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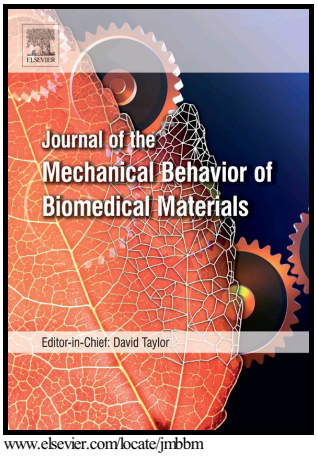

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Abstract

Chronic Venous Disease is caused by chronic venous insufficiency (CVI), which results in significant symptoms such as venous ulcers, ankle eczema, leg swelling, etc. Venous valve incompetence is a major cause of CVI. When the valves of veins in the leg become incompetent (i.e., do not close properly), blood is able to flow backwards (i.e., reflux), which results in blood pooling in the lower extremities, distal venous hypertension, and CVI. Current clinical therapies, such as surgical venous valve reconstruction and bioprosthetic venous valve replacement, are highly invasive and only moderately successful. This is due, in part, to the scanty information available about venous valve leaflet structure and mechanical properties. To date, only one previous study by our research group has reported on the mechanical properties of venous valve leaflet tissue, and only in the case of jugular vein valves. In this study, we conducted equibiaxial tensile tests on bovine saphenous vein valve leaflet tissues to better understand their nonlinear, anisotropic mechanical behavior. By stretching the valvular tissues to 60% strain in both the circumferential and radial directions, we generated stress-strain curves for proximal (i.e., those closest to the heart) and distal (i.e., those furthest from the heart) valve leaflets. Histology and collagen assays were also conducted to study corresponding leaflet microstructures and the biochemical properties of the tissues. Results showed: (1) saphenous venous valve tissues