



Francesco Riitano Research Award of the Italian Academy of Endodontics (AIE)

AIE presents the abstracts of the Francesco Riitano Award of the International Congress of the Italian Academy of Endodontics held in Bologna from February 27 to March 1, 2025. The AIE Francesco Riitano Award is exclusively awarded to graduates in Dentistry who have discussed their degree and/or master's thesis on topics related to endodontics at both Italian and international universities. The Academy has dedicated this award to Dr. Francesco Riitano, regarded as one of the pioneers of modern Endodontics. He recognized that Endodontics necessitated a deeper exploration of anatomy and the endodontic space to enhance instrumentation techniques and disinfection methods, thereby ensuring the most conservative treatment possible. Ultimately, the Italian Academy of Endodontics, through initiatives such as the Francesco Riitano Award, underscores the significance of ongoing advancements in dental care.

For information regarding the 2026 awards of the 3rd International Congress titled "Minimal Invasiveness: Myth or Reality?" organized by the Italian Academy of Endodontics, please scan the QR code or visit the following link:

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The role of endodontic societies in improving healthcare practice

Nicola Maria Grande

Past President AIE

Membership in an endodontic society such as the Italian Academy of Endodontics (AIE) offers substantial professional and scientific advantages for practitioners. It also enhances the broader field through collaboration, education, and innovation. For individual clinicians, membership grants access to a community of peers with similar clinical interests and challenges. This connection promotes the exchange of knowledge, experience, and best practices, enabling practitioners to remain current with evolving techniques, materials, and technologies in endodontics. Through conferences, workshops, and continuing education programs, members can continually improve their clinical skills, ensuring that patients receive the highest standard of care. Furthermore, endodontic societies can develop evidence-based guidelines for clinical practice and position statements, which serve as valuable tools for practitioners. These can also be utilized in legislative processes or legal cases.

Endodontic societies also play an essential role in advancing research. By bringing together clinicians, academics, and researchers, societies create an environment where ideas can be tested and validated through scientific collaboration. The Italian Academy of Endodontics boasts a high scientific reputation, with many members actively involved in both education and research. Consequently, other members gain opportunities to contribute to and learn from new studies that drive evidence-based practice. Access to society journals and research databases further supports members in integrating the latest findings into their clinical decision-making. *Annali di Stomatologia* typically publishes clinical and scientific articles related to endodontic topics and is the official journal of the society. Moreover, societies often fund or facilitate research projects, encouraging innovation in diagnostic methods, instrumentation, and biocompatible materials that ultimately improve patient outcomes.

A distinctive strength of endodontic societies resides in their capacity to connect practitioners with manufacturers and industry partners. These relationships are mutually advantageous: specialists provide feedback grounded in real-world clinical experience, while manufacturers share insights into emerging materials and technologies. Through structured collaborations—such as product evaluations, sponsored symposia, or research partnerships—these societies ensure that new tools and materials are both scientifically validated and practically effective. Such exchanges facilitate the acceleration of translating scientific advances into dependable clinical solutions.

At an organizational level, endodontic societies assist in establishing and upholding professional standards. They offer guidance on ethical conduct, foster quality assurance, and advocate for patient safety. Moreover, these societies serve as the collective voice of the profession in dialogues with regulatory authorities, academic institutions, and the public, ensuring that the significance of specialized endodontic care is acknowledged and promoted.

Ultimately, membership in an endodontic society enriches the professional lives of practitioners by providing education, community, and influence. Simultaneously, it advances the entire field by promoting collaboration among clinicians, researchers, and manufacturers. This interconnected approach not only fosters innovation but also guarantees that endodontic practice continues to develop pursuant to scientific rigor, clinical excellence, and a shared dedication to enhancing patient care.

The Italian Academy of Endodontics has attained notable success in recent years through its unwavering dedication to scientific excellence, innovation, and collaboration. By fostering ongoing education and advocating for evidence-based practices, AIE has elevated the standards of endodontic care both within Italy and internationally. Its annual congresses and training programs attract leading experts and emerging professionals, establishing a vibrant platform for the dissemination of research and clinical advancements. Strategic alliances with universities and global dental organizations have further bolstered its esteemed reputation. Through its commitment to quality, inclusivity, and professional development, AIE has established itself as a benchmark for endodontic excellence and leadership.

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Microscopical evaluation of the disinfection potential of a new endodontic irrigating system: an *in vitro* study

Gianmarco Baima¹, Mishel Londo¹, Narcisa Mandras², Janira Roana², Damiano Pasqualini¹, Mario Alovisi¹

¹ University of Turin, Department of Surgical Sciences, Dental School, Turin, Italy

² University of Turin, Department of Public Health and Pediatrics, Turin, Italy.

Objective: The objectives of this study were to assess the *in vitro* disinfection capabilities of the iVac Apical Negative Pressure Irrigation and Activation System in comparison to the conventional syringe irrigation protocol, through microscopic analysis.

Materials and Methods: Twelve (N=12) sound extracted monoradicular teeth were selected for access cavity preparation, canal scouting, and shaping until ProTaper Next X3 (Dentsply Sirona, Ballaigues, Switzerland). The specimens were subsequently sterilized via autoclaving and infected with pure colonies of *Enterococcus faecalis*. Subsequently, irrigation protocols were compared by assigning each sample either to Group 1 (n=5), in which the iVac device was tested as an irrigant delivery system, or Group 2 (n=5), which employed a 30G needle and syringe as the irrigation delivery system. Two samples served as controls.

NaOCl 2% and EDTA 17% were utilized as irrigant solutions, following the manufacturer's instructions. The samples were subsequently stained with BacLite Dead-Live (PI + SYTO9 – Sigma) and prepared for analysis via Confocal Laser Scanning Microscope (CLSM). The *Mean Ratio* (MR) of red fluorescence (indicating dead cells) relative to the total red/green fluorescence percentage, as well as the *Mean Penetration Depth* (MPD) of red fluorescence, were computed for the coronal, middle, and apical sections. MPD was assessed at both inner (proximal to the canal lumen) and outer levels. The variance between groups was analyzed using the non-parametric Kruskal-Wallis test and the Chi-Square test.

Results: The myocardial ratio (MR) of red fluorescence relative to total fluorescence (%) did not differ significantly between groups (Group 1: Mean 52,355, range 46,551 - 67,782; Group 2: Mean 53,543, range 45,873 - 59,375; $p > 0,001$). A positive correlation was observed between the apical sections and the mean proportion of dead cells ($p = 0,003$). The mean pixel density (MPD) of red fluorescence was similar between the two groups in superficial sections; however, in outer sections, the MPD increased in Group 1 compared to Group 2. These findings reached statistical significance solely in the coronal and middle sections ($p < 0,05$). Variance analysis using the Chi Square Test indicated that there was no significant difference between the groups ($p = 0,06$).

Discussion

Several ways to implement endodontic irrigation have been tested over the years, with conflicting results. Until today, apical negative pressure and ultrasonic vibrations have never been incorporated in one single device during endodontic irrigation. iVac System provided qualitatively increased irrigation outcomes by allowing greater irrigants' penetration depth. As a result, it could be employed in untreated chronic apical periodontitis, in which bacteria could penetrate deeper into the dentinal tubules.

Conclusions

iVac system can be considered a reliable device to implement the irrigation procedures during endodontic treatments in monoradicular teeth.

Comparative evaluation of bone healing in patients with large periapical maxillary lesions treated with and without GBR

Nicol Bianconi¹, Simone Grandini², Emanuele Ambu³

¹ *Scuola di Specializzazione in Chirurgia Orale, Università degli Studi di Torino, Italia*

² *Dipartimento di Biotecnologie Mediche, Università degli Studi di Siena, Policlinico Le Scotte, Siena, Italia*

³ *Clinical Assistant Professor in Endodonzia e Chirurgia Endodontica, Università degli Studi di Siena, Corso di Laurea in Odontoiatria e Protesi Dentaria, Siena, Italia*

Objective: The purpose of this study is to assess the effectiveness of guided bone regeneration (GBR) using Bio-Oss and resorbable collagen membranes in enhancing bone regeneration following the surgical treatment of large anterior maxillary periapical lesions. This study aims to compare the outcomes of patients who received GBR with those who underwent standard surgical procedures without GBR, focusing on the extent of bone healing and lesion size reduction as measured by cone-beam computed tomography (CBCT) over a 12-month period.

Materials and Methods: This retrospective cohort study analysed clinical records of 21 patients diagnosed with large periapical maxillary lesions and treated in Bologna, Italy, from 2021 to 2023. Patients were divided into two groups: those who underwent guided bone regeneration (GBR) with Bio-Oss and those who did not. Preoperative and 12-month followup measurements of lesion dimensions were taken using cone-beam computed tomography (CBCT). Results: The study found improvements in bone regeneration in the GBR group compared to the non-GBR group. Measurements indicated a more substantial reduction in lesion size for patients who received GBR, with marked improvements in both vestibulo-palatal and mesio-distal dimensions.

Discussion: GBR demonstrated faster and more effective bone healing compared to lesion enucleation without regeneration. Patients treated with GBR experienced significantly greater reductions in lesion dimensions, with a 100% complete healing rate in cases treated with two membranes. CBCT proved to be a valuable tool for detailed evaluation of cyst characteristics and bone regeneration. However, the retrospective nature of the study and the small sample size represent limitations. Further research is needed to validate these findings in multicenter settings.

Conclusion

The use of Bio-Oss and resorbable collagen membranes in GBR techniques significantly enhances bone healing and regeneration in the treatment of large maxillary periapical lesions. These findings support the integration of GBR into clinical practice to improve structural restoration and patient outcomes in maxillofacial surgery. Future research should focus on optimizing these techniques for broader clinical application.

Endo-perio microbiota analysis in periodontopathic teeth using nanopore sequencing

Alessio Buonavoglia¹, Francesco Pellegrini², Gianvito Lanave², Georgia Diakoudi², Maria Stella Lucente², Fausto Zamparini¹, Michele Camero², Maria Giovanna Gandolfi¹, Vito Martella² and Carlo Prati¹

¹Department of Biomedical and Neuromotor Sciences, Dental School, University of Bologna, Bologna, Italy;

²Department of Veterinary Medicine, University of Bari, Valenzano, Bari, Italy

Objectives: Endo-periodontal lesions (EPL) are bacterial diseases that affect both periodontal and endodontic tissues, defined by a pathological communication between the pulpal and periodontal tissues.

The common pathologic communication between these tissues can occur by a carious or traumatic lesion that affects the pulp and secondarily periodontium between apical foramen, accessory canals, and dentinal tubules.

When it comes to pulpal pathology of periodontal origins, the matter is more controversial.

It is still unclear if bacteria can reach the root canal system, or if inflammation is only due to their metabolic products.

The aim of this study was to evaluate if in non-vital teeth with severe periodontal disease not reaching the apex root segment and with clinically intact external surface there is presence of bacteria in the endodontic space.

Materials and methods: Periodontal (P) and endodontic (E) tissue samples of root canals from six intact teeth with severe periodontal compromise hindering any periodontal or conservative treatment were sampled for analysis of microbial population using Nanopore technology.

Inclusion criteria were teeth affected by EPL without clinically and radiographically identified caries lesions, cracks/fractures and/or restorations and periodontal pockets could not reach the apical root segment.

Results: Bacterial DNA was identified in all the 12 samples analyzed from the study group.

The genera most frequently identified in P samples ($n = 6$) were *Fusobacterium* (50%), *Prevotella* (50.0%), *Streptococcus* (50.0%), *Treponema* (50.0%), *Actinomyces* (41.7%), *Olsenella* (41.7%), *Parvimonas* (41.7%), and *Tannerella* (41.7%).

Streptococcus (50.0%) and *Actinomyces* (41.7%) were the most frequently detected genera in E samples ($n = 6$). *Actinomyces* and *Streptococcus* were detected with equal prevalence (41.7–50.0%) in both P and E samples, whilst *Fusobacterium*, *Prevotella*, and *Treponema* were detected with higher prevalence in P (50.0%) than in E samples (16.7%) (Tables 1-3).

Discussion

All the teeth presented bacteria on the root surface and in the root canal system, demonstrating the possibility of bacteria to spread directly from the periodontal pocket to the root canal system, despite the apical foramen was not reached by periodontal lesion.

Moreover, some bacteria seem to have a greater ability of migration between the two spaces. In fact, *Actinomyces*, *Streptococcus*, *Parvimonas*, and *Veillonella* were present with similar frequencies both in the periodontal pocket and in the root canal system.

Although their high frequency on root surfaces, some bacteria such as *Porphiromonas* and *Prevotella* were slightly identified in the root canal system. Several factors, including bacterial size, adhesive properties, motility, or micro-environmental selectivity may affect the degree of permeability to the dentinal tubules and virulence.

Conclusions

The study demonstrated the possibility of bacteria to spread directly from the periodontal pocket to the root canal system even in the absence of crown's loss of integrity, although not all bacterial species seem to possess the same capacity of migration. In vital teeth affected by deep periodontal pockets, particular attention should be always paid to pulpal status.

An untreated deep periodontal pocket may serve as a bacterial reservoir to contaminate/re-contaminate the root canal system.

Table 1. Sequence read distribution of bacterial genera detected in the periodontal (P), endodontic (E) and control (M) tissue samples of root canals from teeth of patients expressed as BarPlot charts.

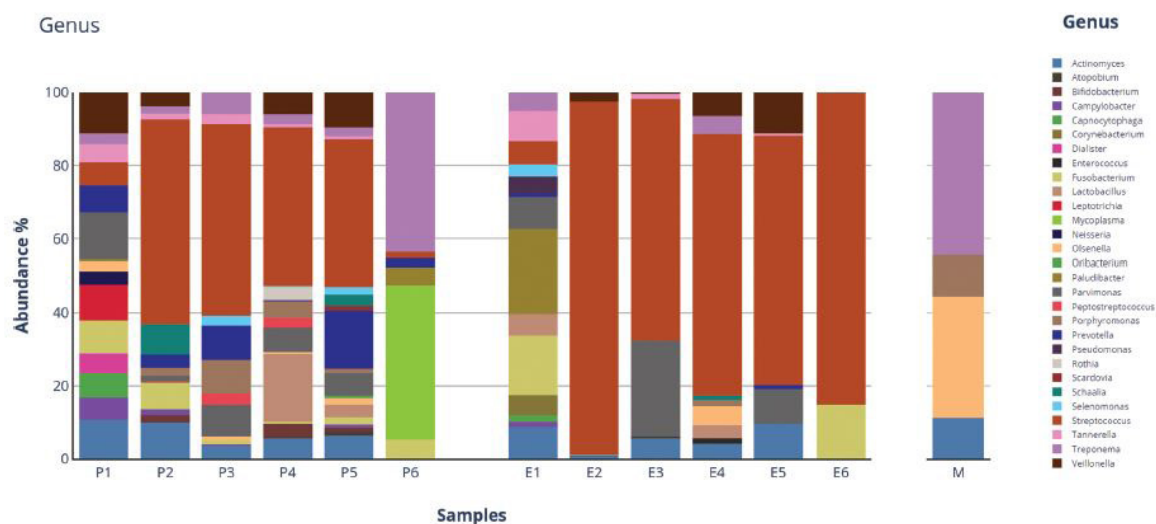


Table 2. Presence of bacterial genera in periodontal (P) and endodontic (E) tissue samples of root canals from patients affected by severe periodontitis.

P/E	Samples										
	P1	P2	P3	P4	P5	P6	E1	E2	E3	E4	E5
Patient	#1	#2	#2	#2	#2	#3	#1	#2	#2	#2	#2
Bacterial Genera											
<i>Actinomyces</i>	+	+	+	+	+	-	+	+	+	+	+
<i>Atopobium</i>	-	+	-	+	+	-	-	+	+	-	-
<i>Bifidobacterium</i>	-	+	-	+	+	-	-	-	-	-	-
<i>Campylobacter</i>	+	+	+	-	+	-	+	-	-	-	-
<i>Capnocytophaga</i>	+	+	-	-	-	-	+	-	-	-	-
<i>Corynebacterium</i>	-	-	-	-	-	-	+	-	+	-	-
<i>Dialister</i>	+	-	-	-	-	-	-	-	-	-	-
<i>Enterococcus</i>	-	-	-	-	-	-	-	-	-	+	-
<i>Fusobacterium</i>	+	+	+	+	+	+	+	-	-	-	-
<i>Lactobacillus</i>	-	-	-	+	+	-	+	-	-	+	-
<i>Leptotrichia</i>	+	+	-	-	-	-	-	+	-	-	-
<i>Mycoplasma</i>	-	-	-	-	-	+	-	-	-	-	-
<i>Neisseria</i>	+	-	-	-	-	-	-	-	-	-	-
<i>Olsenella</i>	+	+	+	+	+	-	-	-	-	+	-
<i>Oribacterium</i>	-	-	-	-	+	-	-	-	-	-	-
<i>Paludibacter</i>	+	-	-	-	-	+	+	-	-	-	-
<i>Parvimonas</i>	+	+	+	+	+	-	+	-	+	-	+
<i>Peptostreptococcus</i>	-	-	+	+	-	-	-	-	-	-	-
<i>Porphyromonas</i>	-	+	+	+	+	-	-	-	-	+	-
<i>Prevotella</i>	+	+	+	+	+	+	+	-	-	-	+
<i>Pseudomonas</i>	-	-	-	-	-	-	+	-	-	-	-
<i>Rothia</i>	-	-	-	+	-	-	-	-	-	-	-
<i>Scardovia</i>	-	-	-	-	+	-	-	-	-	-	-
<i>Schaalia</i>	-	+	-	-	+	-	-	-	-	+	-
<i>Selenomonas</i>	-	-	+	+	+	-	+	+	-	-	-
<i>Streptococcus</i>	+	+	+	+	+	+	+	+	+	+	+
<i>Tannerella</i>	+	+	+	+	+	-	+	-	+	-	+
<i>Treponema</i>	+	+	+	+	+	+	+	-	-	+	-
<i>Veillonella</i>	-	-	-	-	-	-	-	-	-	-	-

Table 3. Distribution of bacterial genera, expressed as percentage, in periodontal (P) and endodontic (E) tissue samples of root canals from patients affected by severe periodontitis.

Bacterial genera	P (%)	E (%)
<i>Actinomyces</i>	41.7	41.7
<i>Atopobium</i>	25.0	16.7
<i>Bifidobacterium</i>	25.0	0.0
<i>Campylobacter</i>	33.4	8.3
<i>Capnocytophaga</i>	16.7	8.3
<i>Corynebacterium</i>	0.0	8.3
<i>Dialister</i>	8.3	0.0
<i>Enterococcus</i>	0.0	8.3
<i>Fusobacterium</i>	50.0	16.7
<i>Lactobacillus</i>	16.7	16.7
<i>Leptotrichia</i>	16.7	8.3
<i>Mycoplasma</i>	8.3	0.0
<i>Neisseria</i>	8.3	0.0
<i>Olsenella</i>	41.7	8.3
<i>Oribacterium</i>	8.3	0.0
<i>Paludibacter</i>	16.7	8.3
<i>Parvimonas</i>	41.7	25.0
<i>Peptostreptococcus</i>	16.7	0.0
<i>Porphyromonas</i>	33.4	8.3
<i>Prevotella</i>	50.0	16.7
<i>Pseudomonas</i>	0.0	8.3
<i>Rothia</i>	8.3	0.0
<i>Scardovia</i>	8.3	0.0
<i>Schaalia</i>	16.7	8.3
<i>Selenomonas</i>	25.0	16.7
<i>Streptococcus</i>	50.0	50.0
<i>Tannerella</i>	41.7	25.0
<i>Treponema</i>	50.0	16.7
<i>Veillonella</i>	33.4	33.3

Influence of electroerosion manufacturing process on the cyclic fatigue resistance of endodontic instruments

Anna Ciarlini¹, Federica Veneri¹, Chiara Pirani², Francesco Iacono², Francesco Cavani³, Giovanni Bolelli⁴, Eugenio Pedullà⁵, Luigi Generali¹

¹ Department of Surgery, Medicine, Dentistry and Morphological Sciences with Transplant Surgery, Oncology and Regenerative Medicine Relevance (CHIMOMO), University of Modena and Reggio Emilia, Modena, Italy

² Private practice, Bologna, Italy

³ Department of Biomedical, Metabolic and Neural Sciences, University of Modena and Reggio Emilia, Modena, Italy

⁴ Department of Engineering "Enzo Ferrari", University of Modena and Reggio Emilia, Modena, Italy

⁵ Department of General Surgery and Surgical-Medical Specialties, University of Catania, Catania, Italy

Objectives: Comparing the mechanical properties of the new HyFlex EDM (Coltene) [Group1] instruments, manufactured using electroerosion, with similar instruments available on the market, grouped by the same taper and tip diameter (30.04) but produced using traditional manufacturing processes: HyFlex CM (Coltene) [Group 2], Orodeka Plex-V (Orodeka Dental Co.) [Group 3], and ZenFlex (Kerr) [Group 4].

Materials and Methods: Dynamic cyclic fatigue tests at controlled temperature ($35^{\circ}\text{C} \pm 1^{\circ}\text{C}$) were conducted using a dedicated device (patent nr. 10202000008560) on 10 new samples of instruments from each group. Time-to-fracture (TtF) values were obtained, and the Number of Cycles to Fracture (NCF) was calculated based on the recommended Rpm values from the manufacturers. Fractographic analysis was performed using SEM-FEG (Nova NanoSEM 450) at 400x magnification on the fracture surfaces of each of the 40 samples subjected to cyclic fatigue testing. Morphological analysis using SEM-FEG was conducted on one new sample from each group, analysing surface differences microscopically at various magnifications (from 200x to 3,000x). Concurrently, EDX microanalysis was used to determine the surface chemical composition and contamination of the instruments. Measurements of cross-sectional areas were performed on different sections of the instruments from each group. One section at 1, 3, 4, and 8 mm from the tip, totalling 16 sections, was analysed using SEM-FEG at 400x magnification and subsequently measured with ImageG (Fiji) software. Raman spectroscopy was used to study the possible presence of oxides on the surface of one new instrument from each group. Statistical analysis of the TtF and NCF values was performed using the Shapiro-Wilk test and ANOVA.

Results and discussion: The data showed a significantly higher dynamic cyclic fatigue resistance of HyFlex OGSF instruments, with a statistical significance level of 95%. Observation of the separated instrument ends revealed a recurring fractographic pattern typical of cyclic fatigue fractures, although slightly different for the instruments in the first group, the only ones displaying a "rough-sparked" surface. High-magnification images of the surfaces of the different instruments confirmed the evident macroscopic differences between instruments manufactured using electroerosion [Group 1] and those produced by traditional turning [Group 2, Group 3, and Group 4]. Measurements from the cross-sectional areas of the 16 instrument sections provided data on perimeter, core, and flute, which were subsequently plotted and correlated. Spectroscopic analysis highlighted two distinct trends: one for groups 1 and 2, as they were covered with surface oxides from manufacturing, and another for groups 3 and 4, which lacked this coating.

Conclusions

This study highlighted a greater resistance of instruments produced through an innovative electro-erosion manufacturing process compared to their competitors made via traditional turning. These results are further supported by the characteristic microscopic features of both the external and fracture surface, which emphasize properties and characteristics that distinguish them from other instruments available on the market.

Avoiding the washout of bioceramic sealers in microsurgical endodontics using fibrin sealant: an in vitro study

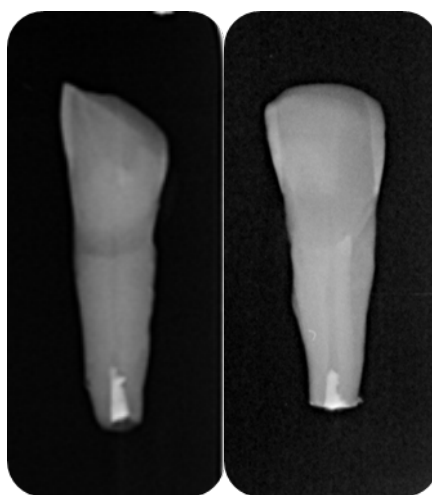
De Leonardis R.¹, Grande N.M.¹, Castagnola R.¹, Marigo L.^{1,2}.

¹ Dipartimento Testa- Collo ed Organi di Senso, Università cattolica del Sacro Cuore di Roma

² UOC di Clinica Odontoiatrica, Dipartimento di Neuroscienze, Organi di Senso e Torace, Fondazione Policlinico Universitario A. Gemelli IRCCS

AIM: As we demonstrated in our previous study, Well-Root PT®, a bioceramic sealer, was found to be significantly more susceptible to washout during the removal of hemostatic material from the bone crypt in microsurgical endodontics compared to SuperEBA®. This can compromise the retrograde seal and consequently reduce the success rate of the treatment. To prevent washout while maintaining the effectiveness of the bioactive properties of bioceramics, we aimed to protect the retrograde filling during the bone crypt rinse using Tisseel® fibrin glue, a biocompatible and resorbable material. The aim of this study is so to compare the washout susceptibility of retrograde fillings made with Well-Root PT® with and without the application of Tisseel® protection.

Materials and Methods: For this study 24 extracted single-rooted teeth were selected. All the samples were then radiographed and scanned with CBCT in order to include only those which presented homogeneous section, diameter, and root canal anatomy. We divided the samples into two groups: Group A (n=12), treated with retrograde filling made of Well-Root PT®; and Group B, treated with retrograde filling using Well-Root PT® protected by the application of Tisseel® fibrin sealant. After that, using CBCT, the most suitable site for microsurgical endodontic treatment was selected between 9 pig mandibles. The endodontic microsurgical procedure was then performed by replacing the pig teeth with human samples. After the microsurgical treatment and retrograde filling were completed, fibrin glue was applied with a brush only to the samples from Group B. Ferric sulfate was then removed from the surgical crypt using rotating instruments mounted on a surgical turbine under abundant irrigation for 10 seconds per sample. Washout was assessed two weeks later by measuring the linear distance between the deepest point of the filling material remained in the retrograde cavity and the apical resection surface on 3D scans of each sample.



Group A (on the left) and B (on the right) samples radiographed two weeks after crypt rinsing.

Results: In Group B, no washout of Well-Root PT® was observed, whereas in Group A, the samples exhibited significant washout of the bioceramic sealer used for retrograde filling. One-way ANOVA analysis showed a statistically significant difference in the means between the two groups.

P-value resulting from the Anova one-way test performed between the two groups.

Source	DF	Sum of Square	Mean Square	F Statistic	P-value
Groups (between groups)	1	50230264.5	50230264.5	11.1127	<u>0.002079</u>
Error (within groups)	34	153682356.5	4520069.31		
Total	35	203912621	5826074.886		

Discussion

Tisseel® fibrin glue effectively prevented washout of the bioceramic sealer. Unlike other non-resorbable materials, fibrin glue also ensures, upon resorption, the bioactive properties of Well-Root PT® on periapical tissues via the release of calcium ions. Its biocompatibility further supports the healing of periapical tissues.

Conclusions

The washout resistance exhibited by Well-Root PT® when protected by Tisseel® makes fibrin sealant a promising material for preventing washout, particularly given the potential to secure the bioactive properties of the bioceramics after sealant's resorption. Only small amounts of Tisseel® were required in our study, making its use economically sustainable.

Cyclic fatigue resistance of innovative double heat-treated endodontic instruments

Chiara Florini¹, Federica Veneri¹, Giovanni Bolelli², Francesco Cavani³, Luigi Generali¹

¹ Department of Surgery, Medicine, Dentistry and Morphological Sciences with Transplant Surgery, Oncology and Regenerative Medicine Relevance (CHIMOMO), University of Modena and Reggio Emilia, Modena, Italy

² Department of Engineering "Enzo Ferrari", University of Modena and Reggio Emilia, Modena, Italy

³ Department of Biomedical, Metabolic and Neural Sciences, University of Modena and Reggio Emilia, Modena, Italy

Objectives: This thesis explores the cyclic fatigue resistance of innovative endodontic instruments made from nickel-titanium (NiTi) alloys, with a particular focus on newly developed instruments subjected to dual thermal treatment, known as BlueShaper PRO. These files were examined and compared with commercially available instruments, BlueShaper and ProTaper Gold.

Materials and Methods: The instruments underwent dynamic cyclic fatigue testing at $35^{\circ}\text{C} \pm 1^{\circ}\text{C}$ to replicate intracanal conditions. Subsequently, fractographic analyses using a field emission scanning electron microscope (SEM-FEG), morphological analysis, and energy-dispersive X-ray spectroscopy (EDX) were conducted to study surface defects. Additionally, Raman spectroscopy was used to evaluate the chemical and physical properties of the alloy.

Results: The dynamic cyclic fatigue tests at $35^{\circ}\text{C} \pm 1^{\circ}\text{C}$ revealed that ProTaper Gold instruments exhibited significantly higher cyclic fatigue resistance compared to BlueShaper and BlueShaper PRO. SEM-FEG analysis showed that ProTaper Gold instruments had more homogeneous fracture surfaces with less propagation of microcracks. Raman spectroscopy confirmed that the NiTi alloy of ProTaper Gold displayed greater stability of martensitic phases and a higher ability to dissipate mechanical stress. BlueShaper and BlueShaper PRO instruments showed lower performance, with a higher incidence of microcracks in areas of maximum flexion. EDX analysis revealed that BlueShaper instruments contained nickel, titanium, carbon, and oxygen, with slight chemical differences influencing their mechanical properties and cyclic fatigue resistance. Conversely, ProTaper Gold instruments consisted exclusively of a nickel-titanium alloy without significant amounts of carbon and oxygen.

Discussion

The study results indicate that the thermal treatment applied to ProTaper Gold is a crucial factor in enhancing their mechanical properties. The combination of higher cyclic fatigue resistance and a more uniform metallurgical surface ensures greater safety during clinical use, especially in curved or complex canals. While BlueShaper and BlueShaper PRO instruments offer good performance, their cyclic fatigue resistance is lower than that of ProTaper Gold, highlighting a difference in the quality of the applied thermal treatment. These characteristics make ProTaper Gold more reliable instruments for minimizing fracture risk and managing complex treatments with greater predictability. However, the findings suggest that clinical performance depends not only on instrument quality but also on the appropriateness of the operative technique used and the anatomy of the treated canal.

Conclusions

ProTaper Gold instruments represent the benchmark for cyclic fatigue resistance among current endodontic instruments. While BlueShaper and BlueShaper PRO have demonstrated good characteristics, their cyclic fatigue behavior is inferior, suggesting that further metallurgical improvements may be necessary to reach the excellence levels of ProTaper Gold. These findings highlight the importance of selecting high-quality instruments to ensure effective and safe endodontic treatments.

Micro-CT and Finite Element analysis of dentin preservation and stress distribution in mesial roots of mandibular molars after shaping with different tapers

Giuliano C.¹, Guerrieri G., Dho F.¹, Alovise M.¹, Pasqualini D.¹

¹ Università degli Studi di Torino, dipartimento di scienze chirurgiche, dental school, Torino

Introduction: The aim of this study was to evaluate the dentin preservation and fracture resistance of mandibular molars mesial roots after shaping with different tapers using micro-computed tomography (micro-CT) and Finite Element analysis (FEA).

Materials and Methods: Forty-eight mandibular first molars with independent mesial canals were selected. The mesio-lingual and mesio-buccal canals were randomly assigned (n=12) to ProTaper Gold (PG), ProTaper Next (PTN), ProTaper Ultimate (PU) and B4U instrumentation systems. Pre- and post- shaping micro-CT scans were performed to compare root canal volume and cervical dentin volume. The centroid shift and the percentage and distribution of the dentin removal in correspondence of the mesial canals were analyzed in coronal, middle and apical points of analysis and below the furcation at the "danger zone". The residual dentin thickness in the distal and mesial aspects of the mesial canals was measured. A linear elastic model of a mesial root of a mandibular molar was created through Finite Element Method (FEM) and a 200N perpendicular load was applied on the root canal coronal third. One-way factorial ANOVA with Bonferroni correction and post-hoc Tukey-Kramer tests were used ($P < 0.05$).

Results: The mean cervical dentin volume removal resulted statistically lower for the B4U compared with PG system ($P < 0.05$). The canal centering ability resulted statistically more accentuated for the B4U group in the coronal and middle third, whilst higher centroid shift variations occurred for PG system ($P < 0.05$). The residual dentin thickness appeared statistically higher after shaping with B4U through the mesial and distal root aspect at the coronal point of analysis and at the danger zone ($P < 0.05$). PG removed more dentin in the coronal root canal third ($P < 0.05$). The FEM analysis showed no statistically significant differences between groups ($P > 0.05$).
Discussion and Conclusions: The reduction of the root canal taper may improve the instruments' centering ability and the preservation of the residual dentin tissue, especially in the coronal and middle third. The root canal taper seems not to influence the stress distribution pattern through the mesial root of the lower molars.

In vitro evaluation of the accuracy of two electronic apex locators in the presence of orthodontic brackets

Piera Mastrogiuseppe¹, Edoardo Staderini^{1,2}, Raffaella Castagnola¹, Nicola Maria Grande¹, Luca Marigo^{1,2}

¹ Dipartimento Universitario Testa Collo ed Organi di Senso, Università Cattolica del Sacro Cuore, 00168 Rome, Italy

² UOC di Clinica Odontoiatrica, Dipartimento di Neuroscienze, Organi di Senso e Torace, Fondazione Policlinico Universitario A. Gemelli, IRCCS, 00168 Rome, Italy

AIM: The aim is to evaluate the accuracy of two electronic apex locators (EALs), the Tri Auto ZX2+ (J. Morita, Tokyo, Japan) and the X-Smart Pro+ (Dentsply Sirona, Charlotte, USA) in determining the working length (WL) of root canals in the presence or absence of orthodontic brackets and sodium hypochlorite irrigation.

Materials and Methods: 30 extracted single-rooted teeth were used and divided into four groups: without brackets and without irrigation; without brackets but irrigated with 5.25% sodium hypochlorite; with brackets but without irrigation; with brackets and irrigated with 5.25% sodium hypochlorite. The teeth were embedded in agar up to the cemento-enamel junction to simulate oral conditions according to the protocol of Kaufman AY et al.. A K-file #10 was used to measure WL with both EALs. Each measurement was performed three times and the mean was calculated. The Actual Working Length (AWL) was determined using a digital caliper and a K-file #10 at stereomicroscope 30x. Then, the WL was calculated by using the formula according to Plotino et al. protocol: $WL = \Delta(DWL \text{ mean} - AWL \text{ mean})$.

Results: Student's t-test found no statistically significant differences in the accuracy of WL measurements between the two EALs in most conditions ($p > 0.05$). However in the presence of both brackets and irrigation a statistically significant difference ($p = 0.014$) was observed.

Considering the average differences with respect to the AWL between the two devices, the one that deviates the most is the X-Smart Pro+, which detects lengths shorter than the apex.

Discussion

The study assessed the accuracy of two electronic apex locators (EALs) in measuring working lengths (WL) in the presence of metal brackets, finding no significant differences in measurements with the exception of the group with 5.25% sodium hypochlorite irrigation. The results obtained are therefore in disagreement with what was shown in the pilot study by Şen ÖG et al., although a fixed distance of 1 cm was maintained between lip clip and metal bracket. In addition, the LDL measured with the X-Smart Pro+ was found to be slightly longer in the presence of sodium hypochlorite and brackets than the actual working length. While EALs are commonly used, their accuracy can be affected by factors like metallic restorations and canal irrigants. Further research is needed to explore these influences.

Conclusions

Modern electronic apex locators are generally reliable for the determination of WL. However, the combination of metal brackets and irrigants may affect the accuracy of some locators. Patients undergoing fixed orthodontic therapy have an increased risk of developing caries and we recommend, if root canal therapy is necessary in the presence of brackets, proper drying of root canals and combined EAL and radiographs to ensure accuracy in clinical practice.

Direct pulp capping versus pulpotomy with a light-cured, resin-modified calcium silicate in permanent molars with extremely deep caries: a pilot case series study

Davide Mondin¹, Virginia Romeo², Eugenio Pedullà³, Daniele Angerame¹

¹ Dipartimento di Scienze Mediche, Chirurgiche e della Salute, Università di Trieste, Trieste, Italia

² Dipartimento di Scienze Mediche, Chirurgiche e della Salute, Università di Trieste, SCU Odontostomatologia Pediatrica, IRCCS Materno Infantile Burlo Garofolo, Trieste, Italy

³ Dipartimento di Chirurgia Generale e Specialità Medico Chirurgiche, Università di Catania, Catania, Italia

Objectives: The objective of this exploratory clinical study was to compare the outcomes of direct pulp capping and pulpotomy using two formulations of the bioceramic material TheraCal on molars affected by penetrating caries, in order to preserve pulp vitality and adopt minimally invasive therapeutic approaches.

Materials and Methods: Twenty-five patients affected by penetrating caries were selected; 18 completed the study, divided into two groups: 7 treated with pulpotomy (arm 1) and 11 with direct pulp capping (arm 2). The choice of treatment was dependent on the extent of pulp exposure, bleeding, and symptoms and was assessed intraoperatively. The procedures included local anesthesia, rubber dam isolation, and caries removal. In cases of punctate pulp exposure (≤ 1 mm) and controllable bleeding if direct pulp capping with TheraCal LC is performed, in cases of greater exposure or persistent bleeding pulpotomy with TheraCal PT. The clinical and radiographic success rate was assessed by cold vitality tests, axial percussion and periapical radiographs at one week, one month and three months. In addition, the change in post-operative pain was monitored by means of the Numerical Rating Scale (NRS). To verify whether there was a significant relationship between the membership of the two groups and the presence of pulpitis or necrosis, the chi-square test was performed. To compare the pain between the two study groups, the T test for paired data was used. In addition, the odds ratio (OR) was calculated to estimate the association between the group membership and the presence of pulpitis or necrosis. Values of $p < 0.05$ were considered significant.

Results: The success rate at month 3 was 57.1% for pulpotomy and 81.8% for direct pulp capping. In the pulpotomy group, pulpitis was found in two cases, at one week and one month, and necrosis in a third case at three months, while in the pulpotomy group two patients developed pulpitis after three months. In the pulpotomy group, a statistically significant pain record ($p=0.017$) was recorded between pre- and post-op. No significant relationship was found between group membership and the presence of pulpitis ($p=0.506$) and necrosis ($p=0.389$). Pain reduction was greater in group 1 ($p<0.05$).

Table 2 - Success rate at the recalls

	Pulpotomy (arm 1)		Direct pulp capping (arm 2)		Total	
	n	%	n	%	n	%
one week	6	85,71%	11	100,00%	17	94,44%
one month	5	71,43%	11	100,00%	16	88,89%
three months	4	57,14%	9	81,82%	13	72,22%

Discussion

The results highlight a possible role of TheraCal as a bioceramic material for vital pulp therapy, markedly for direct pulp capping. TheraCal stands out for its ease of handling, but the presence of the resin matrix may limit its effectiveness. In cases treated with pulpotomy, penetrating caries lesions were in a more advanced state and preoperative symptoms were more pronounced; this explains the greater reduction in pain observed. However, possible contraction of the material and lack of sealing may explain the inflammatory or necrotic evolution. The greater number of successes in pulp capping cases suggests less pulpal compromise, in addition to the fact that this procedure is less invasive than pulpotomy.

Conclusions

Although the data show greater success of direct pulp capping compared to pulpotomy, they are not sufficient to draw definitive conclusions. Further studies with larger sample sizes and prolonged follow-ups are needed to validate the efficacy and predominant indications of TheraCal in vital pulp therapy.



Figure 1. Clinical process of direct pulp capping with TheraCal LC



Figure 2.. Clinical process of pulpotomy with TheraCal PT

Hemostatic effect of surgical glue in microsurgical endodontics: a randomized clinical trial

S. Oricco¹, M. Alovizi¹, D. Pasqualini¹, E. Berutti¹

¹Dental School Lingotto, Dipartimento di Scienze Chirurgiche, Università degli Studi di Torino Reparto Conservativa ed Endodonzia

Objective: To investigate the clinical and biological efficacy of two hemostatic materials used in endodontic microsurgery: 15.5% ferric sulfate and a surgical glue based on n-hexyl-cyanoacrylate (IlaBond, Dipromed, Italy). The research project is divided into two studies:

In vivo: to evaluate the influence of surgical hemostatic glue (n-hexyl-cyanoacrylate) on intraoperative bleeding and the quality of life of patients undergoing surgical microendodontics compared to traditional hemostatic solutions.

In vitro: to assess the cytotoxicity of ferric sulfate and surgical glue on human osteosarcoma cell lines (MG63).

Materials and Methods: *Randomized Clinical Study:* patients diagnosed with apical periodontitis in endodontically treated teeth, where orthograde endodontic treatment was not feasible, were included. Patients were randomly assigned to two groups: 1) surgical glue (test) and 2) ferric sulfate (control). Bleeding level and surgical field visibility were evaluated before (T0) and after (T1) applying the hemostatic agent. Patients' quality of life was assessed using a pain perception questionnaire. Additionally, lesion size, presence or absence of cortical bone were evaluated using periapical radiographs and CBCT.

In Vitro Study: Human osteosarcoma MG63 cells were cultured in a nutrient solution under standard conditions and seeded at 30% for 24 hours in wells.

Sample Preparation:

1. The surgical glue was applied to Whatman filter paper, allowed to polymerize, and incubated in a humidified environment at 37°C for 30 minutes.
2. The surgical glue was polymerized with blood, forming crystals, which were then placed in 1 mL of culture medium (BHA, Becton Dickinson, BD) for 10 minutes. The mixture was centrifuged, and the supernatant containing polymerization products was collected.
3. A 15.5% ferric sulfate solution in 1 μ L or 2 μ L quantities was added to the wells, and after 15 minutes, the supernatant was removed and replaced with fresh culture medium.

Results: *Randomized Clinical Study:* Baseline lesion characteristics showed a higher prevalence of larger defects in the surgical glue group ($P < 0.05$). Both products were equally effective in controlling intraoperative bleeding ($P > 0.05$). There were no significant differences in bleeding resumption after material removal ($P > 0.05$). However, surgical glue was associated with a higher incidence of postoperative swelling and analgesic use compared to ferric sulfate ($P < 0.05$), while all other parameters were comparable.

In Vitro Study: Surgical glue released formaldehyde and exhibited cytotoxicity proportional to the amount of glue used and exposure time. However, removing the toxic stimulus allowed the remaining cells to resume proliferation. Conversely, the 15.5% ferric sulfate solution coagulated proteins within seconds, eliminating the possibility of cytotoxicity in the tested cells.

Discussion

Surgical glue appears to be more suitable for large lesions. In such cases, its application helps maintain good visibility of the surgical field. However, it is important to note the need for its removal before suturing, as it does not demonstrate high biocompatibility over time. Nevertheless, a larger sample size is required to confirm the preliminary findings obtained.

Conclusions

Surgical glue is suitable for large lesions where it enhances surgical field visibility. However, it must be removed before suturing, as prolonged exposure causes cytotoxicity. Additional patient data are needed to confirm these findings.

The bactericidal effect of different solutions during regenerative endodontic procedures

Nicolò Pancini¹, Narcisa Mandras¹, Janira Roana¹, Damiano Pasqualini¹, Vittorio Fenoglio¹, Lia Giordano¹, Nicola Scotti¹, Mario Alovisi¹.

¹Università degli Studi di Torino, dipartimento di scienze chirurgiche, dental school, Torino.

Aim of the study:

1. To compare the bactericidal efficacy of calcium hydroxide (CaOH₂) and triple antibiotic paste (TAP) for regenerative endodontic procedures (REPs).
2. To evaluate the possible increase of bacterial amount during time after the inoculation of the blood clot inside the root canal.

Materials and Methods

Specimen Preparation: Eighteen noncarious human teeth were selected and stored in 1% sodium hypochlorite buffer. A root segment with a length of about 7 to 8 mm was prepared. Each root canal was enlarged to a size of a Largo bur Ø1,50mm under 17% EDTA irrigation. The specimens were sterilized by autoclave for 20 minutes at 121°C. Then, sterility was checked by incubating of each specimen in 5 mL of brain heart infusion (BHI) broth at 37°C for 24 hours. One specimen it has been used as negative control.

Dentin Infection with *E. faecalis*: To create the bacterial inoculum, isolated colonies (24 hours) of pures cultures of *E. faecalis* grown aerobically on BHI agar plates were suspended in 3.0 mL BHI for 14 days. After the incubation period, the root canals of dentin blocks were divided into three groups corresponding to the test groups, 1. Calcium hydroxide, 2. Tri-antibiotic paste, and 3. positive and negative controls. Superficial longitudinal grooves were made in the buccal and lingual surface to facilitate the fracture of the specimens.

The determination of bacterial viability: The samples were treated with Saline, Calcium hydroxide, and 3MIXC for 1 week and then stained with BacLite Dead-Live (PI + SYTO9 – Sigma). Afterwards, three root canals were irrigated with EDTA 17% and saline and the roots were fractured before CLSM evaluation. The other samples were stored in blood for seven days in order to maintain a blood clot before cleaning with saline irrigation and analyzing with CLSM.

CLSM Analysis: The dentin segments were examined on an inverted Leica TCS-SPE confocal microscope (Leica Microsystems GmbH, Mannheim, Germany). The mounted specimens were observed using a 40X oil lens and a 63X oil lens with an additional zoom of 3X. The images were acquired using the Leica Application Suite-Advanced Fluorescence software (LAS AF, Leica Microsystems GmbH).

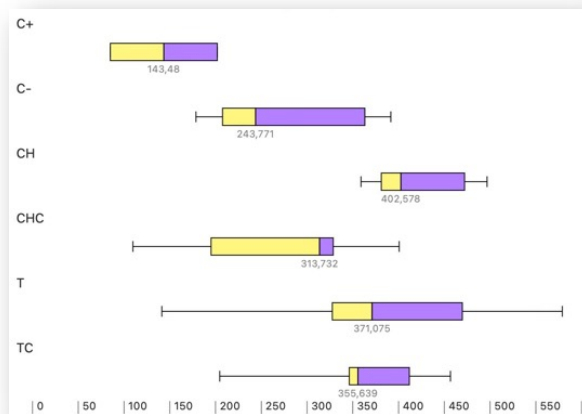
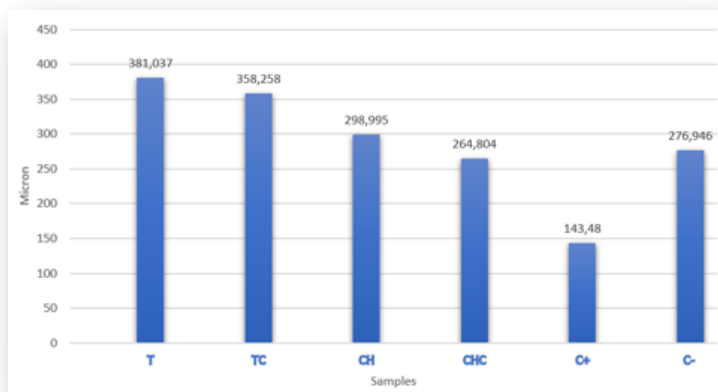
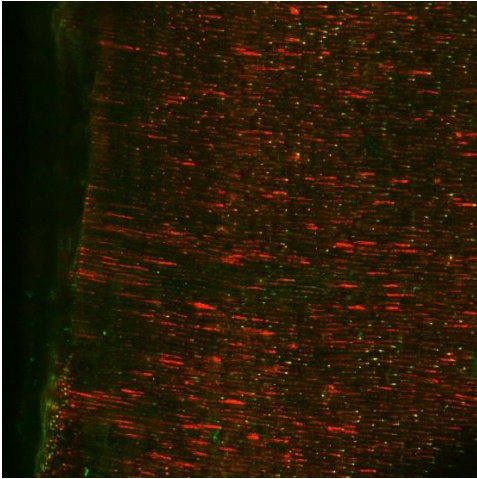
Results: Tri-antibiotic paste has more disinfection and penetration power even with the presence of a blood clot inside the root, compared to calcium hydroxide and saline solution.

Discussion

The infected root canal system can be disinfected but not sterilized, but the tri-antibiotic paste is the best substance to obtain the highest disinfectant level.

Conclusions

The regenerative endodontic procedure (REP) does not involve any filling of the canal, but the blood clot is necessary as a scaffold inside the canal. The presence of the blood clot without continuous blood circulation could serve as a culture for bacteria over time, leading to the failure of regenerative endodontic procedures.



Manual VS mechanical canal scouting

Ex - vivo study

Yoanna Bogomilova Pilyakova¹, Mario Alovise¹, Gianmarco Baima¹, Dr. Vittorio Fenoglio¹, Damiano Pasqualini¹

¹ Università degli Studi di Torino, dipartimento di scienze chirurgiche, dental school, Torino

AIM: The experimental study aimed to compare traditional manual canal scouting with the innovative mechanical canal scouting to evaluate the effectiveness, advantages, disadvantages and possible clinical application of the latter.

Materials and Methods: The work was performed on 36 elements (premolars and molars). Each canal represented a single sample for a total of 100 samples equally divided randomly between 3 experimental groups, of which **control group 1** was treated with **manual scouting** (#08 #10 (phase 1), #12 #15 (phase 2)), **group 2** with **Path Files 1** (phase 1) and **2** (phase 2) and group 3 with the **STARTER B4U**. For mechanical scouting, the Morita ZX2+ endodontic motor (OGP2 program) was used. The dental elements were x- rayed and the individual variables were analyzed (Figure 2a). During the canal scouting of each canal, the different outcomes divided by category were evaluated (Figure 2b). All the data were collected in a database where each sample was inserted in a row and the individual variables in a column, also distinguishing the individual phases described. Each qualitative variable was assigned an identifying numerical value (0=no; 1=yes).



OPERATOR	SAMPLE (N)	GROUP 1/2/3	TOOTH TYPE UFP, USP, UFM, USM, LFP, LSP, LFM, LSM	TYPE OF CANAL (P, DB, MB1, MB2, D, ML, MV)	CONFLUENCE	WL (mm)	AAE difficulty score RADIOGRAPHIC APPEARANCE OF CANAL	AAE difficulty score CANAL ROOT MORPHOLOGY - curvature	CURVATURE 5 TYPES (straight, continuous, coronal third, medium third, apical third)
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Primary outcomes				Secondary outcomes								2 a
Reachability FWL (Phase 1) YES/NO	Necessity of preflaring (Phase 1) YES/NO	Reachability FWL (Phase 2) YES/NO	Necessity of preflaring (Phase 2) YES/NO	Damage of the instrument (fracture, unwinding) YES/NO	Blockage with manual recovery YES/NO	Ledge with manual recovery YES/NO	EXTRUSION YES/NO	FWL (s) (Phase 1)	FWL (s) (Phase 2)	MOTIONS to reach FWL (Phase 1)	MOTIONS to reach FWL (Phase 2)	

2 b

Figure 2. Descriptive statistical analyzes were conducted using R software (version 4.2.1). The stats and ggplot2 packages were used and the statistical significance threshold was set at $p=0.05$. A preliminary test was performed to verify the homogeneity of the proportions of the categorical variables (Chi-square). For the outcome Pecking motions, data were analyzed using the non-parametric Mann-Whitney U test.

Results: The results highlight that the variables **AAE canal root morphology** and **Curvature** (in particular the apical one and in the middle third) **emerge as key prognostic factors, showing significant differences**. As regards the need for preflaring, the **B4U starter** was the one that needed it least in both the apical and middle thirds. As regards the morphological AAE (curvature > 30°/S - shaped), the **B4U starter** was particularly effective in reaching the full working length and with less need for preflaring. The **AAE canal root morphology** was then significant for *instrument damage, blockages and ledges*, while **Curvature** influenced *blockage with manual recovery*.

Discussion

Manual canal scouting is influenced by several factors such as operator experience and apical anatomy and can lead to instrument complications and iatrogenic damage (Mounce et al., 2006; Min et al., 2016). The literature lacks studies dedicated to this operative phase and understanding what the future prospects could be for improving it and making it simpler even for an inexperienced hand is fundamental.

Conclusions

The following study shows that mechanical canal scouting is a clinical reality. In particular, mechanical scouting helps more in canal curvatures in the middle third. As regards apical curvatures, manual scouting is still decisive, but the B4U starter achieves the same performance.

At baseline, the techniques analyzed were used equally between the groups, without significant imbalances in the difficulty of the cases, therefore the comparisons on outcomes can be considered valid.



Psychological assessment of patients with Apical Periodontitis and Caries: a case-control study

Ashkan Tavakkoli¹, Carlo Gaeta¹, Pietro Carmellini, Alessandro Cuomo², Andrea Fagiolini², Simone Grandini¹, Giulia Malvicini¹, Crystal Marruganti¹

¹ Unit of Endodontics and Restorative Dentistry, Department of Medical Biotechnologies, University of Siena, Siena, Italy

² Department of Molecular and Developmental Medicine, Division of Psychiatry, University of Siena School of Medicine, Siena, Italy

Objective: To evaluate the association between mental health and apical periodontitis (AP).

Background: A periapical lesion is a consequence of chronic inflammatory processes, itself triggered by a bacterial infection of the pulpal and endodontic microenvironment. Evidence suggests that chronic infection could alter inflammatory cytokines leading to behavioral changes. These effects in the context of anxiety, depressive, and eating behaviors has not been fully investigated.

Materials and Methods: 120 individuals were included in the current study. sixty subjects were assigned to case (AP+) and 60 to control group (AP-). The periapical status was assessed through radiographic images (OPT, periapical radiographs) and dental examination; the DMFT index (decayed, missing, and filled teeth) and the periapical index (PAI) were reported in the questionnaire. All subjects were interviewed to compile medical history data, anxiety (Hamilton A), depression (Hamilton D), and eating disorder (Eat-26) questionnaires. Inferential and regression analyses were performed.

Results: Significant associations were observed between AP and higher scores on HAM-A, HAM-D, and EAT-26. The regression model showed that higher PAI scores were significantly associated with increased odds of anxiety, depression, and disordered eating. A PAI score of 3 showed increased odds of anxiety (OR = 5.57, $p = .004$) and depression (OR = 3.65, $p = .025$). A PAI score of 4 showed even greater odds for anxiety (OR = 8.68, $p = .001$), depression (OR = 14.07, $p = .001$), and disordered eating (OR = 3.98, $p = .032$). Participants with more than one periapical lesion were 3.56 times more likely to report higher levels of anxiety ($p = .007$), 3.59 times more likely to experience elevated depression ($p = .018$), and 3.08 times more likely to exhibit disordered eating behaviors ($p = .028$). Additionally, higher DMFT scores were associated with an increased likelihood of higher HAM-A scores (OR = 1.18, $p = .001$).

Conclusions

The study results show a statistically significant higher prevalence of mood disorders and mental health-related conditions including anxiety, depression, and eating disorders in patients with AP in the observed population. Further studies are necessary to understand better the nature of relationship between mental health and periapical lesions.

Impact of Apical Gauge in Disinfection of the Root Canal System: a systematic review

Ana Moura Teles^{1,2}, José Rodrigues¹, Miguel Cardoso^{1,2}, Rita Noites^{1,2}

¹ Universidade Católica Portuguesa, Faculty of Dental Medicine, Viseu, Portugal

² Universidade Católica Portuguesa, Center for Interdisciplinary Research in Health (CIIS), Viseu, Portugal

Non-surgical Endodontic Treatment encompasses a synergistic integration of mechanical instrumentation and chemical irrigation, within the root canal system, culminating in tridimensional filling. The primary goal is to preserve or restore the health of the periradicular tissues. In clinical practice, the final gauge of root canal shaping is influenced by factors such as root volume, presence of curvatures, type of instruments utilized, and the selection and activation of irrigants, among others.

A larger apical gauge is generally associated with improved disinfection outcomes, as it allows for better access and irrigation of the canal system, thus facilitating the removal of root walls debris and microbial load. However, the optimal apical gauge may vary depending on the specific anatomical complexities of the root canal system and the instrumentation techniques employed.

Objective: This systematic review aims to evaluate the impact of achieving specific apical gauges during the shaping phase of non-surgical endodontic treatment on the disinfection efficacy of the root canal system.

Materials and Methods: A comprehensive literature search was conducted in the ® databases related to apical preparation calibers. The selection of studies was performed

A comprehensive literature search was conducted across PubMed® and Web of Science databases, using specific keywords, to identify studies published up to July 2024 that examined the relationship between apical gauge achievement and disinfection levels during endodontic procedures. Inclusion criteria encompassed both *in vitro* and clinical studies focusing on various shaping techniques and their subsequent effects on microbial reduction within the root canal system. Data were extracted by two independent researchers (J.R. and R.N.) according to predefined inclusion and exclusion and analysed to assess the correlation between apical gauge size and the degree of disinfection achieved.

Results: After thorough analysis, a total of 13 articles met the criteria for inclusion in this review. It was determined, depending on the instrumentation techniques employed, that the final apical gauge should correspond to a file that maximizes contact area within the canal, while respecting the anatomical configuration and minimizing the risk of iatrogenic complications. To enhance the safety and efficacy of nickel-titanium files in the apical region, pre-widening of the middle and cervical thirds is recommended. This approach facilitates the effective delivery of auxiliary chemical agents aimed at eradicating microorganisms, which should be activated to optimize disinfection outcomes.

Keywords: Endodontics, Non-surgical treatment, Apical gauge, Disinfection, Root canal system.

Conclusions

Further research is warranted to ascertain the optimal apical gauge; however, this systematic review suggests that excessively large preparations are unnecessary to achieving effective disinfection. Through the proper activation of irrigants and a judicious combination of chemical agents, efficient canal disinfection can be achieved without significantly compromising tooth structure.

Clinical significance

The apical gauge achieved during shaping of the root canal system plays a substantial role in the level of disinfection achieved with non-surgical endodontic treatment. Clinicians are encouraged to consider the implications of apical gauge size in their treatment planning to enhance the success rates of endodontic procedures. Further research is warranted to establish definitive guidelines regarding optimal apical gauge settings tailored to individual cases.

Degree of contamination of Gutta-Percha points and efficacy of a chairside disinfection protocol

Antea Tramontana¹, Cristina Pina^{1,2,3}, Duarte Guimarães¹, Inês Lopes Cardoso^{1,2,3}, Ana Moura Teles^{4,5}

¹ FCS-UFP, Universidade Fernando Pessoa, Faculdade de Ciências da Saúde, 4200-150 Porto, Portugal

² FP-I3ID, Instituto de Investigação, Inovação e Desenvolvimento, FP-BHS, Universidade Fernando Pessoa, Biomedical and Health Sciences, 4249-004 Porto, Portugal

³ CINTESIS.UFP@RISE, Centro de Investigação em Tecnologias e Serviços de Saúde, Rede de Investigação em Saúde, Universidade Fernando Pessoa, 4200-450 Porto, Portugal

⁴ Universidade Católica Portuguesa, Faculty of Dental Medicine, Viseu, Portugal

⁵ Universidade Católica Portuguesa, Center for Interdisciplinary Research in Health (CIIS), Viseu, Portugal

Objective: Methicillin-resistant *Staphylococcus aureus* (MRSA) is a significant pathogen that poses serious risks to human health, including within the field of Dentistry. The prevention of cross-infection is a key concern across all medical disciplines. Among various materials available for root canal filling, Gutta-Percha (GP) remains the gold standard due to its widespread acceptance. This study aimed to evaluate the in vitro microbial contamination of GP points used in endodontic procedures, specifically focusing on MRSA and Methicillin-sensitive *Staphylococcus aureus* (MSSA), employing both classical microbiological and molecular biological techniques. Additionally, the efficacy of a chairside disinfection protocol was tested.

Materials and Methods: For this study, GP boxes from two different manufacturers were utilized over a minimum period of four weeks, with each box used for an average of eight appointments weekly, stored under conditions compliant with the manufacturer's recommendations. Each GP point was placed in a sterile test tube with 5 mL of Brain Heart Infusion (BHI) medium and appropriately labelled based on ISO gauge standards. Samples were categorized as "A" or "B" according to the commercial box, with accessory points designated as "1" or "2", identified further by gauges "A", "B", "C" and "D" (Figure 1).

A daily sampling process involved collecting four GP points of varying gauges from both commercial packages, resulting in a total of 32 GP points per day. For accessory points, a similar approach yielded 16 additional GP points daily. Each collected GP point was incubated at 37 °C for 72 hours in Brain Heart Infusion (BHI) medium, after which turbidity was assessed as an indicator of microbial growth. Test tubes showing growth underwent subculturing onto selective chromogenic media (chromID® MRSA and chromID® *S. aureus*), with blue colonies indicating MRSA and beige colonies indicating MSSA. Additional tests including Gram staining, catalase, and coagulase were performed as per established protocols. A chairside disinfection protocol (CDP), utilizing 3 mL of 3% sodium hypochlorite (NaOCl) solution for 60 seconds followed by rinsing with sterile distilled water was applied to GP points contaminated. After, the GP point was dried with a sterile gauze and placed in a new sterile tube with 5mL of BHI medium. Incubation at 37°C for 72 hours, when reassessment to assess if the CDP was effective was done.

Results: Out of the 315 GP points collected, only 6 (1.9%) (Figure 2) showed positive microbial growth. PCR confirmation revealed that 1 of the 6 points was contaminated with MRSA, while the remaining 5 were identified as MSSA. The CDP proved effective in eliminating contamination from all affected GP points (Figure 3).

Discussion

The results indicate that GP points from opened, pre-sterilized packages exhibit a low incidence of MRSA/MSSA contamination.

Conclusion

The identification of both MSSA and MRSA strains raises concerns regarding potential contamination in dental clinical environments, highlighting the need for ongoing vigilance in infection control practices.



Figure 1. Commercial boxes from two different manufacturers were used during a minimum period of four weeks, with each box used for an average of eight appointments weekly. Each GP point was collected with sterile forceps.

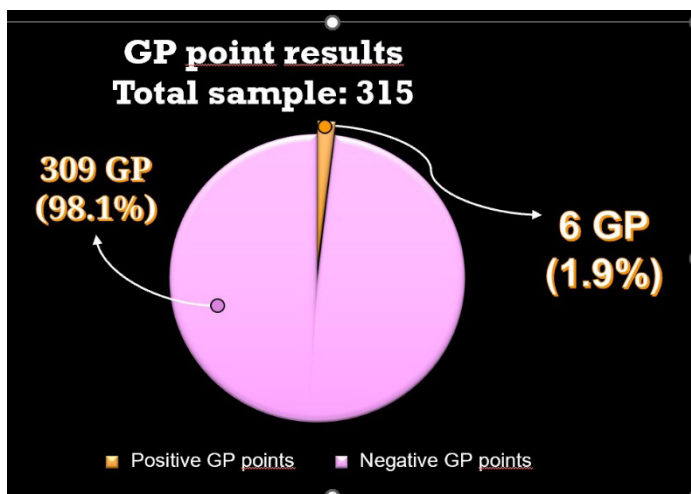


Figure 2. Results of contamination of GP points.

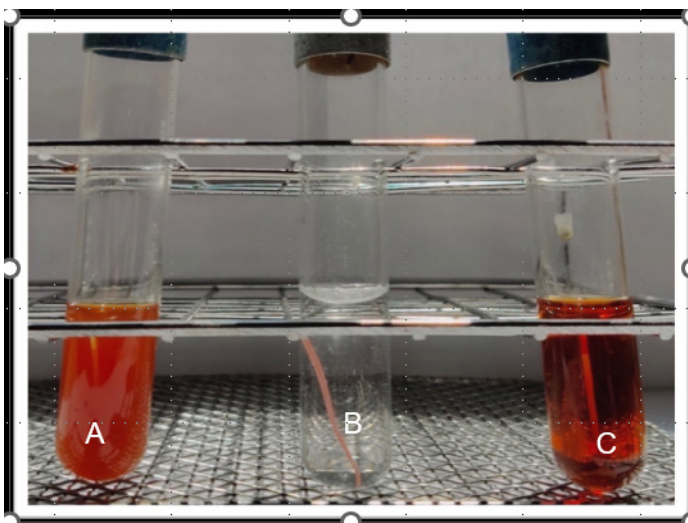


Figure 3. Efficacy of the tested chairside disinfection protocol.

Sealing ability of materials applied to resected root surfaces: a micro-CT evaluation

Manuela Vitaliti¹, Francesca Gattesco³, Eugenio Pedullà², Daniele Angerame³

¹ Department of General Surgery and Medical Surgical Specialties, University of Catania, Catania, Italy.

² Department of General Surgery and Medical Surgical Specialties, University of Catania, Catania, Italy.

³ Clinical Department of Medical Science, Surgery and Health, University of Trieste, Trieste, Italy

Aim: This study aims to evaluate, through micro-computed tomography (microCT), the sealing ability of Adhese (Au), One-Fil Putty (OF), and Geristore (Ge) applied to the surface of the root apex following apical resection.

Materials and Methods: A total of 40 permanent teeth were prepared and filled using the single cone technique (SCT) with the bioceramic sealer One-Fil. After a 3-mm resection of the apex, the samples were divided into five groups. The positive control group (PCG) underwent retrograde filling with mineral trioxide aggregate (MTA), while no additional procedures were performed in the negative control group (NCG) following apical resection. In the remaining three groups (Au, OF, and Ge), a layer of surface sealing material (SSM) was applied to the resected apex.

The samples were immersed in a 50% silver nitrate solution for 24 hours and scanned with microCT at: t0, after orthograde canal obturation; t1: after apical resection; t2: after silver nitrate infiltration.

The volume of voids (VoV) and the volume of silver nitrate infiltration were calculated across the entire endodontic space, as well as the 3-mm and 1-mm apical segments, using Amira software.

Data were statistically analyzed using non-parametric tests with $p < .05$.

Results: Statistically significant differences were found between the groups for total VoV at t1 and silver nitrate infiltration at t2 compared to the PCG ($p < .05$). The SCT technique and apical resection without retrograde filling showed significantly better results in reducing VoV. Among the SSM groups, significantly lower nitrate infiltration values were observed. Moreover, regarding nitrate infiltration into the SSM layer, the Au group demonstrated greater resistance compared to the OF and Ge groups.

Discussion

At t0, no significant differences were observed between the groups, confirming initial homogeneity. However, at t1, the PCG group showed a higher number of voids and significantly greater nitrate infiltration than the other groups, likely due to the complex handling and poor cohesion of MTA. Retrograde preparation with MTA is operator-dependent and can lead to the formation of VoV between the material and endodontic walls.

Among the SSM groups, the OF group showed the highest infiltration levels, likely due to its lower adhesive capacity. Although Adhese and Geristore exhibited comparable performance, Adhese emerged as the preferred option due to its superior handling, photopolymerizable layer, and low infiltration rates. However, it has limitations in terms of radiopacity and dose-dependent biocompatibility.

Conversely, Geristore and One-Fil Putty exhibit good biocompatibility, radiopacity, and ease of application but are less manageable compared to Adhese.

Conclusion

The findings suggest that apical resection without retrograde preparation and filling could represent a viable and less complex option, with lower rates of voids and infiltration compared to the retrograde technique. Among the tested materials, Adhese Universal proved to be the most promising, combining effectiveness and ease of application. Further studies are needed to investigate the properties of other materials and confirm these findings.

Table 1. Calculation of void volumes (VoV) in the entire endodontic space, as well as in the 3-mm and 1-mm apical segments

<u>All</u>	<u>Total VoV at t0</u>	<u>Total VoV at t1</u>	<u>SSM Voids (mm³)</u>
Au	0,029 ^a ± 0,052	0,027 ^a ± 0,057	0,006 ^a ±0,015
OF	0,035 ^a ± 0,052	0,029 ^a ± 0,046	0,128 ^b ±0,355
Ge	0,096 ^a ± 0,102	0,081 ^b ± 0,085	0,028 ^b ±0,034
PCG	0,035 ^a ± 0,059	0,283 ^c ± 0,212	
NCG	0,041 ^a ± 0,058	0,025 ^a ± 0,027	
<u>Apical1</u>			
Au	0,0005 ^a ± 0,0013	0 ^a ± 0	
OF	0,0002 ^a ± 0,0004	0 ^a ± 0	
Ge	0,0031 ^a ± 0,0063	0 ^a ± 0	
PCG	0,0018 ^a ± 0,0026	0,147 ^b ± 0,157	
NGG	0.0001 ^a ± 0,0002	0 ^a ± 0	
<u>Apical3</u>			
Au	0,001 ^a ± 0,0019	0 ^a ± 0	
OF	0,0002 ^a ± 0,0005	0 ^a ± 0	
Ge	0,0031 ^a ± 0,0061	0 ^a ± 0	
PCG	0,0018 ^a ± 0,0025	0,345 ^b ± 0,204	
NCG	0,0036 ^a ± 0,0079	0,001 ^a ± 0,002	

The calculation was performed for each group (Au: Adhese; OF: One-Fil; Ge: Geristore; PCG: Positive Control Group; NCG: Negative Control Group) and for each segment (all: the entire canal; apical1: the last apical millimeter; apical3: the last 3 apical millimeters). The values refer, from right to left, to the mean volumes (mm³) with their respective standard deviation (SD) at t0 and t1; and to the mean volumes (mm³) of voids within the SSM. Same superscript letters indicate no statistically significant differences between the groups for the same outcome ($p > .05$).

Table 2. Nitrate infiltration at t2

<u>Nitrate infiltration (mm³)</u>					
	<u>Au</u>	<u>OF</u>	<u>Ge</u>	<u>PCG</u>	<u>NCG</u>
<u>Sealer</u>	0,008 ^a ± 0,015	0,128 ^{cd} ± 0,142	0,022 ^a ± 0,039	0,686 ^{bc} ± 1,354	0,030 ^{ad} ± 0,036
<u>MTA</u>				0,787 ± 1,402	
<u>SSM</u>	0,033 ^a ± 0,030	0,331 ^b ± 0,289	0,020 ^a ± 0,017		
<u>Apico-coronal distance (mm)</u>					
<u>Sealer</u>	0,115 ^a ±0,222	2,034 ^{cd} ±2,085	0,652 ^a ±1,216	0,829 ^{bc} ±1,10	0,555 ^{ad} ±0,36
<u>MTA</u>				2,120±1,192	
<u>SSM</u>	0,215 ^a ±0,138	0,767 ^b ±0,324	0,301 ^a ±0,177		

The analysis refers to the volume of nitrate infiltration (mm³) and the apico-coronal distance (mm) of nitrate penetration within the cement for each group (Au: Adhese; OF: One-Fil; Ge: Geristore; PCG: Positive Control Group; NCG: Negative Control Group); within the MTA for the PCG group; and within the SSM for the Au, OF, and Ge groups. Same superscript letters indicate no statistically significant differences between the groups for the same material ($p > .05$).

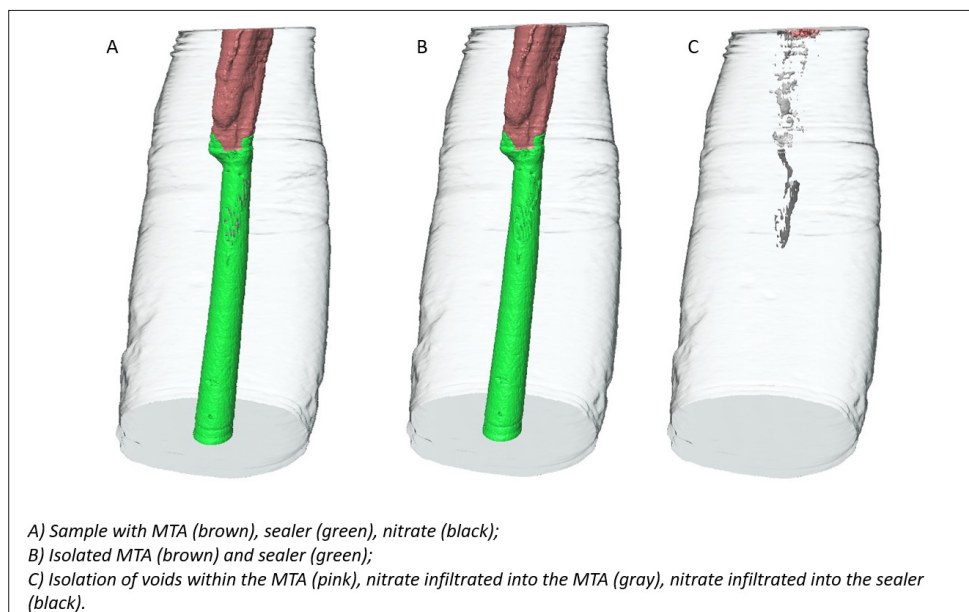


Figure 1. Segmented portions of a PCG sample performed Amira software

Does the taper influence the tooth strength? Correlation between root canal taper and residual resistance of post-and-core restored premolars.

Vittorio Fenoglio¹, Nicolò Pugno¹, Edoardo Moccia¹, Lia Giordano¹, Damiano Pasqualini¹, Mario Alovisi¹

¹ University of Turin, Department of Surgical Sciences, Dental School, Turin, Italy

Objective: To analyze the effect of root canal taper on the fracture resistance of endodontically treated maxillary premolars.

Materials and Methods: Forty extracted, caries-free, maxillary premolars are selected. Before the creation of a traditional endodontic access the specimens are micro-CT scanned at baseline. After the canal scouting phase with #10 K-File, they are divided in 4 groups for the root canal shaping with different tapers: Trunatomy (TN) taper .04, B4U taper .05, Protaper Next (PTN) taper .06 and Protaper Gold (PG) taper .09. During instrumentation, root canals were irrigated with 10 ml of 5% sodium hypochlorite (NaOCl) alternating with 10 ml of 10% EDTA using a 22-gauge needle syringe. The specimens are obturated with dedicated gutta-percha points, and a post-space is created followed by fiber post cementation with a self-etch adhesive system and a dual curing resin cement. Then, the post-and-core build up is completed with a dual-curing build-up material and all specimens are prepared for a full-crown restoration with a 1mm chamfer margin design and 1.5mm occlusal reduction. Specimens are micro-CT scanned at high-resolution after shaping, after post space insertion and after full-crown preparation to assess the coronal dentin removal at the cement-enamel junction (CEJ) level. The volume of dentin removed in the cervical third was analyzed in each group using CTAn software (Bruker, Billerica, MA, USA) in the preoperative, post-shaping and post-preparation phases. The specimens were subjected to static fracture strength testing using a universal testing machine (Instron, Canton, MA, USA) with a 6-mm-diameter transverse steel ball welded to a conical support capable of applying a force at a constant rate of 2 mm/min and at an angle of 30° to the long axis of the tooth. Maximum fracture loads were recorded in Newtons for statistical purposes. Fractured specimens are assessed for failure modes: catastrophic fractures (below the CEJ) and non-catastrophic fractures (above the CEJ).

Results: The dentin removal at the CEJ level after full crown preparation is higher than the amount spared with different shaping tapers ($P < 0.05$). The insertion of a fiber post didn't affect significantly the residual dentin thickness after full crown preparation ($P < 0.05$). The root canal taper didn't influence significantly the residual coronal dentin thickness after full crown preparation ($P > 0.05$). The fracture resistance and failure modes didn't show differences between groups ($P < 0.05$).

Conclusions

The root canal preparation taper seemed not to affect significantly the residual coronal dentin thickness and fracture resistance after full crown preparation in maxillary premolars.

