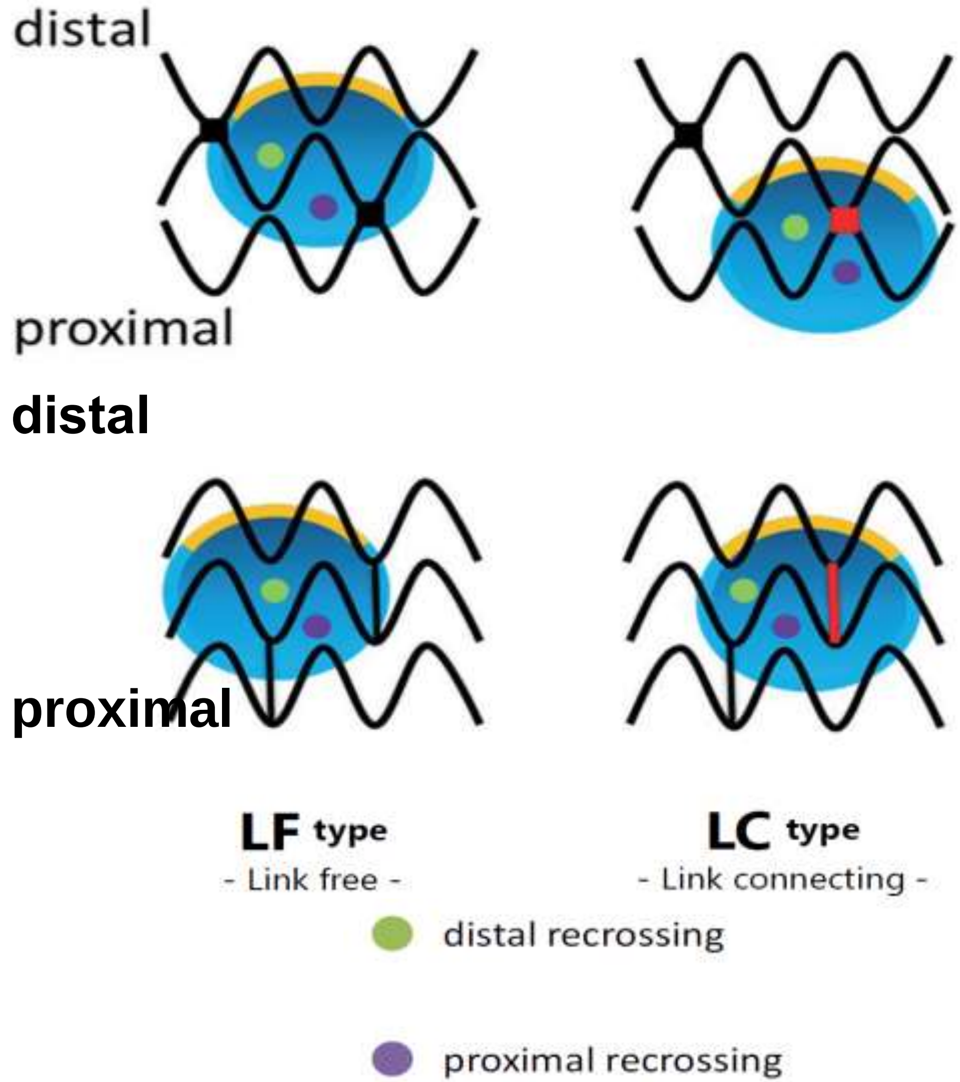


The frequency of binary restenosis and target lesion revascularization was significantly lower in the group with calcium fracture compared with the group without calcium fracture.

Kubo, Akasaka et al. JACC Imag 2015;8:1228-9

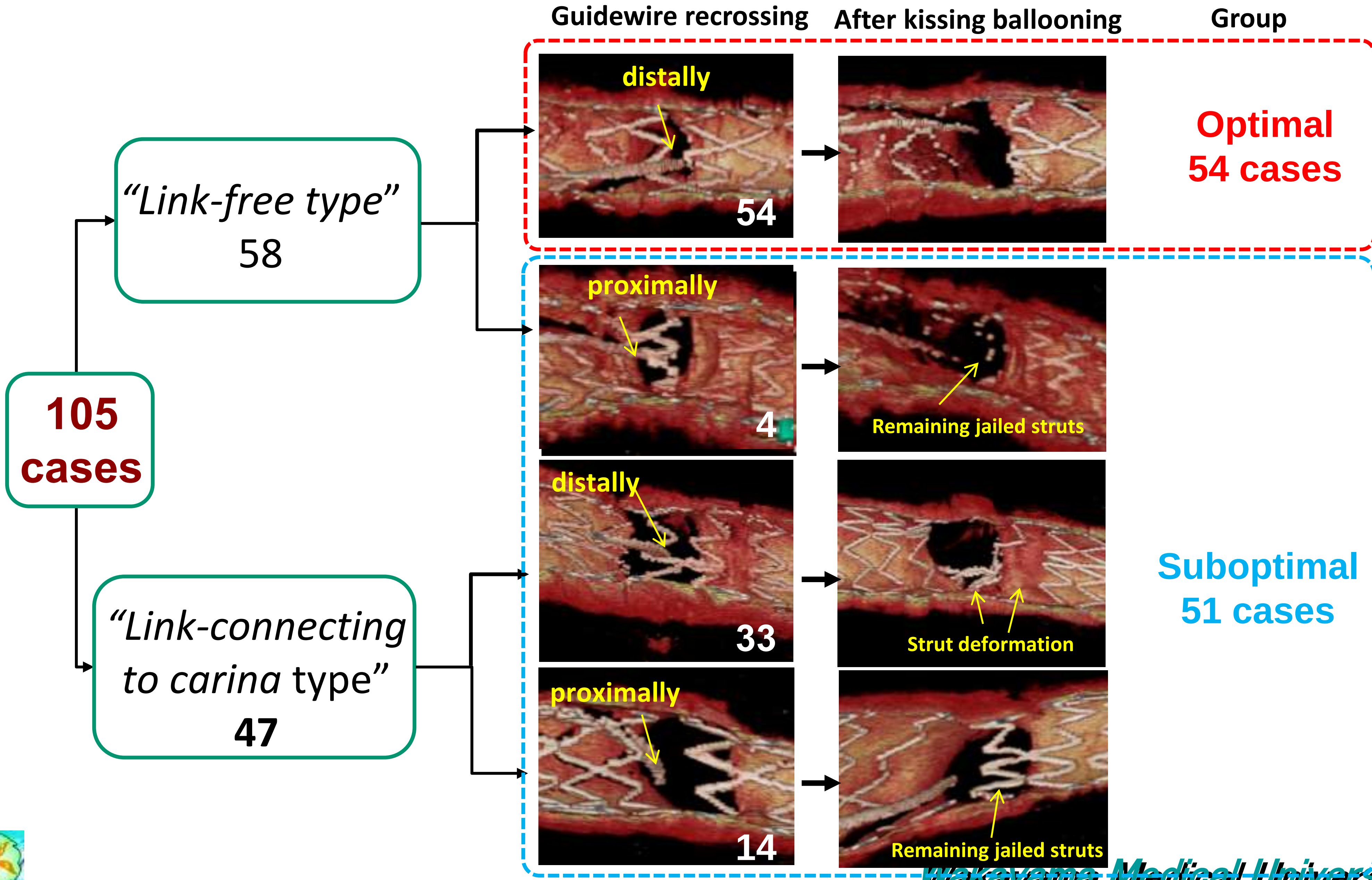
Stent design based on the rink position & wire re-cross point at bifurcation orifice

Peak to Valley (P-V) DES	Peak to Peak (P-P) DES
XIENCE	Synergy Resolute Onyx Ultimaster
	Peak to Peak  Offset Peak to Peak 



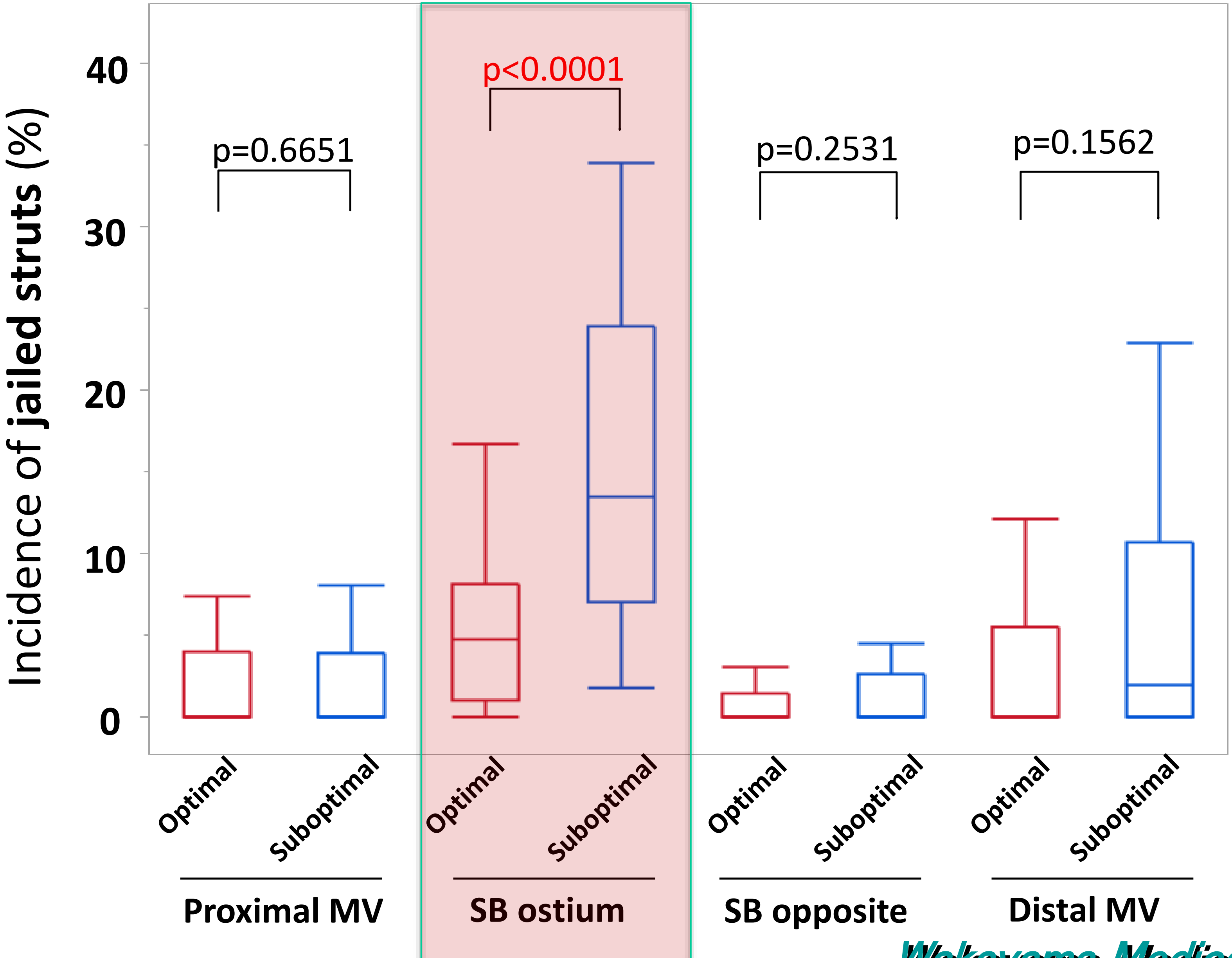
Frequency of jailing configuration & GW rewiring position

Okamura T, et al. EuroIntervention 2018;13: e1785 – e1793



Incidence of ISA at each segment

Okamura T, et al. EuroIntervention 2018;13: e1785 – e1793



Wakayama Medical University

Angiographic ISR at 9 Month

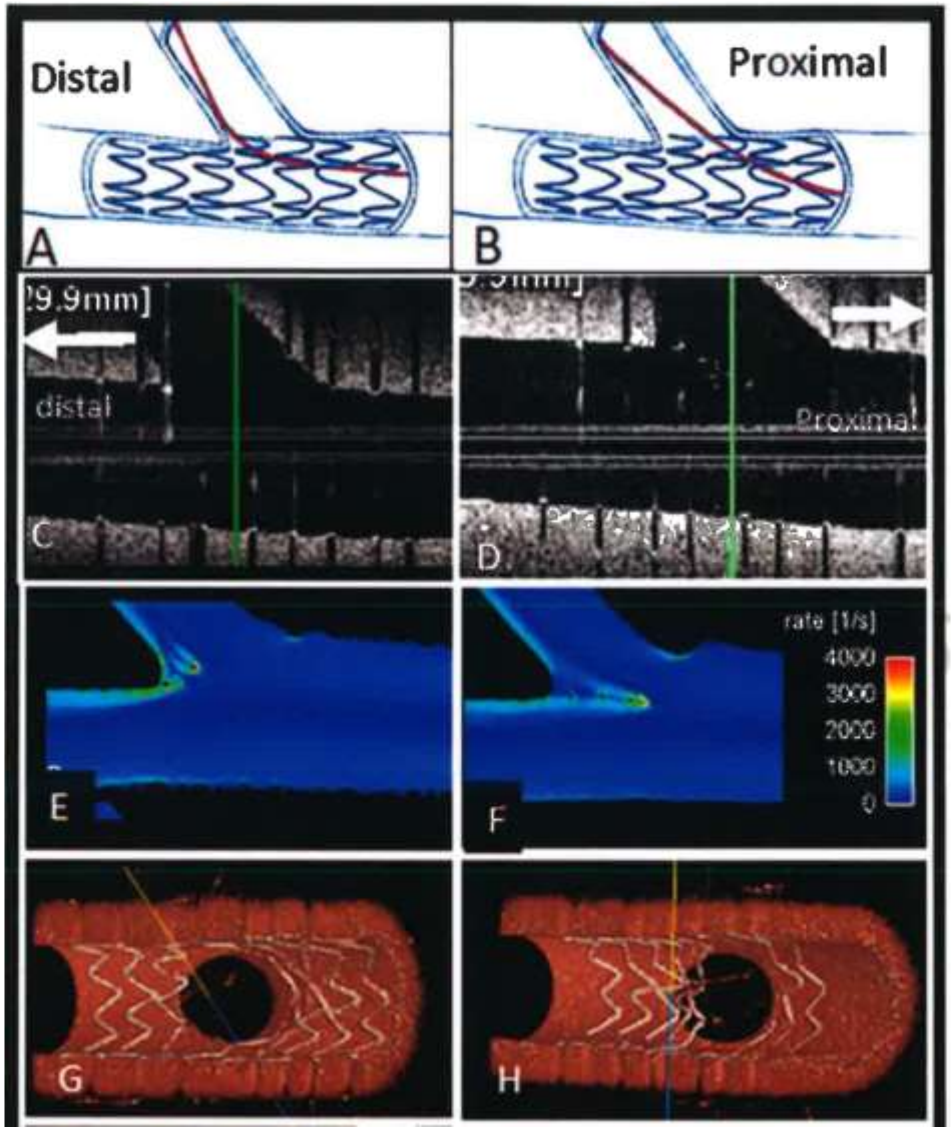
Okamura T, et al. EuroIntervention 2018;13: e1785 – e1793

	All	Optimal	Suboptimal	P value
n	87	48	39	
ISR	12(13.8%)	4(8.3%)	8(20.5%)	0.1254
PMV	0(0%)	0(0%)	0(0%)	-
DMV	1(1.1%)	1(2.1%)	0(0%)	1.0000
Side Br Orifice	12(13.8%)	4(8.3%)	8(20.5%)	0.1254

Impact of the rewiring position

Strut malapposition & shear stress

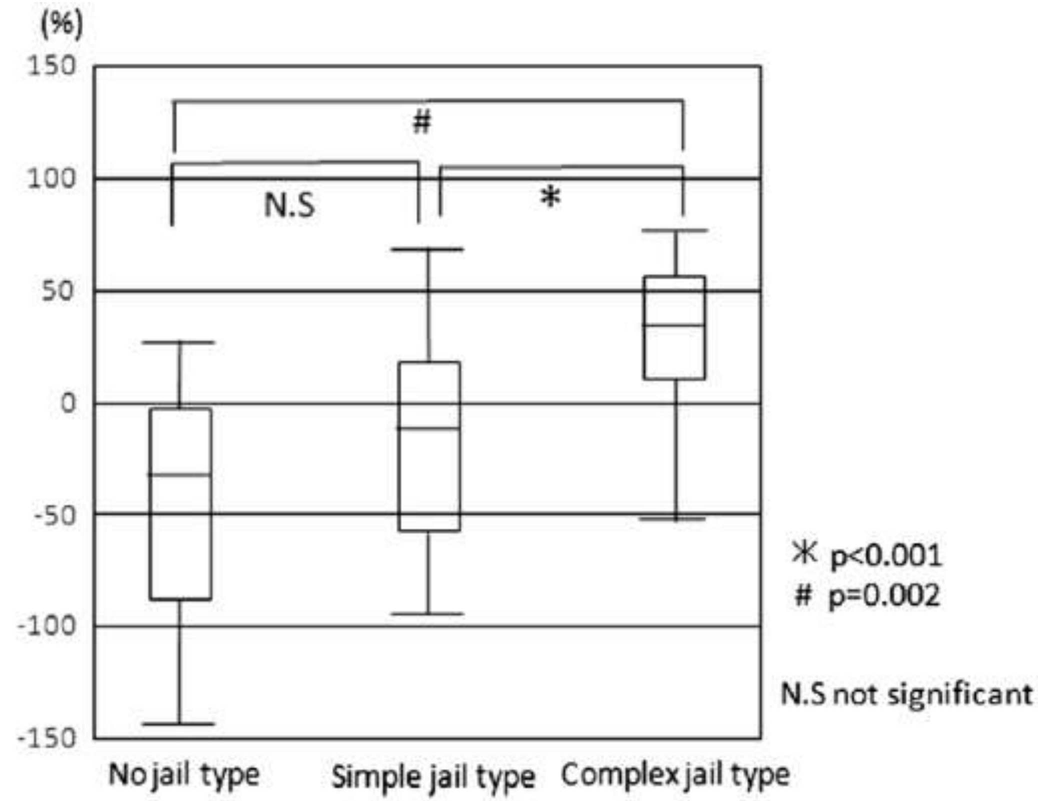
Onuma Y, et al. EuroInterv 2018;accepted



Comparison of % reduction of the side branch flow area

Comparison among each jailed type

Nakamura T, et al. Int J CV Imag 2017;33: 797 – 806



Wakayama Medical University

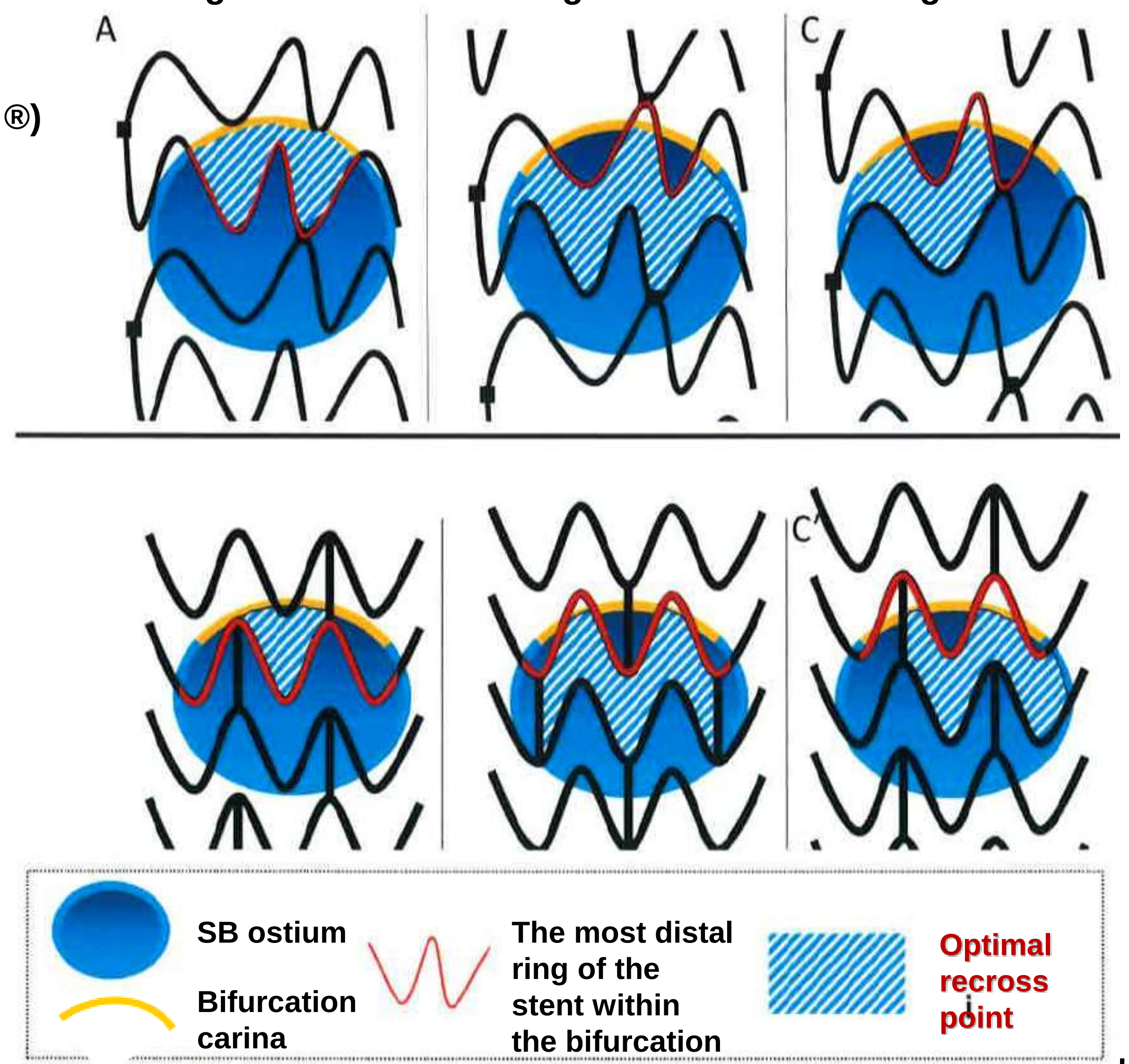
Optimal rewiring point in side branch ostium accoroding to different configurations of overhanging struts

Onuma Y, et al. EuroInterv 2018;accepted

Configuration 1 | Configuration 2 | Configuration 3

Out-of-phase,
Peak to peak design
(Ultimaster ® , Resolute ®)

In-phase,
Peak to valley design
(Xience ®)



Distal

Proximal

Distal

Proximal

Take home message

OCT for Guiding Complex PCI: Wisdom from Experience

- Pre- & post-PCI lesion morphology can be assessed easily, precisely and accurately by OCT because of higher resolution with high frame rate using auto-pullback & auto-measurement systems, and 3D reconstruction, etc..

- OCT-guided PCI is becoming more popular in daily clinical practice by the guideline recommendation as class IIa, and consensus documents regarding OCT-guided PCI has just described officially.

- Much more precise PCI could be expected by OCT compared with IVUS-guidance in specific lesions such as severe calcification, left main bifurcation, and so on, and OCT may allow us to change our daily clinical practice in PCI.

- Randomized prospective studies should be perform to demonstrate the advantages of OCT for specific pathological condition as a game changer in the field of PCI.

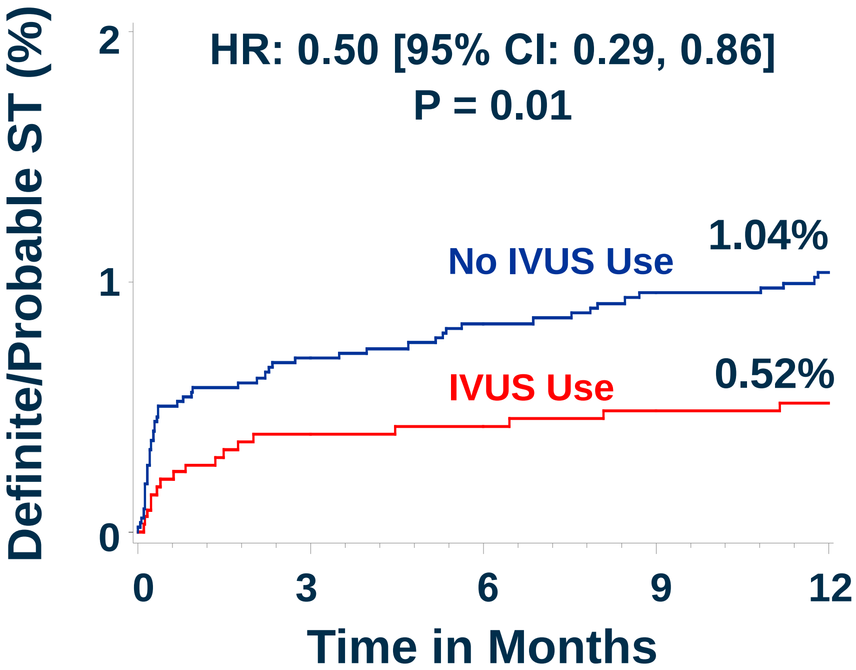
Thank you for your kind attention !!

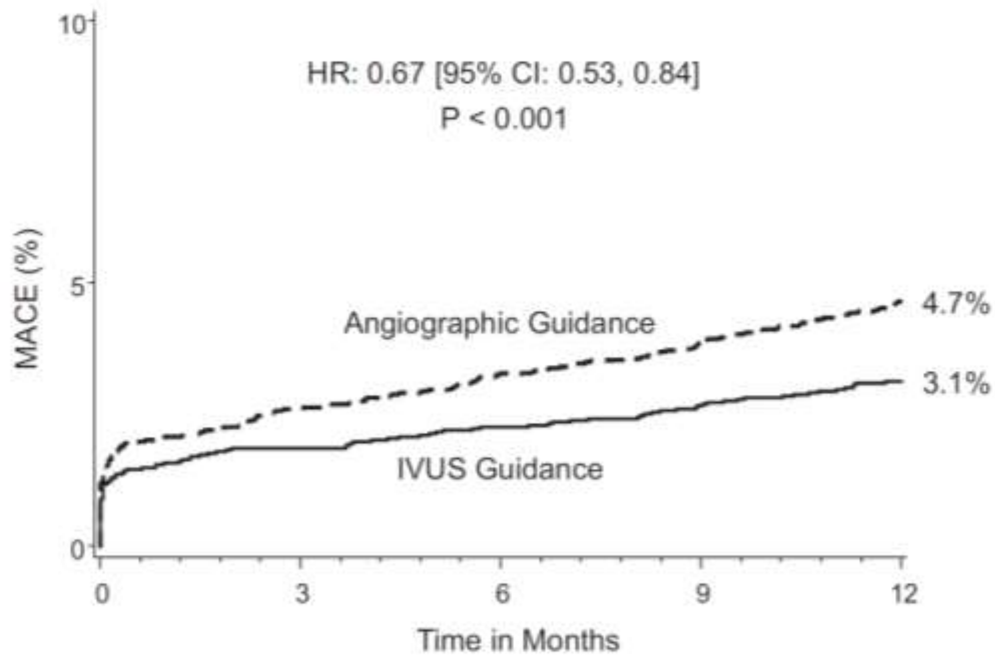
Welcome to APSC 2020 in Kyoto, Japan!!

Thank you for your kind attention !!

IVUS- vs. angio-guided PCI with DES

In the assessment of dual antiplatelet therapy with drug-eluting stent (ADAPT-DES) substudy, IVUS guidance compared with angiography in 8,583 'all-comers' pts at 11 international centers.

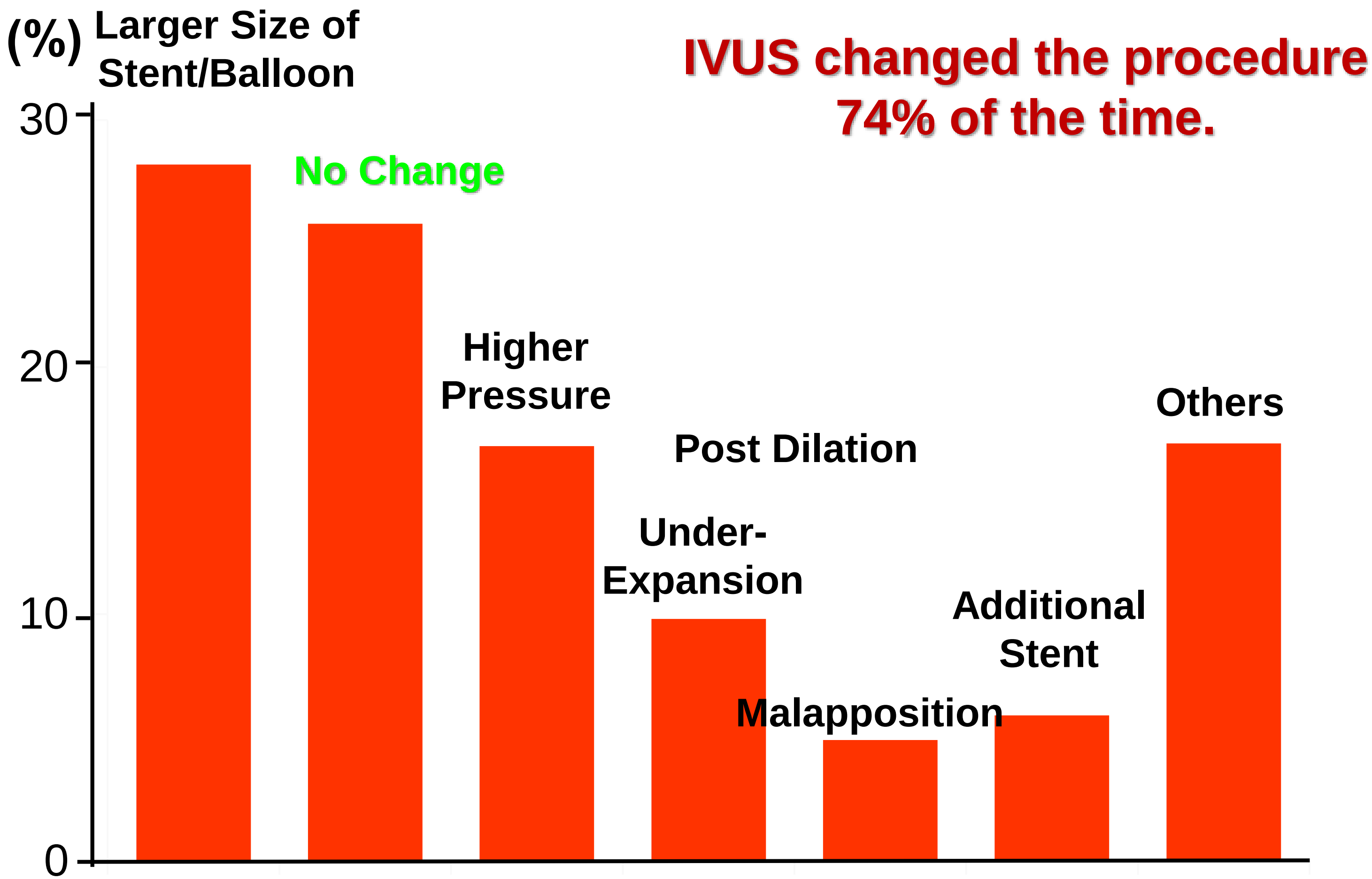




Conclusion: Compared with angiography, IVUS guidance reduces ST in addition to MI and MACE within 1 year after DES implantation.

Witzenbichler B et al. Circulation 2014;129:463-470.

How IVUS changed the procedure in ADAPT-DES substudy



Witzenbichler B et al. Circulation 2014;129:463-470.

Intracoronary imaging & physiology in ESC guideline 2014

Recommendations	Class[a]	Level[b]	Ref.[c]
FFR to identify haemodynamically relevant coronary lesion(s) in stable patients when evidence of ischaemia is not available.	I	A	50,51,713
FFR-guided PCI in patients with multivessel disease.	IIa	B	54
IVUS in selected patients to optimize stent implantation.	IIa	B	702,703,706
IVUS to assess severity and optimize treatment of unprotected left main lesions.	IIa	B	705
IVUS or OCT to assess mechanisms of stent failure.	IIa	C	
OCT in selected patients to optimize stent implantation.	IIb	C	

Eur Heart J. 2014;35:2541-2619