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Use of adipose-derived stem cells to fabricate scaffoldless tissue-engineered neural conduits *in vitro*

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Background

The peripheral nerve traumas are mostly addressed by complex and invasive surgical interventions. The surgeries are aimed at autografts for meeting the severed stumps of the nerve. These traumas can lead to gaps of damaged nerve tissue between viable nerve sections, which result in a loss of function. The injuries that lead to critical nerve gaps require grafts to direct neural regeneration. Nerve grafts from either hosts (autograft) or non-hosts (allograft) are capable of bridging large nerve gaps.[1] However, both types of nerve grafts possess several limitations. There has been considerable research to design alternative technologies to bridge critical nerve gaps. Biological and synthetic conduits have been engineered to possess the attributes of autologous nerve grafts without the limitations of availability, donor site morbidity, and the need for two surgical procedures.[2] To overcome the limitations of both grafts and current scaffold-based conduit alternatives, the above group has designed previously fabricated three-dimensional (3-D) scaffoldless engineered neural conduits (ENCs) using primary fibroblasts and embryonic-derived neural cells.[3]

Methodology

Adipose tissue was dissected from Female Fischer 344 retired breeder rats. The tissue was processed for isolating Adipocytes and the cells obtained were cultured separately under different conditions for fibroblasts and neurospheres respectively. The fibroblast monolayer was obtained at the stage of confluency and growth was arrested. The neurospheres thus cultured, were seeded on top of this layer and allowed to grow into glial lineage. After the consistent growth and differentiation of both cell lineages individually and together, they were manually folded into a cylinder. Various histological and immunohistochemical parameters were assessed for the viability, growth and differentiation of studying the markers.

Implications

The purpose of this study was to permanently induce ASCs to fibroblast and neural lineages and to co-culture these cells to fabricate and characterize an ENC derived solely from ASCs. This study combines the approach of using stem cells in nerve repair technologies with a recently developed technique from this group for fabricating scaffoldless neural conduits In this study, they have demonstrated the differentiation of ASCs to fibroblastic and neural lineages, establishment of a co-culture of both cell types, and co-culture fabrication into a 3-D scaffoldless ENC.

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