

Characterization of Natural Polymers for Guided Bone Regeneration Applications

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Abstract : Introduction: Membranes for guided bone regeneration are essential to perform a barrier function between the soft and the regenerating bone tissue. Bioabsorbable membranes are desirable in this field as they do not require a secondary surgery for removal, decreasing patient surgical risk. Collagen was the first bioabsorbable alternative introduced on the market, but its degradation time may be too fast to guarantee bone regeneration, and optimisation is needed. Silk fibroin, being biocompatible, slowly bioabsorbable, and processable into different scaffold types, could be a promising alternative. Objectives: The objective is to compare the general performance of a silk fibroin membrane for guided bone regeneration to current collagen alternatives developing suitable standardized tests for the mechanical and morphological characterization. Methods: Silk fibroin and collagen-based membranes were compared from the morphological and chemical perspective, with techniques such as SEM imaging and from the mechanical point of view with techniques such as tensile and suture retention strength (SRS) tests. Results: Silk fibroin revealed a high degree of reproducibility in surface density. The SRS of silk fibroin (0.76 ± 0.04 N), although lower than collagen, was still comparable to native tissues such as the internal mammary artery (0.56 N), and the same can be extended to general mechanical behaviour in tensile tests. The SRS could be increased by an increase in thickness. Conclusion: Silk fibroin is a promising material in the field of guided bone regeneration, covering the interesting position of not being considered a product containing cells or tissues of animal origin from the regulatory perspective and having longer degradation times with respect to collagen.

Keywords : guided bone regeneration, mechanical characterization, membrane, silk fibroin

Conference Title : ICABB 2024 : International Conference on Applied Biomaterials and Biomechanics

Conference Location : Venice, Italy

Conference Dates : November 11-12, 2024