Laboratory tests

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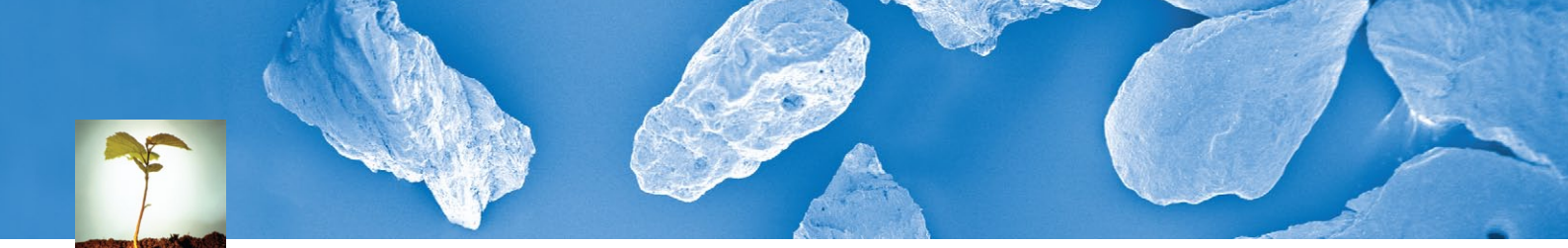
REGENERATION SCIENCE

INSPIRED BY NATURE



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Graphene oxide improves the biocompatibility of collagen membranes in an in vitro model of human primary gingival fibroblasts

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ORIGINAL ARTICLE
Biomedical Materials
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ABSTRACT

In case of guided tissue regeneration (GTR) and guided bone regeneration (GBR) interventions, barrier membranes play an important role for periodontal bone and peri-implant defects treatment, and for bone augmentation. The membrane application helps to prevent the ingrowth of soft connective tissue into bone defects, creating a protected space into which only bone cells can migrate.
The aim of this study was to study the biocompatibility behaviour of collagen membranes coated with graphene oxide (GO). Collagen membranes (OsteoBiol® *Derma*®, Tecnoss®, Giaveno, Italy), derived from porcine dermis after removal of the epithelial layer, were coated with GO by drop casting the aqueous GO solution of proper concentration on the membrane. It was verified that coating was stable and did not leak grapheme oxide in the bulk medium. It has been evidenced that the GO coating changes some features of the membrane, such as stiffness and adhesion of the membrane.
Collagen membranes coated with different GO concentrations were then tested in a human gingival fibroblasts biological model in order to check their early adhesion and proliferation on barrier membranes which switch on a healing process after surgical procedures.

CONCLUSIONS

This study evidenced that the coating with GO of commercial collagen membranes was relatively homogeneous and easy to obtain. The presence of GO increases the roughness and the total surface exposed to the cells as demonstrated by AFM analyses. The obtained material is biocompatible and does not induce inflammation in the tested cells. Moreover, GO coating enhanced the proliferation rate of fibroblasts.
As the Authors stated: *"These results may be connected with the demonstrated ability of GO to favour protein adsorption, an essential step for regulating cell functions and mediate cell adhesion and morphology. This means that the presence of GO should favour cell adhesion and the subsequent cells growth. This study paves the way to the further investigation of this novel coated membranes in terms of promotion of osteoblast differentiation and/or bacteriostatic activity".*

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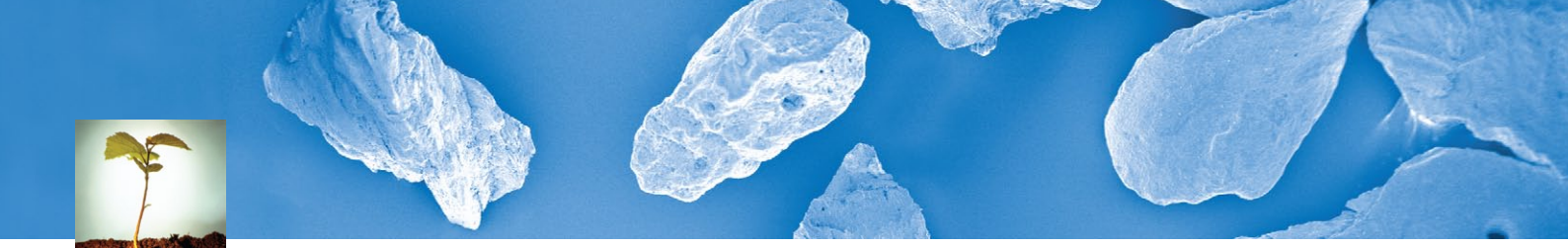

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LABORATORY TESTS

125

Graphene oxide enrichment of collagen membranes improves DPSCs differentiation and controls inflammation occurrence

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ABSTRACT

In oral surgical procedures, barrier membranes are necessary for the treatment of periodontal bone defects and peri-implant defects as well as for bone augmentation using guided tissue regeneration (GTR) and guided bone regeneration (GBR). Collagen membranes have several advantages such as easy manipulation, weak immunogenicity, direct effect on bone formation and chemotaxis of gingival and periodontal ligament fibroblasts. The aim of this study was to confirm that the properties of collagen membranes can be improved by coating them with graphene oxide (GO). In particular, the authors investigated the biocompatibility of collagen membranes coated with GO on human dental pulp stem cells (DPSCs) focusing on biomaterial cytotoxicity, ability to promote DPSCs differentiation process and to control inflammation event induction. As collagen membrane, OsteoBiol® *Derma*, (Tecnoss®, Giaveno, Italy), derived from porcine dermis after removal of the epithelial layer, was used. DPSCs were cultured on uncoated membranes and on both 2 and 10 lg mL21 GO coated membranes up to 28 days. Alamar blue and LDH cytotoxicity assay, PGE2 ELISA assay, real time RT-PCR for RUNX2,BMP2, SP7, TNFa and COX2 genes expression were performed.

CONCLUSIONS

The examined membranes proved their role as good barrier membranes, showing that the cells grew only on the surface of both uncoated and coated membranes and no cells were found in the collagen layer. The GO coated membranes were able to fasten and favour osteoblastic differentiation process and, at the same time, to effectively control the inflammatory events occurrence.
All of these characteristics make the GO coated collagen membranes a good alternative to conventional membranes, as confirmed by the authors' statement: *"Our study showed that the GO coating on collagen membranes, on one hand actually promoted DPSCs attachment and proliferation, and on the other hand, not only had not cytotoxic effects on the cells but also improved at the late stages membranes biocompatibility."*.

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