



*A Clinically Translatable Concept for Periodontal Ligament and Engineering Around Dental Implants. The Characterization of Patient-friendly Materials with Optimal Biomechanical Properties.*

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## **A clinically translatable concept for periodontal ligament engineering around dental implants**

The characterization of patient-friendly materials with optimal biomechanical properties

### **Summary**

The periodontal ligament (PDL) connects the tooth to the alveolar bone. It functions as a shock absorber, forms a barrier against pathogens, and provides sensory information. These capacities are lost when the PDL is damaged, or when teeth are lost.

Replacing missing teeth with dental implants is increasingly popular. However, a common complication of dental implants is peri-implantitis, a progressive bacterial infection of the implant and its surrounding tissues, which leads to loss of alveolar bone. Peri-implantitis is highly recurrent, because the implant surface facilitates bacterial invasion, and because implant overloading causes micro-fractures in the alveolar bone.

In this thesis, we propose a possible solution for peri-implantitis: a concept for the tissue engineering of a PDL around dental implants. With the premise to enable rapid clinical translation, we designed our concept with the patient-friendly materials fibrin and gelatin, and with human adipose-derived stem cells (hASCs).

In the first part of this thesis, we show that the stiffness of the fibrin matrix determines matrix remodeling by hASCs, as well as their differentiation fate. Furthermore, we show that we can align the hASC-seeded fibrin matrix with a mechanical regime that mimics daily mastication.

In the second part of this thesis, we show that the structure and biocompatibility of the gelatin mesh, which is to cover the implant, are not influenced by chemical crosslinking. Furthermore, we create our concept-implant with sterile materials.

Summarizing, the research presented supports clinical translation, and provides a solid basis for further development of an implant with PDL attached.