Imaging of coronary artery plaques using contrast-enhanced optical coherence tomography

Nicolas Foin1*, Jean Martial Mari 2, Justin E. Davies1, Carlo Di Mario3, and Michaël J.A. Girard4

1International Centre for Circulatory Health, St Mary’s Hospital, Imperial College London, 59-61 North Wharf Road 2nd floor, London W2 1LA, UK; 2INSERM 1032, Universite de Lyon, Lyon F-69003, France; 3Biomedical Research Unit, Royal Brompton Hospital, London, UK; and 4Department of Bioengineering, National University of Singapore, Singapore

* Corresponding author. Tel: +44 020 759 434 42, Email: nicolas.foin@gmail.com

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Optical coherence tomography (OCT) has recently emerged as a promising technology for intravascular guidance of interventions. With a resolution on the order of 10 μm, intravascular OCT surpasses intravascular ultrasounds, and allows for precise measurement of cap thickness and identification of lipid-rich thin-cap fibroatheroma. The diagnostic accuracy and assessment of atherosclerotic plaque morphology with OCT remain, however, limited by the rapid attenuation of OCT signal in tissue, limiting contrast on deep plaque structure and accurate assessment of plaque burden.

A contrast enhancement algorithm, previously developed to compensate for light attenuation in spectral-domain OCT images of the human optic nerve head (Panel 1, adapted with permission from the Association for Research in Vision and Ophthalmology), was applied to raw spectral-domain intracoronary OCT data acquired on a C7 system (St Jude Medical, St Paul, MN, USA). Examples of the application of the compensation algorithm on intracoronary OCT data from two different patients pullback are shown (Panel 2). Compared with the original OCT (Panel 2A and C), the compensated images (Panel 2B and D) can significantly improve the interpretation of the OCT images by: (i) enhancing contrast; (ii) removing shadows from dense structure; and (iii) improving the visibility of the deep tissue layers (by correcting for the OCT signal attenuation), revealing details within the superficial (*) and outer contour of the atherosclerotic plaque (arrow) that may be critical for interpretation of plaque composition.

Such a compensation algorithm, previously validated for ophthalmic OCT enhancement, may improve our interpretation of atherosclerotic plaque morphology imaged by intravascular OCT.

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