

initial and pre and post treatment electronic working lengths was compared by using Student *t* test.

Results: Student *t* test revealed insignificant differences between initial working length and pre and post-treatment electronic working lengths. Conclusion : Root ZX and ProPex II can be a useful adjunct during root canal retreatment.

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OZONE APPLICATION IN TEETH WITH CHRONIC APICAL PERIODONTITIS IN VIVO STUDY. MEASUREMENT OF THE BACTERIAL LOAD

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Objective: to compare the bacterial load after conventional endodontic treatment versus combination with HealOzone therapy (Kavo, Biberach, Germany) in teeth with chronic apical periodontitis.

Methods: sterile paper points were taken at three different times from 10 teeth of 8 patients with localized chronic apical periodontitis. The first sample was taken after the opening and location of the root canals with paper point # 15 to the working length during 30 seconds, the second sample was taken after chemomechanical preparation with rotary instrumentation and irrigation with 2.5 % sodium hypochlorite (NaOCl) and finally, the third sample was taken after the ozone application during 40 seconds. The samples were inserted into eppendorf vials and were analyzed with Peri-implant diagnostic kit (GUM® Sunstar Americas, Chicago) to measure the total bacteria and detect the presence of Porphyromonas gingivalis (PG), Aggregatibacter actinomycetemcomitans (AA), Tannerella Forsytia (TF), Treponema denticola (TD), Prevotella intermedia (PI), Parvimonas Micra (PM), Fusobacterium nucleatum (FN), Campylobacter rectus (CR), Eikenella corrodens (EC), Candida albicans (CA), for plurimicrobiotica nature of the lesions. The data were analyzed with the IAI-PadoTest 4.5® (IAI Inc., IAI Institue, Zuchwill, Switzerland).

Results: the application of ozone can improve the antiseptic effect on the endodontic treatment because of decreasing bacterial load.

Conclusion: a reduction of microorganisms that cause chronic apical periodontitis was obtained mainly after the endodontic treatment. This study proposes the combination with ozone applying during 40 seconds to enhance the success in root canals.

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CYCLIC FATIGUE RESISTANCE OF K3, K3XF AND TF FILES UNDER CONTINUOUS ROTATION AND RECIPROCATING MOTION AT 5 MM FROM THE TIP

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Objective: To compare the cyclic fatigue (CF) resistance of K3, K3XF and TF files at 5 mm from the tip under continuous rotation and reciprocating motion.

Methods: 60 K3 (modified triple U cross-section manufactured with a grinding process and conventional NiTi alloy), 60 K3xf (same cross-section and manufactured method but R-phase alloy), and 90 TF (triangular cross-section manufactured with a twisting process and R-

phase alloy) files were divided in seven experimental groups (30 files each one). All files had the same tip diameter (30) and taper (0.06).

GROUP	SPEED (rpm)	TYPE OF MOVEMENT
K3-C	300	Continuous rotation
K3XF-C		
TF1-C		
TF2-C	500	
K3-R		
K3XF-R	300	Reciprocating motion
TF-R		

CF resistance was tested in stainless steel curved canals (60°, *r*=3 mm). Clockwise and counterclockwise rotations were set on a ATR Tecnika Vision electric motor at 1440-720. Using Weibull analysis, mean half-life, beta (related to variability) and eta (at this stress, 0.632 is the probability of failure) were calculated for each group.

Results:

GROUP	MEAN LIFE(s)	BETA	ETA(s)
K3-C	17,35	3,8	19,16
K3XF-C	44,67	2,72	50,21
TF1-C	26,13	3,97	28,84
TF2-C	10,11	3,28	11,27
K3-R	51,32	5,94	55,35
K3XF-R	70,38	5,8	76,01
TF-R	65,25	4,95	71,11

Probability of mean life was significantly higher when used under reciprocation motion than continuous rotation for all files. Under continuous rotation, probability of K3XF-C mean life was significantly higher than the rest of the groups. Under reciprocating motion, there were no significant differences between K3XF and TF mean life, but both were significantly higher than K3 mean life.

Conclusion: R-phase alloy increases the CF resistance of files. Alloy, section of the file, speed of rotation and type of movement parameters has influence in the CF Resistance results.

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DIFFERENCE BETWEEN 2D AND 3D TECHNIQUES FOR EVALUATING SHAPING PERFORMANCE IN SIMULATED ROOT CANALS

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Objective: The use of two-dimensional (2D) methods for evaluating geometry variation in root canal shaping is widely adopted in the literature. Recently, Ounsi et al. (Journal of Endodontics, 2011;37:847-50) concluded that there is statistical difference between 2D and three-dimensional (3D) measurements in assessing canal dimensions after uses of Ni-Ti rotary instruments on resin blocks

simulating curved root canals. In order to verify this conclusion a new set experimental data has been obtained and analyzed.

Methods: Fifteen resin blocks simulating curved root canals have been considered for the analysis. Each block has been scanned with microComputed Tomography (micro-CT) to obtain an high resolution 3D model. 2D digital images of each physical block have been compared with the cross-sections extracted from the corresponding 3D model. Image matching has been carried out by using a digital imaging software (Adobe Photoshop CS4; Adobe Systems Inc, San Jose, CA); canal profiles have been extracted with an automated procedure implemented in Matlab r2010b software (The MathWorks Inc, Natick, MA) for mathematical processing and analyzed to evaluate possible geometrical differences.

Results: Statistical analysis (hypothesis test) of the geometrical differences between the canal profiles obtained from the 2D digital images and the corresponding cross-sections extracted from the corresponding 3D model showed that with a 95 % confidence level the resulting profiles cannot be distinguished.

Conclusion: Experimental data showed that there is no statistical difference in the usage of 2D digital images and 3D micro-CT for measurements in assessing canal dimensions, if simulated root canals in resin block are considered. It is worth noting that such difference would be possible if real root canals are considered, due to the non-planar 3D path followed by the canal axis.

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PULP BIOENGINEERING: TRACKING OF IMPLANTED STEM CELLS BY NUCLEAR IMAGING

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Objective: Endodontic treatment as current therapeutic may occurred when tooth is exposed to severe injuries from caries or traumatic fractures. Such treatment does not exploit the high regenerative cellular potential of the pulp. The present study is part of a larger research project aiming to develop a pulp equivalent implantable in the injured dental pulp, based on the use of mesenchymal pulp stem cells. In tissue engineering, it is a major issue to determine the fate of implanted cells in a living organism. Here, we tracked by nuclear imaging ¹¹¹indium-oxine (¹¹¹In-oxine) radiolabeled pulp cells after implantation in the rat emptied pulp chamber.

Methods: Rat pulp cells were radiolabeled with ¹¹¹In-oxine. Their viability and proliferation rate were controlled *in vitro*. Then, labeled cells were added to polymerizing type I collagen hydrogel in order to obtain a **pulp equivalent**. This scaffold was then implanted in the emptied pulp chamber space in the upper first rat molar, after performing pulpotomy (ethical agreement CEEA34.CC.010.11). Labeled cells were tracked by Nuclear Imaging (Nano SPECT/CT plus, Bioscan®) for 3 weeks. Negative controls were performed using radiolabeled cell lysates. Treated rats were sacrificed at 1, 2 and 4 weeks after surgery. Maxillary were isolated, demineralized before embedding in paraffin for histological staining and immunohistochemistry studies.

Results: In vitro studies showed that ¹¹¹In-labelled pulp cells viability and cell proliferation were similar to unlabeled cells. *In vivo* imaging performed

sequentially over a month showed a significant increased radioactivity level from labeled pulp equivalent into the pulp chamber, compared to controls. This labeling was clearly detectable for 3 weeks, which indicates that implanted cells remained viable in the pulp space. At all-time points, whole-body acquisitions by SPECT/CT showed no signal outside of the pulp chamber, suggesting that most radiolabeled cells remained located in the tooth. Histological and immunochemistry studies showed limited inflammation, proliferation and angiogenesis in the cellular scaffold.

Conclusion: Our study demonstrates for the first time that efficient tracking of pulp cells implanted in the dental pulp can be achieved by Nuclear imaging. Importantly, our data indicate that the grafted cells were viable and remained located in the dental pulp. These results open a promising avenue in the treatment of pulpal dental diseases by tissue engineering.

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COMPARISON OF THE FORCE REQUIRED TO FRACTURE ROOTS VERTICALLY AFTER ULTRASONIC AND IRS REMOVAL OF BROKEN INSTRUMENTS

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Objective: To compare the force required to fracture roots vertically after broken instruments by ultrasonic tips removal and Instrumental Removal System.

Methods: Sixty extracted human anterior teeth with single and straight roots were used. The crown of each tooth was removed until the full length of the tooth was 13 mm. All canals were instrumented to a size 15 K-file and intentionally a S2 Protaper file was fractured at 4 mm in the middle third of the canals. The teeth were randomly divided into three groups: fractured instruments without removal (group 1), fractured instruments with ultrasonic tips removal (group 2) and fractured instruments with iRS removal (group 3). The samples were subjected to a continuous vertical loading, using a universal testing machine (Instron). For each root, the force at the time of fracture was recorded in Newtons.

Results: The force required to fracture the root vertically was significantly higher in the control group (group 1) than experimental groups (group 2 and 3). The roots in which the broken instruments were removed using ultrasonic tips required more force to fracture than roots in the iRS group.

Conclusion: Removal of fractured instruments from the middle third of the roots decreased the force required to fracture the root vertically, regardless of the technique used for instrument removal. There was not difference between the ultrasonic technique and iRS technique.

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CLEANLINESS OF ROOT CANAL WALLS—LASER VERSUS IRRIGATION: A MICRO-RAMAN SPECTROSCOPIC AND SEM ANALYSIS

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