Background

Periodontitis is an inflammatory disease of supporting tissues of teeth caused by specific microorganisms resulting in progressive destruction of periodontal ligament and alveolar bone with pocket formation, recession or both. The main consequences of periodontal disease are periodontal destruction, alveolar bone loss leading to loosening or loss of teeth. It is caused by microbial plaque deposition and host microbial interaction. The main treatment approaches are non-surgical and surgical debridement. Surgical periodontal therapy includes Resective and Regenerative procedures. To date, flap debridement or flap curettage and periodontal regenerative therapy with membranes and bone substitute materials have been employed with distinct levels of clinical success.

The developing field of tissue engineering aims to regenerate damaged tissues by combining cells from the body with highly porous scaffold biomaterials, which act as templates for tissue regeneration, to guide the growth of new tissue. Guided Tissue Regeneration is the method for the prevention of epithelial migration along the cemental wall of the pocket and maintaining space for clot stabilization. Synthetic polymers have excellent design flexibility because their composition and structure can be tailored to the specific applications. Tissue engineering has emerged as a promising solution in treating extensive loss/damage of skin caused by burns, trauma and diseases.

Objective

i. To fabricate third generation GTR membrane containing synthetic polymer Polycaprolactonewith varying concentration of calcium sulphate.

ii. In-vitro characterization of the material- To study the morphological, mechanical, chemical properties and biocompatibility testing.

Materials and Methods

GTR membranes made of polycaprolactone with a molecular weight of 80,000 reinforced with varying concentration of bioactive calcium sulphate (5% and 10%) is fabricated by the method of Electrospinning. After fabrication, their invitro properties are evaluated. Morphology of the membranes such as fibre diameter and fibre density was evaluated by SEM(Scanning electrone microscope), mechanical properties such as tensile strength, suture pull out using Instron 3345 universal testing machine and water contact angle using Data physics OCA 15plus by sessile drop method .For chemical properties FTIR analysis was performed. And finally cytocompatibility analysis were evaluated using L-929 mouse fibroblast by Direct contact assay and Cell adhesion study.

Results

All the electrospun nanofibrous membranes possessed appropriate mechanical as well as chemical properties. Moreover, none of the membranes found to be cytotoxic. On comparing the overall properties, PCL + 10% CaS exhibited superior cell adhesion and mechanical as well as chemical properties which satisfies the ideal properties needed for GTR membranes.

Conclusion

PCL-CaS blend was prepared in a solvent of THF and DMSO and fabricated by employing electrospinning technique.In the present study the results showed that composite electrospun scaffolds (PCL-CaS) were superior to PCL scaffolds alone. Based on the above results, we conclude that the electrospun mat fabricated with PCL incorporated with medical grade Calcium sulfate employed by electrospinning technique is suitable for periodontal tissue engineering. And further animal experiments followed by human clinical trials need to be evaluated for future applications.

Keywords:

Periodontal tissue regeneration, Polycarpolactone, Bioactive calcium sulphate, Electrospinning, Electrospunscaffold.