

COMPARATIVE *IN VITRO* AND *IN VIVO* STUDY OF VERSATILE COLLAGEN SPONGES

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ABSTRACT

In the present interdisciplinary study, the fabrication of a versatile natural medical device is presented, based on the physical process of lyophilization, for the induction of osteogenesis, both through laboratory and preclinical studies, with the goal of using it in orthopedic applications. The main raw material, gelatin, is chemically crosslinked with an additive at various concentrations and under systematically varied conditions, aiming at obtaining suitable mechanical properties, which are compared through rheological studies. The optimized material is based on design principles which are the result of an iterative feedback process. This is first frozen and then dried or alternatively lyophilized as a function of time and temperature, resulting in spongy scaffolds. Their sterilization potential is then evaluated systematically using comparative studies with ethylene oxide gas and gamma radiation. These scaffolds are contrasted with a corresponding commercial formulation in terms of morphology using scanning electron microscopy as well as in terms of integration with the natural tissue by means of histological studies and preclinical investigation, in order to assess biodegradation and absence of inflammation. Finally, these biological medical devices are used as vectors for appropriate growth factors *in vivo*.

KEYWORDS: Hard tissue engineering, scaffold, lyophilization process, collagen sponge, growth factors