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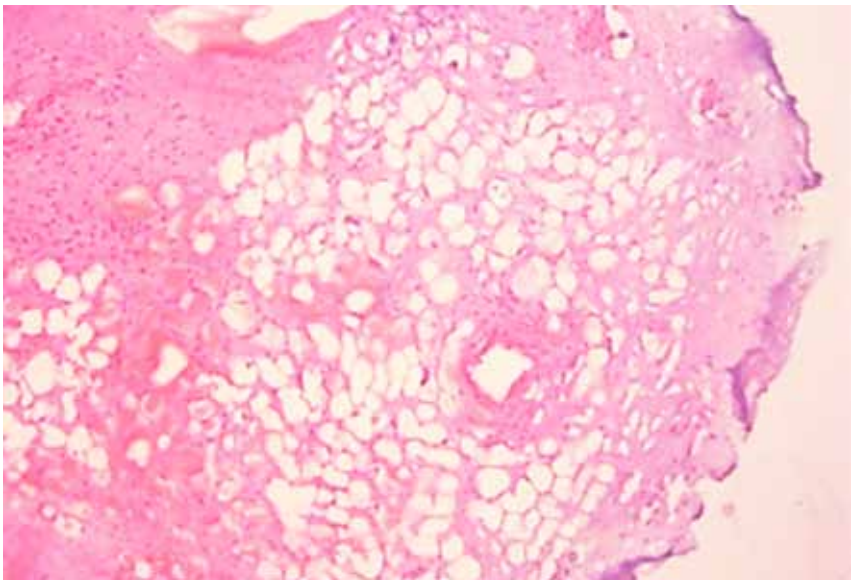

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REGISTRATION Court of Milan n° 89, 3 March 2009

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*Source: Neuhaus, Klaus W, Liebi, Melanie, et. al. Antibacterial Efficacy of a New Sonic Irrigation Device for Root Canal Disinfection. *Journal of Endodontics 2016, 42 (12): 1799-1803.*

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Editorial *Editoriale*

A partire da questo primo numero del 2019 ha inizio il mio secondo mandato come Editor in Chief e volevo innanzitutto ringraziare, oltre, naturalmente, al Consiglio Direttivo, gli Associate Editor, tutti i Membri del Board e i Reviewer per la collaborazione e per l'impegno profuso nel 2018 per mantenere alto il livello delle pubblicazioni.

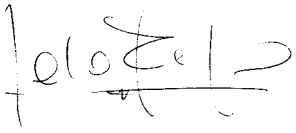
Con grande piacere vi comunico un'importante novità: da quest'anno ci sarà il passaggio della piattaforma del Giornale da Elsevier ad Ariesdue, il che garantirà un flusso di lavoro completamente automatizzato a partire dalla sottomissione dei lavori fino alla gestione del processo di revisione. Questo permetterà un miglioramento e uno snellimento dell'intero processo editoriale.

Purtroppo, però, il 2019 è iniziato con un evento luttuoso, che ha profondamente colpito tutti noi. Il 18 febbraio 2019 ci ha lasciati il Dott. Mariano Malvano, Collega, Amico, personalità di spicco dell'Endodonzia Campana. Ricordare qualcuno che non c'è più è sempre un impegno gravoso, triste, carico di malinconia; ricordare Mariano, per me, lo è ancor di più.

Mariano era, infatti, nel carattere e nell'indole l'essenza della positività, dell'ottimismo, dell'attaccamento alla vita. Ricordo di aver conosciuto Mariano in occasione di un incontro con un comune amico: il mitico Mister Mario Monaco (vice presidente mondiale della Kerr) e di aver sentito subito una grande empatia con quell'uomo schietto, simpatico, di animo nobile. Le occasioni per stare insieme, poi, si sono moltiplicate, ma non per motivi di lavoro, quanto piuttosto per una chiacchiera, una pizza, due risate insieme… Questo era per me il nostro rapporto: solido, forte, fatto di stima reciproca. Mariano aveva una forza d'animo e una tenacia che ho sempre molto apprezzato in lui, specialmente negli ultimi tempi in cui, provato da una malattia inesorabile, manteneva il sorriso di sempre e un'ironia che solo gli uomini intelligenti riescono ad avere. Scherzava sempre, anche sulla sua malattia, anche parlandone con me, ma non mollava mai, non cedeva mai il passo alla tristezza, non si dava mai per vinto… Di questo, della positività che ci ha trasmesso, dei bei momenti trascorsi insieme, lo ringrazio con tutto il cuore.

Abbiamo ormai tutti un'età che ci porta a fare bilanci e valutazioni: bene, la mia amicizia con Mariano è stata un punto fermo, un riferimento nella mia vita privata e un confronto stimolante e dialettico della mia professione. Per la Famiglia, per me, per chi ha avuto il privilegio di conoscerlo e per la SIE a cui tanto teneva, è stata una grande perdita.

Ciao Mariano, che la terra ti sia lieve.



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Editorial *Editoriale*

Mariano Malvano

As from this issue, the first of 2019, my second term as Editor in Chief begins. First of all, I would like to thank the Board of Directors, the Associate Editors, all the Board Members and the Reviewers for their collaboration and commitment performed in 2018, keeping the level of publications high.

I have the pleasure to inform you about a significant news: the platform of our Magazine will switch from Elsevier to Ariesdue, which will guarantee a completely automated workflow, starting from the submission of the work to the management of the review process. Such platform will allow an improvement and a simplification of the entire editorial process.

But, unfortunately, 2019 began with a mournful event, which deeply affected us all: on 18th February 2019 Dr. Mariano Malvano, Colleague, Friend and prominent figure of Campanian Endodontics, passed away. Remembering someone who left us is always tremendously sad; remembering Mariano is even more painful for me.

Mariano was, in fact, a very positive and optimistic person and loved his life. A common friend, the legendary Mr Mario Monaco (world Vice President of Kerr), introduced me to Mariano, and I immediately felt a great empathy towards such a sincere, nice and reliable man. After that, we often spent time together but not for work reasons, but rather for a "chat", a pizza, two laughs together… Our friendship was solid, strong, made of mutual respect. Mariano was brave and tenacious. I have always appreciated this, particularly during the last period of his life: even if he was ill and tired, he kept on smiling and being ironic, a quality common only to clever men. He was able to joke also about his illness, even when chatting with me. He never gave up, he never gave way to sadness… I thank him with all my heart for his good example, his positive attitude and the good time spent together.

At our age we all look back and make some evaluations about our life: well, my friendship with Mariano was both a benchmark in my private life and a stimulating and dialectical comparison in my job. It was a great loss for his Family, for myself, for those who had the privilege of working with him and for the SIE, so dear to him.

Bye Mariano, may you rest in peace.

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ORIGINAL ARTICLE/**ARTICOLO ORIGINALE**

Root canal filling techniques for primary molars: an *in vitro* evaluation

Tecniche di sigillatura canalare in molari decidui: uno studio in vitro

KEYWORDS
Endodontics, Hand file, Lentulo spiral, Centrix syringe, Primary teeth, Root canal obturation.

PAROLE CHIAVE
Endodonzia, File manuali, Lentulo, Siringa Centrix, Denti decidui, otturazione canalare.

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Received 2018, January 23

Accepted 2018, October 11

Abstract

Aim: *This study evaluated the efficacy of three different techniques used in the root canal filling of primary teeth.*
Methodology: *Sixty artificial resin upper and lower primary molars were used. The quality of root canal filling was evaluated using standardized buccal/lingual radiographs, after the use of three different techniques: endodontic hand file, spiral Lentulo and Centrix syringe. Scores were attributed to the obturation length and the presence of voids. Data were statistically analysed and the comparison between groups was calculated using the chi-square test.*
Results: *The use of endodontic hand file demonstrated the best results regarding the endodontic filling length and density. The occurrence of material extrusion was greater when Lentulo spiral was used in palatine root canals of upper molars. The obturation density was similar among the lower molars and in mesio buccal and palatine canals of upper molars, while in the disto buccal canal of upper molars, the endodontic hand file was significantly more effective.*
Conclusions: *The quality of root canal filling was similar among the different groups. However, lentulo spiral allowed greater material extrusion in palatine root canals, and greater occurrence of voids in disto buccal canal of upper molars, in comparison with the other tested techniques.*

Obiettivi: *Questo studio ha valutato l'efficacia di tre differenti tecniche di sigilatura canalare in dentizione decidua.*
Metodologia: *60 molari artificiali decidui superiori e inferiori, in resina, sono stati usati: file endodontico a mano, lentulo spirale e siringa Centrix.*
La qualità della sigillatura canalare è stata valutata usando radiografie buccali/linguali standardizzate. I punteggi sono stati attributi riferendosi alla lunghezza della sigillatura e la presenza di vuoti. I dati sono stati analizzati statisticamente e la comparazione tra i gruppi è stata calcolata usando il test chi-quadro.
Risultati: *Il file endodontico a mano ha mostrato il miglior risultato relativamente alla lunghezza e alla densità della sigillatura canalare. L'evenienza di estrusione di materiale è stata maggiore durante l'uso del lentulo spirale nella radice palatina dei molari superiori. La densità dell'otturazione è stata simile tra i molari inferiori e i canali mesio buccali e palatali dei molari superiori, ma nei canali disto buccali dei molari superiori, il file endodontico è stato molto più efficiente.*
Conclusioni: *La qualità della sigillatura canalare è stata simile tra i differenti gruppi. Comunque, il lentulo spirale ha permesso una maggiore estrusione di materiale nel canale palatino strumentato e riempito con una pasta iodoformica da un unico operatore usando differenti canali radicolari ed una maggiore presenza di vuoti nel canale disto buccale dei molari superiori.*

Introduction

Endodontic treatment aims to eliminate the root canal infection and to retain the tooth functional until its physiological exfoliation. It outcome is influenced by various factors such as biochemical preparation, obturating material, and hermetic seal of root canal (1). Additionally, some particularities must be taken into consideration during the endodontic treatment of primary teeth: the complex primary molars anatomy, with secondary and accessories canals and physiological root resorption; also the child psychological maturity and the cooperation during the treatment may influ-

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ence in the effectiveness of mechanical instrumentation, irrigation of the canals and root canal obturation (2, 3).
In order to increase the success of the endodontic treatment, the properties of filling materials as well as the appropriate insertion into the root canal are crucial. Several methods have been indicated to insert the root canal filling materials into primary teeth (4-7), such as hand held lentulo spiral paste filler, engine driven lentulo spiral paste filler, endodontic plugger, endodontic pressure syringe, endodontic hand files, tuberculin syringes, paper points and other tips (4-8).
Lentulo spiral is a commonly used method, which creates a good distribution of paste in the root canal walls; however, some studies indicate the difficulty of achieving a dense root canal filling when this method is applied (1, 6, 9). The endodontic hand file seems to be effective to make the root canal filling material to achieve the the complete working length, nevertheless may not completely fill the root canal in laterality (10).
Centrix syringe is frequently used for post cementation, composite and glass ionomer insertion (11-14). It usually shows a material layer with few voids and imperfections. The use of this syringe-type applicator optimizes the material insertion due to the homogeneous dispersion of the material. However, the effectiveness of Centrix syringe to obturate primary root canals was not sufficiently investigated (15).
The literature presents few information regarding the most effective method to deliver iodoform paste in primary molars (5-7). Thus, the aim of this study was to compare in vitro the ability of three different techniques using endodontic hand files, spiral lentulo and Centrix syringe. The null hypothesis tested was that the quality of root canal filling is not affected by the different techniques used.

Materials and Methods

Root canal preparation. Sixty artificial resin primary teeth with standardized internal anatomy (Tecnodon, Belo Horizonte, Belo Horizonte, MG, Brazil) was used in this study. The overall sample consisted in 30 upper molars (90 canals) and 30 lower molars (90 canals).
All canals were checked radiographically for apical patency and root canal conditions by inserting a #15 K-file (Dentsply Maillefer, Ballaigues, Switzerland). Each toth was identified by a code, and then assembled in a mannequin (Prodens, Belo Horizonte, MG, Brasil), which was coupled to a head in a dental unit, simulating the clinical conditions. Access to the pulp chamber was obtained with #4 diamond burs (KG Sorensen, Cotia, SP, Brazil) with a high-speed hand piece under water-cooling. A#15 K-file was inserted into each canal until its tip was just visible at the apical foramen, and the length was measured. The working length (WL) was established by subtracting 1 mm from the full length of the tooth.
A previously trained Endodontist performed all the endodontic procedures. Root canals were instrumented manually with K-file (Dentsply, Tulsa, OK, USA). In lower molars the preparation was up to file #25-30 for mesiobuccal and mesiolingual canals and up to #30-35 for distal canals; and in upper molars the enlargement was up to #25-30 in mesiobuccal and distobuccal canals, and #30-35 for palatal canals. After each instrument, the irrigation of root canals was performed using 2 mL of 1% sodium hypochlorite (Asfer Indústria Química Ltd., São Caetano do Sul, SP, Brazil), 5 mL of distilled water was used as final irrigation. The root canals were dried using absorbent paper points (Dentsply, Tulsa, OK, USA).
Root canal filling. Teeth were randomly divided into three groups (n=20, 10 upper molars and 10 lower molars), and the root canals were filled with a iodoform paste using different delivery methods: Group I endodontic hand file (Dentsply, Tulsa, OK, USA); Group II pressure syringe (Centrix, DFL, Taquara, RJ, Brazil); Group III Lentulo spiral (Dentsply, Tulsa, OK, USA). All primary molars were obtured using a single filling material to obtain the same radiopacity and consistency.
In **group I**, a #25 K file (Dentsply, Tulsa,

OK, USA) was used to deliver the obturation paste into the root canal. A rubber stopper was used to keep the file 1 mm short of the apex. The file was smeared with the iodoform-based paste, inserted into the canal and rotated in counter clockwise direction. Subsequently it was driven up and down, with a wiping motion against the canal walls, and then removed from the canal. This process was repeated until the canal orifice appeared to be filled with the paste.

In **group II** a Centrix syringe (DFL, Rio de Janeiro, RJ, Brazil) was used to fill the root canal with the iodoform-based paste. The paste was inserted into the syringe-type applicator and the tip (Centrix Accudose tip, DFL, Rio de Janeiro, RJ, Brazil) was positioned in the Centix syringe. Then, the cement was placed in the coronal portion of the root canal, and the application was performed in the apical-cervical direction. The material was inserted until the canal orifice appeared to be filled with the paste.

In **Group III** #4 lentulo spiral (Dentsply, Tulsa, OK, USA) was passively placed to the working length before the paste was applied, thus reduction the risk of fracture. A rubber stop was placed around the thicker part of the spiral filler to reduce displacement during the filling procedures. Then, the lentulo was mounted on slow speed handpiece, coated with the iodoform paste, inserted into the canal, and withdrew gently while still rotating. The procedure was repeated until the canal orifice appeared to be filled with the paste.

Cotton pliers holding a cotton pellet were used to lightly press the material inside the canal. After the root canal obturation, the pulp chamber of each tooth was sealed with Zinc Oxide Eugenol cement (ZOE).

At the completion of the experiment, standardized buccal/lingual radiographs were taken for each tooth (Spectro 70x, Dabi Atlante, Ribeirão Preto, SP, Brazil) to simulate the clinical conditions.

Radiographic Evaluation. The quality of root canal filling using the different techniques was radiographically accessed by two knowledgeable pediatric dentists. Each radiograph was mounted in a 35 mm slide frame and projected onto screen. Both evaluators were blinded to the filling technique. When disagreement occurred during evaluation, the case was discussed with a third observer until a final agreement was reached.

In order to test the intra- and inter-examiner variability, Kappa coefficient was obtained using a sample of 50 periapical radiographs of teeth presenting different root canal obturation status. The Kappa values for intra-examiner variability was 0.91 and the value for inter-examiner concordance was 0.85, showing excellent agreement.

The quality of the root canal filling was defined as follows (6):

1) Underfilling – when the root canal filling was more than 2 mm short of the apex.

2) Adequate – if the root canal filling was within 0 and 2 mm of the apex

3) Overfilling – if the filling material extruding from the apex.

The density of the root canal filling was defined using modified criteria used by Sigurdsson et al. (16):

1) Good – optimal filling, with no voids.

2) Acceptable – good filling, in which the voids were rarely observed.

3) Unacceptable – presence of large numer of voids in different areas of root canal.

Data analysis. Data were analysed statistically and group differences calculated using SPSS statistical software (version 17.0, SPSS, Inc., Chicago, IL, USA). The results were compared between groups using the chi-square test ($P<0.05$).

Results

A total of 180 posterior root canals of primary teeth were filled using hand files, lentulo spiral and Centrix syringe methods. From these, twelve root canals were excluded from the study due to failures during the root canal preparation, thus, a total of 168 root canals were evaluated.

The obturation techniques included in this study demonstrated similar results regarding the root canal filling length ($p=0.312$). The obturation length was con-

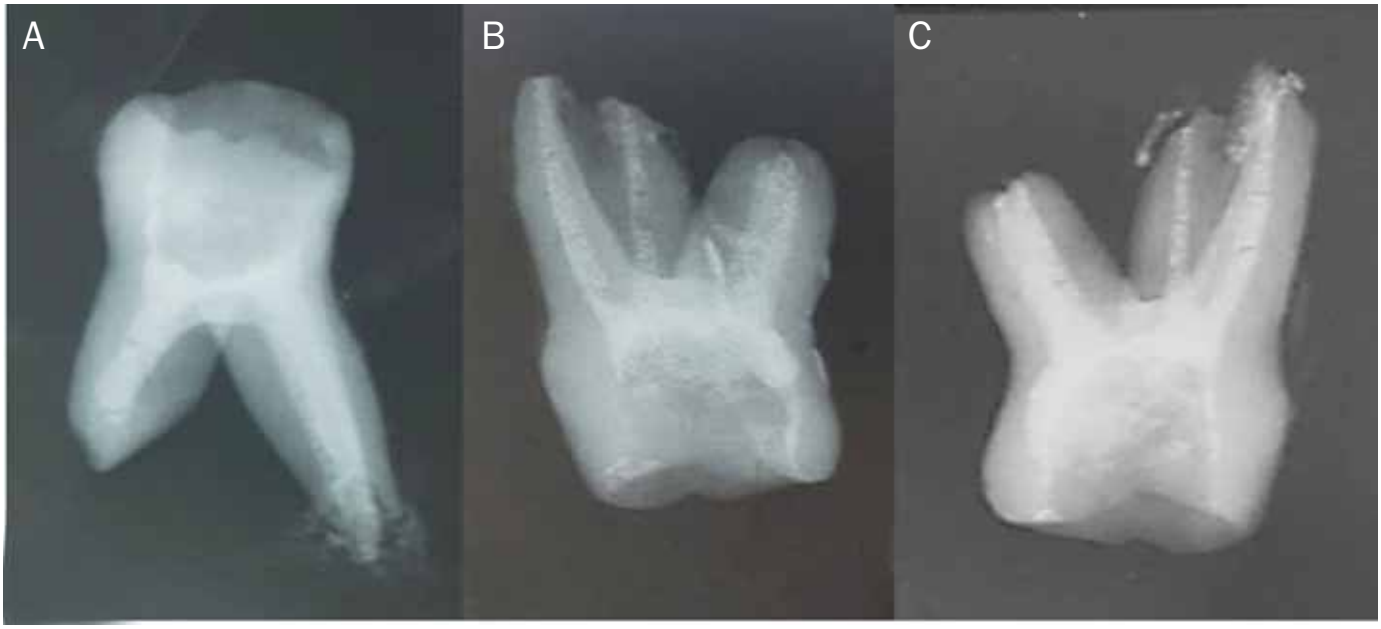

Figure 1
***A** Lower molar filled with Centrix seringe. Adequate root canal filling length and good filling density; **B** Upper molar filled with hand files, presence of voids and adequate root canal filling length; **C** Upper molar filled with lentulo spiral, overfilling and presence of voids.*

sidered adequate in 72.9% of canals filled with hand files; 75.8% of canals filled with centrix syringe and 65.8% of obturations made with lentulo spiral. Regarding the obturation density, 91.2% of canals filled with the endodontic hand file were considered good or acceptable, while the lentulo spiral technique showed the worst scores of obturation density. This results, however, were not significantly different among the obturation techniques (p=0.653) (table 1). In figure 1 it is possible to observe examples from the filling techniques tested and from the evaluated parameters. The filling length were similar, despite the different techniques used in the root canals of lower molars and in the MB (mesio buccal) and DB (disto buccal) canals of upper molars (p>0.05).
However, in the palatine canal of upper molars, Lentulo spiral allowed greater extrusion in comparison with other groups (p= 0.014) (table 2).
The scores attributed to obturation density in the different root canals are described in table 2. There was no difference in the obturation density among the root canals of lower molars and in the MB and palatine canals of upper molars (p >0.05). In the DB of upper molars, the Lentulo technique showed the highest occurrence of unacceptable fillings (p=0.007).

Discussion

The adequate delivery of filling materials to the root canal walls and the complete root canal obturation throughout its length, avoiding gaps and voids, are the ultimate goals of endodontic filling in

Table 1

Distribution frequency of root canal filling methods according to the length and quality of obturation (n=168)

Methods	Root canal filling length				Density of root canal filling			
	Adequate	Underfilling	Overfilling	P value	Good	Acceptable	Unacceptable	P value
Endodontic hand file	44 (72.5)	8 (14.0)	5 (8.8)		41 (71.9)	11 (19.3)	5 (8.8)	
Lentulo spiral	32 (65.3)	11 (22.4)	6 (12.2)	0.312	34 (69.4)	7 (14.3)	8 (16.3)	0.653
Pressure syringe	47 (75.8)	13 (21.0)	2 (3.2)		40 (64.5)	14 (22.6)	8 (12.9)	

Table 2

Distribution frequency of root canal filling methods according to the length and quality of obturation, within the different root canals (n=168)

	Root canal	Methods	Root canal filling length				Density of root canal filling			
			Adequate	Underfilling	Overfilling	P value	Good	Accetable	Unacceptable	P value
Upper Molar	MB	Endodontic hand file	8	1	0	0,412	8	0	1	0,399
		Lentulo spiral	10	0	0		10	0	0	
		Centrix syringe	9	1	0		8	1	1	
	DB	Endodontic hand file	9	0	0	0,810	9	0	0	0,007
		Lentulo spiral	7	2	1		7	0	3	
		Centrix syringe	6	4	0		5	4	1	
	P	Endodontic hand file	6	0	3	0,014	8	0	1	0,253
		Lentulo spiral	3	2	5		6	2	2	
		Centrix syringe	8	2	0		5	3	2	
Lower Molar	MBi	Endodontic hand file	7	3	0	0,222	4	5	1	0,350
		Lentulo spiral	2	3	0		2	1	2	
		Centrix syringe	6	2	2		7	2	1	
	ML	Endodontic hand file	7	1	2	0,184	7	3	0	0,365
		Lentulo spiral	4	3	0		4	2	1	
		Centrix syringe	8	3	0		8	1	2	
	D	Endodontic hand file	7	3	0	0,446	5	3	2	0,640
		Lentulo spiral	6	1	0		5	2	0	
		Centrix syringe	10	1	0		7	3	1	

MB=mesio-buccal, DB=disto-buccal, P=palatal, MBi=mesio-buccalinferior, ML=mesio-lingual, D=distal

primary teeth (4, 17, 18). The method used to take the material into the root canal is one of the factors that imply in the occurrence of failures in the obturation length and density (4). Few studies, however, have been carried out to evaluate the different methods of root canal filling of primary teeth. The present study aims to fill this gap, since it is still necessary to point out the best method of root canal obturation in primary teeth, particularly in molars.

Differently from previous studies, in which the sample consisted in anterior teeth (5, 6); our study assessed the quality of root canal obturation using primary upper and lower molars. To appraise the quality of root canal filling, it is important to consider the anatomic diversity of the root canals instead of a unique tooth, once the techinique difficulties are clearly more frequent in narrow and curved root canals in comparison to large and straight canals. The quality of obturation may also be influenced by the tooth position in the oral cavity, as well as by the management of children's behavior. In this study, before the instrumentation and filling, each tooth was assembled in a mannequin (Prodens, Belo Horizonte, MG, Brasil), which was coupled to a head in a dental unit. Due to the ethical difficulty in achieve natural teeth with standardized anatomy; this study used standardized resin artificial teeth. Although the limitations of this method, which does not reflect properly the in vivo conditions, with the absence of alveolar bone, and physiological root resorption, the use of artificial teeth represents an adequate model to in vitro studies, especially due

to the standardized internal anatomy and root canal wall thickness, very similar to natural teeth.

Different authors advocate that the lentulo spiral is an effective technique for obturation of primary teeth (5, 7). However, in the present study, the lentulo spiral technique demonstrated the worst results regarding both root canal filling length and density.

Around 16.3% of root canal fillings performed with lentulo spiral were considered inadequate, presenting voids, specially in DB canal of upper molars. The obturations performed with endodontic hand file, though, were considered good or acceptable in 91.3% of cases.

These results are in agreement with previous studies which had also reported poor results regarding obturation density when using lentulo spiral (4, 6, 9). In the palatine canal of upper molars, which presents a straight and large anatomy, the lentulo spiral tended to allow the material extrusion beyond the apex. Contrarily, others studies found less extrusion by lentulo technique (9, 19), mainly in curved canals (15). These controverse results may be explained mostly due to the viscosity and consistency of the filling material used in the evaluation. Moreover, the operator skills and the previous experience with the method should also be considered as a bias in results (4). The discrepancies between the outcomes may be justified by differences in the applied methodology: different teeth anatomy, different sample size and evaluation parameters (20). Clinically, the voids mean material leakage, with consequent microorganisms reinfection, and failure of the endodontic treatment (7). However, the material extrusion through the apex probably represents more important role in the endodontic treatment outcome than the presence of voids within the obturation mass (19).

This aspect is particularly important in the root canal treatment of primary teeth, when materials containing zinc oxide and eugenol are used. ZO has low absorption capacity, leaving particles in the periap-

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ical tissues when extravasation occurs (21). Furthermore, due its hardness, it may occur deflection of eruption of permanent teeth (22). However, with the use of iodoform-based or calcium hydroxide-based pastes for the primary teeth root canal filling, the concerns regarding the material extrusion had decreased (23), once these materials are more biocompatible and resorbable (23, 24).

Our results also demonstrated an influence of the root canal anatomy in the quality and in the length of root canal obturation. A statistically significant difference regarding the filling length was noticed in the palatine canal of upper. Also, the results of root canal filling density were statistically different depending on the filling method in the disto-buccal canal of upper molars. There results indicated that large and straight root canals, such as the palatine canal, have a major tendency to be overfilled, and in this case, an endodontic hand file, with a better control of material insertion can be indicated. Otherwise, the mesio-buccal and disto-buccal canals present an atresic and curved anatomy, being positioned in the maxilla which makes the adequate material insertion more difficult to be achieved.

Conclusions

In conclusion, the quality of root canal filling was similar among the different groups. However, lentulo spiral allowed greater material extrusion in palatine root canals, and greater occurrence of voids in disto buccal canal of upper molars.

Conflict of Interest

The authors declare that they have no conflict of interest.

Ethical approval

This article does not contain any studies with human participants or animals performed by any of the authors.

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ORIGINAL ARTICLE/**ARTICOLO ORIGINALE**

Antibiotic therapy in Endodontics: a survey from dental surgeons in Ivory Coast

Terapia antibiotica in Endodonzia: un sondaggio dai chirurghi odontoiatrici in Costa D'Avorio.

KEYWORDS
Antibiotic therapy, endodontics therapy, infection, prescriptions, survey.

PAROLE CHIAVE
Terapia antibiotica, terapia endodontica, infezioni, prescrizioni, sondaggio.

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Abstract

Aim: *The objective of this study was to evaluate the antibiotics prescription in endodontics.*
Methodology: *This was a descriptive cross-sectional survey, type KAP (Knowledge, Attitudes and Practices) of 111 dental surgeons in Abidjan (Ivory Coast).*
Results: *11.70% of practitioners routinely prescribe antibiotics for endodontic treatment; 64.90% prescribes them for Acute Apical Periodontitis, 57.70% for Pulp Necrosis and 52.30% for Abscess. According to the patient general condition, practitioners prescribe antibiotics for general illness (89.20%) or poor hygiene (55%). Beta-lactam antibiotics are prescribed in 98.20% of cases. For 96.4% of practitioners, antibiotic therapy influences an endodontics success; 19.80% do not know about prescription recommendations; 37.80% have received antibiotics self-medicated patients.*
Conclusion: *In Ivory Coast, the antibiotics prescription in endodontics does not always adhere to international recommendations. The anarchic consumption of these drugs is mostly due to self-medication.*

Obiettivi: *L'obiettivo di questo studio è stato quello di valutare la prescrizione degli antibiotici in endodonzia.*
Metodi: *Questo è stato un sondaggio descrittivo trasversale, tipo KAP (Conoscenza, Atteggiamenti e Pratiche) di 111 dentisti a Abidjan (Costa d'Avorio).*
Risultati: *L'11,70% dei professionisti prescrive abitualmente antibiotici per il trattamento endodontico; il 64,90% li prescrive per la parodontite apicale acuta, il 57,70% per la necrosi della polpa e il 52,30% per l'ascesso. Secondo le condizioni generali del paziente, i medici prescrivono antibiotici per la malattia generale (89,20%) o scarsa igiene (55%). Gli antibiotici beta-lattamici sono prescritti nel 98,20% dei casi. Per il 96,4% dei professionisti la terapia antibiotica influenza il successo dell'endodonzia; il 19,80% non è a conoscenza delle raccomandazioni di prescrizione; il 37,80% ha ricevuto pazienti che si sono auto-medicati.*
Conclusioni: *In Costa d'Avorio la prescrizione di antibiotici in endodonzia non sempre rispetta le raccomandazioni internazionali. Il consumo anarchico di questi farmaci è dovuto principalmente all'automedicazione.*

Introduction

Endodontic therapy is one of the most commonly performed procedure in dentistry, especially in Africa, due to late consultations mainly motivated by pain (1, 2). It is performed in irreversible dental pulp diseases and their periodontitis complications when the tooth can be recovered. When treating endodontic infections, antibiotic therapy may be recommended as curative, complementing conventional root canal treatment. Actually, in this treatment, the antibiotic is just an adjuvant and not an alternative to canal cleaning or re-cleaning and pus or exudate drainage (3). Antibiotics are micro-organism natural substances derived or

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synthetic or semi-synthetic produced in laboratory which have low-level dosing of antimicrobial activity (4). They help slowing down and eliminating more quickly the infectious process of the body and thus, to prevent more serious complications. Therefore, do several authors only consider curative antibiotic therapy in endodontics, regardless of the patient infectious level of risk, for the following cases: infection with fever, trismus, lymphadenopathy, progressive or persistent edema (4, 5, 6, 7). Despite these indications, antibiotics are among the most commonly prescribed drugs, unnecessarily or inappropriately sometimes, resulting in the growth of antibiotic-resistant bacterial strain (8, 9).

In an epidemiological and infectious context different from that of northern countries, endodontics practice in Africa is also tainted by bad habits regarding, in particular, antibiotic therapy. Indeed, Azodo and Ojehanon in Nigeria highlighted deficiencies in prophylactic antibiotic treatment and antibiotic therapy choices (10). In 2017, Lalloo carried out a survey on the endodontic drug intake profile which, also ranked these drugs among the most used drugs in South Africa (8). Moreover, their prescribing guidelines are still not always followed and self-medication is very common (11, 12, 13, 14).

The objective of this study was to assess the antibiotic prescription during endodontic therapy, based on a survey of general dental surgeons in the district of Abidjan (Ivory Coast).

Methodology

It was a descriptive, cross-sectional survey on the knowledge, attitudes and practices on antibiotics prescription in endodontics of dental surgeons in the city of Abidjan. It lasted three months, from June 2017 to August 2017. The sample was randomly selected from the National Council of the College of Dental Surgeons of Ivory Coast list (NCCDSIC/in French: CNOCDCI) (15). Private and public dentists practicing in the city of Abidjan were included. Specialists were excluded. An anonymous survey form with four sections, as follows, was used to collect data: sample characteristics, practitioners' knowledge of endodontics therapy, antibiotics prescription in endodontics therapy and self-medication. After validation, the questionnaire being self-administered, available retained practitioners who met the inclusion criteria were given cards. Appointments were made for exchanges and recovery of said cards. The collected data was processed with SSPS 21.0.

Results

Of the 150 cards distributed, 111 were recovered and processed.

Sample characteristics: the sample includes 66 private sector practitioners (59.46%) and 45 (40.54%) from the public sector, where there are 73% male for 27% female (sex ratio 2.7). 48.64% of respondents have between 0 and 5 years of professional seniority.

Practitioners' knowledge of endodontic therapy: all respondents claimed having performed this treatment. Altogether, 29.73% of practitioners make more than 15 endodontic treatments per month. Clinical indications are: Acute Pulpitis (99.10%), Chronic Pulpitis (99.10%), Pulp Necrosis (91%), prior failed Endodontic Treatment (75.70%), Acute Apical Periodontitis (AP) (73.00%), Apical Abscess (45.90%), Chronic AP (34.20%), Pre Pulpitis (32.40%). 69.40% of practitioners routinely perform retroalveolar radiography, 30.60% do not.

Antibiotics prescription during endodontic therapy: on average, 11.70% of practitioners routinely prescribe antibiotics. Other methods of prescription are shown in figures 1, 2, 3 and 4 and table 1. For 96.40% of practitioners, antibiotics prescriptions contribute to an endodontics success and 80.20% have knowledge of international recommendations.

Self-medication: 96.40% of respondents reported having received self-medicated patients for endodontic care. 37.80% used antibiotics. According to 65.80% of respondents, self-medication could hinder the endodontic therapy.

Discussion

This survey identified the knowledge, attitudes and practices of 111 out of 150 dental surgeons who agreed to participate in the study with a participation rate of 74%. General practitioners have been the focus of this study.

In Ivory Coast, even if the number of public dental surgeons is higher than that of the private, some of the first are public servants; moreover, the number of practitioners per chair in offices is three for one. These reasons could explain the business sector's results. Other characteristics are the reflection of the dental surgeons general population on the NCCDSIC (French CNOCDCI) board (15).

This study interviewed practitioners claimed having performed this treatment. Even though frequencies seem disparate, 29.73% perform more than 15 procedures per month. This highlights the importance of endodontics in Ivory Coast. Most respondents use it to treat irreversible dental pulp diseases and their inflammatory periapical complications and also, for a faulty endodontic treatment. In infectious complications, proportions, although important, decrease for the endodontic option probably in favor of radical surgery. These therapeutic choices are consistent with the literature data on pulpal pathologies (16).

When faced with such infectious complications, only an infectious risk related to the patient's general condition or when the tooth reconstitution is not possible, may force the dental surgeon to remove it. Yet, in this study, less than half of the sample reported doing endodontic treatment in these cases. 12.60% of dental offices do not have the radiography, essential therapeutic device in endodontics. The critical part is that 30.60% of practitioners do not routinely perform radiography during endodontic treatment.

This study showed that 11.70% of practitioners routinely prescribe an antibiotic during root canal treatment. Although most of them (88.30%) do it just sometimes because of the diagnosis and/or the patient overall conditions; it is also found in the study of Souaga in Ivory Coast, that some of these prescriptions are without any rational and even unreasonable (11). With good reason, compared with the diagnosis (figure 1), the only pathology for a justified antibiotic prescription, regardless of the therapy to be used, is the Apical Abscess, which is a case of proven infection. However, only 52.30% of respondents recommend anti-infectious treatment in this condition. This suggests that some dentists perform endodontics without antibiotic therapy in this case.

Prescription peaks are observed with Acute Apical Periodontitis (64.90%) and necrosis (57.70%). These behaviors do not comply with the European Society of Endodontology (ESE) guidelines (3). They are even less for prescriptions in cases of acute and chronic pulpitis, en-

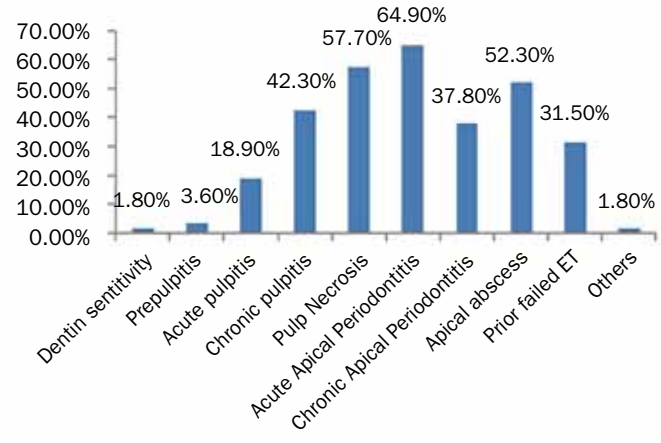

Figure 1
Antibiotics prescription according to the diagnostic type (ET = Endodontic Treatment).

Table 1

Sample distribution according to prescribed antibiotics types

Antibiotics types	Number (n)	Percentage (%)
Beta-lactams	109	98.20
Cyclin	1	0.90
Macrolides	60	54.10
Synergistins	0	0.00
Nitro-5-imidazoles	76	68.50
Others: amoxicillin/Clavulanic acid spiramycin/metronidazole	11	9.90

dodontic retreatment and in the pre-pulpitis status (figure 1). Overall, these findings confirm the inadequacies and abuses in antibiotic prescriptions as noted by many authors worldwide (7, 17, 18, 19).

In practice, respondents prescribe mainly for general illness (89.20%) and poor oral hygiene (55%) (figure 2). But there again, it is about unreasonable prescription because not all general diseases increase the risk of infection (3). In addition, antibiotic therapy is not the solution for poor oral hygiene. However, due to the lack of dental rubber dam in practices in Ivory Coast, antibiotic therapy after endodontics can be implemented in case of contamination by saliva to prevent a post operative flare-up. This could justify the attitude of 34.20% dental surgeons who prescribe antibiotic therapy after the procedure (figure 3). 75% of practitioners prescribe antibiotic therapy during treatment (figure 3). The explanation of this practice is to be found in the answer to the question "influence of antibiotic prescription on therapeutic success" nearly all (96.40%) agreed on that antibiotic therapy guarantees therapeutic success in endodontics. Unlike Azodo and Ojehanon in Nigeria who have found more prescriptions of the combination amoxicillin/metronidazole and Hwang and Iqbalin in Saudi Arabia with more amoxicillin and clavulanic acid, this study shows a preference for beta-lactams (98.20%) as first-line prescription (table 1) (10, 1, 18). These results are also comparable, on one hand, to those of Germack & al. in United States and Bolfoni & al. in Brazil who have all evaluated endodontics prescriptions (20, 17). On the other hand, findings of Segura & al. and Skucaité & al., respectively in Spain and Lithuania, have also indicated amoxicillin as the first choice of general practitioners (4, 7). Lalloo from South Africa found similar data in endodontic prescriptions (8). In this study, Nitro-5-imidazoles (68.50%) and macrolides (54.10%) are respectively at the second and third place (table 1). The relative low cost of β–lactams, their good tolerance and, above all, their broad spectrum of activity, justify their choice compared with macrolides. Nitro-5-imidazoles, just like the Clavulanic Acid, are generally associated with first-line molecules because of the anaerobic bacteria fre-

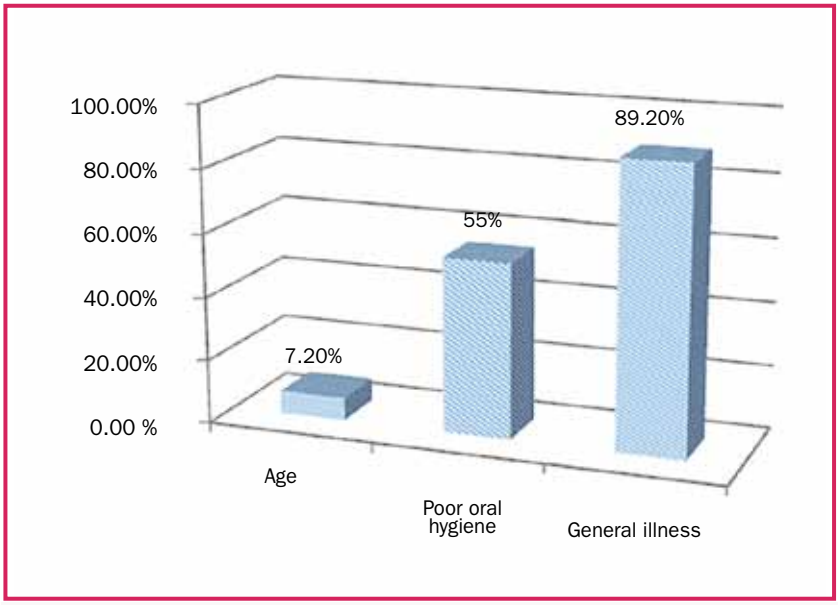

Figure 2

Antibiotics prescription according to the patient oral hygiene and general status.

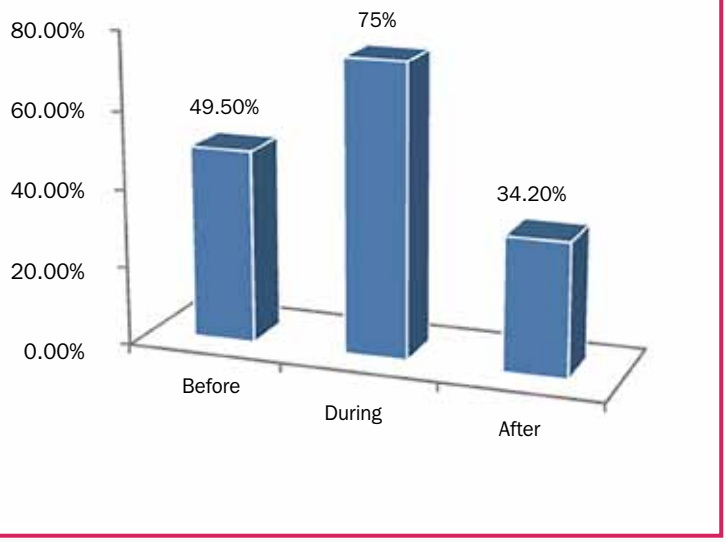

Figure 3
Sample distribution according to prescription time during endodontic treatment.

quency in abscesses. But, their use should be for severe case. Moreover, the ESE recommends them as second-line prescription. This study shows an excessive (63.10%) or insufficient (11.70% never make an association of antibiotics) use of association (figure 4). Paradoxically, nearly 90% of surveyed practitioners are aware of international guidelines for antibiotics prescriptions.

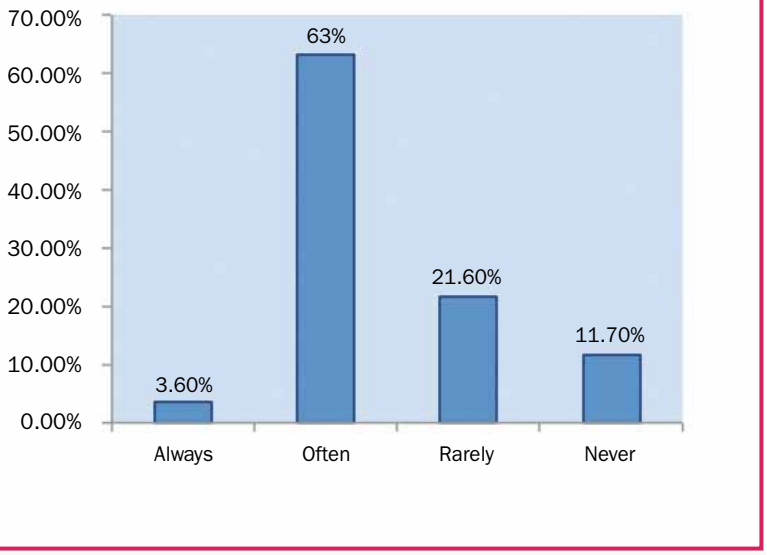

Figure 4
Sample distribution according to prescription of antibiotics combination.

Medication use should be prescribed by a health professional. Unfortunately, this can be the decision of the patient without the practitioner's opinion, as a self-medication. Prescription provides utilization security, even if it has been found to be abusive by practitioners. Self-medication is another important factor in the unreasonable use of drugs in general and antibiotics in particular. It is found everywhere in the world, but with higher frequencies in Africa (2, 8, 11). This study showed that 96.40% of surveyed practitioners have experience with self-medicated patients. Non-steroidal anti-inflammatory drugs are used in 90% of cases, followed by analgesics (54.10%). Antibiotics ranked third with 37.80%.

These rates are important considering the consequences of this practice. Lalloo found 28.6% self-medication with 14% for antibiotics in South Africa (8). Likewise, Souaga et al., in Ivory Coast, interviewing 418 patients attending dental consultations, noted a rate of 37.32% cases of self-medication with 10.08% for antibiotics (11). In contrast to these two authors who surveyed patients, this study focused on practitioners. Consequently, the different results obtained could be related to the methodology used. In all cases, this practice should be denounced and it could hinder the endodontic therapy by 65.80% of respondents. In addition, this phenomenon is a source of resistance to antibiotics, over-consumption of potentially toxic products for the human body and expenses for insurance providers and households. Self-medication is mostly due to the anarchic black market, the trivialization of prescriptions (prescribers of unequal level of knowledge), the abundance of generics, the improper practices, the ignorance of side effects and the absence of a monitoring system of antibiotics use in sub-Saharan Africa.

Conclusions

In Ivory Coast, antibiotics prescription in endodontics not always meet international guidelines. In addition, self-medication is an important part of the uncontrolled consumption of these drugs.

Clinical Relevance

This work makes it possible to draw the general practitioner's attention to inappropriate antibiotic prescriptions, which could be the causes of antibiotic resistance.

Conflict of Interest

The authors declare no potential conflict of interests.

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ORIGINAL ARTICLE/**ARTICOLO ORIGINALE**

Histomorphometric analysis of pulp submitted to the action of bromelain associated with irrigation solutions

Analisi istomorfometrica della polpa sottoposta all'azione di bromelina associata a soluzioni irriganti

KEYWORDS
Bromelains, Endodontics, Root Canal Irrigants, Sodium Hypochlorite.

PAROLE CHIAVE
Bromelina, Endodonzia, Irriganti del canale della radice, Ipoclorito di sodio.

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Abstract

Aim: *The objective of this study was to evaluate the tissue disgregation capacity of pulp in different solutions associated or not with bromelain.*
Methodology: *Fifty bovine mandibular incisors were used, divided into five groups: C: Control, H: sodium hypochlorite 2.5%, B: bromelain, BL: bromelain + L-cysteine, BH: bromelain + sodium hypochlorite 2.5%. The pulp fragments were stored at -20 °C, washed with saline solution and moved to 25°C in eppendorf tubes with 1 ml of each substance. For the histomorphometric evaluation, the pulp fragments were prepared as histological routine, observed with optical microscopy and evaluated using ImageJ 1.49 software.*
Results: *The histomorphometric results showed that, in C: there was no alteration per tissue; H: there was a peripheral and central tissue disintegration; B: there was a protein and cellular degradation pattern, from the peripheral to the central area; BL: there was a central degradation. In BH, showed an effect enhanced by bromelain, when related to sodium hypochlorite, showing greater tissue degradation.*
Conclusions: *The association of bromelain with sodium hypochlorite potentiated the disintegration action of the pulp, opening possibilities for several clinical applications.*

Obiettivi: *L'obiettivo di questo studio era di valutare la capacità di disgregazione del tessuto pulpare in diverse soluzioni associate o meno alla bromelina.*
Materiali e Metodi: *Sono stati utilizzati cinquanta incisivi mandibolari bovini suddivisi in cinque gruppi: C: Controllo, H: ipoclorito di sodio 2,5%, B: bromelina, BL: bromelina + L-cisteina, BH: bromelina + ipoclorito di sodio 2,5%. I frammenti pulpari sono stati conservati a una temperatura di -20 °C, lavati con soluzione fisiologica e portati a 25 °C in provette eppendorf con 1 ml di ciascuna sostanza. Per la valutazione istomorfometrica i frammenti di polpa sono stati preparati come da routine istologica, poi sono stati osservati con microscopia ottica e valutati con software ImageJ 1.49.*
Risultati: *L'analisi istomorfometrica evidenzia che: il gruppo C non evidenzia alterazione del tessuto; il gruppo H presenta una disintegrazione del tessuto periferico e centrale; il gruppo B mostra un pattern di degradazione cellulare e proteica, dalla periferia alla zona centrale; il gruppo BL presenta una zona di degradazione centrale; il gruppo BH ha presentato un effetto potenziato dalla bromelina quando correlata all'ipoclorito di sodio, presentando una maggiore degradazione del tessuto.*
Conclusioni: *L'associazione di bromelina con ipoclorito di sodio ha potenziato l'azione di disintegrazione della polpa, aprendo le possibilità per diverse applicazioni cliniche.*

Introduction

One of the causes of endodontic treatment failure may be due to residual organic tissue or infected tissue left in the root canal after instrumentation (1). That may occur because of contamination and microleakage during and after treatment (2). Thus, there is recommendation for the use of instruments that produce mechanical action associated to chemical substances with antimicrobial activity, organic matter dissolution capacity, lubricating properties and low cytotoxicity (3).
One of the main auxiliary chemical substances used in this procedure is the sodium hypochlorite (NaOCl).

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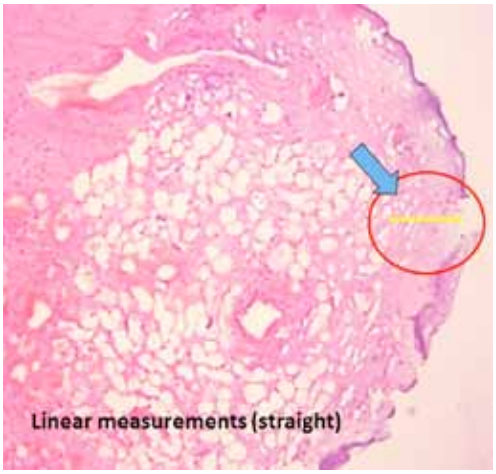

Figure 1
Linear measures of pulp: measurements were made of the periphery of the pulp tissue using the tool "Straight" (ellipse), following the peripheral delimitation of the pulp tissue (arrows).

Sodium hypochlorite is still most widely used irrigation solution by dentists (4). However, many studies have proposed other alternatives, considering that NaOCl is cytotoxic, has allergenic potential and compromises the binding of resin cement and alteration in the peripheral dentin matrix (5, 6). In addition, the undesirable effects such as pain, edema hyperemia, inhibits neutrophil migration and damages endothelial and fibroblast cells that can occur in case of extravasation of hypochlorite (7, 8, 9, 10).
This suggests the necessity of studies that seek to develop laboratory tests with the objective of reaching an irrigating solution that best performs its function without damaging the periapical tissues (11) or reducing the volume and frequency of sodium hypochlorite solution in patients. Extreme caution should be exercised in the application of NaOCl to root canals to avoid increasing occurrence of harmful consequences caused by the spreading of this highly alkaline and cytotoxic material into tissues outside the root canals (12).
Bromelain is one of the agents that has been widely used as an anti-inflammatory drug in the field of medicine and dentistry, as well as its antibacterial efficacy (13). It is a crude aqueous extract from stems and immature fruits of pineapples, configuring a not very common and complex mixture that differ in thiol-endopeptidases and other components not yet fully clarified, such as phosphatases, glycosidases, peroxidases, cellulases, glycoproteins and carbohydrates, as well as others (14).
In light of this, that the association of bromelain with sodium hypochlorite may potentiate the removal of pulp tissue, this research was conducted by adding L-cysteine, which can catalyze the hydrolysis of peptide bonds by deprotonation (15). For that, an *in vitro* study was designed to evaluate the dissolution power and tissue denaturation of these products on the root pulps of bovine teeth.

Materials and Methods

Samples. A total of 50 bovine mandibular incisors were extracted and randomly stored -20 °C in physiological solution during transport to the Laboratory, until further analysis. For this study, no permission from the animal ethics committee was necessary, once that the teeth of animals were collected after slaughtering for meat consumption.
The pulps were removed by means of a cross-sectional cutting in the cervical region, separating the crown from the root. The root pulp was completely removed with Hedstroem (Denstply) type. The pulp fragments were washed during 30 seconds in a physiological solution and, immediately after, they were stored in eppendorf tubes at -20 °C until they were used. Sodium hypochlorite was formulated at a concentration of 2.5% and adjusted to a pH of 9.0, irrigation solution concentration commonly used in endodontic treatment.
Experimental Design. Five experimental groups were established with 10 samples for each group (n =10) as follows

- Group 1, C: control (saline solution)
- Group 2, H: 2.5% sodium hypochlorite diluted in saline solution
- Group 3, B: bromelain 5 mg for each 10 ml saline solution
- Group 4, BL: bromelain 5 mg for each 10 ml saline solution and L-Cysteine, 3 mM
- Group 5, BH: bromelain 5 mg and 2.5% sodium hypochlorite

The pulp fragments in the process of dissolution were moved from -20 °C to 25 °C, washed with saline solution for 30 seconds,

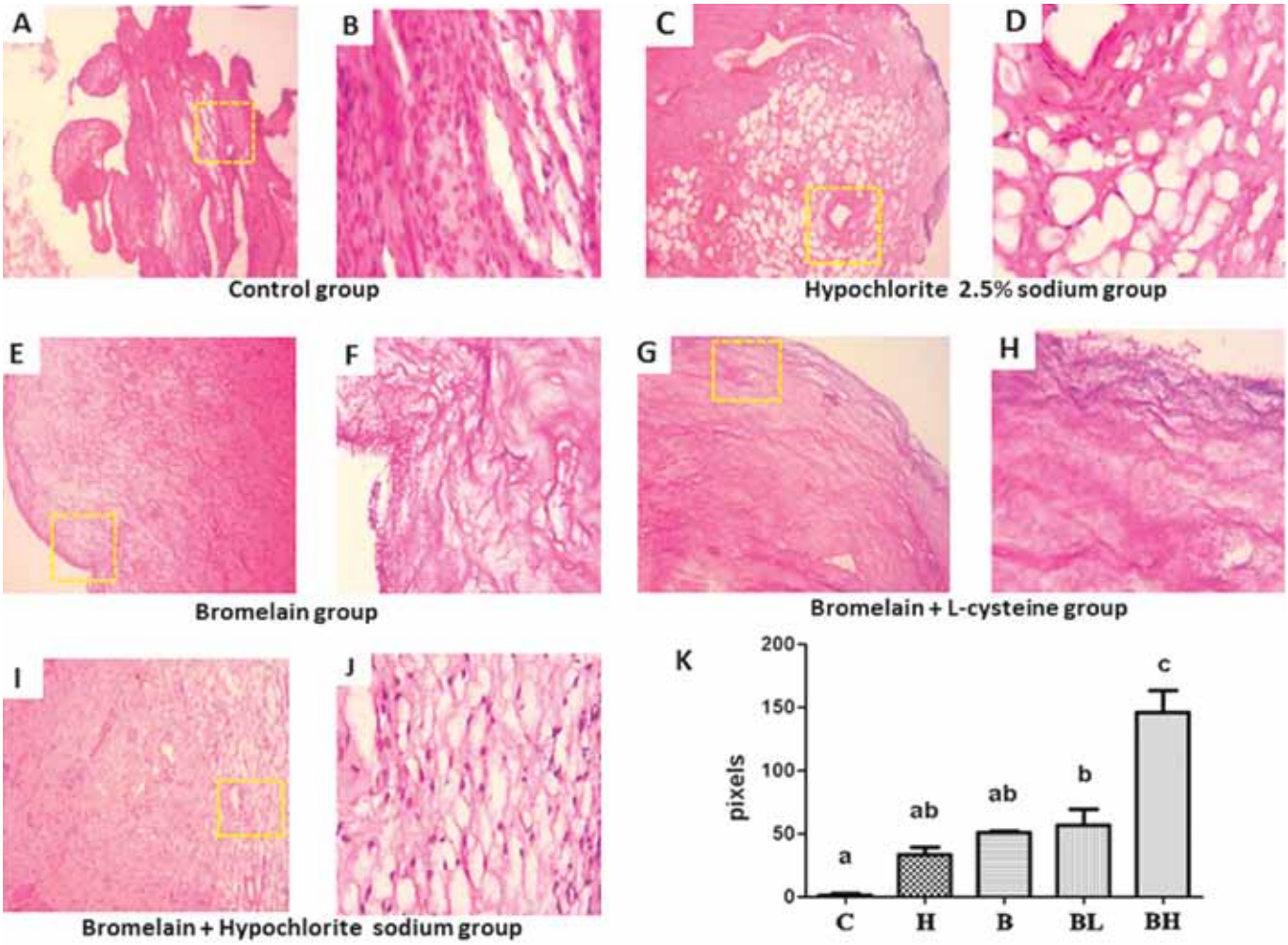

Figure 2

A) *In control group there was no tissue change in any of the samples (150x)* ***B)*** *In control group there was no tissue change in any of the samples (600x)* ***C)*** *Hypochlorite 2.5% sodium group (150x)* ***D)*** *In hypochlorite 2.5% sodium group there was a disintegration of the tissue both peripherally and in its central region (600x)* ***E)*** *Bromelain group (150x)* ***F)*** *Bromelain group, protein and cell degradation pattern occurred, from the peripheral to the central region (600x)* ***G)*** *Bromelain associated with L-cysteine group (150x)* ***H)*** *When the bromelain is associated with L-cysteine group we observed a central degradation of the tissue* ***I)*** *The bromelain is associated with 2.5% sodium hypochlorite group (150x)* ***J)*** *The bromelain associated with 2.5% sodium hypochlorite group demonstrated a potentiating effect (600x)* ***K)*** *Measurements of alteration in the pulp from groups.*

Different letters represent statistical difference p<0.05. C, Control group; H, Hypochlorite 2.5% sodium group; B- bromelain group; BL- bromelain + L-cysteine; BH- bromelain + hypochlorite. Hematoxylin and eosin stain.

dried with filter paper for another 5 seconds. They were put in eppendorf tubes with 1 mL of the solution for a 30 minute time.

Histomorphometric analysis. The pulp tissues were fixed in 10% buffered formaldehyde in 7.0 pH (Dinamica, Diadema, Brazil), dehydrated in increasing concentrations of alcohol: 30, 50, 70, 90 and 100%, diaphanized with xylol, included in paraffin and shaped in blocks for the microtomy with sections of 6 µm of thickness. The sections were stained with hematoxylin and eosin and prepared with Canada balsam (Dinamica, Diadema, Brazil).

Afterwards, the analysis of the image capture was made with the ImageJ v1.49 Software (US National Institutes of Health, Bethesda, MD.) on the pulp linear measure as shown in figure 1.

The area the disintegration of the tissue was measured according presented in fig-

ure 1. Seven images per group were analyzed, totaling 35 images in magnification of 150x and 600x using the light microscope (figure 2).

Statistical Analysis. Results are expressed as median ± standard error from the parameters obtained. Kolmogorov-Smirnov test was used to check the normality of the data. Differences between the groups were examined with the ANOVA one-way test followed by Newman-Keuls test. For the analysis of the data Graph Pad Prism5® was used, considering the value of $p<0.05$ as statistically significant.

Results

The histologic evaluation showed that, in the linear measurements of the tissues evaluated, the control group presented no tissue change in any of the samples, as seen in the figures 2A, 2B. In the 2.5% sodium hypochlorite group there was a significant disintegration of the tissue both peripherally and in its central region ($P<0.05$) (figures 2C, 2D). In the bromelain group, there was a protein and cell degradation pattern from the peripheral to the central region (figures 2E, 2F). The bromelain associated with L-cysteine group, there was a central degradation of the tissue (figures 2G, 2H). In the bromelain associated with 2.5% sodium hypochlorite group, a potentiating effect can be observed, showing greater tissue degradation of the pulp than in the other groups when tested without combination (figures 2I, 2J). The histomorphometric results are demonstrated in figure 2K.

Discussion

In the group where bromelain was used associated with 2.5% sodium hypochlorite a potentiating effect could be observed, showing greater tissue degradation of the pulp than the others when tested. The use of a cysteine protease activator was used, but did not cause a change in the proteolytic activity of bromelain.

During the chemical-mechanical preparation of endodontic treatment, there may be parts of the root canal that remain untouched, which may contain necrotic bacteria and tissue substrates leading to microleakage. This coronary microleakage of restorations has the potential to dissolve the sealing cement, compromising the prognosis of endodontic treatment and resulting in failure of the therapy (16, 17). Endodontic irrigants should have low systemic toxicity and yet allow an optimal disinfection of the root-canal system. Because of the complex anatomy of root canals, approximately 50% of canal walls remain uninstrumented during preparation, which results in an insufficient debridement (18). The use of NaOCl as a root canal irrigator can cause serious clinical problems when extruded into the periradicular tissues, confirming known NaOCl toxicity to the soft tissues after inadvertent extrusion (19).

Bromelain acts by direct proteolytic action, hydrolyzing peptide bonds (20). This proteolytic action occurs on soluble proteins, as well as on membrane structural proteins, mainly on receptors and surface markers (21). It is one of the extensively investigated proteolytic enzymes due to its astonishing applications in various industries (22).

Studies demonstrate the efficacy of bromelain, an enzyme found in the juice and stem of Ananas comosus (pineapple), which has therapeutic potential in fibrinolytic, antiedematous, antibacterial agent, antithrombotic and anti-inflammatory activities both in vitro and in vivo (13, 23, 24). Cellular removal with bromelain was also erratic similar to the other groups tested, with papain, ficin and trypsin where, the distribution with wedge-shaped areas had the highest cell removal. Residual cells were predominantly fibroblasts with adjacent vascular and neural elements intac (25).

In addition, many authors have pointed out that the bromelain reduce edema and inflammation (26, 27). Bromelain has a particularly intense and effective action in edema without acting on the fibrinogen, thus not interfering with the coagulation mechanism (28). It also inhibits lysosomal proteases and reduces platelet aggregation values (27). The properties cited above demonstrate that the bromelain can be

used alone or associated with sodium hypochlorite improving several processes involved in endodontic instrumentation.

Conclusions

The association of bromelain with sodium hypochlorite potentiated the disintegration action of the pulp, opening possibilities for several dental applications.

Clinical Relevance

The bromelain properties can be useful in endodontic instrumentation, because the bromelain presented a potent capacity of disintegrate the pulp tissues, when used alone or associated with sodium hypochlorite, desirable feature in endodontic instrumentation.

Conflict of Interest

The author declares there is no conflict of interests.

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CASE REPORT/**CASO CLINICO**

Treatment of a root canal perforation using a calcium-silicate based sealer: a case report with a 4 year follow-up

KEYWORDS
Bioceramic, EndoSequence, Root repair material, Root canal sealer, Root canal retreatment.

PAROLE CHIAVE
Endosequence, Materiali Bioceramici, Perforazioni radicolari, Otturazione canalare.

Trattamento di una perforazione radicolare con un cemento a base di silicati di calcio: un case report con un follow-up a 4 anni.

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Abstract

Aim: *This case report presents a root canal retreatment distinguished by a canal perforation successfully treated with a calcium-silicate based sealer (EndoSequence BC sealer, Brasseler USA, Savannah, GA, USA) with a 4 year follow-up.*

Summary: *Root canal retreatment of a lower left second molar was performed in 80 years old patient because of a periapical chronic periodontitis with buccal fistula. The scouting of the mesio-lingual and distal canal was obtained with a k-file #10, while the mesio-buccal was not negotiable because of a perforation in the middle third of the root. Instrumentation of patent root canal was performed and the distal canal was filled with AH Plus (Dentsply DeTrey GmbH, Konstanz, Germany) and Thermafil Obturator (Dentsply Maillefer, Ballaigues, Switzerland) whereas the mesial canals and the perforation were sealed using EndoSequence BC Sealer and dedicated EndoSequence BC Points in order to perform a successive apical surgery. The improvement of clinical conditions and, successively, the gradual bone healing, confirmed with analogical radiographs, led to avoid the complicated endodontic surgery on this lower second molar, having already an acceptable clinical success.*

Key Learning Points: *This case report confirmed the favorable physical and biological properties of calcium-silicate based sealers and, most of all, the handling properties of the EndoSequence BC sealer. In selected cases these type of sealers might lead to resolve complex treatments without using specialistic equipments like microscope and help general clinicians to approach complicated endodontic cases in an easier way.*

Obiettivi: *Questo case report presenta un ritrattamento endodontico di un secondo molare mandibolare, trattato con successo utilizzando un cemento canalare a base di silicati di calcio (EndoSequence BC sealer, Brasseler USA, Savannah, GA, USA) con un follow-up a 4 anni.*

Riassunto: *Un paziente di sesso maschile di 80 anni è stato sottoposto ad un ritrattamento canalare su un secondo molare inferiore a causa di una periodontite apicale cronica con ascesso in atto e tragitto fistoloso. Lo scouting dei canali mesio-linguale e distale è stato effettuato con un K-file #10, mentre il canale mesio-buccale non è risultato percorribile a causa di una perforazione nel terzo medio del canale. I canali sondabili sono stati strumentati ed il canale distale è stato chiuso con cemento AH Plus (Dentsply DeTrey GmbH, Konstanz, Germany) e Thermafil Obturator (Dentsply Maillefer, Ballaigues, Switzerland). I canali mesiali e la perforazione sono stati chiusi con il cemento EndoSequence BC Sealer ed i suoi coni di guttaperca dedicati, con lo scopo di eseguire successivamente una revisione chirurgica. Il miglioramento delle condizioni cliniche e la graduale guarigione ossea, confermata dai controlli radiografici, hanno permesso di evitare la chirurgia endodontica che in questo sito sarebbe stata sicuramente complessa.*

Punti chiave: *Questo case report conferma le favorevoli caratteristiche fisiche e biologiche dei cementi a base di silicati di calcio e, in particolare, la facilità di utilizzo dell'EndoSequence BC sealer. In casi selezionati questi cementi possono permettere di risolvere casi complessi senza l'utilizzo del microscopio, rendendo questi trattamenti più accessibili al dentista generico.*

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Introduction

Perforation is an artificial communication between the root canal system and supporting tissues of the teeth (1) that can lead to periodontal defects and tooth lost (2).
It might occur because of caries evolution, internal resorption into periradicular tissues or iatrogenic factors such as preparation of access cavities, insertion of manual or rotary instruments or root canal retreatment in which intraradicular posts need to be removed (3, 4). The frequency of accidental root perforations has been reported to range from 2% to as high as 12% (5, 6).
If the iatrogenic damage is not properly treated, the perforation acts as an open portal of exit encouraging bacterial proliferation and that can prevent healing and elicit inflammatory response leading to tender teeth, abscesses, fistulae and bone resorptive process (7). However, the prognosis differs according to different factors. Large perforations present worst prognosis than smaller ones. Large-sized perforations usually occur during operating procedures such as the opening of the pulp chamber with aggressive burs or post preparation causing more traumatic injuries to the surrounding tissues. Small perforations are easier to repair and they provide a better seal of the defect than the larger ones, avoiding continuous bacterial presence in the damaged area (8, 9). Fuss & Trope (1996) defined coronal, crestal and apical perforations basing this classification on the location of the defect and the related prognosis (10).
The timing of treatment influences as well the prognosis, the best time to repair root perforations is immediately after occurrence. The delay in repair of perforations decreases the prognosis for healing (11, 12, 13). The use of the operating microscope may improve the quality of the sealing of perforations (14).
The ideal root repair material should be biocompatible with the host, non-toxic, non-cariogenic, bacteriostatic and radiopaque. It should also induce osteogenesis and cementogenesis and it should provide adequate seal. It should be easy obtainable, relatively inexpensive and it should not cause the patient or the dentist any unnecessary inconvenience (1, 8, 15, 16). No material offers all of these properties. Nowadays Mineral Trioxide Aggregate (MTA) is the most common root repair material.
More recently, bioceramic-based root canal sealers have been introduced in endodontic practice and they have also been reported as root repair materials. Bioceramics have been classified into "bioinert" or "bioactive" materials depending on the interaction with the living tissues: bioinert materials, such as alumina and zirconia, do not induce any biological or physiological effects on the surrounding tissues. Bioactive materials, such as glass and calcium phosphate, stimulate the growth of hard tissues (17). Bioceramic-based root canal sealers can be classified according to their major constituents into calcium silicate-based sealers, MTA-based sealers and calcium phosphate-based sealers (18).
EndoSequence BC Sealer (BC Sealer, Brasseler USA, Savannah, GA, USA) is a premixed calcium silicate-based sealer that is composed of calcium silicates, monobasic calcium phosphate, calcium hydroxide, zirconium oxide, filler and thickening agents (19). The physical and biological properties of this sealer have been largely studied showing good sealing ability, an high pH and a moderate cytotoxicity (20, 21, 22). The setting reaction of EndoSequence BC Sealer is divided in two phases: in the initial setting time the reaction between calcium hydroxide and calcium phosphate in presence of water produces hydroxyapatite and water. In the final setting time the calcium silicate particles react with the water produced in the previous phase to form a calcium silicate hydrogel (22).
This case report showed a root canal retreatment distinguished by a canal

Figure 1
Endodontic retreatment of mandibular second molar with perforation.
(A) *Initial radiographic aspect,*
(B) *detection of perforation and confirmation of working lenght,*
(C) *working length control with Thermafil Verifier in the distal canal and BC Point in the mesio-lingual canal and*
(D) *final obturation.*

perforation treated with the EndoSequence BC Sealer with a follow-up of 4 years.

Report

A 80-years-old male patient was exposed to root canal treatment of mandibular left second molar because of irreversible pulpitis diagnosed in October 2012. The patient was referred to the department of Operative Dentistry and Endodontics, Fondazione Policlinico Universitario IRCCS Agostino Gemelli, Rome, Italy, in May 2013 complaining pain on biting on tooth 37. At a physical examination, the tooth was tender to percussion, presented a buccal fistula in concurrence with a physiological periodontal probing depth. The periapical radiograph (Figure 1A) showed a radiolucency in the mesial root. The analogical radiographs were taken using X-ray holders Rinn. Based on this finding the tooth was scheduled for a root canal retreatment. The anamnesis was not relevant in this treatment. Regarding his dental history, the patient was a bruxist. The local anesthesia was always obtained with 3% Mepivacaine. During first visit, the removal of the composite filling and a new access cavity with a cylindrical diamond bur and Endo Z bur were performed under rubber dam using prismatic loupes at 4X magnification (Orascoptic, Middleton, Wisconsin). Two mesial canals and one distal canal were located. The scouting was obtained with a K-file #10 (Dentsply Maillefer, Ballaigues, Switzerland) in the distal and in the mesio-lingual canal despite of the presence of gutta-percha whereas the apex was not reached in the mesio-buccal canal. A perforation in the middle part of the canal was detected. The perforation and the working lengths were assessed using an electronic apex locator (Dentaport ZX, J. Morita corporation, Tokyo, Japan) and a radiograph (Figure 1B). The glide-path in mesio-lingual and distal canal was obtained using PathFile (Dentsply Maillefer, Ballaigues, Switzerland) #13, 16 and 19, then they were shaped with Protaper Universal using the whole sequence up to F4 and F3. Unfortunately, the mesio-buccal canal was not negotiable. During instrumentation, 5.25% sodium hypochlorite needle irrigation was performed. After root canal irrigation with saline solution, the canals were dried with steril paper points and the access cavity was temporized with a provisional material (Coltosol F, Coltène/Whaledent AG, Switzerland).
A decision was made to try and save the tooth by filling the mesio-lingual canal with EndoSequence BC Sealer and dedicated EndoSequence BC Points (Brasseler USA, Savannah, GA, USA) and by filling the mesio-buccal canal only with EndoSequence BC Sealer in order to seal the apical third and to prepare the mesial root complex for apical surgery.
One week after the first visit, the tooth was asymptomatic but the fistula persisted. The rubber dam was placed and the temporary filling material was removed with a cylindrical diamond bur. The apical preparation was performed with Verifier Files 0.4 #35 (Dentsply Maillefer, Ballaigues, Switzerland) in

the mesio-lingual canal and #45 in the distal canal. The mesio-buccal canal was prepared with F2 Protaper universal until perforation. Sonic activation with EndoActivator System (Dentsply, Tulsa Dental Specialities, Tulsa, Ok) was performed using 5.25% sodium hypochlorite through the whole canal length. After sodium hypochlorite last flush the canals were flooded with EDTA 17% for 1 minute. The final rinse was obtained by sterile saline solution, and all canals were dried with sterile paper points.
The distal canal was filled with AH Plus (Dentsply DeTrey GmbH, Konstanz, Germany) and Thermafil Obturator #45 (Dentsply Maillefer, Ballaigues, Switzerland) and the mesio-lingual with EndoSequence BC Sealer and EndoSequence BC Point #35. The tip of the EndoSequence BC sealer was inserted until perforation in the mesio-buccal canal and then a "back-filling" of the canal was performed using a light pressure. A Radiograph of the filling was taken (Figure 1D) and a temporary material (Coltosol, Coltène-Whaledent, Langenau, Germany) was used to seal the access cavity. Seven days after the root canal filling the fistula disappeared, the tooth was asymptomatic and it was restored with a direct resin composite. The immediate improvement of clinical conditions led us to prolong the post-operative observational period, in the hope to possibly avoid the apical surgery, if not necessary. Radiographs at 3, 6, 12 months were taken to check the tooth healing (Figure 2A, 2B, 2C). At 48 months the presence of a lamina dura around the tooth and the absence of radiolucency suggested an healthy periodontal ligament (Figure 2D).

Discussion

Root canal perforations represented one of the most difficult situations to deal with in endodontics. Tsesis et al. (2010) reported that root canal perforations more frequently occur in mandibular molar teeth (54.31%) than in other sites (23). The authors ascribe this result to the degree and configurations of mesial canal curvature in the mandibular molar that might impose technical difficulties during instrumentation. As stated above, the ideal material to repair perforations should have several properties such us cytocompatibility, antimicrobial activity and osteogenic potential. Endo Sequence BC Sealer seems to possess all of these features: Zoufan et al. reported that Endo Sequence, both freshly mixed or set, showed lower cytotoxicity than AH Plus (Dentsply De Trey GmbH, Germany) and Tubli-seal (Kerr-Sybron Dental, Orange, CA) sealers; Candeiro et al. found Endo Sequence BC sealer less cytotoxic on human gingival fibroblasts than AH Plus but similar antibacterial effect against Enterococcus faecalis of these two sealers (24,25). Willershausen et al. showed that AH Plus and Pulp Canal sealer (Sybron Dental, Orange, CA) had an higher cytotoxicity than EndoSequence which possessed a superior antibacterial effect (26). Contrarily Loushine et al. described EndoSequence BC sealer more toxic to mouse fibroblast up to the fifth week than AH Plus .
According to the authors these results might be related to the different protocols applied (22). Lastly, EndoSequence BC sealer in vitro seemed to promote more osteoblast differentiation than MTA having potentially in vivo greater osteogenic power (27).
Cytocompatibility and osteogenic potential are important features of an endodontic sealer since the extrusion of the material over the apical foramen is common during the filling of the root canal. During this canal treatment, the extrusion of EndoSequence BC sealer over the perforation and even in the fistulous tract, as well showed in Figure 1D, did not represent a hindrance to the bone healing process.
On the one hand the extrusion of the sealer was a direct consequence of the EndoSequence flow rate that is considered acceptable and higher than AH

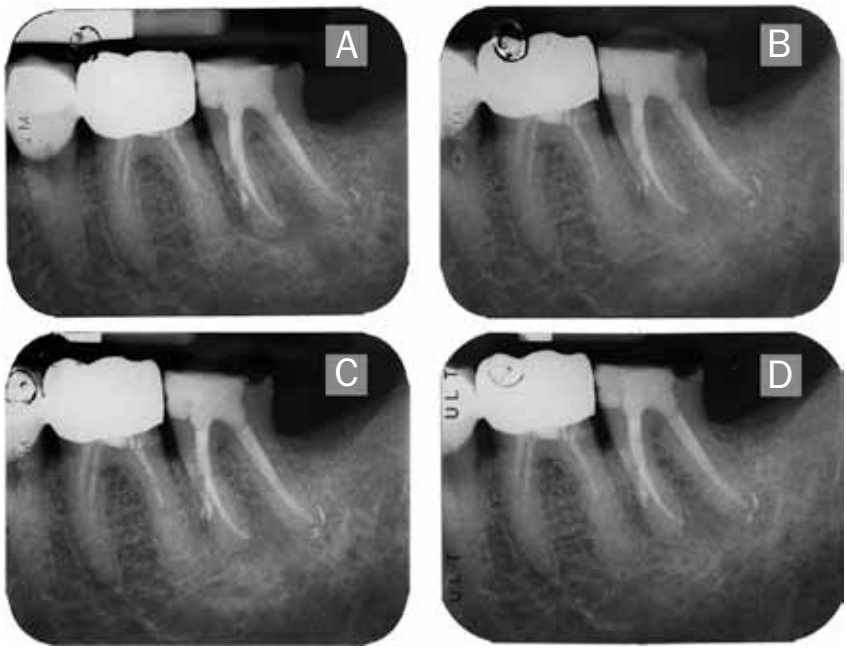

Figure 2
Radiographic follow-up after ***(A)*** *3,* ***(B)*** *6,* ***(C)*** *12 and* ***(D)*** *48 months, evidencing the healing of the area.*

Plus flow rate (21), on the other hand the good flow of this material makes the sealer injectable, more attractive for clinical use and leads a good sealing of the apical foramen, dentinal tubules and accessory canals (22).
In the clinical case here described the extrusion of EndoSequence was not resorbable, after four years of observation almost the same amount of sealer is visible over the apex. Many authors affirmed that the placement of MTA, similar for composition to EndoSequence, should be confined within the root canal system because the extrusion might reduce the possibility of success of the endodontic treatment (28) but, if not, case reports showed a slight reabsorption of the extrusion MTA and a favorable healing around this material (29, 30).
Concerning EndoSequence setting time, the values appear controversial. EndoSequence showed lower values of setting time (2.7 hours) than MTA Fillapex and two epoxy resin-based sealers (AH Plus and Thermaseal) (21). On the contrary Loushine et al., in absence of water, reported an initial setting time of 72 hours and a final set of 240 hours (22). The manufacturer states a prolonged setting time in case of overly dry canals but many authors point out overly water can affect the micro-hardness of the material. Moreover Charland et al. noticed EndoSequence not completely set by 48 hours in presence of blood (31). In this treatment, a week after the root canal filling, the sealer of mesio-buccal and mesio-lingual canals was completely set in the coronal visible part despite the perfect drying of the canals. Unfortunately the clinical setting was not equipped with a microscope hence the decision to use, in the mesial root and for the perforation, a silicate-calcium based sealer to get a fill for the prior to apical surgery. In this case the operator used prismatic loupes at 4X magnification, that couldn't give an ideal visualization of the perforation, during sealing procedures. The healing of the bone was reasonably due to a good sealing of the perforation and to a possible confluence of the mesial canals.

Conclusions

Although many studies demonstrated the importance of using the microscope for root canal treatments (32), this case report confirmed the handling properties of these new calcium silicate based sealers, in particular of the EndoSequence BC sealer, which allow to repair some types of perforations without the use of microscope making these complex cases more accessible to general dentists.

Clinical Relevance

This simple cold root canal filling technique with EndoSequence BC sealer and his dedicate gutta-percha cones could be a valid alternative to warm root canal filling techniques. Further clinical studies are necessary to assess efficacy of this calcium-silicate based sealer.

Conflict of Interest

All authors declare no conflict of interest.

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ORIGINAL ARTICLE/ARTICOLO ORIGINALE

Evaluation of the cyclic fatigue resistance of rotary pathfinding instruments made of nickel-titanium (NiTi) alloys with different heat treatments

KEYWORDS
Endodontics, Nickel-titanium instruments, Cyclic fatigue, Pathfinding files, Heat treatment.

PAROLE CHIAVE
Endodonzia, strumenti al nichel-titanio, fatica ciclica, file per il percorso di scivolamento, trattamento termico.

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Valutazione della resistenza alla fatica ciclica di strumenti rotanti per il percorso di scivolamento realizzati con diversi trattamenti termici delle leghe di nichel-titanio (NiTi).

Abstract

Aim: *The aim of this study was to compare the cyclic fatigue resistance of rotary pathfinding instruments made of nickel-titanium (NiTi) alloys submitted to different heat treatments.*
Materials and Methods: *Eighty NiTi endodontic files were divided into four study groups, as follows: Scout Race 15.02 (FKG Deintaire SA), Pathfile 19.02 (Dentsply Maillefer, Ballaigues, Switzerland), Proglider 16.02 (Dentsply Maillefer, Ballaigues, Switzerland), and Hyflex GPS 20.02 (Coltène Whaledent, Allstätten, Switzerland). The instruments were subjected to cyclic fatigue testing using simulated canals with a 6mm radius and 30° or 45° curvature angles. The data obtained were organized in an Excel spreadsheet and analyzed statistically using BioEstat 5.3 software (Marimauá Institute, Manaus, Brazil). The non-parametric Kruskal-Wallis test was used in the analysis. The Mann-Whitney U-test was used for multiple comparisons, at a significance level of 5%.*
Results: *The Hyflex instrument was superior to all the other instruments ($p<0.05$), and Pathfile had a superior fatigue time ($p<0.05$) compared with Scout Race and Proglider, for both of the curvature angles analyzed. No significant difference was observed between Scout Race and Proglider.*
Conclusions: *Cyclic fatigue resistance of the HyFlex GPF instrument was the highest among those tested, and the curvature radius had a significant effect on fatigue resistance. A significant decrease in the cyclic fatigue time was observed, with an increase in the flexion (curvature angle), irrespective of the instrument analyzed.*

Obiettivi: *Lo scopo di questo studio era di confrontare la resistenza alla fatica ciclica degli strumenti rotanti per il percorso di scivolamento realizzati con leghe di nichel-titanio (NiTi) sottoposte a diversi trattamenti termici.*
Materiali e metodi: *Ottanta strumenti in NiTi sono stati divisi in quattro gruppi di studio, come segue: Scout Race 15.02 (FKG Deintaire SA), Pathfile 19.02 (Dentsply Maillefer, Ballaigues, Svizzera), Proglider 16.02 (Dentsply Maillefer, Ballaigues, Svizzera), e Hyflex GPS 20.02 (Coltène Whaledent, Allstätten, Svizzera). Gli strumenti sono stati sottoposti a prove di fatica ciclica utilizzando canali simulati con un raggio di 6 mm e angoli di curvatura di 30° o 45°. I dati ottenuti sono stati organizzati in un foglio di calcolo Excel e analizzati statisticamente utilizzando il software BioEstat 5.3 (Istituto Marimauá, Manaus, Brasile). Nell'analisi è stato utilizzato il test non parametrico Kruskal-Wallis. Il test U Mann-Whitney è stato utilizzato per confronti multipli, con un livello di significatività del 5%.*
Risultati: *Lo strumento Hyflex è risultato superiore a tutti gli altri strumenti ($p<0,05$) mentre il Pathfile aveva un tempo di fatica superiore ($p<0,05$) rispetto a Scout Race e Proglider, per entrambi gli angoli di curvatura analizzati. Nessuna differenza significativa è stata osservata tra Scout Race e Proglider.*
Conclusioni: *La resistenza alla fatica ciclica dello strumento HyFlex GPF era la più alta tra quelle testate ed il raggio di curvatura influenzava in maniera significativa la resistenza alla fatica. È stata osservata una diminuzione significativa del tempo di fatica ciclica, con un aumento della flessione (angolo di curvatura), indipendentemente dallo strumento analizzato.*

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Introduction

Exploration of the root canals conducted immediately after gaining access to the pulp chamber is essential to allow larger caliber files to reach the working length without any deviation or impediment (1, 2). Thus, a number of files with different nickel-titanium (NiTi) alloys have become available for pathfinding during root canal treatment.

The files are coupled to an engine and driven with continuous rotation kinematics, and they have greater flexibility and resistance to cyclic fatigue, thus enabling improved root canal preparation (3). However, it should be noted that NiTi files are still subject to a considerable risk of fracturing within the root canal, despite having higher quality and efficiency than those made of steel (4).

The separation of NiTi rotary files occurs in two ways: by torsion or cyclic fatigue (5). Torsional fracture occurs when the tip of the file engages the canal and the remainder continues to rotate freely within it (6). Cyclic fatigue fracture occurs when the file rotates freely within the canal in tensile-compressive cycles, until it reaches its point of maximal flexion.

This happens during a complete cycle of the instrument. In the first half cycle, one portion is submitted to tensile and the other to compressive stress, the reverse occurring during the final half cycle. This repeated effect, caused by the curvature of root canals, increases rotational fatigue, and represents the main factor leading to instrument separation (7).

Pathfile (Dentisply Maillefer, Ballaigues, Switzerland) and Scout Race (FKG Dentaire, La Chaux-de-fonds, Switzerland) instruments are manufactured with a conventional NiTi alloy, and are used for exploration of root canals. They have four cutting edges, a square cross-section and a taper of 0.02 mm (8).

Recent technology has been producing pathfinding files with different types of NiTi alloys, aiming at increasing resistance to cyclic fatigue. One of these files is the Proglider (Denstsply Maillefer), an instrument manufactured with a NiTi alloy called M-Wire. This pathfinding system consists of only one file and, unlike the other abovementioned files, has a progressive taper varying from 2% to 8% up to its final diameter (9).

Another instrument manufactured following the latest discovery in NiTi alloy heat treatments was the Hyflex GPF file (Coltène-Whaledent, Allstätten, Switzerland). Its structure is made of a NiTi CM-Wire alloy with controlled memory, making it extremely flexible and more resistant to cyclic fatigue fracture. This file also has a quadrangular cross-section, similar to that of Pathfile and Scout Race (8).

Thus, the aim of this study was to compare the cyclic fatigue resistance of pathfinding rotatory files made of nickel-titanium alloys subjected to different heat treatments. The null hypothesis is that there would be no difference between the fracture times observed in the different study groups.

Materials and Methods

Eighty NiTi endodontic files were used to conduct this experiment. The following file types were used: Scout Race 15.02 (FKG Deintaire SA), Pathfile 19.02 (Dentsply Maillefer, Ballaigues, Switzerland), Proglider 16.02 (Dentsply Maillefer, Ballaigues, Switzerland), and Hyflex GPS 20.02 (Coltène Whaledent, Allstätten, Switzerland).

Two stainless steel devices were fabricated in an angled tube format and used to simulate a root canal, to test the resistance of the instruments to cyclic fatigue fracture. The file to be tested was set to rotate freely within the devices, under constant pressure (Figure 1).

The tubes were made of stainless steel and had an internal diameter of 1.04 mm, total length of 20 mm and curvature radius of 6 mm. The curved portion of the device measured 9.4 mm, and the straight portion, 10.6 mm. One tube had an angle of 30° and the other an angle of 45° relative to the concave surface of the tube curvature. The tubes and the contra-angle were secured in two bench mini-vises to avoid variations in position and angulation during the tests.

Figure 1
Stainless steel devices fabricated in an angled tube format and used to simulate a root canal.

A single holder was created to fit the two mini-vises, with a height difference of 30 mm. This way the mini-vises were always coupled in the same position. The mini-vise used to hold the devices was fixed to a workbench. The other mini-vise was mobile to facilitate handling during insertion and removal of the files at each test; nevertheless, it had a preset, precise fitting guide fixed to the bench (Figure 2).
The instruments were driven by an endodontic motor (VDW Silver, VDW, Munich, Germany) coupled to a 6:1 contra-angle (Sirona Dental Systems GmbH, Bensheim, Germany). The files in each group were tested in clockwise continuous rotation, with the settings of speed and torque recommended by their respective manufacturers. Chlorhexidine gel (Maquira SA, PR, Brazil) was used as a lubricant to reduce the friction between the endodontic instrument and the metal. All the files were activated until their fracture was observed visually. The time elapsed between activation and fracture of each instrument was recorded with a 1/100 s chronometer and tabulated by a single evaluator.
The data were organized in an MS Excel spreadsheet and analyzed statistically using BioEstat 5.3 software (Marimauá Institute, Manaus, Brazil). The non-parametric Kruskal-Wallis test was used, owing to significant differences among the group variances. The Mann-Whitney U-test was used for multiple comparisons, at a significance level of 5%.
The fragments were measured with a digital caliper to assess whether a pattern occurred in the length of the fractured fragment in each group.

Figure 2
Support created with the two mini-vises for the experiment.

Results

The resistance values of the Hyflex file were the highest among all groups, both at 30º and 45º ($p<0.05$) (Table 1).
The fatigue time of the Pathfile instrument was statistically longer than that of the Proglider and Scout Race instruments, for the two angles tested ($p<0.05$). At the 45º angulation, the Pathfile still had a fatigue time longer than that of the Scout Race ($p=0.0425$) and Proglider ($p=0.0046$) instruments. There was no statistically significant difference between the Scout Race and Proglider instruments for either angle ($p>0.05$). The results showed that an increase in flexion (angulation) promoted a significant decrease in cyclic fatigue time, irrespective of the group analyzed ($p<0.05$). Thus, the following ranking was observed for cyclic fatigue resistance, irrespective of the angulation analyzed: Hyflex>Pathfile>Proglider=Scout Race. The fragment length assessment revealed no statistical difference between the study groups (Table 2).

Table 1

Mean cyclic fatigue times (in seconds) for the different instruments used, at the angles of 30° and 45°

Angle\Group	Hyflex	Pathfile	Scout Race	Proglider
30°	9949[a]	2850[b]	841[c]	1010[c]
45°	1247[a]	381[b]	130[c]	147[c]

Different letters represent results with statistically significant differences

Table 2

Mean length (in millimeters) of the instrument fragments measured after cyclic fatigue testing

Files	Angle	Mean (mm)
Hyflex GPF	30°	9.7
Pathfile	30°	9.6
Proglider	30°	9
Scout Race	30°	9.6
Hyflex	45°	10
Pathfile	45°	9.4
Proglider	45°	9.2
Scout Race	45°	9

Discussion

The technological advancement of NiTi files led to the creation of new designs and systems that rendered instrumentation faster and more effective, enabling the original anatomy of root canals to be preserved, and leading to fewer iatrogenic errors during endodontic treatment (10). Despite all the flexibility and elasticity offered by NiTi instruments during endodontic treatment in curved canals, the fracture of these instruments within the root canal remains a distinct possibility (11).

Hence, new manufacturing methods using heat treatments (M-Wire and CM-Wire) have emerged for NiTi files, as well as modified cutting blades and electrochemical polishing, providing even greater elasticity and resistance to prevent cyclic fatigue fracture. Our results showed that the fatigue time at 45º was significantly shorter than at 30º, irrespective of the instrument group analyzed ($p<0.05$). The cyclic fatigue of an instrument is directly related to its degree of curvature; therefore, the higher the degree of curvature, the lower its resistance to cyclic fatigue (12, 13). Martin et al. (2003) (14), obtained a greater number of cyclical fatigue fractures in canals that had more pronounced curvatures. This result corroborates the results of the present study.

The Hyflex GPF file was superior to the others, irrespective of the flexion analyzed. Despite the paucity of information on the performance of this file in relation to cyclic fatigue in terms of time (s), its greater resistance compared with the other files can be attributed to its heat treatment (CM-Wire), which enabled the instrument to adapt to the canal curvature and diminished the areas of tension and compression (15). In another study on static cyclic fatigue, the Hyflex 25.08 file achieved a greater number of cycles compared to the other files, and this result was also related to the properties of the CM-Wire alloy (16).

Uslu G et al. (2018) (17) tested cyclic fatigue in S-shaped artificial canal with R-pilot (VDW, Munich, Germany), Hyflex EDM and Pathfile. R-Pilot had the greatest cyclic fatigue resistance followed by HyFlex EDM and PathFile in both apical and coronal curvature. R-pilot has a reciprocating motion different from the other files that have a rotational movement, according to the author was the main reason to have obtained a better performance than the other files.

In the present study, the cyclical fatigue time of the Pathfile instrument was significantly longer than that of the Scout Race and Proglider instruments, for the two curvature variations tested. The fact that the Proglider file presented lower resistance performance when compared with the Hyflex GPF and Pathfile files can be accounted for the fact that the greater the diameter of the file in the area of tension and compression, the lower its resistance to cyclic fatigue (18, 19, 20).

Capar et al. (2015) (8), and Enalghy et al. (2014) (9), conducted a cyclic fatigue test comparing the Proglider and Pathfile instruments with an angle of 90º and a radius of 5 mm. The results of both studies indicate that the Proglider file reached a greater number of cycles until failure (NCF), diverging from our study. The authors associated

this result to the fact that the Proglider file uses the M-Wire heat treatment during manufacturing to produce an alloy with greater flexibility and greater resistance to cyclic fatigue as compared with the Pathfile instrument, produced with conventional NiTi.

Tpçuoglu et al. (2018) (21) after evaluation of the Cyclic fatigue resistence of ProGlider, PathFile and ScoutRaCe instruments in an artificial S-shaped canal, the ProGlider files were found to have greater cyclic fatigue resistence than the PathFile and ScoutRaCe in the apical curvature. However, there was no significant difference between these files in the coronal curvature, diverging from our study. Serefoglu et al. (2018) (22) performed a cyclic fatigue study comparing the R-Pilot (VDW, Munich, Germany), Wave One Gold Glider (Dentsply, Maillefer) and the Proglider file in a metal device with 90º angle and 3 mm radius. The Proglider showed statistically the lowest performance compared to the other files. The R-Pilot file has a smaller diameter than the Proglider, so the authors indicated that this was one of the relevant factors. The Wave One Gold Glider presented a better result that it was for presented a gold thermal treatment, making the file more flexible and with that it presents a greater resistance to cyclic fatigue in relation to the file Proglider that has M-Wire treatment.

The performance of the Scout Race file was inferior to that of the Hyflex GPF and Pathfile instruments. One of the factors involved in this result may have been the speed variation in rotations per minute (RPM). The Scout Race file runs at 800 RPM, whereas the Hyflex GPF and Pathfile instruments run at 300 RPM.

Analyzing the influence of rotations per minute during cyclic fatigue testing, Lopes et al. (2009) (5), showed that the higher the number of RPM, the lower the resistance to cyclic fatigue.

The length of the fragment of all fractured files was similar in all groups and angulations tested. This can be explained by the fact that the cyclic fatigue process involves the instrument rotating freely within the root canal, and then undergoing tensile and compressive stress at the point of curvature, leading to metal fatigue (23). Other authors state that the cyclical fatigue fracture occurs because it undergoes contraction and flexion as it moves through the point of curvature (24, 25). Thus, since all files were standardized at 22 mm with a rubber stop, they all fractured at the point of tension of the curvature of the devices used during the tests. The NiTi rotary pathfinding files included in this study vary widely in terms of alloy type, taper, diameter, and recommended torque and RPM settings; this may have influenced the results of the tests performed to evaluate cyclic fatigue (26).

Within the limitations of this study, the CM-Wire NiTi alloy showed greater resistance to cyclic fatigue than NiTi M-Wire and conventional instruments. To avoid fractures of the instruments it is necessary to understand the physical properties and the changes that occur during the different types of heat treatment associated with their different types of cross-section, so that the ideal instrument can be chosen according to the varied clinical situations present in the dentist routine.

Conclusions

The results of this study showed that the Hyflex GPF file presented a significantly higher resistance to cyclic fatigue compared with the other files analyzed, irrespective of the degree of curvature. The observed ranking of cyclic fatigue resistance was Hyflex>Pathfile>Proglider=Scout Race. The files tested with 30º angulation presented greater resistance to cyclic fatigue compared with those tested with 45º angulation. The length of the fractured fragment was similar in all groups and for both angles analyzed.

Clinical Relevance

The present study demonstrated clinical relevance for testing the resistance to cyclic fatigue of pathfinding instruments and thus making the root canal exploration with rotary instruments safer.

Conflict of Interest

The authors declare not to have any conflict of interest.

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CLINICAL ARTICLE/**ARTICOLO CLINICO**

Unusual Anatomies: case series

Anatomie inusuali: case series

KEYWORDS
Unusual anotomies, pre-operative radiography, operative Microscope, ultrasonic tips.

PAROLE CHIAVE
Anatomie inusuali, radiografia pre-operatoria, microscopio operatorio, punte ultrasoniche.

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Abstract

Aim: *The aim of this article is to describe three case reports of unusual teeth anatomy, more precisely of a maxillary right central incisor with two roots and two root canals, a mandibular premolar with four root canals and a second maxillary molar with five root canals associated with an extra small root located in the center of pulp chamber.*
Methodology: *A correct diagnosis, the awareness of finding an unusual anatomic root variation in any endodontic treatment, the use of technological equipment like the operative microscope and ultrasonic tips enabled the operator to solve the clinical case in a safe and predictable way. In order to set a correct treatment plan, it is quite important to evaluate a pre-operative radiograph before starting the endodontic treatment. Another step is the thorough examination of the pulp chamber floor, better if carried out under magnification and coaxial light in order to easily locate all the canal orifices. The endodontic treatment and retreatment of the previously mentioned three uncommon teeth will be discussed.*
Results: *All the root canals were found, treated and obturated in the three presented cases and healing was shown in the follow up radiographs.*
Conclusions: *Anatomic root variations should be anticipated in order to be encountered in the daily endodontic practice.A pre-operative radiography must always be done before endodontic treatment in order to make the right diagnosis.*
The operative microscope magnification is useful in order to work in a safe and precise way.

Obiettivo: *L'obiettivo di questo lavoro è descrivere tre casi clinici con anatomie inusuali, precisamente un incisivo centrale superiore con due radici e due canali radicolari, un premolare mandibolare con quattro canali radicolari e un secondo molare mascellare con cinque canali radicolari e un extra piccola radice situata al centro della camera pulpare.*
Metodologia: *Una corretta diagnosi, la consapevolezza di trovare un'insolita variazione anatomica in qualsiasi trattamento endodontico, l'uso di apparecchiature tecnologiche come il microscopio operatorio e le punte ultrasoniche hanno permesso all'operatore di risolvere il caso clinico in modo sicuro e prevedibile. Al fine di stabilire un piano di trattamento corretto è molto importante analizzare una radiografia preoperatoria prima di iniziare il trattamento endodontico. Un altro passo è l'esame approfondito del pavimento della camera pulpare, meglio se effettuato sotto ingrandimento e luce coassiale per localizzare facilmente tutti gli orifizi canalari. Saranno discussi due trattamenti endodontici e un ritrattamento di denti con anatomie inusuali precedentemente citati.*
Risultati: *Tutti i canali radicolari sono stati trovati, trattati e otturati nei tre casi presentati e la guarigione viene mostrata nei controlli radiografici.*
Conclusioni: *Le variazioni anatomiche delle radici dovrebbero essere anticipate perché possono essere riscontrate nella pratica endodontica quotidiana. Una radiografia preoperatoria deve essere sempre eseguita prima del trattamento endodontico per impostare la corretta diagnosi. L'ingrandimento dato dal microscopio operatorio è utile per lavorare in modo sicuro e preciso.*

Introduction

The bacteria and their byproducts are the main causative factor of infection of the pulp and the periapical area (1).
The goal of modern Endodontics aims to achieve adequate shaping, appropriate 3dimensional (3D) cleaning and finally a correct obturation of the complex root canal system with thermoplasticized gutta-percha (2, 3). This is done so as to eliminate or reduce the bacterial load to levels compatible with the healing process (4).
Based on knowing that everything starts with a correct diagnosis and careful eval-

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Figure 1
Pre-operative radiograph of maxillary central incisor.

Figure 2
Pulp chamber after obturation.

Figure 3
Post-operative radiograph showing the two root canals.

uation of the preoperative radiography, it is possible then to anticipate potential variations of the endodontic anatomy.
When the preoperative radiograph is not clear enough, it is possible to perform alterations by filming from different horizontal angles in order to show the real anatomy of the tooth under examination.
Afterward, a correct access cavity follows using magnifying systems and coaxial light. Utilizing the aid of a magnification tool, the Operating Microscope, it is possible to correctly examine the whole floor of the pulp chamber and point out additional or unusual anatomies. Only after having identified all the existing root canals it is possible to continue the endodontic treatment: shaping, 3D Cleaning and 3D obturation. Otherwise, forgetting one or more root canal can cause failure in the short or long term (5, 6).
The aim of this work is to present and discuss three clinical cases with unusual anatomies that with the help of the indispensable technologies such as the operating microscope and ultrasonic tips have been successfully solved.

Case Series

Case report 1: A 23-year-old male patient was referred because of pain and possible root canal treatment. Patient was complaining from pain with thermal stimulus at the upper right side. Using thermal tests, the clinical examination confirmed that the pain was in tooth 1.1, while the periodontal test was negative. Clinically, the tooth under examination was presented with a prosthetic fixed covering with marginal leakage clinically demonstrated by defective cervical seal.
Upon radiographic examination, anomalous configuration of the roots was visible (Fig. 1). The diagnosis was irreversible pulpitis. The endodontic treatment of tooth 1.1 was then performed with the aid of the operating microscope (Som 32, Kaps). After anesthesia, the tooth was isolated using rubber dam

Figure 4
Six Months follow up.

isolation. A modification in the access cavity was performed in the form of further bucco-palatal extension. The access was done using high speed burs and ultrasonic tips (P Tip, Plastic Endo, Buffalo Grove, USA), two blood clots coming from the canal orifices were located on the floor of the pulp chamber. The identified canals were one on the buccal and one on the palatal sides of the access (Fig. 2).
Afterwards the chemo-mechanical preparation was carried out, alternating the use of rotating instruments, ProTaper Universal in crown-down technique, irrigating with 5% sodium hypochlorite (Niclor 5, Ogna, Muggiò, Milan, Italy) and EDTA. Immediately after, the three-dimensional obturation using warm gutta-percha with the continuous condensation wave technique (System B) (Fig. 3) was done. The final precision of the endodontic treatment was checked using a periapical radiograph, and the patient was referred to follow up checks over time to evaluate the effectiveness of the treatment (Fig. 4).

Case report 2: A 32-year-old male patient was referred for evaluation and possible retreatment of his right maxillary second molar (tooth number 17). Clinically the tooth showed pain on percussion. The periapical radiograph revealed improper previous root canal treatment and a periapical lesion. The tooth was diagnosed with failed root canal treatment associated with chronic apical periodontitis and non-surgical endodontic retreatment of this tooth was the treatment of choice.
After isolating the tooth with rubber dam access cavity was done while using the operating microscope (Kaps, Som 32 Karl Kaps GmbH & Co. KG). After finishing the access opening of the pulp chamber the identification of the palatal root canal then the distal-buccal and mesio-buccal was performed. An increase in the magnification of the surgical microscope (10x) with the help of a special diamond coated ultrasonic tip, ET 18D, (Satelec Acteon group) it was possible to locate the second mesiobuccal canal, MB2, and also locate a small canal found almost in the center of floor. Only after identifying the actual anatomy of this tooth was done, the endodontic retreatment began. Each canal was prepared using ProTaper universal files SX, S1, S2, F1 and F2 (dentsply maillefer) to the working length. The working length for all the canals was determined with the help of the apex locator Morita Root ZX (J. Morita) then the it was confirmed with periapical radiograph.
The irrigation protocol used was 5.25% NaOCl (Niclor 5, Ogna) and 17% EDTA (EDTA 17%, Ogna), saline solution and CHX 2% (Cloreximid, Ogna) as a final wash. The irrigation was activated by ultrasonic activation (passive ultrasonic irrigation PUI).
The phase of obturation was performed with thermoplasticized gutta-percha using system-B technique (system-b, Kerr) after application of the endodontic sealer, in this case the sealer used was Pulp Canal Sealer EWT (Pulp Canal Sealer EWT, Kerr) (Fig. 5A, B, C, D).
The postoperative radiograph showed complete obturation of all the five root

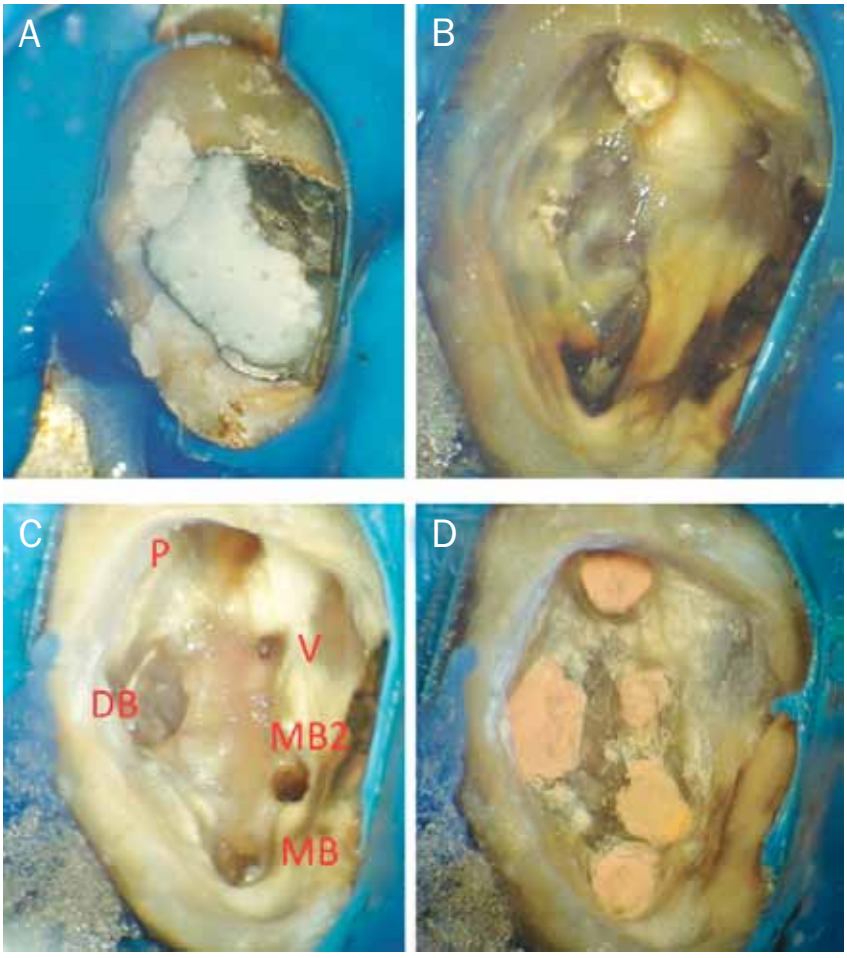

Figure 5
(A) *The maxillary second molar with previous restoration and after rubber dam isolation;* ***(B)*** *pulp chamber after removal of restoration and exposing mesiobuccal MB, distobuccal DB and palatal P canals;* ***(C)*** *the pulp chamber after root canal preparation: locating the accessory canal V also MB2 was found and prepared;* ***(D)*** *all five canals after obturation.*

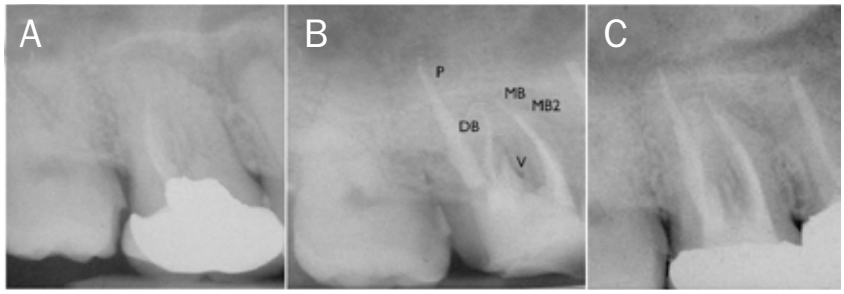

Figure 6
(A) *Pre-operative periapical radiograph of maxillary second molar showing failed endodontic treatment and periapical lesion related to the mesiobuccal root;*
(B) *periapical radiograph after endodontic retreatment and obturation of five root canals including the extra canal in the supernumerary root V;*
(C) *periapical radiograph of 12 months follow up.*

canals, including the small accessory root canal. The first follow up was after 12 months and the radiograph showed healing of the periapical lesion (Fig. 6A, B, C).
Nine years after the retreatment was carried out a CBCT of the upper dental arch was done and by using an endodontic software, 3D Endo (Endo 3D, Sirona Dentsply), it was possible to separate the tooth from the other teeth and rebuild it in three dimensions. This special viewing showed the maintenance of healing and the presence of all 5 of the root canals, including the small central canal (Fig. 7A, B, Fig. 8A, B).

Case report 3: A case of non surgical root canal treatment of tooth number 44 with four root canals. Patient was presented with continuous pain, attrition and cervical abrasion of the affected tooth. Tooth was tender to percussion.
Diagnosis was irreversible pulpitis with apical periodontitis. Root canal treatment was performed under the use of operative microscope (Labomed Prima).
Studying the preoperative radiograph it was possible to see an unusual anatomy of the tooth and with the help of magnification and light all the complex endodontic system was visualized and treated. Utilizing a special diamond coated ultrasonic tip, ET 18D, (Satelec Acteon group) the finishing of the access cavity was performed and the four root canals were exposed.
Afterwards the shaping phase begin, the files used during the shaping phase were as follow hand files 0.8, 10 K and One Flare, OneG and 2Shape TS1, (Micromega, France), as rotary files.
For the 3D cleaning phase Sodium hypochlorite (NaOCl) 5.25%, EDTA 17% and distilled water were used. The NaOCl was activated using 5 Cycles of Internal heating followed by sonic activation for each cycle.
Finally obturation phase was done

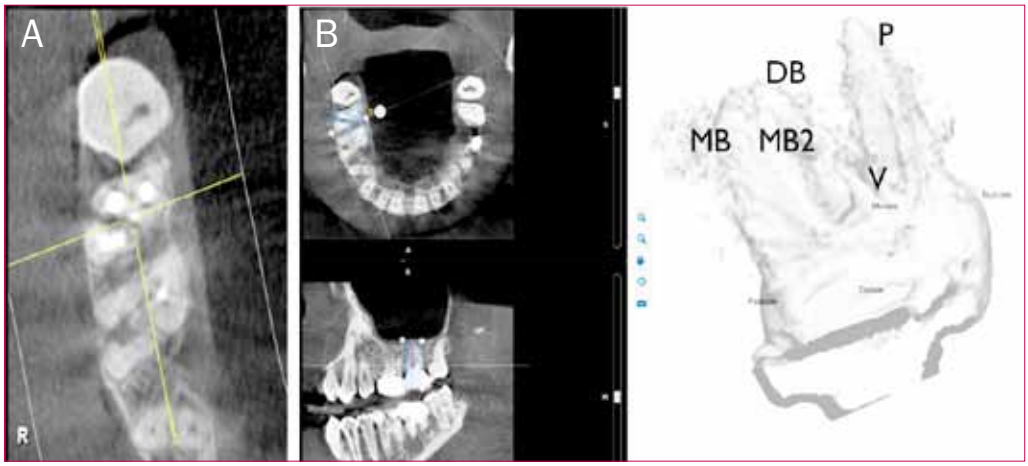

Figure 7
(A) *CBCT showing the five root canals with the fifth canal located in the center of the second maxillary molar;* ***(B)*** *the tooth using software 3D Endo and the small accessory root V can be seen.*

with warm guttapercha using EQV and AH plus as sealer (Fig. 9, 10, 11).

Discussion

Achieving successful root canal treatment is merely dependent on performing proper cleaning and shaping followed by complete obturation in a three-dimensional way of the very complex root canal system (3). Inadequate cleaning of all the existing root canals can lead to leaving remnants of the pulp tissue, which in consequence will lead to failure of the treatment. Even worse results can occur by missing an entire undiscovered root canal.
In order to locate the root canals it's necessary to have proper previous knowledge of the endodontic anatomy and its possible variations.
Equally important is the use of updated technologies such as the dental operating microscope and ultrasonic tips in order to find all root canal orifices and avoid any major causes of treatment failure.
The main use of the operating microscope is to enhance the PDR, or the power of resolution, which means being able to distant two points that are very close to each other in order to be able to distinguish them. The human eye, in fact, can't differentiate between two objects separated by a minimum distance of 0.1 mm (PDR: 0.1 mm): these objects will appear as one to the human eye. The operating microscope is able to increase the power of resolution from 0.1

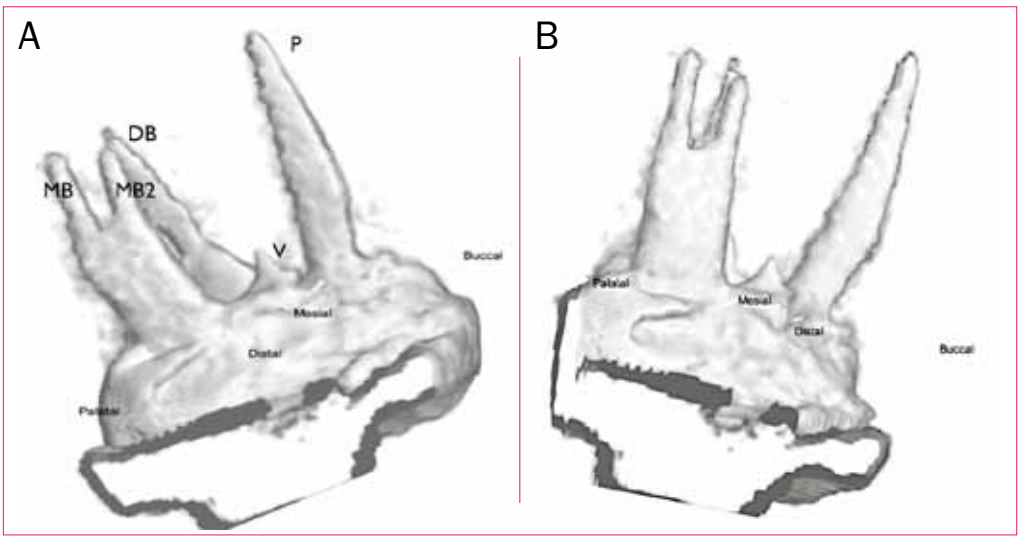

Figure 8
(A) *Another view of the tooth using software 3D Endo and the small accessory root V;* ***(B)*** *different angulation.*

Figure 9
Pre-operative radiograph of second mandibular premolar.

Figure 10
Post-operative radiograph showing the four root canals.

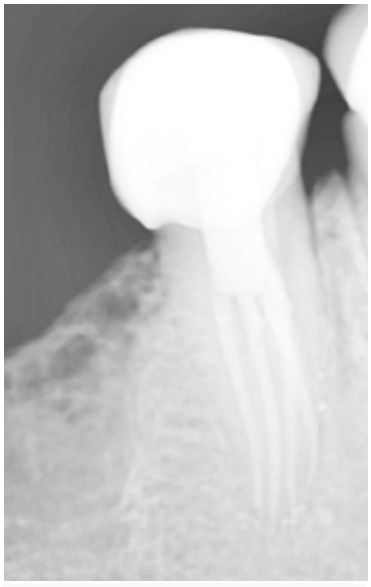

Figure 11
Six months follow up.

mm up to 0.005 mm which is equal to 5 microns, thus making the human eye able to detect more details (7, 8).
The ultrasonic endodontic tips are produced in various types that have different sorts of shapes, length and manufacturing materials. Additionally, utilizing the recent updated ultrasound devices, it is possible to optimize the use of each type of the tips by adjusting the frequency and the amplitude of vibration. The ultrasonic tips offer an improved precise cutting due to their reduced dimensions which permit greater visibility of the operating field when compared to rotary instruments. Such enhanced and more visible field can be optimized by the use of magnification systems as the operating microscope (8).
Therefore, proper knowledge and improved operating field will help in identification of all root canal orifices, only after this, now it is possible to proceed with the phases of shaping, cleaning and finally the 3D obturation.
The maxillary central incisor almost always presents with one root and one root canal.
Reviewing the literature, cases similar to the one presented in this work are very infrequent (9, 10, 11, 12, 13). The shape anomalies may be borne by the crown of the teeth that can be presented in the form of accessory cusps, conical or tubular shape. On the other hand, the anomalies of the root may be in the form of number, shape and size or even of the sole endodontic (14).
The maxillary molars can be presented with different configurations (15): the current case report is describing a maxillary second molar with an unusual root canal morphology.
The particularity of this tooth is the presence of a small auxiliary root localized at the center of the floor. There are similar cases, for example radix mesiolingualis, radix distolingualis and radix paramolaris (16, 17, 18, 19, 20), but never in the litrature a small root in the center of the floor was described even *in vitro*.
Only because of the assistance of magnification it was possible to discover this supernumerary root canal. The encounter of the entire, previously missed, root canal system was the key to ensure the success of the endodontic retreatment of this tooth.
Mandibular premolars can present different root configurations. The most frequent configurations are one root and one

or two root canals or two roots and two root canals. The clinical case shown in this work is very rare because it has four root canals (21, 22, 23).

Conclusions

Achieving short and long term success in endodontics is based on proper knowledge of the root canal morphology of all the teeth and its possible variations. It's also important to use modern updated technology like the operating microscope and ultrasonic tips for aiding in locating all root canals. Only after identifying the actual present root canal anatomy it is possible to proceed to complete and successful endodontic treatment and/or retreatment (24, 25, 26, 2, 3).

Clinical Relevance

The clinical cases presented in this study emphasizes on the importance of the knowledge of the root canal anatomy along with the utilization of recent technologies like operating microscope and ultrasonic tips.

Conflict of Interest

The authors declare that there are no conflicts of interest.

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ORIGINAL ARTICLE/**ARTICOLO ORIGINALE**

Variation of vascular and blood indicators of early endothelial dysfunction after root canal therapy: A clinical and biomolecular study

Variazione degli indicatori vascolari ed ematochimici di disfunzione endoteliale precoce dopo terapia endodontica: studio clinico e biomolecolare.

KEYWORDS
Chronic inflammation, endothelial dysfunction, endothelial activation, apical periodontitis, root canal treatment.

PAROLE CHIAVE
Infiammazione cronica, disfunzione endoteliale, attivazione endoteliale, parodontite apicale, trattamento endodontico.

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Abstract

Aim: *Apical periodontitis (AP) is correlated with a higher risk of developing cardiovascular disease (CVD). No data currently exist to suggest that endothelial dysfunction (ED) improves after endodontic treatment in patients who have AP, despite a link between chronic AP and ED. This study was designed to investigate the expression of early ED markers in young adults with chronic AP, before and after root canal treatment.*
Methodology: *41 subjects (20 controls and 21 patients with AP) were examined at enrolment. Patients with AP were also assessed 2 and 12 months after treatment. ENDO-PAT was used to measure endothelial flow reserve (EFR) and ELISAs were used to assess plasma levels of interleukin (IL)-1, IL-6 and TNF-alpha, vasoconstrictor ED endothelin (ET)-1, the circulating endothelial adhesion markers intercellular adhesion molecule-1 (ICAM)-1/CD54 and soluble vascular cellular adhesion molecule-1 (sVCAM)-1/CD106, soluble CD14, and the endothelial leukocyte adhesion molecule E-selectin.*
Results: *Baseline serum levels of ET-1, ICAM-1, E-selectin, IL-1, and sCD14 were elevated in patients with AP compared to the control group. There was no macroscopic evidence of reduced EFR in either group. Treatment for AP was associated with reduced inflammation and improved early ED, indicated by a lowering of IL-1, sCD14, ET-1, ICAM-1/CD54 and E-selectin levels to resemble those of control subjects.*
Conclusions: *Early vascular ED may be driven by AP but is reversible with effective endodontic treatment.*

Obiettivi: *La parodontite apicale (AP) è stata associate con un rischio aumentato di patologia cardiovascolare (CVDs). Non vi è evidenza che la disfunzione endoteliale (ED) migliori a seguito del trattamento endodontico in pazienti con AP, nonostante sia stata dimostrata un'associazione tra AP e ED. Questo studio è stato disegnato al fine di valutare l'espressione dei marker precoci di ED in giovani adulti con AP cronica, prima e dopo il trattamento endodontico.*
Materiali e metodi*: 41 soggetti (20 controlli e 21 pazienti con AP) sono stati analizzati all'arruolamento. I pazienti con AP sono stati anche valutati a 2 e 12 mesi post-trattamento. ENDO-PAT è stato utilizzato per misurare Endothelial flow reserve (EFR) ed ELISA assays sono stati utilizzati per valutare il livelli plasmatici di interleuchina IL-1, IL-6 e TNF-alpha, il vasocostrittore ED endotelina (ET)-1, i marker circolanti di adesione endoteliale, la molecola di adesione intercellulare (ICAM)-1/CD54 e la molecola solubile di adesione cellulare vascolare (sVCAM)-1/CD106, il CD14 solubile, e la molecola di adesione endoteliale leucocitaria (E-selectin).*
Risultati: *I livelli serici al baseline di ET-1, ICAM-1, E-selectin, IL-1, and sCD14 sono risultati aumentati al baseline nei pazienti con AP rispetto al gruppo di controllo. Non è stata individuata un'evidenza macroscopica di una riduzione di EFR in entrambi i gruppi. Il trattamento endodontico della AP è risultato associato a una riduzione dell'infiammazione e un miglioramento di ED precoce, abbassando i livelli plasmatici di IL-1, sCD14, ET-1, ICAM-1/CD54 e E-selectin a quelli dei soggetti del gruppo di controllo.*
Conclusioni: *La disfunzione vascolare endoteliale precoce può essere promossa da AP ed è reversibile con un trattamento endodontico efficace.*

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Introduction

Cardiovascular disease (CVD) is becoming an increasing burden in the developing world due to an evolving profile of risk factors (1). Furthermore, it is the leading cause of morbidity and mortality worldwide (2, 3).
The endothelium acts as a modulator of vascular tone via the production of relaxing factors, such as vasodilator prostaglandins, nitric oxide (NO) and endothelium-dependent hyperpolarization factors, as well as contracting factors, including endothelin (ET)-1, the most potent endogenous vasoconstrictor (4-7). The expression of cell-surface adhesion molecules on the endothelium, in particular intercellular adhesion molecule-1 (ICAM-1), soluble vascular cellular adhesion molecule-1 (sVCAM-1), and endothelial leukocyte adhesion molecule (ELAM, also known as E-selectin), promotes the binding of circulating leukocytes to the endothelium (8) and drives endothelial cell activation. The development of CVD may be predicted by ED and endothelial cell activation.
Apical periodontitis (AP) occurs in 34-61% of adults aged 35-45 years old living in the developed world and this statistic rises with age (9). Inflammation associated with AP may enhance an individual's risk of developing CVD (10). For example, a correlation has been reported between the presence of lesions of endodontic origin (LEO) or pulpal inflammation and the risk of ischemic heart disease (11-14). There are similarities in the immune responses to AP and periodontal disease (15), including increased levels of serum soluble CD14 (sCD14) and C-reactive protein (CRP) that occurs as a response to lipopolysaccharide-induced activation of endothelial or epithelial cells that do not normally express membrane-bound CD14 (16). Both sCD14 and CRP facilitate systemic inflammation.
Elevated interleukin (IL)-2 and asymmetric dimethylarginine (ADMA), an endogenous inhibitor of nitric oxide synthase (NOS), have been reported alongside poor NO availability in young adult males with AP and early signs of ED (17). Although early pre-clinical ED is likely to be reversible (18) via modifications in life style, recommended drug treatment and the reversal of cardiovascular risk factors (19), there are no data available to indicate that endothelial function is restored following endodontic treatment in patients with AP. The aim of this study was to investigate vascular and molecular markers of early ED before and after root canal treatment in patients with chronic AP.

Materials and Methods

Study population. This study was authorized by the Città della Salute e della Scienza Ethical Committee (ref. nr. 0009323; CS2/510). Every patient included in the study provided signed, written consent. This observational, case-controlled clinical trial was designed with a study power of 80%, for a sample of 19 paired subjects, assuming a 5% significance level.
Patients who had at least one chronic periradicular inflammatory LEO were enrolled into the LEO group. Subjects were below 35 years of age, of normal weight with no medical history of diabetes or systemic, oncologic, or immune system diseases, not taking current immunosuppressive or cortisone drug treatment and not undergoing dental treatment. Age-matched control subjects were recruited randomly from a medical database of the same area. Subjects underwent assessment for CVD prior to study initiation and any subjects with CVD were excluded.
Pulpal and periradicular status were determined using vitality thermal and electric pulp tests (Diagnostic Unit; Sybron, Orange, CA), palpation, and percussion. Complete periodontal charting was recorded. Intra-oral radiographs were used to assess the periradicular status of any cases of suspected AP using phosphor sensor imaging plates (20, 21). At all visits, standardized periapical radiographs were derived using

Rinn XCP (Rinn Corp, Elgin, IL) alignment system with customized silicone bite. Three clinical assistant professors analyzed the clinical and radiological data and made any diagnoses accordingly. Performance calibration was carried out to minimize any interexaminer variability. Examiner concordance was analyzed with the Fleiss k score (k>0.70).

Endothelial function. Peripheral arterial tonometry (PAT) was utilized to measure endothelial flow reserve (EFR) at the distal extremity of the upper limbs. This method is not operator-dependent and provides a reproducible index of endothelial-dependent vasodilation. Finger biosensors measured any changes in vasal tone influenced by the endothelium using ENDO-PAT2000 (Itamar Medical, Caesarea, Israel). Modifications of vasal tone were produced by occlusion of the brachial artery for 5 minutes with a consequent hyperemic response. The opposite arm was used as a control.

Blood sample collection. Blood samples were collected at enrolment from all subjects, and also from the LEO patients at 2 and 12 months after apical treatment. Plasma was isolated by centrifugation at 2400 × g for 15 minutes and frozen immediately at –80 ° C.

Biochemical analysis: enzyme-linked immunosorbent assay (ELISA). Plasma concentrations of IL-1, IL-6, tumor necrosis factor (TNF)-alpha, ET-1, ICAM-1/CD54, sVCAM-1/CD106, sCD14 and E-selectin were determined using ELISAs (R&D systems, Minneapolis, USA and Sigma Aldrich, Milan, Italy).

Endodontic treatment. Access cavity and endodontic pre-treatment were carried out to form a reservoir for irrigant solutions following the administration of local anesthesia and isolation of rubber dam. A size 10 stainless-steel K-File (Dentsply Maillefer, Baillagues, Switzerland) was used to carry out root canal scouting and a mechanical glide path was created using Proglider (Dentsply Maillefer, Baillagues, Switzerland). The endodontic motor (X-Smart, Dentsply Maillefer, Baillagues, Switzerland) was set at a 16:1 contra angle using the suggested settings (300 rpm on display, 5 Ncm), at working length (WL). Electronic WL was recorded with an apex locator (Diagnostic Unit, Sybron, Orange CA, USA) and checked three times during treatment. Initial WL was recorded with a size 10 stainless-steel K-File during canal scouting and initial glide path using an electronic apex locator. A second WL was recorded after glide path with a size 17 K-File using an electronic apex locator and periapical radiographs. Root canal shaping was carried out using ProTaper Next™ X1-X2 (Dentsply Maillefer, Baillagues, Switzerland) at WL. Definitive WL was checked with a size 17 K-File after X1 and shaping was accomplished with X2 at WL, with X-Smart motor set at the suggested settings. A size 10 K-File 0.5 mm beyond the apex was used to establish and confirm apical patency. Irrigation was performed with a syringe and 30 G endodontic needle using 5% NaOCl (Niclor 5, OGNA, Muggiò, Italy) and 10% EDTA (Tubuliclean, OGNA, Muggiò, Italy), for a total of 20 ml each and root canals were subsequently dried with sterile paper points. Root canals were filled immediately following treatment using sealer (Pulp Canal Sealer EWT, Kerr Endodontics, Orange, CA, USA) and Thermafil technique (Dentsply Maillefer, Baillagues, Switzerland), according to the manufacturer's instructions. A temporary filling was used to seal the access cavity (IRM, Dentsply International Inc., Milford, DE USA) which was subsequently reconstructed. Biochemical analysis was carried out in the LEO group at 2 and 12-month timepoints post-root canal treatment and clinical-radiological re-evaluation was conducted 12 months post-treatment to assess the outcome of endodontic treatment (22). Patient outcomes were categorized as "healed", "healing" and "diseased" according to Friedman & Mor (23).

Statistical analysis. Continuous variables were reported as mean ± standard

error of the mean (SEM). The Shapiro-Wilk test was used to assess normality and the Student's t-test was utilized to compare mean values. Statistical significance was set at p=0.05 (Stata Statistical Software, Release 15, StataCorp. 2017 College Station, TX: StataCorp LLC).

Results

Twenty healthy subjects (mean age 32.07 years ± 5.28) were assessed at baseline and 23 LEO patients (mean age 33.05 years ± 6.27) were assessed at baseline and at 2 and 12 months after treatment. Two LEO patients were lost to follow-up at 12 months and were excluded from the analysis. A favourable outcome was reported for 19 LEO patients 12 months after treatment (90.5%), with 13 classified as "healed" and 6 as "healing". Two remained classified as "diseased". There were no statistically significant differences in clinical parameters or markers of systemic inflammation between the groups at baseline, except for higher serum concentrations of IL-1 (Fig. 1A) and sCD14 (Fig. 1B) in the LEO group compared to the control group. Concentrations of IL-1 (Fig. 1A) and sCD14 (Fig. 1B) were significantly reduced at 2 and 12 months after treatment in the LEO patients. Post-treatment concentrations were comparable to those of the control group. Mean EFR, as a measure of endothelial reserve, was similar in the control and LEO groups at baseline and in the LEO group 2 and 12 months after treatment (p>0.05).

ET-1, ICAM-1/CD54 and E-selectin concentrations were all significantly higher in the LEO group at baseline compared to the control group (Fig. 1C, D, E respectively). In each case, concentrations had decreased significantly at 2 and 12 months after treatment. sVCAM-1 levels were comparable between the groups at baseline and did not change following treatment (Fig. 1F).

With the exception of two non-reponders, there was a positive trend for markers of ED to return to concentrations comparable to those of healthy controls after root canal treatment in the LEO group.

Discussion

Endothelial function has attracted much attention in the clinical setting as a reliable marker of cardiovascular events in humans (24). Low NO levels are considered a predictor of ED (25), an early manifestation of cardiovascular atherosclerotic disease. An increase in NOS, an endogenous inhibitor (ADMA), and IL-2 concentrations have been reported in young adult males with AP and early signs of ED (measured by EFR at the level of the distal extremity in the upper limbs using PAT) (17). Our study did not fully support these results as no differences were observed in EFR between the LEO and healthy groups. Therefore, we can only conclude that any changes in biomarker expression observed in this study occurred before a detectable alteration in vasal tone.

In our study, the increased expression of the potent endogenous vasoconstrictor and proinflammatory peptide ET-1 (6), was higher in the LEO group than the healthy group at baseline, suggesting that apical lesions may lead to an increase of serum ET-1 that, in turn, could lead to ED. The subsequent post-treatment reduction in serum ET-1 was associated with the successful treatment of apical lesions.

The well-defined relationship between ED and endothelial cell activation has led to the use of E-selectin (26), sVCAM-1 and ICAM-1 (25) as markers of mortality and subclinical atherosclerosis (27). Indeed, the increased vasoconstriction, smooth muscle cell proliferation, platelet aggregation, leukocyte adhesion, low-density lipoprotein oxidation, and matrix metalloproteinase activation associated with ED and endothelial cell activation, can drive atherosclerosis and vascular disease (27). In this study, baseline levels of ICAM-1 and E-selectin were elevated in LEO patients compared to healthy controls, and these returned

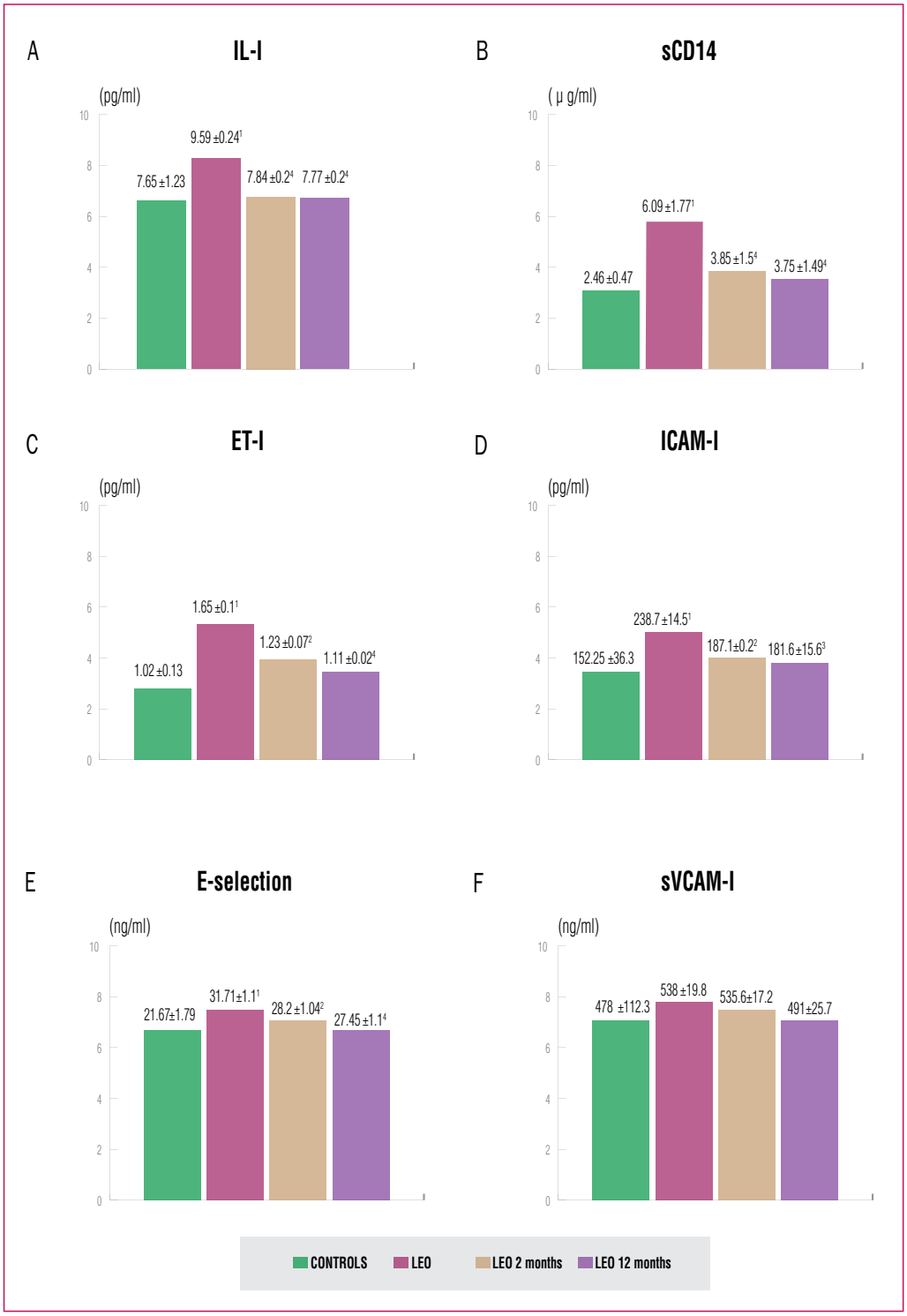

Figure 1
Descriptive statistics (mean and standard error of the mean) and inferential analysis of the tested variables; p≤0.0001 LEO group vs. healthy subjects at baseline[1]; p≤0.01[2], p<0.001[3] and p≤0.0001[4] LEO group 2 or 12 months after root canal treatment vs. LEO group at baseline
(A) *Interleukin-1;*
(B) *soluble sCD14;*
(C) *Endothelin-1;*
(D) *intercellular adhesion molecule ICAM-1;*
(E) *E-selectin;*
(F) *soluble vascular cellular adhesion molecule sVCAM-1. LEO=lesion of endodontic origin.*

to levels equivalent to those observed in healthy controls after root canal treatment. Traditional cardiovascular risk factors, such as hypercholesterolemia, smoking, and oxidative stress, and non-traditional risk factors, such as the proinflammatory cytokines TNF-α and IL-6, are important mediators of endothelial cell activation. The LEO patients in this study had higher serum concentrations of IL-1 and sCD14 than the control patients, whereas the serum

concentrations of IL-6 and TNF–α did not differ between the groups.

Conclusions

These data suggest that AP is correlated with early vascular ED. This is evidenced by elevated serum concentrations of ET-1, ICAM-1 and E-selectin adhesion molecules and inflammatory IL-1 and sCD14, in the absence of any macroscopic evidence of decreased EFR. In each case, concentrations returned to those observed in healthy controls following treatment, suggesting that treatment of AP ameliorates early ED.

Clinical Relevance

Apical periodontitis is correlated to an increase of early vascular endothelial dysfunction markers in the serum. Endodontic therapy returns these to the level observed in healthy subjects.

Conflict of Interest

The authors deny any conflicts of interest related to the study.

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Winner of Giorgio Lavagnoli award III International Congress Milan 2018

CASE REPORT/**CASE REPORT**

Immediate Crown Replacement: a case report of extensive radicular fracture with intra-canal anchorage

Case report relativo alla cementazione adesiva immediata, con ancoraggio intra-canalare, di corona naturale in seguito a frattura radicolare

KEYWORDS
Dental injury, Complicated crown-radicular fractures, Open flap isolation, Reattachment, Fiber post.

PAROLE CHIAVE
Traumi dentali, fratture corono radicolari, cementazione adesiva, riattacco, perni in fibra di vetro.

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Abstract

Aim: *Fracture by trauma is one of the most common type of dental injury in the permanent dentition. The purpose of this case report is to present the multidisciplinary management of a subgingival crown-root fracture in one patient.*
Summary: *In this article we report one case of complicated crown-radicular fractures reattachment, in a traumatized maxillary permanent central incisor, which was treated with a novel method preserving coronal integrity after fiber post placement.*

Obiettivi: *La frattura da trauma è uno dei tipi più comuni di danno dentale nella dentizione permanente. Lo scopo di questo case report è di presentare la gestione multidisciplinare di una frattura corono-radicolare sub-gengivale.*
Sommario: *In questo articolo riportiamo un caso di cementazione adesiva di una frattura corono-radicolare complicata di un incisivo laterale mascellare permanente traumatizzato. L'elemento è stato trattato con nuovo metodo preservando l'integrità coronale dopo il posizionamento di un perno in fibra di vetro.*

Introduction

Traumatic dental injury is a neglected oral condition, despite its relatively high prevalence and significant impact on individuals and public relations (1). Management of traumatic dental injuries (TDI) should involve a multidisciplinary approach to optimize healing while maintaining function and esthetics (2).
Reports suggest that most dental injuries occur during the first two decades of life, usually around 8-12 years and that 70% of such injuries involve the maxillary central incisors followed by maxillary lateral incisors and mandibular incisors (3).
Traumatic lesions in the permanent dentition have an incidence that ranges from 15.2% to 17.8%. The most frequent causes are falls, accidents occurred during sports or as a consequence of violent episodes (4).
There have been numerous classifications since the 50s of the last century that tried to codify traumatic dental lesions based on topographic and morphological criteria. The International Association of Dental Traumatology (IADT) has developed in 2017 a consents statement based on a review of the dental scientific literature (5).
It's an evolution of the Andreasen Classification (1950) and try to propose different therapies for different clinical situations.

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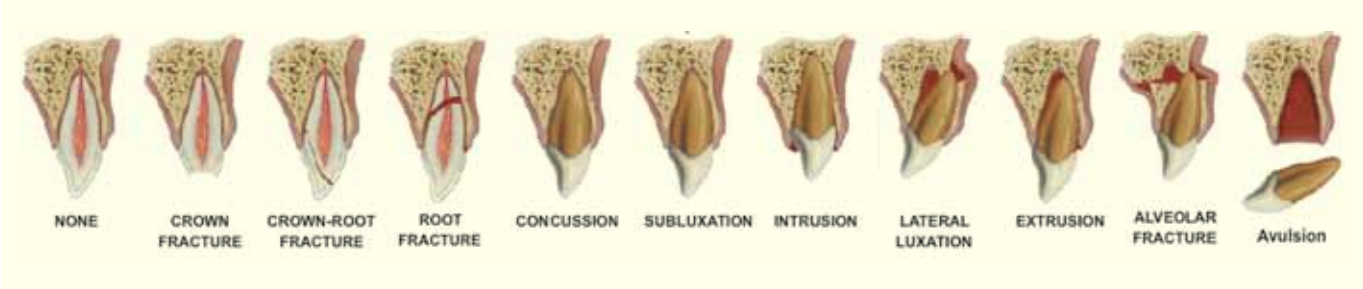


Figure 1
Schematic Illustration about Fractures and Luxations of Permanent Teeth - Diangelis AJ, Andreasen JO, Ebeleseder KA, et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 1. Fractures and luxations of permanent teeth. Dent Traumatol 2012;28:2-12.

This classification is divided in (Fig. 1):

- infractions,
- enamel fractures,
- enamel-dentine fractures,
- enamel-dentine-pulp fractures,
- crown-root fracture without pulp exposure,
- crown-root fracture with pulp exposure (complicated),
- root fracture,
- alveolar fracture,
- concussion,
- sublussation,
- concussion,
- subluxation,
- extrusive luxation,
- lateral luxation,
- intrusive luxation.

Complicated crown-radicular fractures, involving the enamel, dentin, and pulp account for up to 20% of all TDJ with the majority in the maxillary anterior region (2-6). From the guidelines of the International Association of Dental Traumatology endorsed by the American Academy of Pediatric Dentistry in cases of crown-radicular fractures with pulp exposure (without open apex), emerged different therapies:

- removal of the coronal fragment with subsequent endodontic treatment, after that gengivectomy/gengivectomy + ostectomy and osteoplasty and to conclude, a restoration with a post retained crown: this treatment is only indicated in crown-root fractures with palatal subgingival extension;
- orthodontic extrusion of the remaining root: removal of the coronal segment with subsequent endodontic treatment, and orthodontic extrusion of the remaining tooth with sufficient length after extrusion to support a post-retained crown;
- surgical extrusion: removal of the mobile fracture fragment with subsequent surgical reposition of the root in a more coronal position;
- extraction with immediate or delayed implant-reteined crown restoration or a convenctional bridge (Fig. 2) (2-5).

The challenge is to identify the most suitable treatment for a given patient using a combination of evidence-based guidelines and clinical experience (7).
Here we report a case where a new conservative approach was performed, with included the reattachment of the fractured segment, root canal therapy, ors surgery and the insertion of a fiber post.

Figure 2
Different clinical images about the therapy of three different crown-radicular fractures with pulp exposure: ***a)*** *surgical crown lengthening* ***b)*** *orthodontic extrusion (photo with kindly permission of Dr. D. Damaiola, Dr. G. & G. Bormida)* ***c)*** *extraction therapy for the presence of a vertical fracture.*

Figure 3
The preoperative radiograph shows clearly a root fracture which is higher than the mesial and distal bone peaks. It also shows how the fracture enters the pulp chamber of the lateral incisor at issue.

Case Report

This case report refers to a 70-year-old patient with a fractured lateral incisor. Medical history was non contributory. Clinical and radiographic examination revealed a complicated oblique crown fracture on element 1.2 that extended sub-gingivally in the buccal aspect. In this case we noticed bleeding of the gingival sulcus, sensibility testing was negative and there was tenderness during the percussion test (Fig. 3).
The fractured segment was held in place by the gingival attachment. After administration of local anesthesia (1.0cc of articaine 2% with 1:100,000 adrenaline), the fractured segment was extracted with great care, in order to preserve hard and soft tissues (Fig. 4A, 4B).
The fractured segment was then cleaned with 2% chlorhexidine solution and stored in isotonic saline solution (Fig. 5).
Isolation of the operative field during root canal therapy and cementation phases was very complex due to the peculiar shape of the fracture. For this reason an intra-sulcular incision was performed using a 15c surgical blade (Swann Morton Surgical Blades - Sheffield - England). The papillae were incised apico-coronally in order to preserve the interdental vascular supply (8) (Fig. 6).
Once the surgical flap had been raised, a buccal osseus resective surgery (ORS) performed in order to have at least 2 mm of the exposed root coronally to the alveolar crest: these 2 mm will be very important, so as to provide space for the correct formation of the supracrestal attachment (9).
At this point the rubber dam (Dental Dam - Coltene - Cuyahoga Falls - USA) was placed.
The rubber dam was chemically treated in order to reduce the possibility of bac-

Figure 5
In this detailed view the shape of the fracture can be seen: on the buccal aspect the is a bevel which is at least 3 mm more apical than the palatal aspect.

Figure 6
In this detailed view the surgical flap has been raised.

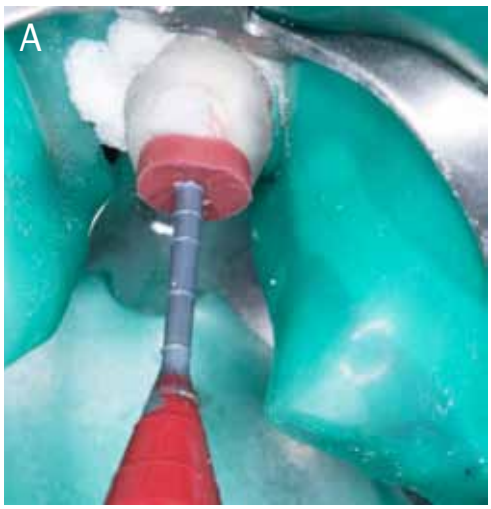
Figure 4A
Only after a correct diagnosis and local anesthesia it is possible to start to remove the fractured portion of the tooth.

Figure 4B
Occlusal view of the root: it is possible to notice a more significant bleeding on the buccal aspect due to the bigger extension of the lesion apico-coronally. The exposure of the pulp is also noticeable.

Figure 7
Rubber dam placed.

terial contamination: the tooth was isolated, without suturing the underlying flap, with a rubber sheet which has been treated with a mouth-wash containing 0,2% chlorexidine (Curaden - Curasept 0,20% + Ialuronic Acid) (Fig. 7).
Once the rubber dam had been positioned with a 9s clamp (Hu-friedy - Chicago - USA) the root canal treatment was performed and the post space was prepared (M-Two NiTi Instruments - Sweden and Martina - Padova - Italy).
The root canal treatment has been performed using Ni-TI instruments with the following tapers and fashion: Preflaring was performed by 10 (diameter)/4% (taper) and 15/05 M-Two Instruments. Working length (WL) was reached with the previous two instruments for shaping in order to continue with 20/06 followed by 25/06 (M-Two NiTi Instruments - Sweden and Martina - Padova - Italy).
For finishing the following two Protaper instruments were used: F2 35/08, F3 30/09 (DentSply - Maillefer Instruments - Ballaigues - Switzarland).
A 5% sodium hypochlorite solution was used and activated for cleaning, with Irri-safe ultrasonic tips (Irri-Safe 20-25 - Acteon Satelec -Merignac - France).
A 3d obturation was achieved using Thermafil system (DentSply - Maillefer Instruments - Ballaigues - Switzarland) (Fig. 8A, 8B).
2/3 of the canal were empty and were cleaned with ultrasonic tip (ET18D - Acteon Satelec -Merignac - France) and a specific brush. It is extremely important to evaluate the size of the post by taking into account the depth of the empty canal and the intra-coronal space.
In this case a post 055/06 taper (Sweden and Martina - Padova - Italy) was selected and then reduced with a diamond disk outside the mouth.
Afterward the tooth crown has to be prepared by removing both mechanically (Burr FG D18 CB Intensive - Montagnola - Switzerland) and chemically (5% Sodium hypochlorite) the remains of the pulpal chamber in order to receive the coronal part of post and to avoid future discolorations.
It is necessary to try the perfect juxtaposition of the crown with the post before cementation: the post does not have to create any sort of obstacle neither in height or in width (Fig. 9A, 9B).
The post was prepared with alcohol and bonding as suggested by the producer of the sealer. In this case we used the Dentsply Core&post System (DentSply - Maillefer Instruments - Ballaigues - Switzarland): we started by cleaning the post with alcohol. Then we applied the Prime and Bond XP/SCA (DentSply - Maillefer Instruments - Ballaigues - Switzarland) mixture on the entire post for at least 5 seconds and after we removed the solvent by blowing gently with air being careful to protect the post from light.
In the meantime both the root canal and the crown has been etched with 37% ortho-phosphoric acid (Ultradent Products - Utah - USA) for 15 seconds

Figure 8A
Canal obturation with thermafil system.
Figure 8B
Periapical Radiography.



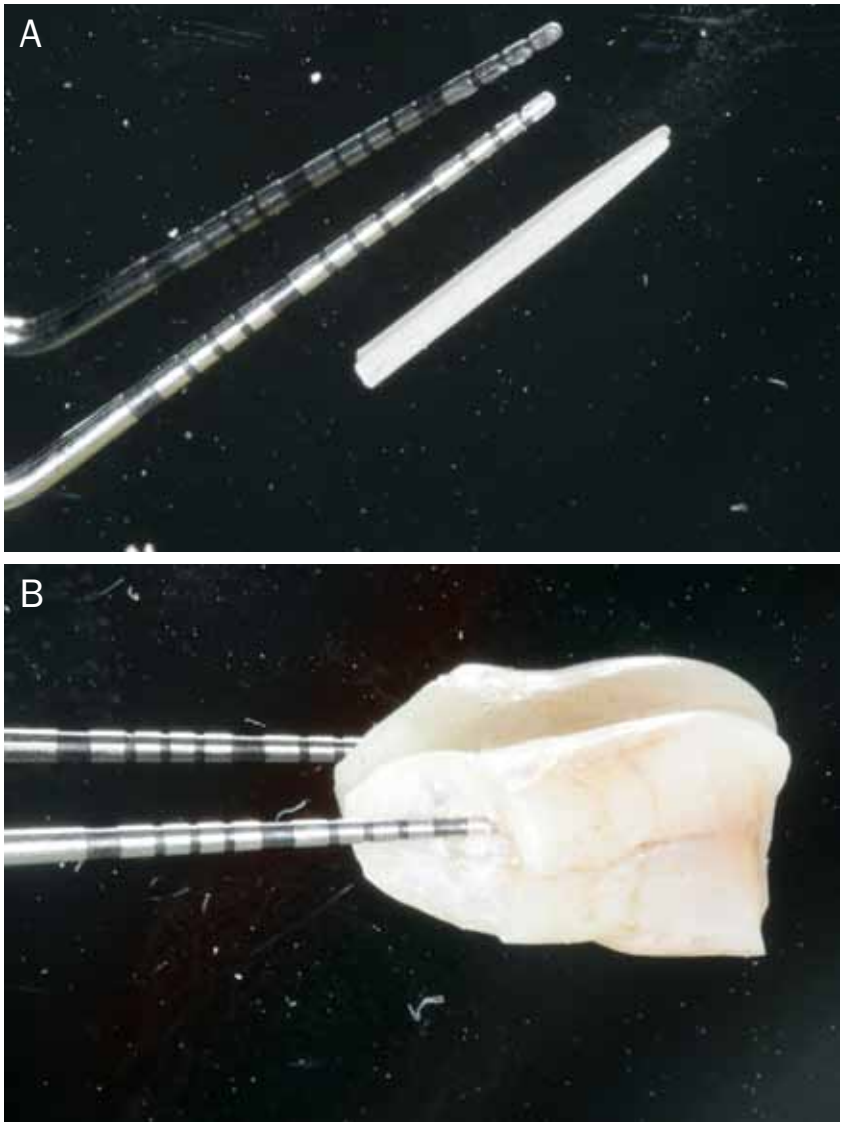


Figure 9A
Evaluation of the post size's.

Figure 9B
Crown preparation.

(each) and then we gently removed the water used for rinsing with air and paper point: it's important not to desiccate dentine (Fig. 10A, 10B).
Afterwards we applied Prime&Bond XP/SCA into the canal and inside the crown cavity and we left it undisturbed for 20 seconds. Then, the excess of primer and bonding solutions was removed and the solvent was evaporated by blowing gently with air.
At this point we applied Core-x flow (DentSply - Maillefer Instruments - Ballaigues - Switzarland) directly in the canal and then placed the post in its final position and we stabilized it.
We had to position at once (post must be fully seated in maximum 40 seconds) core-x flow (DentSply - Maillefer Instruments - Ballaigues - Switzarland) in the coronal cavity with the post and then place the crown in its natural position.
Once removed the excess material, the sealer must be photo-polymerized as if it were a composite inlay (11).
In the end we had to light cure for at least 20 seconds each side of the crown or wait 3 and 1/2 minutes (Fig. 11A, 11B),
Right after removing the rubber dam we did not have to worry about the colour difference: it will evaluated after the rehydration of the tooth.
At this point the tooth must be polished and we must be careful not to leave excess sealer on the junction line of the fracture (Fig. 12).
A monofilament non absorbable surgical suture, 5/0 PTFE (high-density polytetrafluoroethylene polymer) was used in order to avoid plaque accumulation in the days following the procedure (12).
In the post-operative radiograph the correct root canal obturation, the insertion of the fiber post and the perfect juxtaposition of the fractured segment was evaluated (Fig. 13A, 13B).
Sutures were removed 14 days after the procedure.
Follow-up visits confirmed the success of treatment based on clinical (probing depth, bleeding on probing, mobility, dyschromia) and radiographic evaluations (absence of apical radiolucency, thickening of the periodontal ligament).
The patient remained pain-free with good function and aesthetics during a follow-up period of 5 years (Fig. 14A, 14B).

Discussion

Management of complicated crown fragments has undergone major changes in recent years. Regarding crown-root fracture, several treatment options were described, such as much-gingival flaps, procedures involving ORS surgery or surgical extrusion followed by reattachment of the original fragment (12).
The remarkable advances in adhesive systems and resin-based composites

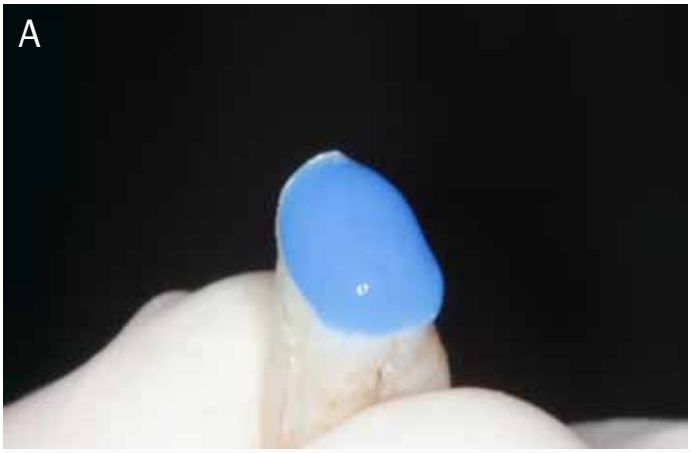


Figure 10A *Etching phases on the root and the fractured crown.*

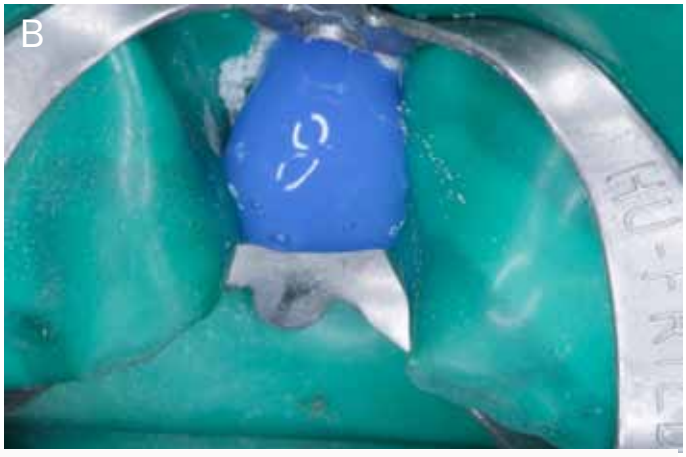


Figure 10B *Cementation phases.*

Figure 11
Cementation phases.

made reattachment procedures more achievable (7).
Because of this, other option includes the restoration of the tooth crown with a restorative material or prosthetic rehabilitation of the tooth depending on the location of the fracture line (13).

Figure 12
It is possible to see the perfect juxtaposition of the fracture which enables us to remove all excess material.

In the cases where the fractured segment is available, reattachment should always be attempted. As described in previous studies, such as Chosack and Eidelman in 1964, the adhesive reattachment of the original fragment offers a conservative, esthetic, and cost-effective restorative option to reinstate the natural shape, contour, surface texture, occlusal alignment, and colour of the tooth (12-14).
Previous studies indicated that the reattachment of the fractured fragment without any preparation of the coronal or root fragments results in lower bonding values (15, 16).
In this case, an internal dentinal groove was prepared on the coronal fragment to provide a higher mechanical strength and longevity.
To reinforce the cervical level of the reattached tooth, it is recommended to

Figure 13A
Two single stitches have been placed on the mesial and distal papilla.

Figure 13B
Post-operative radiography.

use an intra-canal post because of the potential of the post to interlock the coronal and the root portion and to minimize the stress on the reattached tooth fragment (17).
Recently, different types of post materials have been introduced into the dental practice such as carbon fiber, quartz, and glass fiber (18).
The use of fiber post with composite core is recommended as it can create a monoblocco which is a multilayered structure with no weak interlayer interfaces (19).

Conclusions

In case of complex fractures, where the fractured segment is available and there is close approximation of the segment to the remaining tooth, root canal treatment followed by reattachment of the fractured segment with fiber post reinforcement is a feasible option.
This minimally invasive approach seems to be predictable, allowing to reduce costs and the number of interventions for the patient as compared to many other procedures methods.

Figure 14A
5 years follow up photo.

Figure 14B
5 years follow-up periapical radiography.

In addition, satisfying function of the treated elements the procedure provides good and long-lasting esthetics, because the original morphology, color, and surface texture are maintained.

Clinical Relevance

Reattachment of fractured tooth fragments offers a viable restorative option for the clinician because it restores tooth function and esthetics with the use of a very conservative and cost-effective approach.

Conflict of Interest

The authors declare that there is no conflict of interests regarding the publication of this paper.

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Winner of Francesco Riitano award III International Congress Milan 2018

ORIGINAL ARTICLE/**ARTICOLO ORIGINALE**

Micro-CT evaluation of ProTaper Next and WaveOne Gold shaping in maxillary first molars curved canals: an *in vitro* study

KEYWORDS
MicroCT, Glidepath, Shaping, ProTaper Next, WaveOne Gold.

PAROLE CHIAVE
MicroTC, Glidepath, Sagomatura, ProTaper Next, WaveOne Gold.

Valutazione alla micro-CT della sagomatura effettuata con ProTaper Next e WaveOne Gold in primi molari superiori: uno studio in vitro

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Abstract

Introduction: *The aim of this micro-CT study was to analyze the geometrical shaping outcomes after instrumentation with rotary and reciprocating glide path and shaping systems.*
Materials and Methods: *The mesio-buccal canals of thirty extracted maxillary first permanent molars were randomized into two groups (n=15): rotary system ProGlider and ProTaper Next X1, X2 (PG-PTN) was compared with reciprocating system WaveOne Gold Glider and WaveOne Gold Primary (WOGG-WOG). Irrigation was performed with EDTA 10% and NaOCl 5%. Specimens were micro-CT scanned before instrumentation and after glide path and shaping. The measured parameters were the increase in canal volume and surface area, the centroid shift and the canal geometry variation through RDR and RA. These parameters were measured in the apical and coronal levels and at the point of maximum curvature. One-way ANOVA and post hoc Turkey-Kramer tests were used to describe the impact of the instrumentation on the selected parameters (P<0.05).*
Results: *Post glide path analysis revealed that increase in canal surface area was slightly greater in WOGG group (P=0.051). Centroid shift was not significant even if the trend seemed more favorable to PG group, except for the apical third. Centroid shift reported no significant differences.*
Conclusions: *Both rotary and reciprocating systems seemed to create a homogeneous and well-centered glide path and shaping.*

Introduzione: *Lo scopo del lavoro è stato quello di comparare, con la micro-TC, gli esiti della sagomatura dopo la strumentazione con un sistema rotante reciprocante e uno a rotazione continua.*
Materiali e metodi: *Sono stati selezionati 30 primi molari superiori permanenti. I canali MB1 e MB2 sono stati suddivisi randomicamente in due gruppi (n=15): rotazione continua ProGlider e ProTaper Next X1, X2 (PG-PTN), e movimento reciprocante WaveOne Gold Glider e WaveOne Gold Primary (WOGG-WOG). I canali sono stati irrigati con EDTA 10% a NaOCl 5%. I campioni sono stati scannerizzati alla micro-TC prima della strumentazione e dopo glidepath e shaping. Sono stati misurati i seguenti parametri nel terzo coronale, apicale e al punto di massima curvatura: incremento nel volume canalare, superficie canalare, spostamento del centroide e variazioni geometriche (tramite RA e RDR). Per analizzare l'efficacia della strumentazione sui suddetti parametri sono stati utilizzati test ANOVA one-way e post hoc Turkey-Kramer (P<0.05).*
Risultati: *L'analisi post glidepath ha rivelato che l'incremento nella superficie canalare è stato leggermente maggiore nel gruppo WOGG (P=0.051). Lo spostamento del centroide non è risultato significativo, anche se il trend è sembrato più favorevole per il gruppo PG, fatta eccezione per il terzo apicale. Lo spostamento del centroide non ha riportato differenze statisticamente significative.*
Conclusioni: *Entrambi i sistemi sembrano produrre una sagomatura omogenea e ben centrata.*

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Introduction

The goal of the endodontic treatment is the appropriate shaping with respect to the original root canal anatomy (1). The canal scouting with stainless steel sizes 08-10 K-files allows the initial patency and the tactile feedback (2). The subsequent glide path phase lowers the risk of taper lock and torsional stress of the NiTi instruments (3, 4, 5). The root canal shaping permits disinfection and helps the tridimensional filling (6, 7). The glide path and shaping techniques need manual or mechanical nickel-titanium (NiTi) instruments. The latter can be classified according to the kind of movement used: rotary or reciprocating (8).

ProTaper Next (PTN) rotary shaping instruments have a M-wire alloy, a rectangular section and an asymmetrical axis, which permits a "swaggering" movement. These features lead to a reduced contact between the instrument and the canal walls, a more efficient cleaning of debris and a better flexibility (9, 10, 11, 12).

Lately, WaveOne Gold (WOG) reciprocating system was introduced. The reciprocating movement, the new design and alloy properties aim to improve the cyclic fatigue resistance, the root canal shaping ability and the removal of debris (13, 14). WaveOne Gold Glider (WOGG) is a single reciprocating glide path file, which was recently proposed in combination with WaveOne Gold. No comparison is available yet. The micro-computed tomography (micro-CT) is a useful tool for the evaluation of the shaping geometrical outcomes, allowing a non-invasive and reproducible analysis of high-resolution scans before and after treatment (15). The aim of this study *in vitro* is to evaluate the shaping ability of the rotary instrumentation system ProGlider and ProTaper Next compared to the reciprocating system WaveOne Gold Glider and WaveOne Gold.

Materials and Methods

A total of 39 teeth were selected for extraction for peridontal disease: permanent maxillary first molars, without caries, cracks and extended restorations. The specimens were fixed in a customized support and preliminary micro-CT scans were accomplished to attain a root canal anatomy outline (SkyScan 1172, Bruker micro-CT). The morphological parameters of the mesio-buccal (MB1) canals were obtained. Of 39 teeth selected, nine were excluded due to anatomical issues. Thirty samples were randomly assigned to the two groups: ProGlider and ProTaper Next rotary shaping system (group PG-PTN) (n=15) and WaveOne Gold Glider and WaveOne Gold reciprocating shaping system (group WOGG-WOG) (n=15). A single blind operator performed randomization, allocation, and statistical analysis. After a traditional access cavity creation, canal scouting was accomplished in all specimens with #10 K-file at working length (WL). In Group PG-PTN, glide path was performed with Proglider (PG) rotary single file (size 0.16, taper .02 to .082 at D16) (Dentsply Sirona). Then shaping was concluded with ProTaper Next (PTN) X1 (tip size 0.17 mm, taper .04) and X2 (tip size 0.25 mm, taper .06) (Dentsply Sirona) using an endodontic engine X-Smart Plus (Dentsply Sirona) with 16:1 contra angle (300 rpm, 4 Ncm) in continuous rotation up to WL. In Group WOGG-WOG glide path was achieved with WaveOne Gold Glider (WOGG) reciprocating single file (tip size 0.15, taper .017 to .085 at D16) (Dentsply Sirona). Then shaping was ultimated with WaveOne Gold (WOG) Primary (size 0.25, taper .07) (Dentsply Sirona) using an endodontic engine X-Smart Plus (Dentsply Sirona) with 16:1 contra angle having the approved WaveOne Gold settings in reciprocating rotation up to WL. New instruments were used for each specimen. Irrigation was completed with 5,25% NaOCl and 12% EDTA in alternation.

Table 1

3D and 2D parameters utilized for post glide path analysis in each group (PG=ProGlider, WOGG=WaveOne Gold Glider)

		Centroid shift (mm^{-1})	
Group	Level of analysis	Range	Mean±SD
	Coronal	0.02-0.89	0.32±0.25[a]
PG	Middle	0.11-0.64	0.38±0.29[a]
	Apical	0.26-0.69	0.38±0.14[a]
	Coronal	0.18-0.97	0.40±0.30[a]
WOGG	Middle	0.16-0.90	0.44±0.26[a]
	Apical	0.15-0.83	0.24±0.30[b]

Different superscript letters in the same column indicate significant differences between groups (P<0.05). For 2D parameters (centroid shift) significance was compared for the same level of analysis (coronal, middle or apical).

Table 2

3D and 2D parameters utilized for post shaping analysis in each group (PTN=ProTaper Next, WOG=WaveOne Gold)

		Centroid shift (mm^{-1})
Group	Level of analysis	Mean±SD
	Coronal	0.59±0.37[a]
PTN	Middle	0.72±0.27[a]
	Apical	0.44±0.30[a]
	Coronal	1.04±0.36[a]
WOG	Middle	1.15±0.39[a]
	Apical	0.60±0.43[a]

Different superscript letters in the same column indicate significant differences between groups (P<0.05). For 2D parameters (centroid shift) significance was compared for the same level of analysis (coronal, middle or apical).

The selected samples were scanned at high-resolution before preparation, after glide path and after shaping (100 kV, 100 µA, 16 µm resolution, Al+Cu filter and 360° rotation for a total of 2400 projections). Afterwards, the images were reconstructed with NRecon software (SkyScan 1172, Bruker micro-CT) using standard parameters for beam hardening and ring artifact correction and the reconstructed volumes were analyzed with CTAn software (SkyScan 1172, Bruker micro-CT). The increase in canal volume and surface area was calculated for each sample through 3D renderings. Root sections orthogonal to the canal axis were set at 3 different levels: apical (A), 1 mm from the apical foramen; middle (M), set at the point of maximum curvature and coronal (C), set in correspondence to the middle portion of the root canal coronal third defined by 3D calculation of the root canal length from apex to orifice. These levels were selected as most representative of the critical shaping portions (16). The bidimensional parameters were analyzed at each level. The distribution of the data was analyzed with a Shapiro-Wilk normality test. The differences of the root canal curvature at baseline were analyzed with a Kruskall-Wallis and post hoc Dunn tests (P<0.05). One-way ANOVA and post hoc Turkey-Kramer tests were used to analyze the increase of canal surface area and volume, the centroid shift and the impact of the instrumentation on RDR and RA parameters at each level of analysis (P<0.05). All of the statistical analyses were conducted with the Minitab 15 software package (Minitab Inc., State College).

Results

There was no incidence of instrument fracture during canal preparation. Post glide path comparisons are reported in Table 1. The increase of root canal volume between groups was not significantly different (P>0.05), whereas root canal surface area difference was at the limit of significance (P=0.051) and was greater in WOGG group. RDR was statistically significant (P=0.014) in the coronal third, showing values closer to 1 in the PG group. RA value showed no differences between groups (P>0.05). In the coronal and middle third, centroid shift parameter was not significant (P>0.05) even if the trend seemed more favorable to PG group, while in the apical third the difference between the two groups was significant (P=0.020) with data in favor of WOGG. Post shaping comparisons are reported in Table 2.

Volume and canal surface area increase were significantly different and showed a reduced removal of dental tissue by the PTN group compared to the WOG group (P=0.003). In the coronal third (C), RA and RDR were at the limit of significance (P=0.087). RDR was closer to the value of 1 for the PTN group, which had a greater tendency to work symmetrically, while RA, representing the canal widening, was close to 1 for the WOG group. At the point of maximum curvature (M) RDR was at the limit of significance (P=0.056) while RA was significant and demonstrated a reduced root canal widening for the PTN group (P=0.019). Apically RDR was not significant, while the value of RA was significant with values closer to 1 for the WOG group (P=0.040). Between the two groups there were no statistically significant differences about the displacement of the centroid in any of the three levels of analysis (P>0.05).

Discussion

The data obtained show a statistically significant difference between PTN and WOG group for what concerns the tridimensional parameters, with a higher increment in the WOG group.
About the bidimensional parameters, in the coronal third PG instrument seemed to facilitate a more symmetrical shaping and a lower tendency to canal transportation with an RDR value closer to 1. This result may be due to the geometrical features of WOGG, which has a higher conical shape in the coronal and medium third.
However, the ratio between the post- and pre-instrumentation areas (RA) is barely significant in the coronal third, where the WOG tended to produce a minor widening of the canal.
This data could be easily understood by comparing the geometry and the different taper variations between the groups: the WOG Primary shows a 3% taper at 13 mm from the tip, while PTN X2 has a 6% taper. At the maximum curvature point there were no statistically significant differences between the groups.
Post-shaping RA values were statistically significant in the medium third, where PTN systems resulted more conservative. PTN X2 is smaller than the envelope of motion it creates, so being more flexible and sensitive to the curvatures (17).

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Finally, at the apical level of analysis, WOGG was more centered in the canal, probably thanks to its specific reciprocating movement and the lower apical diameter. In the apical third, the reciprocating movement seemed to permit a more conservative preparation, proved by a RA significantly lower in the WOG group (18).

Conclusions

Even though it is necessary to increase the number of the samples in order to achieve a higher statistical significance, within the limits of this study WOGG seems to produce a homogeneous and well-centered glide path, revealing itself as a reliable reciprocating instrument.
Therefore, combining the WOGG with the WOG system, the operator could keep the same configuration of the endodontic motor, optimizing the ergonomics and the working time.

Clinical Relevance

The root canal anatomy preservation after glide path and shaping with modern NiTi rotary and reciprocating shaping systems was evaluated. The reciprocating system removed more dentin especially in point of maximum curvature remaining well centered in the apical third.

Conflict of Interest

We affirm that we have no financial affiliation (e.g. employment, direct payment, stock holdings, retainers, consultantships, patent licensing arrangements or honoraria) or involvement with any commercial organization with direct financial interest in the subject or materials discussed in this manuscript, nor have any such arrangements existed in the past three years.
The Authors declare no competing conflict of interests with the materials discussed in this manuscript.

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Lettera DEL PRESIDENTE

Inizia una nuova avventura nel segno della continuità, una nuova casa editrice, Ariesdue, si affiancherà al nostro ***Editor in Chief, il Professor Sandro Rengo,*** *nei prossimi anni: un grande in bocca al lupo!*

Il nostro giornale si è negli anni affermato a livello internazionale: il formato elettronico e l'essere open access hanno aumentato esponenzialmente il numero dei lettori. La politica di Elsevier, il nostro precedente editore, ci ha costretto a questo cambio che nelle nostre intenzioni dovrebbe garantirci la stessa visibilità internazionale in tempi brevissimi.

In questo caso la sfida è di mantenere quanto raggiunto nel più recente passato.

Oltre a Sandro Rengo, devo e voglio ringraziare i due ***Associate Editor, Carlo Prati e Gianluca Plotino****, per il grande supporto e l'entusiasmo che investono nella rivista, cosi come tutto il comitato editoriale e di lettura.*

Approfitto di questa occasione per introdurvi il nostro prossimo ***36° Congresso Nazionale:*** *quest'anno torneremo nell'amata sede di Bologna al Palazzo della Cultura e dei Congressi.*

Il programma è come sempre ricco e interessante, a partire dal ***Corso Pre-Congresso*** *sui traumi dentali che sarà tenuto dal nostro bravissimo Socio Claudio Pisacane e da Lorenzo Vanini.*

Come nostra tradizione e come da nostra mission, rimaniamo strettamente attaccati all'Endodonzia: ***il titolo del Congresso "Moderna Endodonzia tra tecnologia ed esperienza"*** *descrive perfettamente l'intento del Consiglio Direttivo, ovvero dare ai partecipanti una chiara visione di dove l'Endodonzia sia e di dove stia andando.*

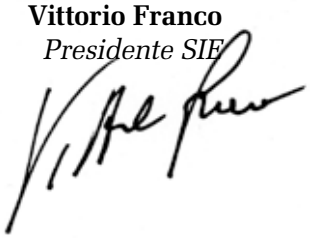
Per questo motivo abbiamo selezionato tra i nostri Soci dei Relatori di alto livello che possano dare informazioni chiare e utili ai partecipanti: ***Maurizio Bossù, Enrico Cassai, Italo Di Giuseppe, Gianluca Gambarini, Fabio Gorni, Vito Antonio Malagnino, Carlo Prati, Alberto Mazzocco, Giovanni Olivi, Franco Ongaro, Andrea Polesel, Mauro Rigolone, Maria Teresa Sberna e Umberto Uccioli,*** *elencati in stretto ordine alfabetico, si alterneranno sul podio della sala principale con relazioni di grande interesse e di grande qualità.*

Anche quest'anno al Congresso, in parallelo al programma della sala principale, potrete assistere o partecipare ai nostri quattro premi ***Riccardo Garberoglio, Giorgio Lavagnoli, Francesco Riitano e il Miglior Poster SIE.***

Trovate in questo numero del giornale i lavori vincitori dei Premi del III Congresso Internazionale di Milano 2018.

Buona lettura e arrivederci a Bologna!

Vittorio Franco
Presidente SIE



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Duillo Dott. Sergio
Socio Onorario
Garberoglio Dott. Riccardo
Socio Onorario
Lavagnoli Dott. Giorgio
Socio Onorario
Mantero Prof. Franco
Socio Onorario
Malvano Dott. Mariano
Socio Attivo
Pecchioni Prof. Augusto
Socio Onorario
Riitano Dott. Francesco
Socio Onorario
Spina Dott. Vincenzo
Socio Onorario
Zerosi Prof. Carlo
Socio Onorario

COME DIVENTARE SOCIO ATTIVO/AGGREGATO

Scaricabile dal sito **www.endodonzia.it**

SOCIO AGGREGATO

Per avere lo status di Socio Aggregato si dovrà presentare la documentazione descritta nel sito www.endodonzia.it che sarà valutata dalla Commissione Accettazione Soci. La documentazione che verrà presentata dovrà mostrare con rigore, attraverso casi clinici, l'interessamento del candidato alla disciplina endodontica.
Un meccanismo a punti è stato introdotto per valutare l'ammissibilità del candidato allo "status" di Socio Aggregato: i punti saranno attribuiti in base al tipo di documentazione presentata. Possono accedere alla qualifica di Socio Aggregato tutti i Soci Ordinari della SIE, in regola con le quote associative degli ultimi tre anni, che completino e forniscano la documentazione alla Segreteria Nazionale (Via Pietro Custodi 3, 20136 Milano) entro i termini che verranno indicati all'indirizzo web: www.endodonzia.it.
La domanda dovrà essere firmata da un Socio Attivo, in regola con la quota associativa per l'anno in corso, il quale è responsabile della correttezza clinica e formale della documentazione presentata.

DOCUMENTAZIONE NECESSARIA PER DIVENTARE SOCIO AGGREGATO

Qualsiasi Socio Ordinario, con i requisiti necessari, può presentare la documentazione per ottenere la qualifica di Socio Aggregato. Un meccanismo a punti è stato introdotto per valutare il candidato: un minimo di 80 punti è richiesto per divenire Socio Aggregato.
La documentazione clinica per ottenere la qualifica di Socio Aggregato dovrà presentare almeno sei casi, di cui non più di tre senza lesione visibile nella radiografia preoperatoria e non più di uno di Endodonzia Chirurgica Retrograda.
Nella domanda non potranno essere presentati casi la cui somma superi i 120 punti per la qualifica di Socio Aggregato.
L'aspirante Socio Aggregato potrà presentare la documentazione clinica in più volte, con un minimo di 40 punti per presentazione, in un arco massimo di cinque anni. Il mancato rinnovo della quota associativa, anche per un solo anno, annulla l'iter di presentazione dei casi.

SOCIO ATTIVO

Per avere lo status di Socio Attivo si dovrà presentare la documentazione descritta nel sito www.endodonzia.it che sarà valutata dalla Commissione Accettazione Soci. La documentazione che verrà presentata dovrà mostrare con rigore, attraverso documentazione scientifica e casi clinici, l'interessamento del candidato alla disciplina endodontica.
Un meccanismo a punti è stato introdotto per valutare l'ammissibilità del candidato allo status di Socio Attivo: i punti saranno attribuiti in base al tipo di documentazione clinica e scientifica presentata. Possono accedere alla qualifica di Socio Attivo tutti i Soci Ordinari della SIE, in regola con le quote associative degli ultimi tre anni, che completino e forniscano la documentazione alla Segreteria Nazionale (Via Pietro Custodi 3, 20136 Milano) entro i termini che verranno indicati all'indirizzo web: www.endodonzia.it.
La domanda di ammissione allo status di Socio Attivo rivolta al Presidente della SIE dovrà essere firmata da un Socio Attivo in regola con la quota associativa per l'anno in corso, il quale dovrà aver esaminato e approvato la documentazione. Quest'ultimo è responsabile della correttezza clinica e formale della documentazione presentata.

DOCUMENTAZIONE NECESSARIA PER DIVENTARE SOCIO ATTIVO

Qualsiasi Socio Ordinario, con i requisiti necessari, può presentare la documentazione per ottenere la qualifica di Socio Attivo. Il Socio Aggregato che volesse presentare la documentazione scientifica e clinica a integrazione di quella clinica già approvata dalla CAS per lo status di socio Aggregato, potrà farlo già dall'anno successivo all'ottenimento della sua qualifica.
Un meccanismo a punti è stato introdotto per valutare il candidato a Socio Attivo. Un minimo di 200 punti è richiesto per divenire Socio Attivo.
Nella domanda non potranno essere presentati casi la cui somma superi i 240 punti per la qualifica di Socio Attivo.
La documentazione scientifica potrà essere presentata, a completamento della documentazione clinica, solo per la domanda per divenire Socio Attivo e non potrà superare i 100 punti.
La documentazione clinica dovrà presentare un minimo di sei casi, di cui almeno 4 di molari pluriradicolati con delle precise tipologie: tra questi casi almeno uno deve essere un ritrattamento con lesione visibile nella radiografia preoperatoria e dei restanti tre almeno due devono avere una lesione visibile nella radiografia preoperatoria.
La documentazione clinica non deve presentare più di un caso di Endodonzia Chirurgica Retrograda con immagini e non più di uno senza immagini.
La documentazione scientifica non potrà presentare più di due articoli come coautore.

MODALITÀ DI DOCUMENTAZIONE DEI CASI CLINICI

Criteri e modalità per la valutazione dei casi clinici idonei ad accedere alle qualifiche di Socio Aggregato e di Socio Attivo sono espressi nell'apposita sezione del Regolamento della Società Italiana di Endodonzia (SIE) all'indirizzo web: www.endodonzia.it.

CRITERI DI VALUTAZIONE

I casi clinici verranno valutati nel loro complesso, coerentemente con gli scopi e fini della SIE, e devono essere presentati dai Candidati considerando non solo l'aspetto clinico, ma anche quello formale della documentazione presentata.
La documentazione scientifica verrà valutata considerando la classificazione ANVUR delle Riviste Scientifiche, i documenti scientifici dovranno essere tutti di pertinenza endodontica.

ADEMPIMENTI DEL CANDIDATO

La domanda di ammissione allo status di Socio Aggregato/Attivo, rivolta al Presidente della SIE, dovrà pervenire, insieme alla documentazione di seguito elencata, alla Segreteria della SIE con un anticipo di 20 giorni sulle date di riunione della CAS, sufficiente per poter organizzare il materiale dei candidati. Le date di scadenza saranno rese note sul sito. La domanda dovrà essere firmata da un Socio Attivo in regola con la quota associativa per l'anno in corso, il quale dovrà aver esaminato e approvato la documentazione. Quest'ultimo è responsabile della correttezza clinica e formale della documentazione presentata.

PRESENTAZIONE DEI CASI ALLA COMMISSIONE

La presenza del Candidato è obbligatoria durante la riunione della CAS; è altresì consigliabile la presenza del Socio presentatore.

LA COMMISSIONE ACCETTAZIONE SOCI

La CAS (Commissione Accettazione Soci) è formata cinque Membri di indiscussa esperienza clinica, quattro Soci Attivi con almeno cinque anni di anzianità in questo ruolo eletti a ogni scadenza elettorale dall'Assemblea dei Soci Attivi e Onorari e uno dei Past President della Società incaricato dal CD a ogni riunione. Compito della CAS è quello di esaminare e valutare la documentazione presentata dagli aspiranti Soci Aggregati e Soci Attivi. Per rispetto del lavoro dei Candidati e per omogeneità di giudizio, in ogni riunione CAS verranno valutati non più di 12 candidati a Socio Attivo; resta libero, invece, il numero dei candidati a Socio Aggregato valutabile in una singola riunione. Il Consiglio Direttivo (CD) incaricando la Commissione Accettazione Soci (CAS) la rende responsabile dell'applicazione delle regole descritte nell'articolo 2 del regolamento. Il giudizio della CAS è insindacabile.

MEMBRI DELLA COMMISSIONE ACCETTAZIONE SOCI 2019

Past President della Società
Dott. **Enrico Cassai**
Dott. **Marco Colla**
Dott. **Mario Mancini**
Dott. **Pier Luigi Schirosa**

Appuntamento a...
Moderna Endodonzia
tra tecnologia ed esperienza
7-9 novembre 2019
Palazzo Della Cultura e Dei Congressi
(Piazza Della Costituzione 4/A, Bologna)

Milano, 8-10 Novembre 2018

Centro Congressi San Raffaele | Dibit 1 | Via Olgettina, 58 | 20132 Milano

Resoconto del III Congresso Internazionale SIE Endodontics: Clinical Solutions

Resoconto a cura del dott. ***Italo di Giuseppe****, Coordinatore della Comunicazione SIE*

Nelle giornate di giovedì 8, venerdì 9 e sabato 10 novembre, presso il Dibit 1 del Centro Congressi del San Raffaele di Milano si è svolto un importante incontro della Società Italiana di Endodonzia (SIE), e segnatamente il **III Congresso Internazionale della Società,** dal titolo: **Endodontics: Clinical Solutions.**

Il Congresso è stato accreditato ECM da CIC Provider e patrocinato dall'Università Vita-Salute San Raffaele, FNOMCeO, Collegio dei Docenti Universitari di Discipline Odontostomatologiche, da ANDI Nazionale e AIO nazionale e si è svolto alla presenza di autorevoli rappresentanti di ESE, AAE e FDI. L'evento, supportato da ben 22 Aziende sponsor e tre Media Partner, ha convogliato a Milano un numero sbalorditivo di partecipanti, più di 1.100, che per tre giorni hanno popolato il moderno impianto del *San Raffaele Congress Center.*

I lavori hanno avuto inizio giovedì mattina, nella lecture room Caravella Santa Maria, con **l'incontro conclusivo dei SIE ENDODONTIC COURSES**: molti degli iscritti ai vari corsi regionali, con sede a Genova, per il corso avanzato, Bologna e Brescia, per i corsi base, più graditissimi ospiti stranieri, hanno potuto seguire le relazioni dei dottori *Italo di Giuseppe* ed *Enrico Cassai*, i quali hanno brillantemente approfondito due dei numerosi argomenti della disciplina endodontica. Al termine la consegna delle pergamene di partecipazione da parte del Presidente, il prof. Francesco Riccitiello e del Segretario, il dott. Roberto Fornara, in rappresentanza della Società.

Nel pomeriggio, nella medesima sala, posti in piedi per il classico **CORSO PRE-CONGRESSO**: i dottori *Augusto Malentacca* e *Arnaldo Castellucci*, entrambi past-president SIE, hanno intrattenuto i numerosissimi partecipanti con due consecutive e spettacolari relazioni dal titolo *Problem solving within the scope and challenges of endodontic procedures.* La consueta assemblea societaria chiudeva la prima giornata di lavori.

Venerdì 9, dopo la **Cerimonia di Apertura Lavori e del Saluto delle Autorità**, in una lecture room Caravella Santa Maria affollatissima, con la possibilità di seguire lo svolgimento del congresso anche dalla lecture room Nina/Pinta grazie alla proiezione delle immagini, si è svolta la **prima sessione congressuale** affidata ai dottori **Filippo Cardinali**, **Vittorio Franco** e **Antonis Chaniotis**; dopo il break di metà mattina, i lavori venivano ripresi dai dottori **Pio Bertani, Mohammad Hossein Nekoofar** e **Stephane Simon**, a completamento della **seconda sessione**.

Stessa sala, stesso auditorio gremitissimo, dopo il lunch break,

Consiglio direttivo 2019/2020

Past President
Prof. Francesco Riccitiello
Presidente
Dott. Vittorio Franco
Presidente Eletto
Dott. Roberto Fornara
Vice Presidente
Dott.ssa Maria Teresa Sberna
Segretario
Dott. Filippo Cardinali
Tesoriere
Dott. Cristian Coraini
Coordinatore Culturale
Dott. Andrea Polesel
Coordinatore della Comunicazione
Dott.ssa Denise Irene Karin Pontoriero
Revisore dei Conti
Dott.ssa Katia Greco
Revisore dei Conti
Dott. Franco Ongaro

1 | I Relatori dell'incontro Finale - Endodontic Courses 2018: Cassai e Di Giuseppe

2 | I Relatori del Corso Pre-Congressuale: Castellucci e Malentacca insieme ai Presidenti SIE

3 | La Cerimonia di Apertura Lavori e Saluto Autorità

4 | La platea in Auditorium

VITA SOCIETARIA

5 | I Teatri Clicnici
6 | 7 | 8 | Tavole Cliniche Sponsorizzate
9 | I Poster
10 e 11 | L'area espositiva durante il break
12 | La consegna della Spilla al Past President Francesco Riccitiello
13 | Il nuovo Consiglio Direttivo SIE 2019/2020

per la **terza sessione**, quella delle **Master Clinician Session Sponsorizzate** dall'intero corpo dei cinque Main Sponsor: **il dott. Walid Nehme per Dentalica Micromega, il prof. Vinio Malagnino per Sweden&Martina, il dott. Vittorio Franco per Dentsply Sirona, il dott. Marco Martignoni per Simit Next e per finire il dott. Giovanni Olivi per Fotona.**
In parallelo, nella lecture room Newton, **fasi finali dei Premi Garberoglio (9.15-11.00), Lavagnoli (11.30-13.15) e Riitano (14.30-16.15);** fasi finali anche del **Premio Miglior Poster SIE**, tra lecture room Vetri e area espositiva.
La consueta **Cena Sociale** presso la Sala Duomo dello scintillante **Excelsior Hotel Gallia** non poteva che essere la migliore conclusione dopo una giornata così intensa e interessante. Tra una portata e l'altra si è trovato anche il tempo di nominare e premiare, con la simbolica "spilletta" SIE, i nuovi Soci Attivi: i dottori **Calogero Bugea, Marco Cinelli, Gennaro Ferraioli, Gianluca Fumei, Fabrizio Libotte, Giovanni Messina, Lucia Reggio e Francesco Sforza** e, da parte del CD uscente, di consegnare un graditissimo pensiero, in ricordo dei due anni di presidenza, al prof. Francesco Riccitiello.
Sabato 10, terzo e ultimo giorno di Congresso, ancora pubblico delle grandi occasioni per seguire **le ultime due sessioni, la quinta e la sesta,** che vedevano protagonisti prima il **prof. Francesco Riccitiello con la dott.ssa Katia Greco, il dott. Patrick Sequeira-Byron e il prof. Francesco Mannocci; poi il dott. Walid Nehme, il prof. Giuseppe Cantatore, il prof. Massimo Gagliani e**, per finire, **i dottori Massimo Giovarruscio e Salvatore Sauro.**
Contemporaneamente, le due interessanti **Sessioni di Ricerca Libera**, nella lecture room Newton; i molto apprezzati tre **Teatri Clinici** (18 relatori, tre grandi topic, ognuno dei quali affrontato in tutte le implicazioni), che in questa edizione sostituivano le Tavole Cliniche istituzionali SIE e le **Tavole Cliniche sponsorizzate** da Dentsply Sirona, Dentalica Micromega, Simit next, Fotona, Sweden&Martina, Septodont, JMorita,
Komet e Acteon: insomma, quello che si definisce l'imbarazzo della scelta per i numerosissimi intervenuti. Tornando ai lavori in lecture room Caravella Santa Maria, terminata la sequenza delle relazioni, il presidente prof. Francesco Riccitiello invitava il nuovo CD, appena eletto, a salire sul palco

VITA SOCIETARIA

14 | Il Vincitore del Premio Riccardo Garberoglio: Beatrice Giuggia
15 | Il Vincitore del Premio Giorgio Lavagnoli: Davide Guglielmi

16 | Il Vincitore del Premio Francesco Riitano: Fabio Tutino
17 | Il Vincitore del Premio Miglior Poster SIE: Marc Krikor Kaloustian

per una presentazione ufficiale davanti a soci e congressisti (vedi box del CD). Poi si è proceduto alla nomina dei Vincitori delle quattro Sessioni Finali dei Premi SIE (vedi box).
La lunga maratona di tre giorni si concludeva con l'intervento finale del presidente, che davanti a un pubblico rimasto incredibilmente numeroso fino alla fine dei lavori, ha dato i sentiti ringraziamenti della Società e un arrivederci a **Bologna**, in occasione del **36° Congresso Nazionale SIE** *(vedi box* ***Appuntamento a...****)*.

I Vincitori delle 4 Sessioni Finali dei Premi SIE

Premio Riccardo Garberoglio

Variation of vascular and blood indicators of early endothelial dysfunction after root canal therapy: a clinical and biomolecular study

Variazioni degli indicatori vascolari ed ematochimici di disfunzione endoteliale precoce dopo terapia endodontica: studio clinico e biomolecolare

Beatrice Giuggia, Loredana Bergandi, Allegra Comba, Mario Alovisi, Giorgia Carpegna, Damiano Pasqualini, Nicola Scotti, Elio Berutti*

Premio Giorgio Lavagnoli

Immediate Crown Replacement: report of extensive radicular fracture case series with intra-canal anchorage

Case series relativo alla cementazione adesiva immediata, con ancoraggio intra-canalare, di corona naturale in seguito a frattura radicolare

*Fabio G.M. Gorni, Davide Guglielmi**

Premio Francesco Riitano

Micro-computed tomography evaluation of ProTaper Next and WaveOne Gold glide path and shaping outcomes in maxillary rst molar curved canals

Valutazione alla micro-CT degli esiti di glide path e shaping effettuati con ProTaper Next e WaveOne Gold in canali curvi di primi molari superiori

Fabio Tutino, Mario Alovisi, Giorgia Carpegna, Damiano Pasqualini, Nicola Scotti, Elio Berutti*

Premio The Best Poster SIE

Effectiveness of the One Flare and 2Shape systems compared with the Reciproc System in Removing Root Canal Filling Material followed by Ultrasonic Passive Irrigation: A Micro Computed Tomographic Study

Effcacia di One Flare e 2Shape versus Reciproc nella rimozione del materiale di otturazione canalare seguito dall'irrigazione passiva ad ultrasuoni: studio alla micro-TC

Marc Krikor Kaloustian, Alfred Naaman, Walid Nehme, Franck Diemer, Issam Khalil*

VITA SOCIETARIA

Viterbo, 9 marzo 2019

Sintesi del Seminario Endodontico di MacroArea Centro

Biomateriali: evoluzione e applicazioni cliniche

Resoconto a cura del Coordinatore di MacroArea Centro, ***Dott. Luigi Scagnoli***

Nella splendida cornice dell'Aula Magna del rettorato dell'Università della Tuscia di Viterbo ha preso il via il nuovo corso della ristrutturazione delle sezioni regionali della SIE in MacroAree. È stata la nostra MacroArea del centro (Abruzzo, Lazio, Marche e Umbria) ad avere avuto l'onore di aprire questa nuova era con il Seminario di Viterbo del 9 marzo scorso. Un primo doveroso ringraziamento va alla Professoressa Anna Maria Fausto, Pro-Rettore Vicario dell'Università della Tuscia e al Professor Felice Grandinetti ordinario di chimica presso lo stesso Ateneo, che tanto hanno fatto affinché tale evento si realizzasse in questa sede.
Infatti l'interesse destato dall'argomento del nostro seminario ***Biomateriali: evoluzione e applicazioni chimiche*** ha fatto sì che rientrassimo nello specifico di molti esperimenti del laboratorio di scienze biologiche dell'Università della Tuscia e quindi di potere essere inseriti in programmi di ricerca futura con la struttura universitaria in un contesto di collaborazione scientifica.
Buona è stata l'affluenza dei partecipanti intervenuti da tutte le Regioni di appartenenza della MacroArea, anche grazie alla caratura dei Relatori a programma.
L'analisi degli stessi, negli argomenti trattati, ha dato certamente molti input a tutti i colleghi presenti per l'utilizzo dei biomateriali nelle varie applicazioni cliniche in **Endodonzia ortograda e chirurgica**, grazie alle chiare, e come sempre supportate da casi documentati in modo impeccabile, relazioni di **Filippo Cardinali** e **Augusto Malentacca**.
Lucio Daniele ci ha dimostrato come anche i risultati da lui ottenuti nei casi di incappucciamenti diretti e indiretti facciano di questi materiali un motivo di utilizzo nel tentativo di avere, da parte del clinico, un'arma in più anche nell'adulto nel caso di esposizione pulpare durante la rimozione di tessuto carioso e quindi di mantenere la vitalità pulpare con conseguente risparmio di tessuto biologico del dente naturale.
Un plauso a **Manuele Mancini**, cui avevamo affidato forse il compito più impegnativo: fare una panoramica su tutti i biomateriali prodotti dalle varie aziende. Manuele, in modo molto semplice ma altrettanto efficace, ha evidenziato le caratteristiche fisico-chimiche ed organolettiche di ogni singolo prodotto ed è riuscito a creare una relazione di altissimo livello e interesse dando una classificazione precisa dei vari materiali a seconda delle loro composizioni e le loro diverse modalità di utilizzo nei vari procedimenti clinici.
Direi, quindi, un risultato più che soddisfacente, considerando anche la scelta della sede del seminario, certamente non facile da raggiungere, ma che, alla luce delle considerazioni fatte in sede di programmazione da me e dai miei Referenti Regionali Alessandra D'Agostino, Stefano Vecchi e Lucio Daniele, è risultata vincente e ha portato la SIE a essere presente in una città bellissima ma poco sfruttata, nell'ottica di promuovere eventi dove la SIE non è spesso presente e deve, di conseguenza, per aumentare l'interesse dei colleghi a partecipare alle varie manifestazioni, andare incontro alle loro esigenze, muovendosi in prima persona.

Il Coordinatore di MacroArea Centro, Scagnoli, insieme ai Referenti Locali di Lazio e Marche, D'Agostino e Vecchi

Sopra | L'Aula dell'Università della Tuscia e i Relatori
Sotto |Apertura Lavori con il Relatore del Seminario, Cardinali

Torino, 30 marzo 2019

Sintesi del Seminario Endodontico di MacroArea Nord-Ovest

Endodonzia vs medicina legale: confronto a 360°

Resoconto a cura del Coordinatore di MacroArea Nord-Ovest, ***Dott. Davide Castro***

Il seminario SIE 2019 della MacroArea Nord-Ovest si è tenuto sabato 30 marzo presso l'Aula Magna della Dental School di Torino.
Dopo una breve introduzione da parte del Coordinatore di MacroArea **Davide Castro** e del Presidente del Corso di Laurea Magistrale in Odontoiatria e Protesi Dentaria, **Elio Berutti**, è stata data la parola ai due Relatori, **Mario Lendini** e **Gian Luca Roggero** i quali, grazie a una elevata competenza in campo clinico e medico legale, hanno saputo coinvolgere rapidamente e con grande disinvoltura gli 80 partecipanti, analizzando le nuove normative che regolano i contraddittori giuridico-assicurativi.
Nonostante l'argomento particolarmente complesso è emersa la loro grande capacità comunicativa esaltando un confronto serrato tra una vasta casistica clinica e i potenziali rischi di contestazione medico-legale e interagendo con le numerose domande poste dai partecipanti.
Il confronto a 360° ha permesso di fugare ogni dubbio sulle norme che regolano il comportamento deontologico in campo odontoiatrico e di chiarire le linee guida su cui si basano le azioni dei medici legali e degli avvocati delle parti assicurative.
Dopo quasi quattro ore di approfondimento del confine clinico tra Endodonzia e Implantologia sono giunti gli ultimi consigli "pratici" dei due Relatori al fine di migliorare l'approccio clinico multidisciplinare verso i pazienti e di tutelarsi con maggiore efficacia dai rischi di contenziosi oggi giorno sempre più frequenti.

Apertura Lavori e Saluto delle Autorità: Berutti

La platea del seminario

A sinistra | I Relatori Roggero e Lendini insieme al coordinatore di macroarea nord-ovest, Castro

Qui a lato | Relatori, Presidenti di Sessione e Autorità: Del Mastro, Roggero, Castro, Berutti e Lendini

VITA SOCIETARIA

Napoli, 6 aprile 2019

Sintesi della Giornata Endodontica di MacroArea Sud

Endodonzia, protocolli clinici e ricerca

Come orientarsi correttamente nell'era dei social network

Resoconto a cura del Coordinatore di MacroArea Sud, ***Dott. Giorgio Vittoria***

Il 6 aprile 2019 presso l'aula Magna Gaetano Salvatore dell'Università degli Studi di Napoli Federico II si è tenuta la prima giornata di MacroArea sud della SIE.
La giornata ha avuto un ottimo successo in termini di partecipazione con circa 160 partecipanti che hanno affollato l'area espositiva e l'auditorium dando giusta soddisfazione ai tanti Sponsor e ai Relatori della giornata.
Al saluto delle autorità hanno partecipato il Presidente della Scuola di Medicina e Chirurgia dell'Università degli Studi di Napoli Federico II Prof. **Luigi Califano**, che ringrazio ancora sentitamente per averci concesso l'utilizzo della splendida e tecnologica Aula Magna; il Presidente CAO nazionale Dott. **Raffaele Iandolo**, la Dott.ssa **Sandra Frojo** Presidente CAO Napoli, il Prof. **Sandro Rengo** Presidente CLOPD dell'Università degli Studi di Napoli Federico II nonché Past President della SIE, la Dott.ssa **Giuliana Luciano** Presidente ANDI Napoli, il Prof. **Alfredo De Rosa** Professore di Endodonzia all'Università degli Studi della Campania Luigi Vanvitelli e il Prof. **Francesco Riccitiello** Past President SIE.
Il saluto delle Autorità è stato momento estremamente commovente per il ricordo sentito che tutti hanno fatto del Dott. **Mariano Malvano**, nostro Socio Attivo recentemente scomparso, la giornata infatti è stato il primo momento societario successivo alla scomparsa del caro Mario e per molti è stato difficile trattenere l'emozione durante la commemorazione.
Le relazioni hanno visto nella prima parte della giornata il Dott. **Giuseppe Squeo** illustrare il ruolo fondamentale della strumentazione manuale in Endodonzia, mentre il Prof. **Ernesto Rapisarda** e il Dott. **Alfio Pappalardo** hanno trattato dell'importanza della strumentazione meccanica nella detersione canalare. La Dott.ssa **Katia Greco** ha illustrato le strategie operative nella gestione di anatomie endodontiche complesse e il Dott. **Alfredo Iandolo** ha mostrato il risultato dei suoi ultimi lavori sui protocolli di attivazione degli irriganti.
Al fine di dare grande soddisfazione agli sponsor, che ringrazio per aver partecipato e reso possibile la giornata, il coffee break è durato un'ora abbondante.
Contemporaneamente sono partite le due tavole cliniche dei Main Sponsor tenute dai dottori **Claudio Farnararo** per Simit Next e dal Dott. **Claudio Musetta** per Sweden & Martina, che sono state molto seguite.
La giornata si è conclusa con le esposizioni del Dott. **Domenico Ricucci** che ha relazionato sulla possibilità di rigenerare l'organo pulpare, dei dottori **Multari (Giuseppe e Stefania)** che hanno parlato di stato dell'arte dell'otturazione canalare, del Dott. **Ciro Fuschino** che ha illustrato procedure cliniche per raggiungere l'eccellenza in Endodonzia e del Dott. **Carmelo Pulella** che ha chiuso le relazioni parlandoci di Endodonzia Chirurgica.
Permettetemi di ringraziare ancora una volta tutti i Relatori che in amicizia e mostrando quanto sia alto il valore culturale della Società hanno reso possibile questa giornata, i Presidenti di Sessione, **Massimo Amato, Paola Carratù** e **Michele Siemone** e immancabile è il ringraziamento alla nostra vulcanica segretaria Gaia Garlaschè che mi ha dato supporto eccellente e fondamentale.


Apertura Lavori e Saluto delle Autorità: il ricordo a Mariano Malvano e i Relatori della Giornata con il Coordinatore di Macroarea Sud, Vittoria

I Relatori della Giornata

Relatori e Presidenti di Sessione: Vittoria, Ricucci e Simeone

VITA SOCIETARIA

16/03/2019 - 30/03/2019 - 13/04/2019 - 04/05/2019

Corsi di formazione teorico-pratici della Società Italiana di Endodonzia

SIE Endodontic Courses - Sede Bologna
I Ritrattamenti Endodontici Ortogradi

Coordinatore di MacroArea Nord-Est, ***Dott. Stefano Gaffuri***
Resoconto a cura del Referente Locale e organizzatore, ***Dott. Luca Venuti***

L'argomento dei *Ritrattamenti Endodontici* probabilmente appartiene a una delle più complesse situazioni cliniche odontoiatriche che quotidianamente incontriamo.
L'***Endodontic course*** di quest'anno ha dato la possibilità a 21 giovani corsisiti di comprendere come affrontare con dovuta attenzione e corretti strumenti un ritrattamento endodontico.
Nelle quattro giornate di corso i Soci Attivi emiliano-romagnoli della SIE hanno costruito una road map da seguire in questa situazione clinica complessa: dalla diagnosi e piano di trattamento al sigillo apicale, passando da gradini, perforazioni, strumenti fratturati, isolamento del campo operatorio e tecniche di irrigazione.
Il filo comune, dettato da una meticolosa ricerca bibliografica, ha permesso ai 13 relatori di suggerire una corretta condotta clinica da adottare per tutti i corsisiti.
La presenza di workshop pratici ha fatto toccare con mano alcune fasi di tecniche dei ritrattamenti, alcune tecniche di utilizzo dei materiali bioattivi e valutato su denti estratti il comportamento di diversi strumenti di sagomatura.
Il feedback dei partecipanti è stato estremamente positivo e vista la ricchezza dei contenuti sarebbe auspicabile riproporre tale programma in altre sedi nazionali.

I corsisti dell'Endodontic Course

Si ringrazia per l'attiva partecipazione: la Dott.ssa **Irene Franchi**, il Dott. **Enrico Cassai**, il Dott. **Paolo Generali**, la Dott.ssa **Rita Gnoli**, la Dott.ssa **Veronica Orsi**, il Dott. **Luigi Generali**, il Dott. **Francesco Iacono**, la Dott.ssa **Chiara Pirani,** il Dott. **Pio Bertani**, il Dott. **Luca Venuti**, il Dott. **Mauro Venturi**, il Dott. **Emanuele Ambu**, il Dott. **Stefano Milani**.

Il Relatore Cassai durante la relazione

I Relatori Generali, Gnoli e Iacono insieme al Referente Locale del Corso, Luca Venuti

I corsisti dell'Endodontic Course

EQ-V sweden & martina

EQ-V: L'EVOLUZIONE PER UNA OTTURAZIONE COMPLETA E TRIDIMENSIONALE DEL CANALE RADICOLARE

Ha da poco fatto il proprio ingresso nel mercato endodontico ed EQ-V si è già affermato come la nuova valida soluzione per gli utilizzatori di tecniche di otturazione con onda continua di condensazione.

Sviluppato da Meta Biomed come evoluzione del precedente EQ-MASTER, utilizzato da migliaia di endodontisti nel mondo e già distribuito da Sweden & Martina, EQ-V è un'opzione affidabile, pratica, sicura.

EQ-V consente il trattamento tridimensionale dell'intero canale radicolare attraverso due moduli separati e complementari: EQ-V Pack ed EQ-V Fill, dall'innovativo design di manipolo e pistola, studiato e ricercato per garantire la massima leggerezza, ergonomicità nell'impugnatura e maneggevolezza.
Entrambi vantano materiali di alta qualità e di facile manutenzione per quanto riguarda le procedure di pulizia, la cui resistenza ai comuni disinfettanti è stata testata con giorni di immersione in agenti chimici. Nella sigillatura apicale EQ-V Pack presenta caratteristiche vincenti: il **riscaldamento istantaneo dei plugger** compattatori e la possibilità di raggiungere comodamente qualsiasi canale sia a livello mandibolare che mascellare, grazie all'anello di attivazione del dispositivo, che può essere premuto in qualsiasi punto.
Rapidità e immediatezza di riscaldamento conferiscono a EQ-V Fill performances eccezionali: in soli 35 secondi il dispositivo fluidifica la guttaperca e raggiunge la temperatura di 200°C.
L'elevata sensibilità del grilletto consente poi di estrudere il materiale in maniera fluida, per la sigillatura del terzo coronale.
Flessibilità e resistenza caratterizzano **gli aghi** che, potendo **ruotare a 360°**, consentono una precisione estrema, garantendo impareggiabili capacità di accesso al canale, anche nelle condizioni più difficili.
Un ulteriore plus significativo di questo sistema cordless è l'utilizzo di **batterie al litio ricaricabili** più efficienti, durevoli e pratiche da rimuovere e sostituire. Ciò consente un utilizzo prolungato di EQ-V, rendendolo il dispositivo ideale anche in caso di procedure endodontiche complesse.
EQ-V, frutto della tecnologia d'avanguardia Meta Biomed, è un prodotto affidabile nell'affiancare e supportare il professionista nelle procedure endodontiche di ogni giorno.

Per informazioni:
Sweden & Martina S.p.A.
www.sweden-martina.com
customerservice@sweden-martina.com

sweden & martina

La rivoluzione SphereTEC® continua ...
Nuovo Ceram.x Spectra™ ST flow: il composito fluido estetico più semplice e versatile.

Con il lancio di Ceram.x Spectra™ ST flow Dentsply Sirona estende i vantaggi della tecnologia brevettata di riempitivi SphereTEC® ai compositi fluidi. L'eccellente effetto camaleontico consente con sole 5 tinte di coprire l'intera scala VITA®[1] e la gestione del flow controllata offre maggiore versatilità in tutte le situazioni cliniche rispetto ai fluidi tradizionali.

Nel 2015 Dentsply Sirona lancia sul mercato il composito ceram.x® Universal e introduce SphereTEC®, l'innovativa tecnologia avanzata di riempitivi sferici. Dopo oltre 14 milioni di restauri realizzati, Dentsply Sirona utilizza la stessa tecnologia per il nuovo composito fluido Ceram.x Spectra™ ST flow. In questo modo, la linea completa di compositi universali Ceram.x Spectra™ ST si arricchisce, dando l'opportunità ai clinici di poter usufruire di tutti i vantaggi della tecnologia SphereTEC®, primi tra tutti l'eccellente lavorabilità e l'ottimo effetto camaleontico, che assicura una resa cromatica eccezionale e la lunga durata del restauro.

I riempitivi SphereTEC®, su cui si basa la tecnologia brevettata da Dentsply Sirona, sono riempitivi pre-polimerizzati in forma sferica prodotti con vetro di bario sub-micronico che consentono un eccellente adattamento alle superfici della cavità e lavorano insieme a particelle di riempitivi di forma irregolare più piccole per ottenere una gestione del fluido controllata grazie alla viscosità del materiale.

La perfetta corrispondenza del riempitivo SphereTEC® con la matrice resinosa Ceram.x Spectra™ ST flow crea un eccellente effetto camaleontico e un abbinamento perfetto con le tinte del composito universale Ceram.x Spectra™ ST. L'esclusiva struttura dei riempitivi SphereTEC® massimizza la resistenza e la durata, mentre la dimensione delle particelle primarie sub-microniche assicura un'estetica e una lucidabilità senza paragoni.

Il nuovo composito Ceram.x Spectra™ ST flow utilizza cinque tinte universali CLOUD dalla A1 alla A4 che coprono l'intera scala VITA®[1] Classic, ottimizzando l'assortimento di colori in studio e garantendo risultati clinici altamente estetici, grazie all'effetto camaleontico.

Il composito Ceram.x Spectra ST flow offre anche una tinta per denti sbiancati (BW), due tinte dentina opache (D1 e D3) e una tinta di smalto traslucido (E1) per soddisfare le richieste di casi specifici.

1. VITA® non è un marchio registrato di Dentsply Sirona Inc.

Per saperne di più visita il sito www.dentsplysirona.com o contatta Simit Next al numero 0376.267811

Dentsply Sirona | Simit® NEXT Endodonzia & Conservativa

VDW®

Endo
Easy
Efficient

EDDY® è il sistema sonico d'irrigazione canalare sicuro, efficace e clinicamente testato.

EDDY®

Numerosi studi clinici e più di due anni di utilizzo nella pratica quotidiana hanno dimostrato che l'attivazione sonica dell'irrigante con la punta EDDY® della VDW deterge in modo sicuro ed efficace anche i canali radicolari più curvi.

La punta EDDY® per l'attivazione sonica dell'irrigante risolve i problemi dei sistemi ultrasonici e dell'irrigazione manuale. Realizzata in poliammide, effettua un movimento oscillatorio di elevata ampiezza nel canale radicolare generato dall'aria compressa ad alta frequenza, dai 5.000 ai 6.000 Hz. Questo movimento tridimensionale innesca la cavitazione e il microstreaming dei liquidi che rendono la detersione più efficiente anche nei canali laterali, nelle ramificazioni apicali e negli istmi.
La punta EDDY® in poliammide, inoltre, è più morbida della dentina e particolarmente delicata e flessibile, rispetta l'anatomia del canale ed evita il rischio di creare gradini o perforazioni.
Un ulteriore vantaggio di EDDY® consiste nel notevole risparmio di tempo - richiede solo un massimo di 30 secondi per intervallo durante la preparazione - e assicura una maggiore efficienza rispetto all'irrigazione manuale con cannule.

Movimento oscillante della punta in poliammide EDDY®

Studi clinici dimostrano il successo del trattamento a lungo termine

Diversi studi clinici (Neuhaus et al., Urban et al.) hanno confrontato le prestazioni di EDDY® rispetto agli altri metodi di irrigazione e hanno dimostrato che produce risultati eccezionali: rimuove il biofilm batterico nei canali con anatomie complesse tanto efficacemente quanto l'irrigazione ultrasonica passiva, risultando più delicata sulle pareti canalari grazie alla morbidezza e flessibilita della poliammide. Sia l'attivazione sonica che ultrasonica rafforzano le proprietà degli irriganti di dissoluzione del tessuto. Infine, è stato dimostrato che EDDY® rimuove depositi e detriti di idrossido di calcio in modo più efficace rispetto all'irrigazione manuale.
Essendo una punta monouso di dimensioni universali, EDDY® può essere facilmente ed efficacemente integrata nella pratica clinica quotidiana, grazie alla sua compatibilità con la maggior parte degli Airscaler disponibili sul mercato.

EDDY® su Airscaler sonico

Per maggiori informazioni consultare il sito web https://www.vdw-dental.com/en/products/detail/eddy/

Morita: Modern treatment systems for perfect procedures

Endodonzia Sicura… passo per passo

Il primo passo in ogni trattamento endodontico di successo è **una diagnosi precisa** basata su immagini 3D accurate ad alta risoluzione fornite dalla tomografia computerizzata a cone-beam (CBCT).
Morita supporta questi obiettivi diagnostici con il suo nuovo sistema a raggi X **Veraview X800** per immagini 3D, panoramiche e cefalometriche.

Vantaggi

- Questo apparecchio offre un livello di qualità dell'immagine senza precedenti in un sistema di imaging 2D/3D (risoluzione: 2,5 LP/mm MTF).
- È versatile! Non solo produce immagini rapide e accurate, ma fornisce anche la massima sicurezza per l'operatore e il paziente con dosi minime efficaci (ALARA). Infatti il sistema utilizza il collaudato campo R100 di riduzione della dose con la sua forma Ruleaux (triangolare).
- Esposizioni in modalità di 180 gradi e 360 gradi, esposizioni cefalometriche veloci in soli 3,5 secondi, o una funzione di ricostruzione dello zoom che crea una registrazione di 80 µm da una registrazione voxel 125 µm senza richiedere un Retake.

Morita è inoltre sinonimo di…

Precisione e sicurezza per il canale radicolare: una volta che l'endodontista procede alle effettive procedure intraorali, sono disponibili diversi strumenti di alta qualità per assistere il suo delicato lavoro. Per una comoda preparazione della cavità di accesso, Morita offre le **potenti turbine TwinPower** e i **manipoli della serie TorqTech e Tokyo**; offrendo una coppia massima a piccoli diametri dello strumento, forniscono una buona vista dell'area di lavoro e spazio sufficiente durante il trattamento dei molari.

Nelle fasi successive essenziali del trattamento – misurazione, strumentazione, riempimento e polimerizzazione – Morita offre una soluzione innovativa per tutti questi tre step, **il nuovo motore endodontico TriAuto ZX2 con localizzatore Apicale.**
ITriAuto ZX2 è l'unico sistema del suo genere che integra la localizzazione Apicale e la preparazione del canale radicolare in un unico manipolo: è stato progettato per la massima sicurezza ed è dotato sia della funzione OTR che della nuova funzione ottimale glidepath.
L'OTR cambia la direzione di rotazione del file non appena viene superato il livello di coppia pre-impostato singolarmente. Dopo aver invertito la rotazione di 90 gradi, torna a ruotare nella direzione di taglio; se la coppia è ancora troppo alta, il processo viene ripetuto tre-quattro volte dopo un ulteriore 180 gradi. Questo sistema aiuta a conservare la morfologia originale del sistema dei canali radicolari e facilita la rimozione affidabile dei detriti. Tutti questi fattori si combinano per abbreviare il tempo di trattamento.
L'OGP fornisce una preparazione rapida e automatizzata del glide-path, che è la prima fase di preparazione effettiva, e quindi prepara il canale radicolare per procedure endodontiche sicure. In combinazione con la funzione del dispositivo, il clinico può portare lo strumento endodontico fino alla lunghezza di lavoro senza fratture, ostruzione o formazione di sporgenza. Semplicemente ingegnoso e assolutamente sicuro. Un display LCD fornisce un feedback completo dal canale radicolare mostrando i dati di misura esatti acquisiti dal manipolo, soprattutto la distanza del file dall'apice.
Quindi il TriAuto ZX2 conserva la struttura dentale naturale e rende il trattamento ancora più efficiente perché è richiesto solo un numero limitato di file.
Un'altra caratteristica sorprendente di questo sistema endodontico è la sua **piccola testina e il peso ridotto** (140 g), che lo rende molto maneggevole. Essendo un **apparecchio cordless** migliora significativamente la flessibilità di trattamento e ottimizza il flusso di lavoro clinico. Il funzionamento semplice e intuitivo e le funzioni automatizzate assicurano risultati affidabili e sicuri in ogni momento.

LA MISSION DI MORITA

Morita offre un portfolio completo di prodotti di alta qualità che coprono tutte le fasi del trattamento, dalla diagnosi al controllo, permettendo di lavorare sempre in modo efficiente, ergonomico e sicuro. I dentisti apprezzeranno la convenienza e i pazienti apprezzeranno il comfort di un trattamento migliorato. Il nuovo sistema di imaging Veraview X800 2D/3D e il nuovo motore TriAuto ZX2 endo con localizzatore Apex mettono in primo piano la sicurezza e rappresentano nuovi standard nei loro segmenti. Queste soluzioni sottolineano l'impegno di Morita: rispondere alle esigenze degli utenti e dei pazienti in ogni fase e continuare a fornire il "Gold standard" per il successo del trattamento nella pratica endodontica.

GUIDELINES FOR AUTHORS

Giornale Italiano di Endodonzia publishes original scientific articles, reviews, clinical articles and case reports in the field of Endodontology. Scientific contributions dealing with health, injuries to and diseases of the pulp and periradicular region, and their relationship with systemic well-being and health. Original scientific marticles are published in the areas of biomedical science, applied materials science, bioengineering, epidemiology and social science relevant to endodontic disease and its management, and to the restoration of root-treated teeth. In addition, review articles, reports of clinical cases, book reviews, summaries and abstracts of scientific meetings and news items are accepted. Please read the instructions below carefully for details on the submission of manuscripts, the journal's requirements and standards as well as information concerning the procedure after a manuscript has been accepted for publication in Giornale Italiano di Endodonzia. Authors are encouraged to visit **www.giornaleitalianoendodonzia.it** for further information on the preparation and submission of articles and figures.

Ethical guidelines

Giornale Italiano di Endodonzia adheres to the below ethical guidelines for publication and research.

Authorship and Acknowledgements

Authors submitting a paper do so on the understanding that the manuscript has been read and approved by all authors and that all authors agree to the submission of the manuscript to the Giornale Italiano di Endodonzia. Giornale Italiano di Endodonzia adheres to the definition of authorship set up by The International Committee of Medical Journal Editors (ICMJE). According to the ICMJE, authorship criteria should be based on 1) substantial contributions to conception and design of, or acquisiation of data or analysis and interpretation of data, 2) drafting the article or revising it critically for important intellectual content and 3) final approval of the version to be published. Authors should meet conditions 1, 2 and 3. It is a requirement that all authors have been accredited as appropriate upon submission of the manuscript. Contributors who do not qualify as authors should be mentioned under Acknowledgements.

Manuscript preparation

Manuscripts should be uploaded as Word (.doc) or Rich Text Format (.rtf) files (not write-protected) plus separate figure files: TIF, EPS, JPEG files are acceptable for submission.
The text file must contain the **abstract, main text, references, tables and figure legends**, but no embedded figures or title page. The title page should be provided as a separate file. In the main text, please reference figures as for instance **figure 1, figure 2** etc to match the tag name you choose for the individual figure files uploaded.
Please note that **manuscripts must be written in English**. Authors whose native language is not English are strongly advised to have their manuscript checked by a language editing service or by a native English speaker prior to submission.

Manuscript Types Accepted

Original Scientific Articles must describe significant and original experimental observations and provide sufficient detail so that the observations can be critically evaluated and, if necessary, repeated. Original Scientific Articles must conform to the highest international standards in the field.
Review Articles are accepted for their broad general interest; all are refereed by experts in the field who are asked to comment on issues such as timeliness, general interest and balanced treatment of controversies, as well as on scientific accuracy. Reviews should generally include a clearly defined search strategy and take a broad view of the field rather than merely summarizing the authors´ own previous work. Extensive or unbalanced citation of the authors´ own publications is discouraged.
Mini Review Articles are accepted to address current evidence on well-defined clinical, research or methodological topics. All are refereed by experts in the field who are asked to comment on timeliness, general interest, balanced treatment of controversies, and scientific rigor. A clear research question, search strategy and balanced synthesis of the evidence is expected. Manuscripts are limited in terms of word-length and number of figures.
Clinical Articles are suited to describe significant improvements in clinical practice such as the report of a novel technique, a breakthrough in technology or practical approaches to recognised clinical challenges. They should conform to the highest scientific and clinical practice standards.
Case Reports or **Case Series** illustrating unusual and clinically relevant observations are acceptable, but they must be of sufficiently high quality to be considered worthy of publication in the Journal. On rare occasions, completed cases displaying nonobvious solutions to significant clinical challenges will be considered. Illustrative material must be of the highest quality and healing outcomes, if appropriate, should be demonstrated.

Manuscript Format

The **official language** of the publication is **English**. It is preferred that manuscript is professionally edited. All services are paid for and arranged by the author and use of one of these services does not guarantee acceptance or preference for publication.
Authors should pay special attention to the **presentation** of their research findings or clinical reports so that they may be communicated clearly.
Technical **jargon** should be avoided as much as possible and clearly explained where its use is unavoidable. **Abbreviations** should also be kept to a minimum, particularly those that are not standard. Giornale Italiano di Endodonzia adheres to the conventions outlined in Units, Symbols and Abbreviations: A Guide for Medical and Scientific Editors and Authors. When non-standard terms appearing three or more times in the manuscript are to be abbreviated, they should be written out completely in the text when first used with the abbreviation in parenthesis. If abbreviations are used in the text, authors are required to write full name+abbreviation in brackets [e.g. Multiple Myeloma (MM)] the first time they are used, then only abbreviations can be written (apart from titles; in this case authors have to write always the full name). If names of equipment or substances are mentioned in the text, brand, company names and locations (city and state) for equipment and substances should be included in parentheses within the text.
The **background** and **hypotheses** underlying the study, as well as its main conclusions, should be clearly explained. Titles and abstracts especially should be written in language that will be readily intelligible to any scientist.

Structure

All manuscripts submitted to Giornale Italiano di Endodonzia should include Title Page, Abstract, Main Text, References and Acknowledgements, Tables, Figures and Figure Legends as appropriate.
Title Page should bear:

I. Title, which should be concise as well as descriptive (no more than 150 letters and spaces);
II. Initial(s) and last (family) name of each author;
III. Name and address of department, hospital or institution to which the work should be attributed;
IV. Running title (no more than 30 letters and spaces);
V. Three to five key words (in alphabetical order);
VI. Name, full postal address, telephone, fax number and e-mail address of author responsible for correspondence (Corresponding Author).

Abstracts should be no more than 250 words giving details of what was done: please choose
Abstract for Original Scientific Articles should be no more than 250 words giving details of what was done using the following structure:

- **Aim:** give a clear statement of the main aim of the study and the main hypothesis tested, if any.
- **Methodology:** describe the methods adopted including, as appropriate, the design of the study, the

setting, entry requirements for subjects, use of materials, outcome measures and statistical tests.
- **Results:** give the main results of the study, including the outcome of any statistical analysis.
- **Conclusions:** state the primary conclusions of the study and their implications. Suggest areas for further research, if appropriate.

Abstract for Review Articles should be non-structured of no more than 250 words giving details of what was done including the literature search strategy.
Abstract for Mini Review Articles should be non-structured of no more than 250 words, including a clear research question, details of the literature search strategy and clear conclusions.
Abstract for Case Reports and **Case Series** should be no more than 250 words using the following structure:
- **Aim:** give a clear statement of the main aim of the report and the clinical problem which is addressed.
- **Summary:** describe the methods adopted including, as appropriate, the design of the study, the setting, entry requirements for subjects, use of materials, outcome measures and analysis if any.
- **Key learning** points: provide up to five short, bullet-pointed statements to highlight the key messages of the report. All points must be fully justified by material presented in the report.

Abstract for Clinical Articles should be no more than 250 words using the following structure:
- **Aim:** give a clear statement of the main aim of the report and the clinical problem which is addressed.
- **Methodology:** describe the methods adopted.
- Results: give the main results of the study.
- **Conclusions:** state the primary conclusions of the study. Main Text of Original Scientific Article should include Introduction, Materials and Methods, Results, Discussion and Conclusion.

THE STRUCTURE

Main text for Original Scientific Articles

Introduction: should be focused, outlining the historical or logical origins of the study and gaps in knowledge. Exhaustive literature reviews are not appropriate. It should close with the explicit statement of the specific aims of the investigation, or hypothesis to be tested.

Material and Methods: must contain sufficient detail such that, in combination with the references cited, all clinical trials and experiments reported can be fully reproduced.

(I) Clinical Trials: should be reported using the CONSORT guidelines available at www.consort-statement.org. A CONSORT checklist and flow diagram (as a Figure) should also be included in the submission material.

(II) Experimental Subjects: experimentation involving **human subjects** will only be published if such research has been conducted in full accordance with ethical principles, including the World Medical Association Declaration of Helsinki (version 2008) and the additional requirements, if any, of the country where the research has been carried out. Manuscripts must be accompanied by a statement that the experiments were undertaken with the understanding and written consent of each subject and according to the above mentioned principles. A statement regarding the fact that the study has been independently reviewed and approved by an ethical board should also be included. Editors reserve the right to reject papers if there are doubts as to whether appropriate procedures have been used. When **experimental animals** are used the methods section must clearly indicate that adequate measures were taken to minimize pain or discomfort. Experiments should be carried out in accordance with the Guidelines laid down by the National Institute of Health (NIH) in the USA regarding the care and use of animals for experimental procedures or with the European Communities Council Directive of 24 November 1986 (86/609/EEC) and in accordance with local laws and regulations. All studies using human or animal subjects should include an explicit statement in the Material and Methods section identifying the review and ethics committee approval for each study, if applicable. Editors reserve the right to reject papers if there is doubt as to whether appropriate procedures have been used.

(III) Suppliers of materials should be named and their location (Company, town/city, state, country) included.

Results should present the observations with minimal reference to earlier literature or to possible interpretations. Data should not be duplicated in Tables and Figures.

Discussion: may usefully start with a brief summary of the major findings, but repetition of parts of the abstract or of the results section should be avoided. The Discussion section should progress with a review of the methodology before discussing the results in light of previous work in the field. The Discussion should end with a brief conclusion and a comment on the potential clinical relevance of the findings. Statements and interpretation of the data should be appropriately supported by original references.

Conclusions should contain a summary of the findings.

Main Text of Review Articles

should be divided into Introduction, Review and Conclusions.

The **Introduction** section should be focused to place the subject matter in context and to justify the need for the review. The **Review** section should be divided into logical subsections in order to improve readability and enhance understanding. Search strategies must be described and the use of state-of-the-art evidence-based systematic approaches is expected. The use of tabulated and illustrative material is encouraged. The **Conclusion** section should reach clear conclusions and/or recommendations on the basis of the evidence presented.

Main Text of Mini Review Articles

should be divided into Introduction, Review and Conclusions; please note that the **Conclusions section** should present clear statements/recommendations and suggestions for further work. The manuscript, including references and figure legends, should not normally exceed 4,000 words.

Main Text of Case Reports and Clinical Articles

should be divided into Introduction, Report, Discussion and Conclusion. They should be well illustrated with clinical images, radiographs, diagrams and, where appropriate, supporting tables and graphs. However, all illustrations must be of the highest quality.

IMPORTANT TO KNOW

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Acknowledgements: Giornale Italiano di Endodonzia requires that all sources of institutional, private and corporate financial support for the work within the manuscript must be fully acknowledged, and any potential conflicts of interest noted. Grant or contribution numbers may be acknowledged, and principal grant holders should be listed. Acknowledgments should be brief and should not include thanks to anonymous referees and editors. Under this section please specify contributors to the article other than the authors accredited. Please also include specifications of the source of funding for the study.

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British Endodontic Society - Guidelines for root canal treatment. Giornale Italiano di Endodonzia 1979;16:192-5.

Journal supplement
Frumin AM, Nussbaum J, Esposito M () Functional asplenia: demonstration of splenic activity by bone marrow scan (Abstract). Blood 1979;54 (Suppl. 1):26a.

Books and other monographs
Personal author(s)
Gutmann J, Harrison JW Surgical Endodontics, 1st edn Boston, MA, USA: Blackwell Scientific Publications, 1991.

Chapter in a book
Wesselink P Conventional rootcanal therapy III: root filling. In: Harty FJ, ed. Endodontics in Clinical Practice, (1990), 3rd edn; pp. 186-223. London, UK: Butterworth.

Published proceedings paper
DuPont B Bone marrow transplantation in severe combined immunodeficiency with an unrelated MLC compatible donor. In: White HJ, Smith R, eds. Proceedings of the Third Annual Meeting of the International Society for Experimental Rematology; (1974), pp. 44-46. Houston, TX, USA: International Society for Experimental Hematology.

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Ranofsky AL Surgical Operations in Short-Stay Hospitals: United States-1975 (1978). DHEW publication no. (PHS) 78-1785 (Vital and Health Statistics; Series 13; no. 34.) Hyattsville, MD, USA: National Centre for Health Statistics.8

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