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Periosteal derived cells and bone tissue regenerative medicine

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Mesenchymal stem cells (MSCs), showing a high capacity of self-renewal and differentiation into various lineages, have primarily used for the biological repair of cartilage and bone. Even though MSCs have been identified in different organ tissues, cells from different sources may show phenotypic heterogeneity, different in vivo results and specific functions of graft regions after transplantation. Therefore, a correct selection of MSC source is crucial to obtain a more efficient treatment for regeneration of injured osteochondral tissues. Periosteum Derived Progenitor Cells (PDPCs), which possesses multipotency at single cell level and can form cartilage and bone in vitro and in vivo may represent as an interesting cell resource for bone tissue engineering.

Aim of the present study is the isolation and characterization of human PDPCs and the evaluation of their ability to grow on bioresorbable composite scaffolds for bone tissue engineering applications.

PDCPs were obtained from periosteal tissue harvested from healthy subjects undergoing surgery for orthopedic trauma. Prior to cells seeding cell were phenotipically characterized. Three composite scaffolds, differing in weight ratios between the components were tested. The scaffolds were coded as CEL2/POL 0/100, 40/60 and 70/30 where CEL2 is a bioglass and POL the organic component based on chitosan and gelatin. Cells were cultured for 14 and 21 days. Our culture conditions favour the selection of a mesenchymal stem cells population. The obtained PDPCs displayed a good ability to interact with the different tested scaffolds. Morphological and biochemical analysis performed showed that cells maintain their metabolic activity and ability to proliferate on the scaffolds. Differentiation over proliferation that occurred to PDCPs at the increase of bioactive glass concentration proves the capacity of these scaffolds to modulate osteogenic properties. This strengthens the hypothesis of periosteum as stem cell source for an osteochondral tissue regenerative medicine based on in situ cell recruitment.

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Keywords: periosteal precursor, stem cells, bone tissue, biomaterials