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Extended Abstract

Characterization of Novel Hybrid Materials Conditioned as Sheets for Skin Repair †

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The association of natural or synthetic polymers with metal nanoparticles resulted in hybrid materials with improved chemical, physical, and biological properties for the repair of human tissues [1]. Collagen (COL) is a natural polymer and the main protein of skin extracellular matrix, providing high tensile strength to this tissue [2]. Skin proteoglycans decorated with chondroitin sulfate (CS) chains are involved in maintenance of water in the tissue, due to their numerous negatively charged carboxyl and sulfate groups but also in controlling the cell behavior [3]. Elastin (EL) as a protein polymer confers resilience to skin, while soluble EL peptides take part in processes that prevent and regulate skin photoaging [4]. The aim of this study was to evaluate optimal formulations of hybrid materials based on natural polymers, COL, CS, and EL, combined with nanosilver (nAg) for physico-chemical and structural properties, as well as for their interaction with skin cells, in order to provide temporary dressings for skin lesion repair.

Two variants of hybrid materials were prepared by vigorous mixing of COL, CS, k-EL, and nAg, in weight ratios of 10:1:0.5:0.01 (A) and 10:1:1:0.01 (B) and conditioned as thin, elastic membranes by drying in the oven. Density/porosity, swelling degree, and biodegradation were comparatively determined. SEM observations were performed to investigate their microstructure and nAg distribution. In vitro cytotoxicity tests were conducted in L929 mouse fibroblasts using the MTT assay. Cell viability and adhesion of fibroblasts to the hybrid materials were assessed by fluorescence microscopy using Live&Dead kit and phalloidin/DAPI staining.

The porosity and swelling degree were higher for variant A membrane, compared to variant B, even if they contained the same quantity of CS, responsible for water absorption. Membrane incubation in physiological conditions (PBS) for seven days revealed higher stability of variant B, in correlation with its lower swelling degree. However, both membranes exhibited a similar pattern of biodegradation in the presence of collagenase, indicating that an increase of EL amount did not influence the cross-linking of polymeric fibers, and the situs for collagenase attack remained exposed. The hybrid materials showed a dense, microporous structure with tight interaction between polymeric fibrils and a homogeneous distribution of nAg even for swelled samples. Both hybrid materials showed no cytotoxic effect in vitro and stimulated fibroblasts proliferation, especially in

case of variant B. Moreover, good adhesion of cells was observed at the surface of hybrid materials after 48 h of cultivation.

All these results demonstrated that the hybrid material with higher concentration of elastin presented good properties to act as an efficient skin wound dressing.

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