Contents lists available at ScienceDirect

Journal of Controlled Release

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Cover Story

Human extracellular matrix powders for tissue engineering

Biocompatible and biodegradable polymers have been playing a central role in tissue engineering. Their function is to guide complex multicellular processes of tissue formation and regeneration by providing three-dimensional scaffolds. Both naturally-derived and synthetic materials have been explored extensively, and yet researchers in this field have only limited options on biomaterials for tissue engineering. In general, naturally-derived materials (e.g., purified protein components such as collagen from animal tissues) are advantageous because of their biocompatibility, tendency of enzymatic degradation, and other inherent biological properties. Nevertheless, many issues have arisen including complicated purification steps, immunogenicity, and pathogen transmission. Synthetic materials (e.g., polyesters-based biodegradable polymers such as poly(lactic-co-glycolic acid)) also possess good mechanical properties, controlled biodegradability, and ability to form sophisticated architecture design. The synthetic materials, however, often cause foreign body reactions and integrate poorly with the host tissue. The article in this issue by Professor Yong Woo Cho and his group for the first time describes human fat tissue as an ideal source of materials for tissue engineering [1]. Fresh human fat tissue was obtained by a simple surgical operation, commonly known as liposuction. After removing blood and oil components, the tissue was homogenized, centrifuged, freeze-dried, and ground to powders by milling. According to the study, the human extracelluar matrix (ECM) powders derived from fat tissue provided excellent substrates for cell adhesion, spreading, and proliferation. In an *in vivo* study using nude mice, the human ECM powders containing human adipose-derived stem cells (ASCs) induced well-organized adipose tissue constructs without any signs of tissue necrosis, cystic spaces, or fibrosis.

Fat tissue is the most prevalent tissue and is found all over the human body. Fat tissue is a type of loose connective tissue and contains many cells including lipid-filled adipocytes, fibroblasts, smooth muscle cells, endothelial cells, immune cells, and ASCs. Thus, fat tissue is rich in ECM components, such as collagen, elastin, fibronectin, laminin, glycosaminoglycans, and proteoglycans. The structural and functional molecules of adipose tissue provide the means by which cells communicate with each other and with the external environment. The most important feature of fat tissue as a biomaterial source might be the relative ease and safety with which it can be obtained in large quantities with minimal risk. It is highly likely that ECM-based biomaterials derived from human fat tissue will successfully lead to development of clinically useful products. They will be useful not only for aesthetic plastic surgery, such as breast implants, but also for reconstruction of tissues lost as a result of extensive deep burns, tumor resection, and hereditary and congenital defects. The study by Professor Cho and his colleagues is very interesting, as it provides a new avenue of developing highly biocompatible ECM that can be used for tissue engineering and tissue reconstruction.

Reference

[1] J.S. Choi, H.-J. Yang, B.S. Kim, J.D. Kim, J.Y. Kim, B. Yoo, K Park, H.Y. Lee, Y.W. Cho, Human extracellular matrix (ECM) powders for injectable cell delivery and adipose tissue engineering, J. Control. Release 139 (2009) 2–7.

Ick Chan Kwon
Korea Institute of Science and Technology,
Biomedical Research Center,
Seoul, Republic of Korea
E-mail address: ikwon@kist.re.kr.

0168-3659/$ – see front matter
doi:10.1016/j.jconrel.2009.07.012