Generation and Implantation of Engineered Dermis Tissue, Fortified by Chitosan and Multiwall Carbon Nanotubes

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Abstract

Aim of the project
To investigate the effectiveness of multiwall carbon nanotubes (MWCNTs) and chitosan in improving the properties of collagen-based engineered connective tissues (ECT) for wound healing treatment.

Methods
ECT containing primary dermal fibroblasts was prepared by using different concentrations of chitosan with and without chitosan-coated MWCNT. The ECT was evaluated in-vitro and were implanted subcutaneously in mice to investigate the ECT behavior and body reaction in-vivo over 2 and 4 weeks.

Results
The inhabitant fibroblasts were viable, and the addition of chitosan caused a concentration-dependent inhibition of matrix contraction by these cells. In-vivo data showed that the implants integrated with the adjacent skin tissue after two weeks and that the presence of chitosan was associated with more reparative inflammatory reactions, low level of fibrosis and angiogenesis at the interphase between the implant and the skin. After four weeks, higher degree of fibrosis and less inflammation was detected. The presence of MWCNT further enhanced the inflammatory response and angiogenesis as compared to chitosan alone.

Conclusion
Chitosan enhances the healing processes including fibrosis and angiogenesis, which can be further significantly enhanced by MWCNTs.