3D Optical Coherence Tomography (OCT) the Application in Evaluation of a Therosclerosis and Stent in Patients' Coronary Arteries

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Intravascular ultrasound (IVUS) and OCT are two clinical imaging techniques both can show the inside of vessels of patients, however OCT has higher resolution than IVUS that offers the evaluation of the plaques and stents in patients coronary arteries with the best precise nowadays to OCT. Current IVUS and OCT present a sequence of 2D slices of the lumen but the individual slices are short of the quantitative of the spatial structure of plaque and stent. As developing, 3D OCT as 3D IVUS helped by two X-ray angiographies can reconstruct the objects and show them in the realistic space. A 3D OCT system was produced in our lab and it was successfully used in the diagnosis of patients in Emory University Hospital. In the abstract, the principle of the 3D OCT is introduced. Two examples, two patients, with comprehensive process and significant results by the technique are presented. One patient has mild atherosclerosis in the left anterior descending artery (LAD) to whom IVUS and OCT both scanning was performed. The LAD has been reconstructed by the 3D OCT then the flow filed was calculated by computational fluid dynamics (CFD) that the inlet condition came from the Doppler velocity measuring during the scanning. The result shows that the distribution of intima thickness evaluated by the OCT imaging inversely matched up with the distribution of wall shear stress (WSS) in the segment. Another patient was implanted stent in the proximal LAD and OCT scanning was performed before the stent implantation and after implantation. The 3D lumens before implantation and after were compared and reconstructed. The stent placement in the lumen included the entire twist and deformation of the stent was shown. The local features of the struts apposition with the wall can be evaluated as the superior resolution of the 3D OCT.