Effects of Composite Films of Silk Fibroin and Graphene Oxide on the Proliferation, Cell Viability and Mesenchymal Phenotype of dental Stem Cells.

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Background: In regenerative dentistry, stem cell-based therapy often requires a scaffold to deliver cells and/or growth factors to the injured site. Graphene oxide and silk fibroin are promising biomaterials for tissue engineering as they are both non toxic and promote cell proliferation[1]. On the other hand, periodontal ligament stem cells (PDLSCs) are mesenchymal stem cells readily accessible with a promising use in cell therapy [2]. The purpose of this study was to investigate the effects of composite films of graphene oxide, silk fibroin and graphene oxide combined with fibroin in the mesenchymal phenotype, viability and proliferation rate of PDLSCs.

Methods: PDLSCs were cultured on graphene oxide, silk fibroin or combination of graphene oxide and silk fibroin films up to 10 days. The proliferation rate of the cells was assessed using the MTT assay. Level of apoptosis was determined using Annexin-V and 7-AAD and mesenchymal markers expression of PDLSCs were analyzed by flow cytometry.

Results: At day 7 of culture, MTT experiments showed a high rate of proliferation of PDLSCs growing on graphene oxide films compared to the other tested biomaterials, although it was slightly lower than in plastic (control). However PDLSCs growing in fibroin or graphene oxide plus fibroin films showed a discrete proliferation. Importantly at day 10 of culture we observed a significant increase in PDLSCs proliferation rate in graphene oxide films compared to plastic (p<0.05), as well as in graphene oxide plus fibroin compared to fibroin alone (p<0.001). Flow cytometry analysis showed that culture of PDLSCs in fibroin, graphene oxide or graphene oxide plus fibroin films did not significantly alter the level of expression of the mesenchymal markers CD73, CD90 or CD105 up to 168 hours, being the cell viability in graphene oxide even better than obtained in plastic.

Conclusion: Our findings suggest the strong potential of the combination of human dental stem cells/fibroin/graphene oxide based-bioengineered constructs for their therapeutic use in regenerative dentistry.

References