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Optimizing the Chemical Aspect of Root Canal Irrigation

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Abstract

Root canal treatment is aimed at the removal of inflamed and infected tissue present in the root canal system. It will prevent the entrance of new microorganisms or nutrients in order to maintain or create a healthy environment around the root. There is sufficient evidence that shows that traditional endodontic therapy cannot make the root canal system completely free of bacteria. Moreover, it may not always result in complete healing of apical periodontitis, highlighting the need of optimizing the cleaning procedures.
In this thesis, new models and methodologies were examined to measure, to image and to compare the cleaning efficiency of various irrigation methods and solutions and to optimize the chemical aspect of root canal irrigation. Strategies for optimizing the chemical efficiency of NaOCl in contact with dentine were suggested by analyzing the effect of concentration, temperature, pH, laser and ultrasonic activated irrigation, irrigant refreshment and exposure time in the reaction rate of NaOCl. This work also brought new insight to the evolution of temperature and pH of irrigants during root canal therapy and on the occurrence of transient cavitation (the growth and subsequent implosion of bubbles) around sonic and ultrasonic activated endodontic instruments. Finally, the cleaning efficiency of different irrigation methods and solutions in confined accessory root canal anatomy was investigated with the introduction, in endodontic research, of a novel hydrogel model that mimics the biofilm viscoelastic properties.
The models and methodologies characterized here serve as a promising tool for future endodontic research.
The results reported in this thesis contribute to the scientific and clinical awareness of the mechanical and chemical aspects of irrigation, which may lead to a better clinical outcome.