

Novel enriched hydrogel nano-hap induced osteogenic differentiation of SCAP

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INTRODUCTION: Enriched nano-HAP hydrogels could serve as novel therapy material for osteogenic and chondrogenic regeneration. Here we investigate the biocompatibility and bioactivity of nano-HAP in the form of hydrogels, enriched by chondroitin sulphate, sodium hyaluronate, hydroxyl methyl cellulose, or propylene glycol.

MATERIALS AND METHODS: Stem cells from apical papilla (SCAPs), previously isolated and characterised, were used in the study. Biocompatibility was investigated by MTT test, in 96-well plates. Hydrogels were diluted in DMEM in various concentrations (0.125, 0.25, 0.5, and 1 %) and added to corresponding wells. After 24 h of culturing, MTT test was performed. Osteogenic and chondrogenic potential was investigated next. Cells were seeded in 24-well plates. Upon reaching confluency, osteogenic or chondrogenic mediums were added in corresponding wells. Hydrogels diluted to final concentration of 0.125 % were added in experimental groups. Cells were cultured for 7 days, and Alizarin red and Alcian blue staining were performed. Qualitative images were obtained, and afterwards the staining was further quantified. All experiments were performed in triplicate, in two separated experiments. Kolmogorov-Smirnov test was used for normality of data distribution, and One-way ANOVA was used for comparison between groups. GraphPad Prism software 9.0 was used.

RESULTS AND DISCUSSION: No cytotoxic effect was observed after 24 h of culturing. The concentration of 0.125 % for hydrogels shown to be the most stimulative for cell mitochondrial activity in most experimental groups, so this concentration was used for further bioactivity tests. All tested materials induced significant osteogenic differentiation after 7 days of culturing ($p < 0.0001$). There was no difference between hydrogels, in regards to stimulation effect. On the other hand, no significant chondrogenic differentiation was observed in any experimental group, in comparison to the control.

CONCLUSIONS: Enriched nano-HAP hydrogels shown to induce significant osteogenic differentiation of SCAP during 7 days of culturing. Prolonged time period of chondrogenic induction, and various gel concentrations should be investigated in the future, to determine its' full effect on SCAPs in means of chondrogenic differentiation.

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