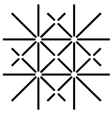


University of Basel

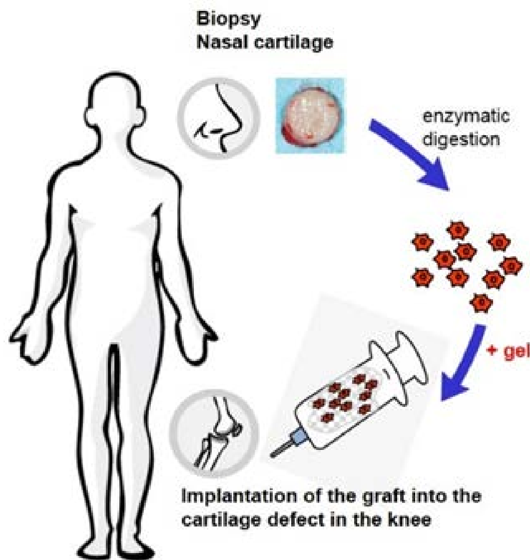
Department of Biomedical Engineering

Injectable hydrogel with nasal chondrocytes for intraoperative articular cartilage repair

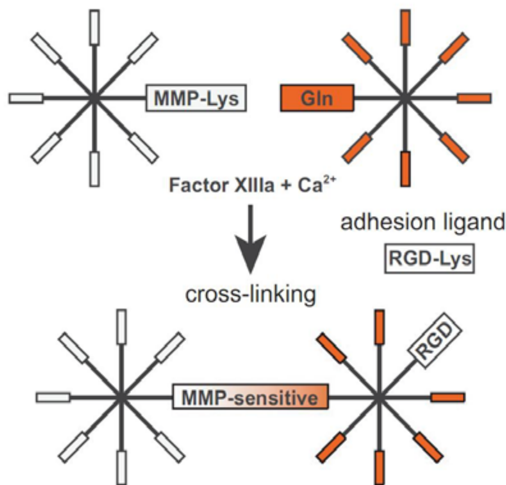
Master's Thesis by Raluca Trofin in Tissue Engineering research group at DBM

Articular cartilage has a very limited self-repair capacity and once damaged, it undergoes irreversible degenerative changes. Current treatments are not capable to fully restore the properties of this hyaline cartilage regarding the quality, durability and reproducibility of the formed tissues. Recent studies demonstrated that nasal chondrocytes represent an alternative cell source for the treatment of cartilage lesions due to their superior and more reproducible regenerative capacity as compared to articular chondrocytes that are currently used. Moreover, once embedded into a degradable Poly (ethylene glycol) (PEG) hydrogel containing platelet lysate and RGD peptide, they efficiently proliferate and produce cartilage matrix.

This project primarily aimed at improving the polymerization kinetics by reducing the gelation point of the hydrogel to guarantee a proper intraoperative injection of the graft. Secondly, the simplification of the hydrogel formulation was evaluated by removing the RGD adhesion peptide, while maintaining the proliferation and cartilaginous properties of the embedded cells. The gelation time was reduced from 4 minutes to approx. 1 minute by increasing the crosslinker (FXIII) concentration, while maintaining the therapeutic effect of the graft. The experiments also showed that RGD peptide can be removed from the gel formulation without affecting the cells` biological functions.



Project overview: freshly isolated nasal chondrocytes embedded in a hydrogel are implanted arthroscopically into the knee cartilage defect in the same day (Andrea Barbero)



Schematic representation of degradable PEG hydrogels polymerization containing the MMP-sensitive sites and optionally the integrin adhesion ligand RGD, crosslinked by FXIIIa in the presence of calcium ions (EhrbarLab, University Hospital Zurich)

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