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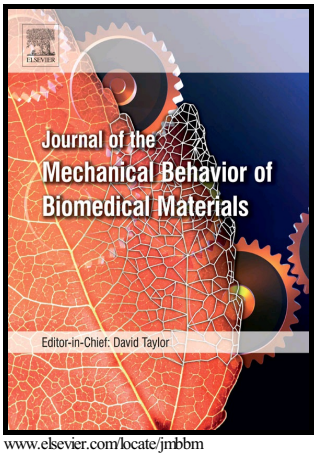

www.elsevier.com/locate/jmbbm

PII: S1751-6161(16)30075-3
DOI: http://dx.doi.org/10.1016/j.jmbbm.2016.04.011
Reference: JMBBM1878

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

Received date: 10 December 2015
Revised date: 4 April 2016
Accepted date: 6 April 2016

Cite this article as: Yu Xie, Ying Guan, Soo-Hyun Kim and Martin W. King, The Mechanical Performance of Weft-knitted/Electrospun Bilayer Smal Diameter Vascular Prostheses, *Journal of the Mechanical Behavior o Biomedical Materials,* http://dx.doi.org/10.1016/j.jmbbm.2016.04.011

The Mechanical Performance of Weft-knitted/Electrospun Bilayer Small Diameter Vascular Prostheses

Yu Xie[1], Ying Guan[2], Soo-Hyun Kim[3], Martin W. King[1,2]

[1]College of Textiles, North Carolina State University, Raleigh, NC, USA, [2]Donghua University, Shanghai, China, [3]Korea Institute of Science & Technology, Seoul, South Korea.

Abstract

Cardiovascular disease (CVD) accounts for a significant mortality rate worldwide. Autologous vessels, such as the saphenous vein and the internal mammary artery, are currently the gold standard materials for by-pass surgery. However, they may not always be available due to aging, previous harvesting or the pre-existing arterial disease. Synthetic commercial ePTFE and polyester (PET) are not suitable for small diameter vascular grafts (<6 mm), mainly due to their poor circumferential compliance, rapid thrombus formation and low endothelialization. In order to reduce thrombogenicity and improve cell proliferation, we developed a collagen/elastin knitted/ electrospun bilayer graft made of biodegradable and biocompatible poly(lactic acid) (PLA) and poly(lactide-co-caprolactone) (PLCL) polymers to mimic the multilayer structure of native arteries. We also designed the prostheses to provide some of the required mechanical properties. While the bilayer structure had excellent circumferential tensile strength, bursting strength and suture retention resistance, the radial compliance did not show any observable improvement.

Keywords

knitting; electrospinning; vascular prosthesis; biodegradable polymer; collagen impregnation; elastin impregnation; mechanical performance

1. Introduction

Cardiovascular disease (CVD) is one type of fatal disease that leads to a significant death rate worldwide. It is estimated by the American Heart Association (AHA) that about 800,000 people in United States died from CVD in 2013 (AHA, 2016). Coronary artery disease (CAD) and peripheral artery disease (PAD) are two associated and highly prevalent CVDs, also known as atherosclerosis. It reported that about 8 million people in the United States were suffering from PAD, while CAD accounted for nearly 405,309 individual deaths in the United States in 2008 (Allison et al, 2007; Miniño et al, 2011). Autologous vessels, such as the saphenous vein and the internal mammary artery, are considered the gold standard biomaterials for bypass surgery. However, about one-third of patients do not have veins or arteries suitable for grafting due to aging, pre-existing

[1] Correspondence to: Yu Xie; phone: 9193971351; email: yxie3@ncsu.edu