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Biocompatibility of Experimental Fluoride-Doped Calcium Phosphates as Promising Remineralizing Materials

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Objectives Innovative fluoride-doped calcium phosphates (FDCP) may be used as “bioactive” materials for dental applications. This in vitro study aimed at assessing the biocompatibility and osteoinductive potential of the tested FDC and experimental adhesives containing FDCP fillers on Human Dental Pulp Stem Cells (hDPSCs).

Methods Five specimens of FDCP doped with different concentration of fluoride (0, 5, 10 and 20 %), as well as adhesives containing 0, 5, 10 and 20% of fluoride on hDPSCs were tested at different dilutions (undiluted, from 1:5 to 1:100) and the eluates were prepared according to ISO 10993-12. Viability assays were conducted using the MTT test. Furthermore, self-renewal and migration activity evaluations were carried out. Osteogenic differentiation potential was tested by Alkaline Phosphatase Activity and Alizarin Red Staining.

Results Our results demonstrated that the powders with greatest toxicity on hDPSCs were those without 0 and 20% fluoride when diluted at 1:1. The undiluted adhesives showed a reduction in viability after 24 hours, while at 1:50 and 1:100 diluted adhesives containing the filler FDCP 20% fluoride caused an increase in cell proliferation after 48 hours. The FDCP powder containing 20% fluoride caused a significant decrease in clonogenic capacity, while the adhesive had the opposite effect. The scratch test did not highlight significant differences in terms of the migratory capacity of the cells. The FDCP powder with 20% fluoride showed an osteoinductive effect, while the adhesives seemed not to affect the osteogenic differentiation.

Conclusions The experimental fluoride-doped calcium phosphates are not cytotoxic on hDPSCs at specific dilutions, which can also promote cell proliferation, stem proprieties and osteoinductive potential. Hence, our future studies will now focus on the most appropriate concentrations of FDCP to be used in order to obtain experimental materials for preventive and operative dentistry.