Endodontics

Influence of Photon-Induced Photoacoustic Streaming (PIPS) on root canal disinfection and post-operative pain: a preliminary randomized clinical trial

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Aim: Quality of endodontic treatment is the most important factor to achieve high success rate. PIPS device was introduced as a method to improve efficiency of cleaning. It implies the use of Er:YAG laser and irrigating solutions. Potential risk of apical extrusion of infected debris during endodontic treatment, correlated with use of laser, can produce an acute inflammatory response, with postoperative pain. This clinical study evaluates the ability of PIPS Er:YAG laser to reduce the root canal bacterial count in vivo compared to traditional technique by collecting intracanal bacterial samples. Moreover, the study evaluated patients post-operative quality of life after therapy through a questionnaire filled by patients.
Methods: Fourty eight anterior and posterior teeth with pulp necrosis and apical periodontits were selected for endodontic treatment and randomly assigned to group A (n=24) with traditional irrigation and group B (n=24) with PIPS method applied according to protocol. Irrigation was carried out with NaOCl 5% and EDTA 10% solutions. Intracanal samples were taken before and after endodontic treatment with sterile paper points and were subjected to culture test. Values of microbical analysis were evaluated with Kolmogorov-Smirnov normality test and Mann-Whitney test (p<0,05). Self-assessment questionnaire was presented to patients to evaluate postoperative pain during 7 days after therapy. Variation of quality of life's indicators were assessed with a form of analysis of variance for repeated measurements and the Student's T-test.
Results: The results obtained from the microbial analysis show a significant reduction of the CFU counts for both techniques in vivo, but there is no statistically significant difference between traditional method and PIPS method. In the seven days following the treatment, however, there were statistically significant differences for:
- maximum perceived pain (p = 0.02),
- difficulty eating (p = 0.03),
- difficulty in performing usual functions (p = 0.02),
lower, on Day 1, for patients who underwent endodontic treatment with PIPS irrigation method. As for the other variables analyzed, such as average perceived pain, difficulty in speaking, difficulty in relationships, quality of life in general, number of pain killers taken, PIPS method seems to cause less discomfort, but the data are not statistically significant.
Conclusion: PIPS method and traditional method seem to be equally effective in reducing the bacterial load in vivo, but PIPS method in general seems to cause less discomfort for the patient. Therefore PIPS could represent a promising aid to root canals disinfection, especially in case of simplified operative protocols and reduced times of instrumentation.

Metallurgical characterization of Reciproc and Reciproc Blue Ni-Ti instruments

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Aim: To evaluate the mechanical properties and thermal behaviour of Reciproc Blue compared to Reciproc M-wire files and to analyse the usage degradation of the files after ex-vivo test in extracted human teeth. The instruments underwent Scanning Electron Microscope (SEM) imaging, Energy Dispersion Spectroscopy (EDS), Raman Spectroscopy, metallographic analysis, DSC, XRD and nano-hardness test.
Methods: Reciproc and Reciproc Blue 25 .08 variable taper files were used in the study. Ten brand new instruments and ten used in four severely curved root canals were observed by SEM with EDS to study the new file's morphology and chemical composition and to verify the degradation of the files. The surface of both new and used files was analyse with micro-raman spectroscopy at room temperature with a Nd:YAG laser at 532.05 nm.The microstructure of both new and used files was studied with a light microscope on etched cross-sections and the samples were also observed with SEM for better analyse the morphology of the alloys' grains. DSC was used to analysed the transition temperatures of both new and used files by using segments of the files (10-15 mg of overall weight). XRD was used for investigate the phase composition of three new and used Reciproc and Reciproc Blue files at room temperature using a Cu-Kα monochromatic radiation (40 kV and 40 mA). The hardness and elastic modulus of two new and used Reciproc and Reciproc Blue files were evaluated using nano-indentation test using a Berkovich diamond tip according to ISO 14577. Statistical analyses were performed using STATA version 11 (STATA Corp., Texas, USA).
Result: Reciproc and Reciproc Blue files have a slightly different tip geometry and on both instruments are visible milling grooves perpendicular to the long axis. They are both composed of almost the same equiatomic NiTi alloy. The SEM analysis of used files reveals the presence of microcracks along the surface of four instruments per type. The micro-raman spectroscopy confirms the presence, on Reciproc Blue, of a superficial oxide layer of TiO2 arranged in Brookite and Rutile while no signal of a detectable titanium oxide was showed on Reciproc surface. The etched surface of both new and used files appeared characterized by several precipitates dispersed in a matrix composed by acicular martensitic grains and austenitic plain areas. The area of Reciproc Blue grains was statistically lesser than Reciproc one. A two-stage reverse phase transition curve was found for Reciproc Blue. M-Wire Reciproc files do not complete their reverse phase transformation at 37°C, while Reciproc Blue Austenite finish temperature is equal or less than body temperature. XRD confirms that both files have a mixed phase composition, including austenite, martensite and R-phase. Reciproc Blue have a lower nano-hardness and elastic modulus compared to Reciproc files in used conditions.
Conclusion: Reciproc and Reciproc Blue files are composed of the same NiTi alloy but they undergo different thermal treatment. The Reciproc Blue show a titanium oxide superficial layer as confirmed by Raman spectroscopy and are more flexible than Reciproc M-Wire due to their different thermal treatment. The smaller and denser grains of Reciproc Blue files are responsible for the different transition temperatures of the two instruments.

A micro-computed tomographic analysis of retreatability of two bioceramic sealers using rotary instrumentation with supplementary irrigant agitation techniques

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Aim: Hydraulic tricalcium silicate-based bioceramic materials have been recently introduced as root repair cements. The retreatability of Guttaflow Bioseal (Coltene Whaledent, Langenau, Germany) and BioRoot RCS (Septodont, Saint Maur des Fossés, France) has not been investigated thus far. Aim of this study was to evaluate the retreatability of two tricalcium silicate-based materials (BioRoot RCS and Guttaflow Bioseal,) using a combination of rotary instrumentation and supplementary irrigant agitation techniques (syringe irrigation, Tornado Brush and ultrasonically activated irrigation) by high-resolution micro-computed tomography.
Methods: Single-rooted mandibular premolars were prepared to size 40/0.04 (Hyflex EDM rotary nickel-titanium instruments, Coltene, Coltene/Whaledent AG, Altstatten, Switzerland) and randomly divided into 2 experimental groups (n=24) depending on the root filling material. Root canals were filled with Guttaflow Bioseal (Group 1) or BioRoot RCS (Group 2), scanned using a microCT scanner (Skyscan1172, Brunker microCT, Antwerp, Belgium) at 80 kV and 100 µA with an isotropic resolution of 11 µm and stored in phosphate buffered saline for 4 months. In all the groups, the root filling was removed using the R-Endo nickel-titanium rotary instruments (MicroMega) according to the manufacturer