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"In vitro" osteogenic and angiogenic potential evaluation of a coculture of dental pulp stem and endothelial cells grown on the BisGMA/TEGDMA Chitlac coated thermosets

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Securing an adequate blood supply for survival of cell transplants is critical for a successful outcome in tissue engineering. Moreover during regeneration of weaken teeth, which is susceptible to reinfection, fracture and loss, the teeth apical canal is open and a limited blood supply is allowed. Thus the interactions between endothelial and dental pulp progenitor stem cells are important for vascularization of regenerating tissue cells. In particular, the interplay of dental pulp stem cells and endothelial cells can enhance "in vitro" osteo/odontogenic and angiogenic potential (Dissanayaka J Endod 2012, 38,454-463) and "in vivo" ensure angiogenesis and pulp regeneration (Dissanayaka Tissue Engin Part A 2015, 3-4, 550-563). Since dental pulp microenvironment supports HUVEC survival and capillary network formation in the absence of scaffolding material and external angiogenic stimulation , "in vitro" osteogenic and angiogenic potential of dental pulp stemcells cocultured with endothelial cells grown on BisGMA/TEGDMA Chitlac coated thermosets was evaluated.

Results: DPSCs were grown on BisGMA/TEGDMA Chitlac coated thermosets, a composite material used in dental restoration, in the presence of two different concentrations of endothelial cells (1:1 e 1:5) for 28 days and their metabolic activity and cytotoxic response were evaluated.

MTT analysis discloses that cell metabolic activity significantly increases in the presence of endothelial cells, mainly at 21 days of culture, along with cytotoxic response, while at 28 days of culture a light cytotoxic response occurs. An increasing ALP activity is evidenced in the coculture systems up to 28 days, both in the presence and in absence of Chitlac thermosets and this evidence is further supported by Alizarin red staining, which does not detect mineralization in the early stages of differentiation, but is significantly increased at 28 days of culture in both the conditions (1:1 e 1:5).

Even though the positive effect on DPSC differentiation, Chitlac thermosets could induce an inflammatory response in the system and thus an ELISA IL6 assay reveals an increased inflammatory response in 1:1 coculture system after 28 days of culture, furtherly increased in 1:5 coculture system.

In parallel an increased PGE2 release is evidenced in 1:1 coculture system in the presence of thermosets, reduced in 1:5 coculture system, suggesting the potential occurrence of neoangiogenesis, furtherly supported by a tubular network formation when DPSC are grown on matrigel.

These results evidencing that endothelial cells enhance "in vitro" osteo/odontogenic differentiation of DPSCs and angiogenesis, and that this response is revealed in the presence of Chitlac, usually used in dental restorative practice, indicate a coculture of DPSC and endothelial cells as a promising source for regenerative endodontics.

Keywords

Osteogenesis, angiogenesis, DPSC/endothelial cells coculture, BISGMA/TEGDMA Chitlac coated thermosets

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