University of Victoria | Graduate Studies

Notice of the Final Oral Examination
for the Degree of Master of Applied Science

of

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BSc (University of Victoria, 2014)

"Monitoring the Effects of Structure and Function on 3D Bioprinted Hydrogel Scaffolds for Applications in Tissue Engineering"

Department of Mechanical Engineering

Wednesday August 14, 2019
1:00 P.M.
Engineering Office Wing
Room 502

Supervisory Committee:
Dr. Mohsen Akbari, Department of Mechanical Engineering, University of Victoria (Supervisor)
Dr. Keivan Ahmadi, Department of Mechanical Engineering, UVic (Member)

External Examiner:
Dr. Jeremy Wulff, Department of Chemistry, UVic

Chair of Oral Examination:
Dr. Helga Hallgrimsdottir, School of Public Administration, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

The field of tissue engineering has grown immensely since its inception in the late 1980s. However, currently commercialized tissue engineered products are simple in structure. This is due to a pre-clinical bottleneck in which complex tissues are unable to be fabricated. 3D bioprinting has become a versatile tool in engineering complex tissues and offers a solution to this bottleneck. Characterizing the mechanical properties of engineered tissue constructs provides powerful insight into the viability of engineered tissues for their desired application. Current methods of mechanical characterization of soft hydrogel materials used in tissue engineering destroy the sample and ignore the effect of 3D bioprinting on the overall mechanical properties of a construct. Herein, this work reports on the novel use of a non-destructive method of viscoelastic analysis to demonstrate the influence of 3D bioprinting strategy on mechanical properties of hydrogel tissue scaffolds. 3D bioprinting is demonstrated as a versatile tool with the ability to control mechanical and physical properties. Structure-function relationships are developed for common 3D bioprinting parameters such as printed fiber size, printed scaffold pattern, and bioink formulation. Further studies include effective real-time monitoring of crosslinking, and mechanical characterization of multi-material scaffolds. We envision this method of characterization opening a new wave of understanding and strategy in tissue engineering.