Seyed Babak Mahjour, J Material Sci Eng 2015, 4:5
http://dx.doi.org/10.4172/2169-0022.C1.029

OMICS International
conferenceseries.com

4th International Conference and Exhibition on
Materials Science & Engineering
September 14-16, 2015 Orlando, USA

Formation of hair follicle using 3D biomimetic nanofibers constructs

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The wound healing and management of full-thickness skin defects such as chronic ulcers remains a major clinical challenge. In recognition of the essential pathophysiological functions of hair follicles, which are often missed from the healed skin, it would be a viable approach to fabricate tissue-engineered skin grafts with hair-regeneration capacity. However, the difficulty of culturing and developing follicular structures from isolated cells *in vitro* determines the need to develop an effective and innovative strategy. The aim of this study is to investigate the use of a novel and highly controllable, layer-by-layer nanofiber scaffold assembly method that is able to generate uniformly seeded 3D constructs with additional pre-cultured dermal papillae (DP) cells aggregates to produce functional hair follicles. DP cells isolated from rat vibrissa were expanded *in vitro* and then cultured into aggregates via hanging droplets. Aggregates were placed between 3D construct in different depth and were seeded with fibroblasts and keratinocytes. Upon extended culture, proto-hair-like structures were observed in the skin grafts, but were closely related to the spatial organization of different cell types. A pilot study was also designed using the 3D L-b-L construct with addition of DP aggregates which was grafted into full-thickness skin defects on the backs of nude mice. Results represent that novel 3D constructs has great potential to produce a proto-hair in *in-vitro* culture. Proto-hair formation was seen where aggregates be placed at the interface of the keratinocytes and fibroblasts. The grafted DP cells *in-vivo* produced full sized hairs.

Biography

Seyed Babak Mahjour has completed his MD (Doctor of Medicine) from Shiraz University of Medical Sciences, Iran and received his ME (Master of Engineering) from Stevens Institute of Technology in 2012. He is PhD Candidate in Biomedical Engineering department at Stevens Institute of Technology. His work has been published in 4 peer-reviewed journal articles, a book chapter, patent and numerous conference paper and posters.

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