Association of OCT derived wall shear stress and neointimal healing in stented coronary arteries

**Purpose**: Optical coherence tomography (OCT) is the highest resolution intracoronary imaging technique. This allows for clear identification of neointimal growth and coronary artery stents. Excessive neointimal growth can result in stent restenosis. Wall shear stress (WSS) is the tangential force of blood flow against the vessel wall and areas of low WSS have previously been associated with increased neointimal growth. In this study, we aimed to develop a better understanding of the relationship between WSS and neointimal thickness.

**Methods**: Sixty patient's underwent cardiac catheterization and were imaged at baseline post stent and at 12-month follow up. Patients were randomized to either receive a Resolute (n=31) or Xience stent (n=29). Coronary angiograms and OCT images were combined to create a 3D reconstruction of coronary arteries (n=60). These vessels were meshed using SimVascular and computational fluid dynamics (CFD) was performed to calculate WSS. The baseline and follow-up OCT images were co-registered to calculate neointimal growth in the 12-month period. Regions of the vessel within 0.1mm of a stent strut were marked as an in-strut location. Underexpanded regions were defined as frames where lumen area was less than 90% of the reference area.

**Results**: Neointimal thickness was split into 3 groups (<0.2, 0.2-20.29, >0.3 mm) while WSS was also divided into 3 groups (low, medium and high). A relationship between WSS and neointimal thickness was found in in-strut and underexpanded segments. In areas with the greatest amount of neointimal thickness (>= 0.3mm) low WSS was more commonly observed versus medium or high WSS.

**Conclusion**: We found greater neointimal growth in areas with low WSS in vessel regions that are both in-strut and underexpanded.