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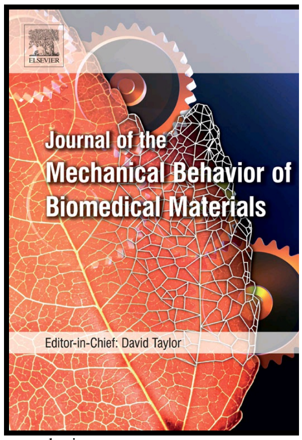

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A Mechanical Argument for the Differential Performance of Coronary Artery Grafts

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ABSTRACT

Coronary artery bypass grafting (CABG) acutely disturbs the homeostatic state of the transplanted vessel making retention of graft patency dependent on chronic remodeling processes. The time course and extent to which remodeling restores vessel homeostasis will depend, in part, on the nature and magnitude of the mechanical disturbances induced upon transplantation. In this investigation, biaxial mechanical testing and histology were performed on the porcine left anterior descending artery (LAD) and analogs of common autografts, including the internal thoracic artery (ITA), radial artery (RA), great saphenous vein (GSV) and lateral saphenous vein (LSV). Experimental data were used to quantify the parameters of a structure-based constitutive model enabling prediction of the acute vessel mechanical response pre-transplantation and under coronary loading conditions. A novel metric Ξ was developed to quantify mechanical differences between each graft vessel in situ and the LAD in situ, while a second metric Ω compares the graft vessels in situ to their state under coronary loading. The relative values of these metrics among candidate autograft sources are consistent with vessel-