

Incorporation of Moxifloxacin-Loaded Silica-Based Mesoporous Nanocarriers in Electrospun PLGA Fibers for Periodontal Regeneration

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Mesoporous silica-based nanoparticles (MSNs) are unique drug carriers due to their ordered pore structure, which allows high drug loading and release capacity. [1] Calcium (Ca), magnesium (Mg) and strontium (Sr) doped MSNs are capable of inducing in vitro osteogenesis and in vivo bone formation through the release of Ca, Mg, Sr, and Si ions, which compel their use for bone scaffolds fabrication. [2] Electrospun membranes are promising materials for guided tissue regeneration (GTR) as they provide a suitable framework for the formation of new functional periodontal tissues. [3] The fabrication of multifunctional local drug delivery systems for sustained and prolonged drug release can be used in periodontal applications such as interventions to simultaneously prohibit epithelium downgrowth and proper healing and regeneration of damaged periodontal tissues. [4] The aim of this study was the development and characterization of novel composite membranes from poly(lactic-glycolic acid) (PLGA)/Moxifloxacin-loaded MSNs through electrospinning. Degradation, swelling, drug release, biocompatibility in human periodontal ligament cells and erythrocytes, as well as mechanical and physicochemical properties were evaluated. The incorporation of moxifloxacin-loaded MSNs in PLGA led to a sustained and prolonged release while maintaining satisfactory mechanical strength. The increase in the amount of the polymer yielded more uniform fibers with large diameters and pores. During the electrospinning process, the increase of the applied voltage and the rotation speed of the collector led to more uniform fibers with larger diameters and pores. The composite membranes were found to be hemocompatible at masses less than 1 mg after exposure to healthy erythrocytes. The morphology, physicochemical, and biological properties of the fabricated membranes yield them promising for periodontal tissue regeneration.

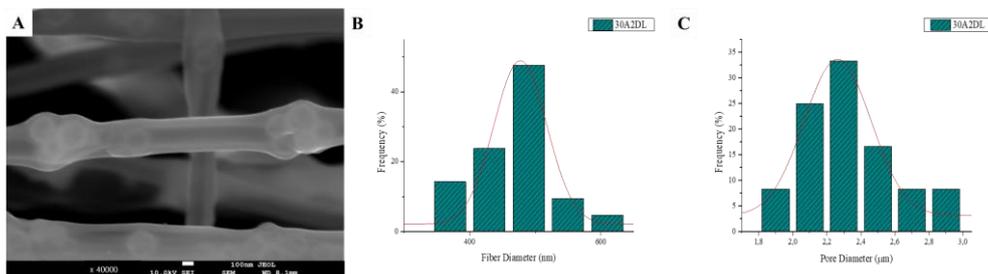


Figure 1: SEM microphotograph (A) and fiber (B) and pore (C) diameter distribution of composite membranes.

References

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