

Author's Accepted Manuscript

Prediction of circumferential compliance and burst strength of polymeric vascular grafts

O. Castillo-Cruz, C. Pérez-Aranda, F. Gamboa, J.V. Cauich-Rodríguez, D. Mantovani, F. Avilés



PII: S1751-6161(17)30590-8
DOI: <https://doi.org/10.1016/j.jmbbm.2017.12.031>
Reference: JMBBM2634

To appear in: *Journal of the Mechanical Behavior of Biomedical Materials*

Received date: 24 October 2017
Revised date: 21 December 2017
Accepted date: 29 December 2017

Cite this article as: O. Castillo-Cruz, C. Pérez-Aranda, F. Gamboa, J.V. Cauich-Rodríguez, D. Mantovani and F. Avilés, Prediction of circumferential compliance and burst strength of polymeric vascular grafts, *Journal of the Mechanical Behavior of Biomedical Materials*, <https://doi.org/10.1016/j.jmbbm.2017.12.031>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Prediction of circumferential compliance and burst strength of polymeric vascular grafts

O. Castillo-Cruz¹, C. Pérez-Aranda¹, F. Gamboa², J. V. Cauich-Rodríguez^{1*}, D. Mantovani³, F. Avilés¹

¹ Centro de Investigación Científica de Yucatán, A.C., Unidad de Materiales, Calle 43 No. 130 x 32 y 34, Col. Chuburná de Hidalgo, 97205 Mérida, Yucatán, Mexico.

² Centro de Investigación y de Estudios Avanzados del IPN, Unidad Mérida, Depto. de Física Aplicada, km 6 Antigua Carretera a Progreso, 97310 Mérida, Yucatán, Mexico.

³ Lab. for Biomaterials & Bioengineering (CRC-I), Dept. of Min-Met-Materials Engineering & CHU de Quebec Research Center, Laval University, Quebec City, Canada.

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.*

*Corresponding autor: jvcr@cicy.mx

Download English Version:

<https://daneshyari.com/en/article/7207270>

Download Persian Version:

<https://daneshyari.com/article/7207270>

[Daneshyari.com](https://daneshyari.com)