Impact of Bifurcation Dual Stenting on Endothelial Shear Stress

Henry Y. Chen[a], Bon-Kwon Koo[b] and Ghassan S. Kassab[a]

[a]*California Medical Innovations Institute, San Diego, CA*
[b]*Division of Cardiology, Seoul National University Hospital, Seoul, South Korea.*

Chen, HY, B-K Koo and GS Kassab. Impact of Bifurcation Dual Stenting on Endothelial Shear Stress, *J Appl. Physiol* (1985). 119(6):627-32, 2015.

Introduction

The objective of this study is to determine the effect of dual bifurcation stenting on hemodynamic parameters known to influence restenosis and thrombosis.

We hypothesized that double stenting, especially with a longer (e.g., 30% longer than lesion) SB stent has a negative effect on wall shear stress (WSS), wall shear stress gradient (WSSG), and oscillatory shear index (OSI).

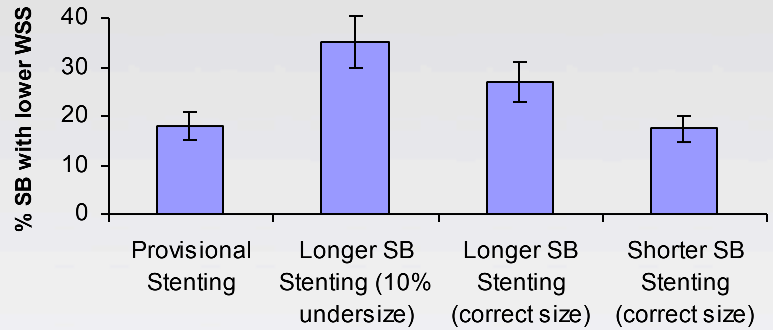
Methods

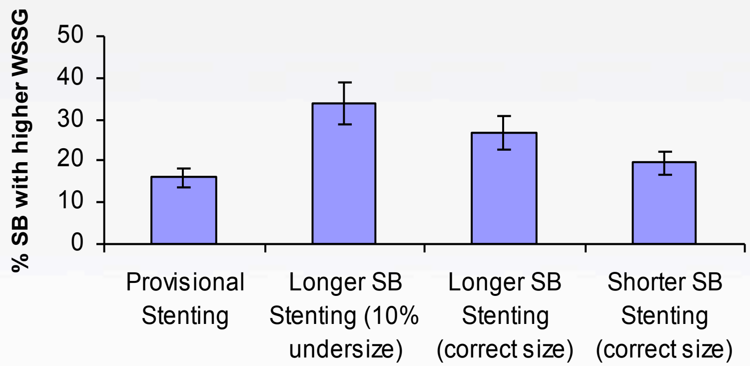
- To test this hypothesis, we developed computational models of dual stents at bifurcations and non-Newtonian blood simulations.

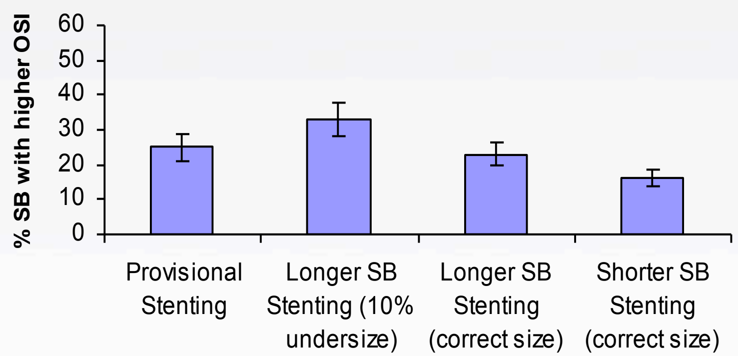
- The models were then interfaced, meshed and solved in a validated finite element package.

- The blood was modeled with flow waveform based on human left coronary artery pulsatile velocity measurements applied at the inlet of vessel.

Effects of SB stent on the % area of adverse endothelial hemodynamics

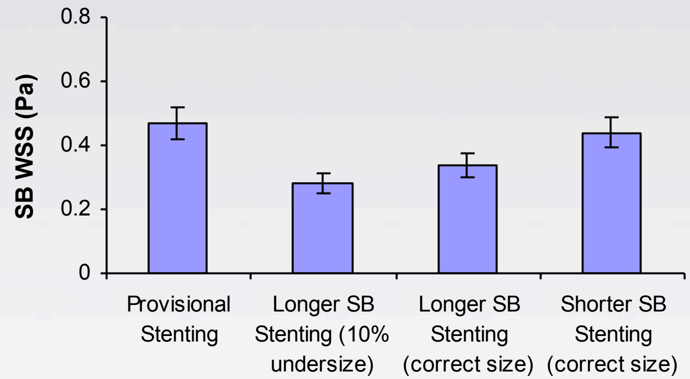


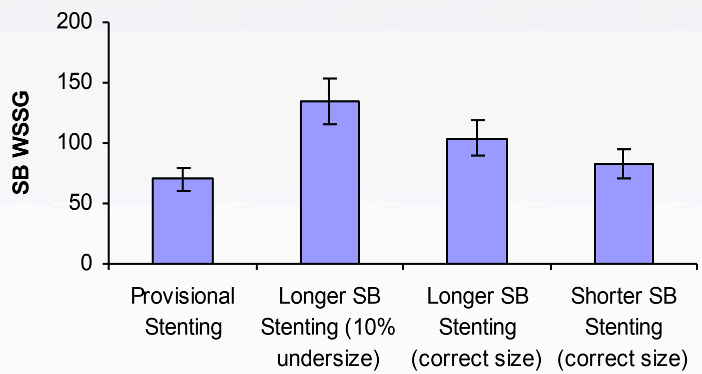


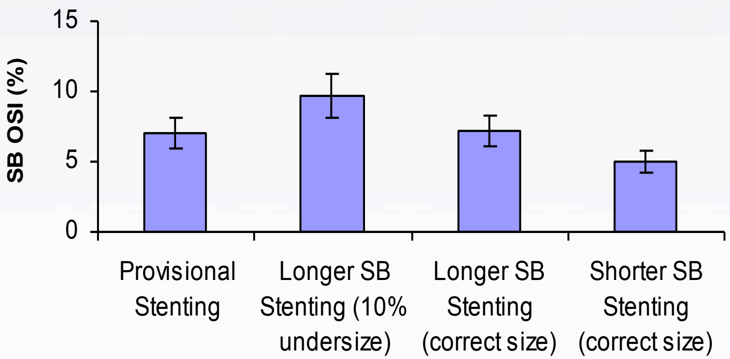


Dual stenting with SB stent opens up the SB stenosis. However, for the rest of SB, the % area of lower WSS, higher WSSG and OSI are more extensive for dual stenting with longer SB stent. Shorter (length of lesion) SB stenting reduces negative effects on the rest of SB.

Effects of SB stent on the endothelial hemodynamics







Shorter SB stenting as well as provisional stenting are more beneficial than dual stenting with longer (30% longer than lesion) SB stent on the endothelial hemodynamic parameters.

Conclusions

- The simulations predict a negative hemodynamic role for SB stenting which is exaggerated with a longer stent, consistent with clinical trial findings that dual stenting is comparable or inferior to provisional stenting.

- Shorter SB stent (only to cover the stenosis) reduces negative effects on the SB by lowering the OSI as compared to provisional stenting, but increases the WSSG.

- Undersized stents exaggerate the negative hemodynamic effects of SB stenting.