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## Comparative study of hyperpure chlorine dioxide with two other irrigants regarding the viability of periodontal ligament stem cells

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### Abstract

**Objectives:** Periodontal ligament stem cells (PDLSCs) have an underlined significance as their high proliferative capacity and multipotent differentiation provide an important therapeutic potential. The integrity of these cells is frequently disturbed by the routinely used irrigative compounds applied as periodontal or endodontic disinfectants (e.g., hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) and chlorhexidine (CHX)). Our objectives were (i) to monitor the cytotoxic effect of a novel dental irrigative compound, chlorine dioxide (ClO<sub>2</sub>), compared to two traditional agents (H<sub>2</sub>O<sub>2</sub>, CHX) on PDLSCs and (ii) to test whether the aging factor of PDLSC cultures determines cellular responsiveness to the chemicals tested.

**Methods:** Impedimetry (concentration-response study), WST-1 assays (WST = water soluble tetrazolium salt), and morphology analysis were performed to measure changes in cell viability induced by the 3 disinfectants; immunocytochemistry of stem cell markers (STRO-1, CD90, and CD105) measured the induced mesenchymal characteristics.

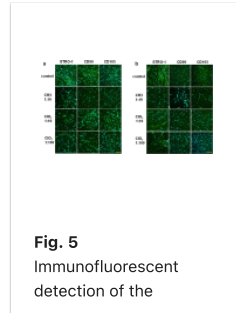
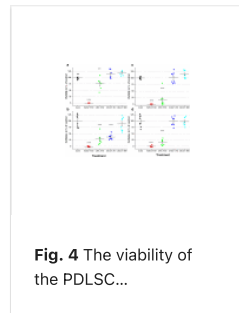
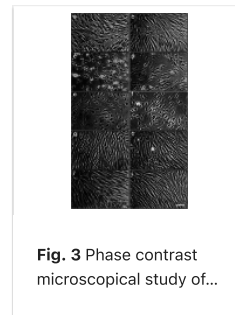
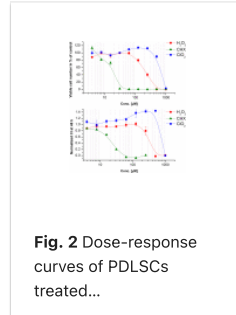
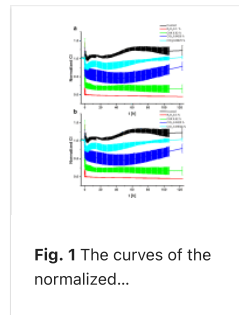
**Results:** Cell viability experiments demonstrated that the application of ClO<sub>2</sub> does not lead to a significant decrease in viability of PDLSCs in concentrations used to kill microbes. On the contrary, traditional irrigants, H<sub>2</sub>O<sub>2</sub>, and CHX are highly toxic on PDLSCs. Aging of PDLSC cultures (passages 3 vs. 7) has characteristic effects on their responsiveness to these agents as the increased expression of mesenchymal stem cell markers turns to decreased.

**Conclusions and clinical relevance:** While the active ingredients of mouthwash (H<sub>2</sub>O<sub>2</sub>, CHX) applied in endodontic or periodontitis management have a serious toxic effect on PDLSCs, the novel hyperpure ClO<sub>2</sub> is less toxic providing an environment favoring dental structure regenerations during disinfectant interventions.

**Keywords:** Chlorhexidine; Chlorine dioxide; Dental stem cells; Hydrogen peroxide; PDLSC; Toxicity; Viability.

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