

Tissue Engineering of Cartilage Using Prefabricated Microvascularized Perichondrial Bioabsorbable Polylactide Nonwoven Scaffolds

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Introduction: It has been demonstrated (Ruuskanen et al.) that cartilage can be grown by using free perichondrial transfers in muscle tissue. The size of such grown cartilage pieces is however limited by the ability of nutrients and oxygen to diffuse into the cartilage because the lack of vascularity to supply the tissue to be grown. Growth factors have been tried to correct this but none have been successful so far to induce permanent vascularity to the transfer.

Aim: The aim of this experiment is to demonstrate if it is possible to grow definitely larger and eventually thicker pieces of cartilage by using a composite prefabricated grafts. These would provide vascularity and favourable environment for the chondrocytes to migrate into and grow.

Materials and methods: We used rabbits as experimental animals. As the source of perichondrium we used dorsal ear perichondrium with central artery and vein. For biodegradable scaffold we used PLDLA 96/4 (poly-L/D-lactic acid 96/4) in non-woven form 1 mm thick 80 x 30 mm size pieces. The perichondrial flap was raised and the pedicular vessels were dissected free and separated. The scaffold was cut to size of the flap and rounded at the corners. The flap was situated under the ventral skin of the rabbit. The pedicular vessels were anastomosed to the femoral vessels, artery end-to-end and vein side-to-end. The ear skin was closed over the existing cartilage and the inguinal incision over the anastomosis area. The follow-up groups were 1 month, 3 months and five months. As controls we used three animals, one with biodegradable scaffold only, one with perichondrial flap and scaffold without microvascular method and one with microvascular perichondrial flap without biodegradable scaffold. The controls were all in the 5 month group.

Results: Preliminary results have shown that the procedure is feasible and the animal as well as the flaps survived from follow-up groups were harvested and they are prepared for histological examination, the results of which will be presented

Conclusions: Microvascularised perichondrial flaps combined with biodegradable scaffolds can be used to tissue-engineer cartilage constructs in rabbits model. This may have an impact in staged clinical cartilage reconstruction in human.

Key words: biodegradable scaffolds, cartilage, microsurgery, tissue engineering