

Growth factor release and enhanced encapsulated periodontal stem cells viability by freeze-dried platelet concentrate loaded thermo-sensitive hydrogel for periodontal regeneration.

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Abstract

Periodontium regeneration is a highly challenging process as it requires the regeneration of three different tissues simultaneously. The aim of this study was to develop a composite material that can be easily applied and can sufficiently deliver essential growth factors and progenitor cells for periodontal tissue regeneration.

Freeze-dried platelet concentrate (FDPC) was prepared and incorporated in a thermo-sensitive chitosan/ glycerol phosphate /GP hydrogel at concentrations of 5, 10, or 15 mg/ml. The temperature rises from 25 °C to 37 °C. Growth factor (TGF- β 1), platelet-derived growth factor (PDGF-BB) and insulin-like growth factor (IGF-1) were investigated at four time points (1, 2, 4, 8 weeks). Periodontal ligament stem cells (PDLSCs) were isolated from human third molars and encapsulated in the different hydrogel groups. Their viability was investigated after 7 days in non FDPC-loaded hydrogel.

Results showed that loading FDPC in the hydrogel lowered the initial viscosity in comparison to the unloaded control group and did not affect the sol-gel transition in any group. All FDPC-loaded hydrogel groups exhibited sustained release of TGF- β 1 and PDGF-BB for two weeks with significant difference between the different concentrations. The loading of 10 and 15 mg/ml the PDLSCs viability significantly compared to the unloaded hydrogel and was comparable to the standard culture conditions.

Accordingly, it may be concluded that loading FDPC in a chitosan/ GP hydrogel can offer enhanced injectability, a sustained release of growth factors and increased viability of encapsulated stem cells which can be beneficial in periodontium tissue regeneration.

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