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Evaluation of biomimetic nanocomposite scaffold using mesenchymal stem cell derived osteoblast-like cells

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Objective: A biomimetic nanocomposite scaffolds based on GEL/calcium phosphate were fabricated and behavior of differentiated osteoblast cells was evaluated after seeding on this scaffold.

Methods: Porous GEL/ calcium phosphate nanocomposites were fabricated by gelatin in deionized water 10% (w/v). Disodium hydroxide phosphate (1 M) and calcium chloride (0.6 M) were prepared and the pH of both solutions was brought to about 7.4 using Tris and HCl. In the next step, the GEL–calcium containing solution was poured into a cylindrical mold and kept at 4°C for 2 h until physical gelation occurred. Afterward, gel was extracted and soaked into the phosphate containing solution and incubated at 4°C for about 48 h. Following diffusion of ions into the gel, a white precipitate formed within the gel in a gradient manner from the border to the center of gel. The resulting nanocomposite was extracted and freeze dried to create a porous structure through solvent sublimation. Scaffolds were incubated in a 1% glutaraldehyde (GA) solution for 24 h. To achieve a fine powder from fabricated scaffolds for some of the characterization methods, the samples were chopped and milled. Prepared scaffolds were assessed in terms of attachment, alkaline phosphatase activity, gene expression and proliferation of osteoblast cells.

Result: The matrix mineralization was approved by alizarin red and the treated cultures with osteogenic media and BMP2 were positive for osteopontin and osteocalcin antibodies. RT-PCR confirmed presence of osteopontin, osteonectin and alkaline phosphatase mRNA after differentiation in EnSCs-derived osteoblast-like cells.

Conclusion: It has been shown that the biomimetic nanocomposites possess appropriate chemical and physical properties to support the attachment and proliferation of differentiated osteoblast cells.

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