Official Journal of TESMA
Regenerative Research
www.regres.tesma.org.my
E-ISSN 2232-0822
Tissue Engineering and Regenerative Medicine Society of Malaysia

Regenerative Research 7(1) 2018 74

TOUGHENING OF BIOMIMETIC SCAFFOLDS FOR TISSUE ENGINEERING

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ARTICLE INFO

Published: 26th August 2018
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KEYWORDS

Biomimetic scaffolds;
Tissue engineering

SUMMARY

Tissue engineering has great potential in offering solutions and transcending the limitation of current treatment of damaged tissue. A typical approach of tissue engineering involves seeding cells on a highly porous scaffold, which acts as a template of providing microenvironment and promoting the regeneration and proliferation of cells. Recent research shows an improvement of tissue regeneration by applying chemical and mechanical stimuli on the seeded scaffolds using bioreactor. Such external loading can induce failure, and in this regards mechanical properties of tissue engineering scaffolds become critical. However, many biomaterials such as hydrogel have poor mechanical properties and limit the use of bioreactors. This talk will review our latest development of tissue engineering scaffolds having mechanical properties comparable to that of native biological tissues. Fish gelatin scaffolds having microstructures mimicking nanometer fiber and porous structure of native biological tissue were developed by using an electrospinning technique. Their microstructure morphology including fiber diameters and porosity was controlled by adjusting the process parameters. Further, natural small intestinal submucosa also was decellurized and reinforced in alginate hydrogel to form composite scaffold. The fracture toughness of the composite shows similar toughness of natural skin. The developed tissue engineering scaffolds not only have adequate mechanical properties that sustain mechanical loading from bioreactor but also have porous fibrous network structures ranging from nanometer to micrometer length scales mimicking native tissue structures.