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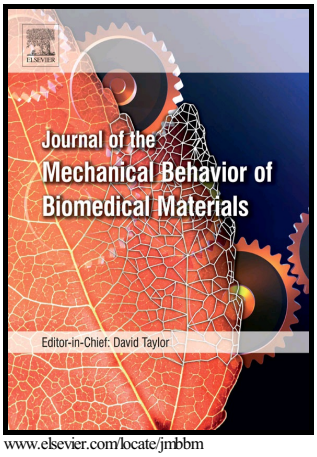

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Prediction of circumferential compliance and burst strength of polymeric vascular grafts

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Abstract

The circumferential compliance and burst strength of vascular grafts are predicted through the conically modified von Mises and elasticity theories, providing an analytical closed form solution for both parameters. Besides the graft's radii, the model for circumferential compliance depends solely on the elastic modulus and Poisson's ratio of the polymer material, and its accuracy was verified by finite element analysis and measurements. The analytical expression of the burst strength requires accurate determination of the material's tensile and compressive yield stress, which were carefully obtained by using digital image correlation measurements in uniaxial tensile and compressive tests of the constitutive material. The average measured circumferential compliance and burst strength of an 8 mm graft made of a commonly used biomaterial, Tecoflex® SG-80A, are 1.05 %/100 $mmHg^{-1}$ and 34.1 psi (1763 mmHg) and the proposed analytical predictions fall within the experimental scattering. Thus, it is shown that the circumferential compliance and burst strength of vascular grafts can be analytically predicted by knowing the elastic and yield material properties accurately, without needing to actually test the graft under radial pressure. This is a major advantage which can aid in the design and tailoring of vascular grafts.

Keywords: *Conically modified von Mises criteria, Elasticity theory, Thick-walled cylinders, Predictive model, Circumferential compliance, Burst strength.*

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