CHAPTER 14

Skeletal Muscle Tissue Engineering: The Myoblast and the Dream of Engineering a Functional Muscle Tissue

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Summary

Trauma, tumor ablation or muscle deficiency may lead to the need for restoration of damaged muscle tissues as a loss of functional muscle tissue causes major impairments of the functionality of the body. Limitation of active movement and severe restrictions of the respiratory system may be possible consequences. Available treatments such as tissue transfer, however, are associated with donor site morbidity. Only a few alternatives may provide functional and aesthetic restoration of lost muscle mass. One of these alternatives, tissue engineered skeletal muscle, may be a promising approach to solve such problems. This article describes three major experimental studies attempting to create a functional skeletal muscle tissue. After isolating myoblasts and their clear characterization with specific staining and functional methods, the suitability of combining them with different biomaterials was tested in vitro. A rat model was also developed to test methods invivo. In a modified model, a motor nerve was implanted into the myoblast-biomaterial-construct to determine if the ingrowth of nerve fibers would occur. In addition, the potential of developing neuromuscular junctions was determined. Primary cultured myoblasts were successfully seeded onto different biomaterials and remained viable cells after implantation. However, differences in the suitability of the materials was evident. Fibers of the motor nerve grew into the implanted tissue, and newly developed neuromuscular junctions could be detected. Although currently not available as an everyday clinical treatment, growing new skeletal muscle tissue is an exiting experimental field. First attempts described by literature have already achieved some success.

The results found by our group seem to show promise for future applications.

KEYWORDS: tissue engineering, skeletal muscle, myoblasts, nerve ingrowth, neuromuscular junction

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