PLGA+HA/ β TCP scaffolds embedding simvastatin induced mineral deposition by mesenchymal stem cells

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Background

The search for bone substitutes that might promote osteoconduction, osteoinduction, and osteogenesis, has fomented research on tissue engineering. Studies based on the association of new approaches, including scaffolds, biological inducers, and mesenchymal stem cells, have shown promising results.

Aim

The aim of this study was to evaluate the deposition of mineralization nodules in the extracellular matrix induced by simvastatin (SIM) embedded in scaffolds of poly(lactic-co-glycolic) acid (PLGA) and biphasic ceramic (BC) composed of hydroxyapatite (HA) and β -tricalcium phosphate (β TCP).

Methods and Materials

Samples Preparation

Groups

G1	Experimental:	Stem Cells from Human Exfoliated Deciduous Teeth (SHED) in non-osteogenic medium
G2	G1) PLGA+HA/ β TCP	
G3	G2) PLGA+HA/ β TCP+COL	
G4	G3) PLGA+HA/ β TCP+SIM	
G5	Control:	Stem Cells from Human Exfoliated Deciduous Teeth (SHED) in non-osteogenic medium
G6	G5) SHED in non-osteogenic medium	
G7	G6) SHED in osteogenic medium	
		G7) MC3T3-E1 in osteogenic medium

Mineral deposition assay

Von Kossa staining methodology was performed after 21 days of cell culture to assess the capacity of scaffolds to induce mineral deposition by SHED. After staining, all groups were taken to optical microscope and photographed, as presented in the Figure 1.

Results

G6 visibly presented the highest amount of mineralization nodules followed by G3 and G7. G5 presented a high density of eosin-colored cells, but just a few points of mineralization. G1, G2, and G4 showed a variable distribution of both eosin-colored cells and mineralization nodules.

Figure 1. Von Kossa methodology to detect mineralization nodules (colored in brown/black) at day 21 of cell culture.

Conclusions

PLGA+HA/ β TCP+SIM scaffolds were the most beneficial among experimental groups in regards of deposition of mineralization nodules in the extracellular matrix by SHED. This signalizes SIM embedded in scaffolds of PLGA+HA/ β TCP might be a promising biomaterial for tissue engineering, comprehending osteoconduction, osteoinduction, and osteogenesis. Further analyses are suggested to confirm the osteoinductive potential of these scaffolds to be used as bone substitutes for clinical applications.

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