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- EDITORIAL

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- CANAL TRANSPORTATION CAUSED BY ONE SINGLE-FILE AND TWO MULTIPLE-FILE ROTARY SYSTEMS: A COMPARATIVE STUDY USING CONE-BEAM COMPUTED TOMOGRAPHY
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Uno dei megatrend della nostra disciplina è la valutazione dei fattori critici coinvolti nel successo del trattamento canalare e lo sviluppo di nuove tecniche per ridurre il tasso di fallimento. Nonostante l’alto tasso di successo del trattamento endodontico, i fallimenti si verificano in un gran numero di casi e il più delle volte possono essere attribuiti alla persistenza di batteri nei canali e all’apice, a una detersione inadeguata o a scarsa qualità dell’otturazione. L’opzione di trattamento di prima linea dopo il fallimento del trattamento iniziale è un ritrattamento non chirurgico. L’Endodonzia chirurgica e l’autotraplanto devono essere a loro volta considerati prima dell’estrazione e della sostituzione con un impianto singolo.

In questo numero del GIE un articolo è focalizzato sui fattori coinvolti nella sopravvivenza dei denti dopo un trattamento endodontico chirurgico. Il successo dell’Endodonzia chirurgica è migliorato nel corso degli anni e questo interessante studio fornirà nuove informazioni utili per la pratica clinica quotidiana.

L’attuale evidenza dalla letteratura sull’autotraplanto di denti mostra percentuali di successo e sopravvivenza favorevoli e bassi tassi di complicanze, indicando che si tratta di un’opzione di trattamento affidabile. L’obiettivo finale dell’Endodonzia è quello di mantenere i denti naturali del paziente. A questo proposito, l’auto-traplanto di denti è un’alternativa terapeutica che endodontisti, parodontologi ed ortodontisti non dovrebbero dimenticare.

One of the megatrend of our discipline is the evaluation of critical factors involved in the success of root canal treatment and the development of new techniques to reduce the failure rate. Despite the high success rate of Endodontic treatment, failures do occur in a large number of cases and most of the times could be attributed to persistence of bacteria in the canals and apex, inappropriate mechanical debridement and poor obturation quality. The first-line treatment option after failure of initial root canal treatment is nonsurgical retreatment. Surgical Endodontics and autotransplantation should be considered before extraction and replacement by a single-tooth implant.

In this issue of GIE an original article is focused on the factors involved in the survival of teeth after a successful Endodontic surgical retreatment. Surgical Endodontic success has improved over the years and this interesting study will provide new information useful for daily clinical practice.

Current evidence from the literature on autotransplantation of teeth shows favourable survival and success rates and low complication rates, indicating it is a reliable treatment option. The ultimate goal of Endodontic treatment is to retain the natural dentition. In this regards tooth autotransplantation is an alternative treatment option that Endodontists, periodologists and orthodontists should not forget.

Sandro Rengo
Editor-in-Chief
Giornale Italiano di Endodonzia
E-mail address: editor.giornale@endodonzia.it
Il sistema Mtwo: immutato negli anni ma sempre in evoluzione nell’utilizzo clinico

MASTER CLINICIANS SESSION
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Ideato dal Prof. Giuseppe Siciliani e dal Team dell'Università degli Studi di Ferrara
PROGRAMME

THURSDAY 8TH NOVEMBER, 14.30 - 18.30

PRE-CongRESS COURSE “Problem solving within the scope and challenges of endodontic procedures”
Augusto Malamenta - Amaldo Castellucci

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| L'isolamento del campo operatorio in Endodonzia: la gestione dei casi complessi | Filippo Cardinali
9.40 Clinical approach to working lengths
| Un approccio clinico alle lunghezze del lavoro | Vittorio Franco
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| Un nuovo approccio per la strumentazione ed il management dei sistemi canali complessi | Antonios Chaniotis

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| Endodonzia rigenerativa, lo stato attuale | Mohammad Hossein Nejooifar
12.50 Calcium-silicate based material: a new way for restorative and endodontics filings
| Materiale a base di Silicato di Calcio: una nuova possibilità per la Restaurativa e l’otturazione Endodontica | Stephane Simon

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| DENTALICA MICROMEGA | SWEDEN & MARTINA | DENTSPLY SIRONA
SESSION CHAIRMAN: Maria Teresa Sberna
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SESSION CHAIRMAN: Alberto Rieppi
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CLINICAL THEATRE I Complex Endodontic treatment: solutions and tricks
| Trattamenti Complessi: Soluzioni ed espedienti
CLINICAL THEATRE II Endocanal Posts: an overview
| Overview sui pinni endocanalari
CLINICAL THEATRE III Decision Making for canal obturation
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Comparison of shaping ability of ProTaper Next and 2Shape nickel–titanium files in simulated severe curved canals

Analisi sperimentale della preparazione endodontica in canali artificiaali con curvature complesse: ProTaper Next Vs. 2Shape

Simone Staffoli a,*, Taha Özyürek b, Avi Hadad c, Alex Lvovsky c, Michael Solomonov c, Hadas Azizi c, Joe Ben Itzhak c, Maurizo Bossù a, Nicola M. Grande d, Gianluca Plotino e, Antonella Polimeni a

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Abstract
Aim: To evaluate the centering ability of ProTaper Next (PTN) and 2Shape (TS) nickel–titanium (NiTi) instruments in terms of maintaining the original root canal configuration in a simulated tooth with severe curvature.
Methodology: Twenty standardized simulated curved root canals were prepared to an apical size of 0.25 mm using PTN and TS (n = 10 canal/group) nickel-titanium files. A gig was constructed to enable reproducible image acquisition using a photographic camera. Pre- and post-instrumented images were recorded and superimposed using a computer software. The ability of the instruments to remain centered in the canal was determined by calculating a centering ratio at three independent points of the simulated canal: coronal, middle and apical third of the curvature.
PAROLE CHIAVE
Nickel-Titano; Capacità di centratura; Trattamento termico; 2Shape; Protaper Next.

Introduction

The purpose of instrumentation is mechanical debridement, the creation of space for the delivery of irrigation and optimized canal geometries for adequate obturation, while maintaining the original canal anatomy. In the curved canal, large stainless-steel files (SS) are less flexible and tend to straighten and transport the canal with creating of apical zips and ledges. In danger zone areas, such straightening may lead to strip perforations. Nickel-titanium (NiTi) instruments have been reported to have a decreased tendency for canal transportation and better centering ability than SS due to their greater elasticity. Manufacturers strive to improve NiTi instruments by changing their design and enhancing the structural alloy in an attempt to improve their mechanical performance.

ProTaper Next (PTN; Dentsply Sirona, Ballaigues, Switzerland) is made of M-wire heat-treated alloy with an asymmetric square cross-section. The PTN system is consist of X1 (17/.04), X2 (25/.06), X3 (30/.07), X4 (40/.06), and X5 (50/.06) files. 2Shape (TS; MicroMega, Besancon, France) is made of T-wire heat-treated alloy with an asymmetric triangular cross-section. The TS system is composed of TS1 (25/.04), TS2 (25/.06), TS3 (35/.06), and TS4 (40/.04) files.

To our knowledge, no research investigated the centering ability of TS instruments. Thus the purpose of the present study was to evaluate the centering ability of PTN and TS instruments in terms of maintaining the original root canal configuration in a simulated tooth with severe curvature. The null hypothesis was that there would be no significant difference between the PTN and TS in terms of shaping abilities.

Materials and methods

In order to standardize the root canal curvature, 20 artificial molar tooth models (MM tooth; Micro-Mega) having severely MB and ML canals (>60°) were selected. The working length (WL) of the ML and MB canals were 23.5 mm and 23 mm respectively. An apical foramen size of 0.1 mm was confirmed by a #10 K-file (Dentsply Sirona). Each simulated canal was colored with blue ink injected using a 27-G closed-end tip and side-vented needle (Ultradent Products, Inc., South Jordan, UT). The canals were randomly assigned to two groups (n = 10) according to the system that was used for canal instrumentation.

In Group 1, MB and ML canals were prepared using One G (Micro-Mega), 2Shape TS1 (25/.04) and TS2 (25/.06) files at 300 rpm and 1.2 Ncm torque values using VDW Gold (VDW, Munich, Germany) endodontic motor.

In Group 2, MB and ML canals were prepared using PathFile 1 and 2 (Dentsply Sirona), ProTaper X1 (17/.04) and X2 (25/.06) files at 300 rpm and 2 Ncm torque values using VDW Gold endodontic motor.

A single operator with experience in rotary systems performed all instrumentation procedures according to the manufacturer’s instructions. Each new instrument was used to prepare only two canals. Between each preparation step, apical patency was confirmed by using a #10 K-file until the tip of the file could be seen protruding through the apical foramen. The canal was irrigated with 1.0 mL sterile water using a 27-gauge needle after each file and as a final rinse. Each tooth was embedded in a putty base without obscuring the canals. A gig was constructed to

using a computer software. Statistical analysis was performed using one-way analysis of variance (ANOVA) followed by independent sample t-test at 5% significance level.

Results: No significant difference was found between the two systems (p > 0.05). At the apical third, the mean centering ratio was significantly higher than the centering ratio of the coronal and the middle thirds in both TS and PTN (p < 0.05).

Conclusions: There were no significant differences in the centering ability of the ProTaper Next and 2Shape systems in simulated severe curved canals. Both systems exhibited some degree of transportation, especially in the apical third.

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enable reproducible image acquisition using a photographic camera (EOS 70D; Canon, Tokyo, Japan). Three reference points were marked around the tooth position to allow for exact superimposition of the images. Pre- and post-instrumented images were recorded. Then, the images were superimposed using a computer software (Adobe Photoshop 7.0.1; Adobe Systems, Inc., Mountain View, CA, USA). The ability of the instruments to remain centered in the canal was determined by calculating a centering ratio at three independent points (coronal, middle, and apical) of the simulated canal.

The calculation of the centering ratio was used the following formula: \((X_1 - X_2)/Y\) \((X_1 \text{ — the maximum extent of canal movement in one direction, } X_2 \text{ — the movement in the opposite direction, } Y \text{ — the wideness of the final canal preparation}). The calculation was made using a computer software (ImageJ; NIH, Bethesda, MD).

Statistical analysis was performed using SPSS 22.0 (IBM-SPSS Inc., Chicago, IL, USA) using one-way analysis of variance (ANOVA) followed by independent sample t-test at 5% significance level.

### Results

The mean centering ratio for TS and PTN were 0.42 and 0.43, respectively. No significant difference was found between the different systems \((p > 0.05)\) as shown in Fig. 1. At the apical third, the mean centering ratio was significantly higher than the centering ratio of the coronal and the middle thirds in both TS and PTN \((p < 0.05)\) (Fig. 2). There was no difference between the coronal third and the middle third with the different systems.

### Discussion

In the past, files and reamers were manufactured from either carbon-steel or SS. The relatively high modulus of elasticity of these materials made it difficult for the larger file sizes to negotiate curved canals. NiTi rotary files are manufactured from a NiTi alloy that is significantly more elastic than SS and was developed by William Buehler in 1962. In 1988, Walia et al. introduced NiTi for the manufacturing of endodontic instruments.

Since the introduction of this alloy, a number of different files have been developed from NiTi. Many studies demonstrate that NiTi instruments remain better centered in the canal compared to SS. Esposito and Cunningham compared NiTi hand and engine-driven files to SS hand files in curved canals. They found that for instruments larger than ISO size 30, both hand and rotary NiTi files were significantly more effective than SS in maintaining the original path of the canal. Glossen et al. reported similar findings with instruments larger than size 45.

However, transportation of the canal can still occur with NiTi instruments in the apical, middle, and coronal thirds. Over the years, many NiTi instruments have been developed to improve root canal preparation. Hand and rotary instruments are available in various designs that differ in tip and taper design, rake angles, helical angles, pitch and different types of alloys.

Numerous studies compared the ability of several new rotary NiTi systems to maintain original canal shape and therefore remain better centered. The present study focused on two relatively new rotary NiTi systems with asymmetrical cross-section and with a different type of heat treated NiTi alloy. PTN is a M-wire alloy and TS is a T-wire
alloy. Both M-wire and T-wire are nitinol after a proprietary thermomechanical processing procedure that increased the flexibility and the fatigue resistance.

In the present study, both PTN and TS exhibit some degree of deflection of the original canal axis. There were no significant differences between the tested file systems. Both systems showed significantly more deflection at the apical third of the simulated canal.

It would be of clinical interest to investigate the performances and centering abilities of these systems in severely curved canals in human teeth.

**Conclusion**

Based on the parameters examined in this study and within its limitations, it can be concluded that there were no significant differences in the centering ability of the PTN and 2Shape systems in simulated severe curved canals. Both systems exhibited some degree of transportation, especially in the apical third.

**Clinical relevance**

The respect of the original anatomy is one on the goals of modern endodontics.

Investigation may help the clinical expectation of the instruments tested and help clinicians.

**Conflict of interest**

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

**Acknowledgement**

Thanks to the companies that provided the materials to make this research possible.

**References**


Canal transportation caused by one single-file and two multiple-file rotary systems: A comparative study using cone-beam computed tomography

Trasporto canalare causato da un sistema rotante mono-strumento e due sequenze di strumenti rotanti: studio comparativo con tomografia computerizzata a fascio conico

Eshagh Ali Saberi, Narges Farhad Mollashahi, Forugh Farahi *

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KEYWORDS
Canal transportation; Nickel—titanium; Rotary files; CBCT.

Abstract
Aim: This ex-vivo study aimed to compare canal transportation in mesio-buccal canal of mandibular first molars prepared with Mtwo and Revo-S multi-file and Neoniti single-file nickel—titanium (Ni—Ti) rotary systems using cone-beam computed tomography (CBCT).
Methodology: CBCT scans were obtained from 60 extracted mandibular first molars and the teeth were randomly divided into three groups. Mesio-buccal canal of mesial root was prepared with Revo-S, Neoniti or Mtwo rotary systems according to the instructions of the manufacturers. Post-operative CBCT scans were also obtained. A single operator performed canal preparations while another operator blinded to the group allocation of teeth did the measurements. Data were analyzed using SPSS 20. The mean and standard deviation (SD) of the amount of canal transportation were calculated and compared between the groups using the Friedman test ($P < 0.05$).

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1121-4171/ © 2018 Società Italiana di Endodonzia. Production and hosting by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).
Introduction

The main objective of endodontic treatment is to eliminate or minimize microorganisms in the root canal system while maintaining the original shape and path of root canals. Variations in the anatomy and morphology of the root canal system, presence of isthmus, communications within the root canal system and with the periodontal ligament via the accessory canals, canal curvature and oval shape root canals, complicate an efficient disinfection of the root canal system and with the periodontal ligament via the stress applied to it, making it a suitable instrument for decrease the risk of procedural errors. Moreover, the length of pitch from the tip to the shaft has increased in this system. This design has two advantages namely decreased screwing into the canal and decreased extrusion of debris through the apex. The manufacturer of this system suggests the single-length preparation technique instead of crown-down technique. A previous study showed that preparation of curved canals with Mtwo maintains the central path of canal.

Nickel—titanium (NiTi) instruments were introduced in the 1990s to enhance and accelerate the process of root canal preparation especially in curved canals since they are more flexible than stainless-steel instruments. Evidence shows that NiTi rotary instruments enable the clinician to adequately and predictably prepare the root canal and decrease the risk of procedural errors.

The Mtwo rotary system (VDW, Munich, Germany) was introduced worldwide in 2005. It has a S-shaped cross-section and two cutting blades, enabling efficient cutting of dentin. Moreover, the length of pitch from the tip to the shaft has increased in this system. This design has two advantages namely decreased screwing into the canal and decreased extrusion of debris through the apex. The manufacturer of this system suggests the single-length preparation technique instead of crown-down technique. A previous study showed that preparation of curved canals with Mtwo maintains the central path of canal.

Revo-S (Micro-Mega, Besancon Cedex, France) is a NiTi rotary instrument with asymmetrical cross-section. This design should enhance the flexibility of the file and reduce the stress applied to it, making it a suitable instrument for canal negotiation.

Results: No significant difference was noted in canal transportation among the groups in the middle and apical third (P > 0.05). The rotary single-file instrument caused significantly greater canal transportation in the coronal third.

Conclusion: No significant difference exists among different rotary systems in the amount of canal transportation caused in the middle and apical third of the mesio-buccal canal in mandibular first molars. Although all rotary files caused some degrees of canal transportation, the rotary single-file instrument caused significantly greater canal transportation than the multiple-file sequences in the coronal third.
Canal transportation caused by one single-file and two multiple-file rotary systems

In a study on canal transportation and centering ability, no significant difference was noted between Revo-S and Mtwo rotary systems. Another study compared preparation of severely curved canals with six rotary instruments including Revo-S and Mtwo and found no significant difference in canal transportation caused by rotary files; however, canal transportation was greater by use of the hand files compared to rotary files.

Single-file systems were recently introduced on the market, mainly used in reciprocating movement. These systems are efficient and require less time for bio-mechanical preparation of root canals. Recently, a new single-file rotary system, known as Neoniti (Neolix SAS, Chatres-La-Foret, France), was introduced to the market. It operates with full rotation movement and has been recommended for efficient root canal preparation. This system is manufactured by electric discharge machining technology, which confers unique properties to the file such as greater flexibility, sharp cutting edges, changing profile and variable built-in abrasive properties.

Moazzami et al. compared the amount of canal transportation caused by the use of Neoniti and Reciproc files using cone-beam computed tomography (CBCT) and concluded that canal transportation was lower when Neoniti instruments were used; they attributed this finding to the non-homothetic rectangular cross-section and rounded tip of this file.

CBCT is among the recent techniques suggested for assessment of the quality and efficacy of root canal preparation techniques. CBCT has advantages such as low patient radiation dose and a small field of view, which enhances the resolution and diagnostic value. CBCT scans are more accurate than the conventional radiographs and do not require destruction of samples. They have high reproducibility and can provide numerous images of a single canal.

No previous study has compared canal transportation caused by Mtwo and Revo-S multi-file and Neoniti single-file systems. Thus, this study aimed to compare canal transportation in the mesio-buccal canal of mandibular first molar prepared with Mtwo and Revo-S multi-file and Neoniti single-file NiTi rotary systems evaluated using CBCT.

Materials and methods

This ex vivo study was conducted on 45 mandibular first molars extracted for periodontal or orthodontic reasons in the Oral and Maxillofacial Surgery Department of Zahadan University of Medical Sciences, School of Dentistry. The study protocol was approved in the ethics committee of this university (IR.ZAUMS.REC.1395.101). The teeth had closed apices and the mean root curvature was 20–40° according to the Schneider’s method. Root curvature had 5–9 mm distance from the apex and the mean length of root was 19–22 mm.

Tissue remnants and calcified debris were removed by a scaler. The teeth were immersed in 0.1% thymol solution for 24 ours at 9 °C for disinfection. They were rinsed under running water to eliminate thymol residues and stored in saline at 4 °C. Initial radiographs of the mesial root were obtained and degree of root curvature was measured. Mesial canals each had a separate apical foramen and had no signs of calcification or internal resorption. S- or C-shaped canals were excluded. All teeth were inspected under a stereomicroscope at 12× magnification to ensure absence of craze lines, cracks or fracture. The teeth with such defects were excluded and replaced with sound teeth. Access cavity was prepared by a diamond bur and high-speed hand-piece under water and air spray. To determine the working length of the mesio-buccal canal, a size 10 K-file (Mani, Tochigi, Japan) was introduced into the canal until its tip was visible at the apex. One millimeter was subtracted of this length to determine the working length.

Silicon impression material (Oranwash, Zhermack spa, Rovigo, Italy) was used to cover the cementum surface to simulate the periodontal ligament. Apical foramen was sealed with red wax to prevent intrusion of silicon material into the apical foramen. The teeth were then mounted in blocks measuring 5 × 5 cm filled with putty to the level of the cemento-enamel junction in a parallel fashion to standardize pre- and post-operative radiographs. A small piece of orthodontic wire was placed at the corner of silicon blocks as a reference to mark the direction of scanning. The teeth were randomly divided into three groups of 15. Mtwo was used in group 1, Revo-S was used in group 2 and Neoniti was used in group 3.

Root canal preparation

All canals were instrumented to the working length using a hand-piece (X-Smart; Dentsply-Maillefer, Baillagues, Switzerland) with the torque recommended by the manufacturer for each system along with irrigation with 2.5% sodium hypochlorite with 30 gage needle between instruments; 17% EDTA and 5.25% sodium hypochlorite were used for final rinse and elimination of smear layer.

Group 1. Mtwo rotary system (VDW GmbH, Germany) was used for root canal preparation in this group. First, a #10 K file was used to obtain a glide path to the working length. Then, 10/0.04, 15/0.05, 20/0.06 and 25/0.06 files were used at 280 rpm and 1.2 N/cm torque for instrumentation of the coronal, middle and apical thirds of the root canal to the working length. Frequent recapitulation was done using a #10 K-file. Root canals were rinsed with 2.5% sodium hypochlorite after using each instrument. Glyde (Dentsply-Maillefer, Konstanz, Germany) was used as the lubricant.

Group 2. Revo-S (Micro Mega, Besançon, France) NiTi file was used for root canal preparation, which was started with SC1 (25/0.06) at 300 rpm with 2 N/cm torque according to the manufacturer’s instructions followed by SC2 (25/0.04) and SU (25/0.06) to the working length for final preparation. Recapitulation was repeatedly done using #10 K-file and rinsing with 2.5% sodium hypochlorite was performed after using each instrument. Glyde was used as the lubricant.

Group 3. Mesio-buccal canal in this group was prepared using Neolix (25/0.08) (Neoniti A1, France) at 300 rpm and 1.5 N/cm torque according to the manufacturer’s instructions to the working length. Recapitulation was repeatedly done using #10 K-file and rinsing with 2.5% sodium hypochlorite was performed after using each instrument. Glyde was used as the lubricant.

Three-dimensional CBCT scans were obtained (Vatec, Korea) with high resolution, 50 × 50 mm, 89 kVp, 5.4 mA,
considered statistically significant.

and internal root surface to the un-instrumented canal border to the un-instrumented canal border; instrumented canal, \([38_TD$DIFF]\) distance from the external root surface to the border of instrumented canal, \([38_TD$DIFF]\) is the minimum distance from the internal root surface to the un-instrumented canal border and \([38_TD$DIFF]\) is the minimum distance from the internal root surface to the instrumented canal border. In this formula, \(CT = 0\) indicates no transportation while negative values indicate transportation toward the distal (furcation site) and positive values indicate transportation toward the mesial.

It should be noted that canal preparation was done by a single operator while measurements were made by another operator blinded to the group allocation of teeth. Data were analyzed using SPSS version 20. The mean and standard deviation (SD) of root canal transportation were calculated and compared using non-parametric Kruskal–Wallis test (since data were not normally distributed). \(P \leq 0.05\) was considered statistically significant.

Results

Table 1 and Fig. 1 shows the mean and SD of canal transportation in mesio-distal direction in the three systems. No significant difference was noted in canal transportation among the three systems at the middle and apical third \((P > 0.05)\); but this difference in the coronal third was statistically significant and Neoniti removed significantly more amount of dentin from the internal wall of the curvature in the coronal third and caused significantly greater canal transportation toward the mesial. \((P = 0.008)\).

Discussion

One major goal of root canal preparation is to create a conical shape from the apical to the coronal while maintaining the original canal path. \(^2\) Mandibular molars that commonly require endodontic treatment usually present a curved mesial root. \(^19\) The greatest curvature is usually seen in the mesio-buccal canal. \(^19\) Thus, this canal is more susceptible to transportation during instrumentation compared to other canals. If transportation occurs, it would be impossible to regain the original canal shape and risk of ledge formation, perforation and zipping increases. \(^5,20\)

CBCT is an efficient modality for assessment and measurement of dentin thickness, canal curvature, canal transportation and centering ability. \(^2\) This experimental study assessed canal transportation in the mesio-buccal canal of extracted human mandibular first molars using CBCT and showed that the three types of NiTi rotary systems, irrespective of the number of files used (single-file or multi-file systems) were significantly different in terms of canal transportation.

The results of this study showed that Neoniti file caused significant transportation in the cervical third of canal toward the furcation. No significant difference was noted among the rotary instruments in the middle and apical thirds.

Evidence shows that dimensions of instrument, metallurgical properties, design of instrument and its application mode can all affect the amount of canal transportation during instrumentation. \(^21\) Neoniti system has a single file with 8\% taper and triangular-shaped cross-section. Greater tapering of this instrument compared to \(Mtwo\) and Revo-S can explain greater removal of dentin from the cervical third and greater transportation compared to other multi-file systems in the cervical third of the canal. \(^1\)

Moazzami et al. \(^1\) showed that Neoniti file caused significantly greater transportation in bucco-lingual compared to mesio-distal direction in the apical 5 mm of the canal. Revo-S has constant taper and a cross-section with three asymmetrical blades. This design decreases mechanical stress on the instrument and enhances canal preparation by snake-like movement. A previous study assessed the effect of asymmetry on three-helix cross-section and concluded that this modified performance decreases axial stress. \(^20\) Another study compared the amount of canal transportation and centering ability of Revo-S and ProTaper and concluded that although no significant difference existed between the two systems, Revo-S had a superior performance than ProTaper. \(^22\) In the present study, \(Mtwo\) caused the least amount of canal transportation; \(Mtwo\) has two cutting blades with a small S-shaped cross-section. This design aims to increase the flexibility of the instrument and to achieve higher cutting ability compared to triangular cross-section. \(^8\) In the present study, the least amount of transportation caused by \(Mtwo\) was in the middle region, which can be attributed to the relatively low number of blades per each unit of length. Yang et al. reported results similar and concluded that \(Mtwo\) well preserves the original canal path. \(^23\) Schäfer et al. showed that \(Mtwo\) preserved the original canal curvature significantly better than other instruments. \(^24\)

Apical transportation more than 0.3 mm results in loss of seal in the apical region and compromises the prognosis of treatment. \(^25\) In the present study, the amount of transportation ranged from 0.04 to 0.09 mm, which would not affect apical seal.

<table>
<thead>
<tr>
<th>Region</th>
<th>System</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>(P) value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apical third</td>
<td>Neoniti A1</td>
<td>(.0933)</td>
<td>(.11238)</td>
<td>(.102)</td>
</tr>
<tr>
<td></td>
<td>Revo-S</td>
<td>(.0400)</td>
<td>(.10403)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Mtwo)</td>
<td>(.0800)</td>
<td>(.10862)</td>
<td></td>
</tr>
<tr>
<td>Middle third</td>
<td>Neoniti A1</td>
<td>(.0600)</td>
<td>(.10593)</td>
<td>(.443)</td>
</tr>
<tr>
<td></td>
<td>Revo-S</td>
<td>(.0200)</td>
<td>(.08255)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Mtwo)</td>
<td>(.0133)</td>
<td>(.10024)</td>
<td></td>
</tr>
<tr>
<td>Coronal third</td>
<td>Neoniti A1</td>
<td>(.1733)</td>
<td>(.09824)</td>
<td>(.041)</td>
</tr>
<tr>
<td></td>
<td>Revo-S</td>
<td>(.0267)</td>
<td>(.11112)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Mtwo)</td>
<td>(.0800)</td>
<td>(.12509)</td>
<td></td>
</tr>
</tbody>
</table>

\(P\) value: Kruskal–Wallis test.
Conclusion

No significant difference was noted in terms of the amount of canal transportation among different rotary systems in the apical and middle third. Although all rotary systems caused some degrees of canal transportation, Neoniti caused significantly greater canal transportation in the coronal third.

Conflict of interest

The authors deny any conflict of interest.

Acknowledgements

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References


Survival study on teeth after successful endodontic surgical retreatment: influence of crown height, root length, crown-to-root ratio and tooth type

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Abstract

Aim: To assess the influence of the crown height, root length, crown-to-root ratio, and tooth type on the survival of teeth subjected to surgical endodontic retreatment and classified as periapically healed.

Methodology: A single operator performed endodontic microsurgery interventions between 2008 and 2018 on teeth with refractory apical periodontitis. The present analysis selected the teeth classified as “complete periapical healing” according to the scale suggested by Molven. The postoperative periapical radiographs and those taken at the last recall visit were analysed by two
Introduction

When conducted in full respect of the principles of contemporary root-end surgery techniques with magnification tools, microinstruments, ultrasonic tips, and specific filling materials, surgical endodontic retreatment (SER) is a reliable and successful approach in cases root-filled teeth with chronic apical periodontitis, according to randomized controlled trials and meta-analyses.1—4 Indeed, SER can have higher success rates than orthograde retreatment after 1 year, but the healing rates of the two approaches tend to be similar after 3 years.5—7 A possible explanation for this phenomenon is the occurrence of late failures in 5—25% of SER cases,8 the causes of which are only partially understood and predictable. A copious series of clinical studies has investigated the outcome of SER in the middle- and long-term9—17; nonetheless, their huge methodological differences in techniques, instruments, materials, selection criteria, and follow-up...
periods constitute an obstacle to synthesize and compare their data in a meta-analysis.\textsuperscript{17}

During the surgical intervention, apical resection is an essential phase to remove the majority of the secondary endodontic structures\textsuperscript{18} and the infected content, where this is arduous or impossible in an orthograde way.\textsuperscript{19} However, root resection, by definition, inevitably shortens the root and may alter the biomechanical behaviour and stress distribution of the treated tooth.\textsuperscript{20—22} It is noteworthy that, even after complete periapical recovery, apically resected teeth continue to be exposed to occlusal loading, whose impact might be harmful, especially when the tooth is not prosthetically splinted to other abutment teeth. Although it has been suggested that the apical loss of 3 mm of root length has minimal influence in the biomechanical parameters of teeth supported by a normal periodontium,\textsuperscript{21} teeth undergoing SER are frequently affected by various degrees of periodontal bone loss in the clinical settings. A recent finite element analysis showed that the periodontal bone loss progressively deteriorates the biomechanical response of apically resected teeth, in comparison with a tooth with intact periodontal support.\textsuperscript{20}

The crown-to-root ratio (CRR) is a parameter that was invented for the evaluation of teeth eligible as abutments to prosthetic bridges and crowns; the condition in which CRR is equal to 1:1.5 is considered optimal, while a 1:1 ratio is the minimum that can be accepted.\textsuperscript{23} It is still unknown whether the same criteria could be valid for the teeth that have been subjected to apical resection,\textsuperscript{24} since CRR was originally conceived for the assessment of the periodontal support loss at the coronal third of the root and not at the apical level. Furthermore, other biomechanical factors may — hypothetically — play a relevant role in the determination of the tooth prognosis after successful SER, crown height (CH) or root length (RL) in the first place, acting independently of CRR.

All of this considered, the aim of the present study was to assess how CH, RL, CRR, and the tooth type affect the survival of teeth subjected to apicectomy and classified as periapically healed.

Materials and methodology

The present retrospective study was conducted in full accordance with the last version of the Declaration of Helsinki (9th July 2018). Clinical data were collected from patients of the Dental Clinic of the Ospedale Maggiore, University of Trieste, Trieste, Italy. Dental records and periapical radiographs were searched exclusively from the charts of the patients that had given their approval for the handling and analysis of their data for epidemiological and scientific purposes by signing a dedicated form. Dental records of patients who underwent SER for the treatment of teeth with refractory periapical pathosis between 2008 and January 2018 were included in the present study. Teeth used as an abutment for prosthetic bridges, splinted to the surrounding teeth, or originally affected by a lesion of combined endodontic-periodontal origin were excluded.

Surgical procedures

A single experienced endodontist performed all the surgical interventions, according to the modern principles of microsurgical endodontics. All surgical procedures were carried out using an operating microscope (MS25, Leica Microsystems CMS GmbH, Mannheim, Germany). In brief, the flap was reflected after local anaesthesia with lidocaine and 1:50,000 epinephrine and an osteotomy performed with rotary burs. Inflammatory soft tissues were manually removed with a surgical curette and the root was sectioned 3 mm from its tip with a tapped fissure bur kept perpendicular to the root longitudinal axis under copious water irrigation. After having reached haemostasis applying ferric sulphate (Astral, Ogna, Muggio`, Italy), methylene blue was used to stain the resected surface to exclude the presence of visible fractures and locate the canals by using surgical micromirrors (Obtura Spartan, Fenton, MO, USA). A 3-mm deep root-end cavity was prepared with ultrasonic tips (KIS, Obtura Spartan), dried with sterile paper points (Inline, BM Dentale, Turin, Italy), and filled with SuperEBA cement (Bosworth, Skokie, IL, USA). The flap was sutured with 5-0 monofilament sutures, and a postoperative periapical radiograph was taken.

Following the routine follow-up schedule of our clinical practice, the patients were contacted by telephone every 6 months for 2 years and, after the 2 first years, annually. On every follow-up visit, the treated teeth were checked clinically and radiographically.

Radiographic examination and analysis

The periapical radiographs taken at the recall visits, as well as the immediate postoperative ones, were subjected to image analysis with dedicated software (DBSWIN, Dürr Dental, Bietigheim-Bissingen, Germany). Two independent, trained, and calibrated operators measured in a blind manner the CH, defined as the distance between the alveolar ridge and the top of the cusp, and RL, defined as the distance between the alveolar ridge and the resected apex. For each case, CRR was arithmetically calculated. The measurements were made on the postoperative ($t_0$) and on the last available ($t_1$) radiographs. The level of intra- and interobserver agreement was tested with the Bland-Altman plots with 95% limits of agreement (GraphPad Prism 7, GraphPad Software, La Jolla, CA, USA).

Statistical analysis

A statistician, who was kept blind from the study design and purpose, handled and analysed the collected data, conducting the whole analysis using statistical software (Statistical Package for Social Sciences v.15, SPSS Inc., Chicago, IL, USA). Continuous data were tested for the normality of the distribution and equality of variances by means of a Shapiro—Wilk and a Levene test, respectively. Differences in the variables of interest (CH, RL, CRR) between the two considered timepoints ($t_0 - t_1$) were assessed by means of a paired sample $t$-test. A survival analysis was performed by...
using Kaplan—Meier plots and a log-rank test to assess the significance of the differences among the subgroups defined by the following criteria: (a) CH lower or greater than the median value; (b) RL lower or greater than the median value; (c) CRR lower or greater than 1; (d) CRR lower or greater than the median value; (e) single-rooted teeth vs. multi-rooted teeth. All types of unrecoverable SER-related late failures were considered as “event” for the analysis, including a tooth fracture, acute periradicular abscess, formation of class III periodontal furcation defects, grade 3 tooth mobility, etc. The level of significance was set at 0.05.

**Results**

A minimal and not significant \((p > 0.05)\) variation of the variables of interest was observed between the measurements made on the postoperative and on the last available radiographs: CH, \(7.84 \pm 2.51\) mm at \(t_0\) and \(7.73 \pm 2.48\) mm at \(t_1\); RL, \(10.22 \pm 1.95\) mm at \(t_0\) and \(10.61 \pm 1.91\) mm at \(t_1\); CRR, \(1.48 \pm 0.49\) at \(t_0\) and \(1.52 \pm 0.60\) at \(t_1\). The complete distribution of CH, RL, and CRR values relative to the sample of patients selected for the present study is shown in the box and whiskers plot in Fig. 1. The level of inter- and intra-observer agreement was found to be fully satisfactory, as demonstrated by the Bland—Altman plots reported in Fig. 2.

Three teeth were excluded from the present study because they were not available for the evaluation, as they had been previously extracted by other dentists for prosthetic purposes. At the end of the analysis, the sample was constituted by 42 patients, each one contributing to the study with a single tooth, who were followed-up on average for 4.2 \(\pm 2.4\) years. In the sample, the mean age was 45 \(\pm 12\) years and 26 patients were female. The treated tooth types of the included patients were as follows: 20 incisors (19 maxillary), 7 canines (5 maxillary), 9 premolars (6 maxillary), 6 molars (5 maxillary).

Data distribution and survival rates are shown in Table 1. The outcome of the survival analysis is represented by means of Kaplan—Meier curves in Fig. 3. In the comparison between the teeth with the longest roots (longer than the median value, 8 mm) and those with the shortest roots, the former subgroup showed improved survival \((p < 0.05)\). No statistically significant difference emerged among the remaining considered subgroups.

**Discussion**

The present study seems to preliminarily demonstrate that the clinical relevance of CRR in teeth successfully subjected
Table 1  Data distribution and univariate log-rank analysis of the treated teeth included in the present study.

<table>
<thead>
<tr>
<th>Variables</th>
<th>No. of teeth</th>
<th>No. of teeth with late failure</th>
<th>No. of survived teeth</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crown height</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; median value</td>
<td>21</td>
<td>1 (4.8)</td>
<td>20 (95.2)</td>
<td>0.459</td>
</tr>
<tr>
<td>&lt; median value</td>
<td>21</td>
<td>2 (9.5)</td>
<td>19 (90.5)</td>
<td></td>
</tr>
<tr>
<td>Root length</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; median value</td>
<td>21</td>
<td>0 (0.0)</td>
<td>21 (100.0)</td>
<td>0.028</td>
</tr>
<tr>
<td>&lt; median value</td>
<td>21</td>
<td>3 (14.3)</td>
<td>18 (85.7)</td>
<td></td>
</tr>
<tr>
<td>Crown-to-root ratio</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 1</td>
<td>35</td>
<td>3 (8.6)</td>
<td>32 (91.4)</td>
<td>0.381</td>
</tr>
<tr>
<td>&lt; 1</td>
<td>7</td>
<td>0 (0.0)</td>
<td>7 (100.0)</td>
<td></td>
</tr>
<tr>
<td>Tooth type</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single-rooted</td>
<td>34</td>
<td>2 (5.9)</td>
<td>32 (94.1)</td>
<td>0.377</td>
</tr>
<tr>
<td>Multi-rooted</td>
<td>8</td>
<td>1 (12.5)</td>
<td>7 (87.5)</td>
<td></td>
</tr>
</tbody>
</table>

Percentages of teeth are in parentheses. A significant difference is indicated by the log-rank test ($\alpha = 0.05$): comparison of the survival rate within each factor.

Figure 3  Kaplan–Meier cumulative survival curves of teeth subjected to surgical endodontic retreatment in relation to the division in subgroups. CH, crown height; RL, root length; CRR, crown-to-root ratio.
to SER might be limited, despite the hypotheses of other Authors, who reported that CRR changes significantly after apical resections of 3.58 ± 1.43 mm and could play a significant role in the long-term prognosis of root-end resected teeth. Conversely, the clinical relevance of the residual RL deserves to be further investigated, since in the present study longer roots were associated with higher survival, apparently regardless of CRR. A possible explanation for this finding is that the biomechanical behaviour of an apically resected tooth is affected only in small part by the apical loss of 3 mm of root length, while a more relevant influence is attributed to the loss of marginal periodontal bone. In turn, this is ascribable to the little impact that the loss of a small portion of the external root surface has, compared to the attachment loss at the coronal level, where the root surface is much greater for geometrical reasons, being the root approximately cone-shaped. It is noteworthy that the majority (>75%) of the analysed teeth exhibited undesirable CRR ratios (>1). Given the high survival rates observed in this subgroup (32/35 cases, 91.4%), this finding might be preliminarily indicative that the 1:1 threshold value of CRR suggested in prosthetic dentistry may be excessively “pessimistic” when applied to teeth subjected to SER.

In the clinical setting, the assessment of treatment outcome is generally based on the subjective symptoms reported by the patient, the findings of the clinical examination, and the radiographic signs. From its introduction several years ago, the Molven’s scale has been widely used for the radiographic evaluation of SER outcome in a multitude of clinical studies. The global acceptance of Molven’s scale can be attributed to its intrinsic simplicity of interpretation and completeness in the contemplation of the possible healing patterns of a periapical defect. For the medium- and long-term follow-up of apically resected teeth, one may argue that cone-beam computed tomography should be preferred over traditional two-dimensional periapical radiography because it is known that the latter has inherent limitations such as superimposition and distortion of anatomical structures that may interfere with a correct diagnosis. However, the objective of the present study was to evaluate teeth whose periapical healing process had already been documented; this kind of assessment is undoubtedly more straightforward than the search for a periapical lesion for diagnostic purposes, which, differently from a surgical defect, can be limited to the cancellous bone and not easily detectable. Although the accuracy of cone beam computer tomography is considered excellent, the Authors strongly believe that this three-dimensional imaging technique should be used for the cases where it is diagnostically advantageous and not for routine follow-up controls, in order to minimize the radiation dose for the patient. Furthermore, the very positive outcome of the Bland–Altman analysis demonstrates that the use of periapical radiographs was a reliable analytical approach for the purpose of the present investigation.

In comparison with other previously published reports with similar research objective, the present study analysed a relatively small-sized sample. However, the small number of selected cases was due to the restrictive inclusion criteria that were chosen for the present study. Specifically, the exclusion of teeth adhesively or prosthetically connected to other teeth caused a relevant decrease of the number of the eligible patients but guaranteed protection against the bias that could derive from the biomechanical impact of tooth splinting. Moreover, the present study was designed to minimize the impact and number of confounding factors, as it intentionally involved the analysis of cases treated by a single operator and following the same unvaried surgical protocol. Such decision inevitably reduced the sample size but provided a sample that is likely to be homogeneous and, thus, capable of furnishing more reliable data. Notwithstanding, some results of the present study must be interpreted with caution because some subgroups were composed of few elements, as was the case of CCR <1 and multi-rooted teeth subgroups. For better understanding of the influence of these factors, a study on a larger scale appears advisable. If a more numerous sample becomes available, the possible effect other clinical variables could be tested, considering the impact of occlusal load distribution, para-functional activities, and periodontal health in the first place.

As to teeth with more than one root, further tomographic investigations could hypothetically take into consideration the effect that the root surface area may have on tooth survival. Indeed, it may be speculated that root characteristics other than the length may contribute to improve the prognosis of root-end resected teeth, for example root shape, transversal diameters, curvature, etc. For instance, it is conceivable that a thin root may be at risk when strong occlusal forces are exerted on the apically resected tooth, especially in case of loss of other teeth, bruxism, or clenching.

Conclusions

Under the conditions of the present study, teeth with longer residual roots after apical surgery exhibited better chances of survival when compared to teeth with roots shorter than 8 mm. The other considered variables did not seem to affect the survival of apically resected teeth. Further studies are needed to confirm these findings on a larger sample of patients.

Clinical relevance

The present retrospective study preliminarily suggests that, after successful root end surgery, the residual root length might play a more relevant role than the crown-to-root ratio in determining the long-term survival of the apically resected teeth.

Conflict of interest

The authors declare that there are no conflicts of interest.

Acknowledgements

The study was self-funded.

References

Survival study on teeth after successful endodontic surgical retreatment


CASE REPORT/CASO CLINICO

Ludwig’s angina: a case report with a 5-year follow-up

Angina di Ludwig: un caso clinico con 5 anni di follow-up

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KEYWORDS
Ludwig’s angina; Endodontic therapy; Endodontic infection; CBCT; Management infection.

Abstract
Aim: Ludwig’s angina is a rare aggressive infection, often of dental origin, characterized by a rapid spread of cellulitis in the submandibular and sublingual spaces. Ludwig’s angina is potentially fatal, if it obstructs the airways and if it is not treated with appropriate antibiotic therapy.

Summary: The case report describes the diagnosis and the management of a Ludwig’s angina caused by an endodontic infection in a 16 years-old female patient. The infection has been caused by a decay of the second lower right molar. After hospitalization and systemic antibiotic therapy, in accordance with the patient and the parents endodontic and restorative treatments of the tooth were performed. After 3 and 5 years, the radiological examination revealed no periapical lesions around right lower second molar and the presence of lamina dura.

Key learning points: This aggressive infection may often be undervalued and this may cause dangerous consequences to the patient’s life. The infection can be prevented by periodic dental care and interventions, which can avoid odontogenic infections. In the case of Ludwig’s angina, early diagnosis is fundamental to save the patient’s life. After the initial antibiotic therapy and once the life of the patient is no longer at risk, an appropriate endodontic therapy can be considered a valid therapy for this disease.

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Introduction

Ludwig’s angina is a rare aggressive infection, often of dental origin, characterised by a rapid spread of cellulitis in the submandibular and sublingual spaces.1,2

The first case was described by Karl Friedrich Wilhelm von Ludwig in 1836.3 The most common victim of Ludwig’s angina is a male, aged between 20 and 40.4 The origin of Ludwig’s angina is odontogenic in 90% of cases.5 It is usually the consequence of tooth extraction or infection.2 The origin is generally the second and third inferior molar (70–80%).6 In fact, the roots of these teeth penetrate the mylohyoid ridge, such that any abscess or dental infection has direct access to the submaxillary space. The propagation of the cellulitis depends on the anatomy of the neck.7 Once infection develops, it spreads contiguously to the sublingual space. Infection can also spread uncontrollably to involve the pharyngomaxillary and retropharyngeal spaces.8 Other causes of infection have also been reported, such as pharyngeal infection or tonsillitis, infections due to foreign bodies, or infections that are secondary to squamous cell carcinoma, located at the base of the tongue and at the floor of mouth.8 Other predisposing conditions include poor dental hygiene, dental caries, intravenous drug abuse, malnutrition, diabetes mellitus, AIDS, immunosuppression, and systemic lupus erythematosus. In children, Ludwig’s angina can occur without any predisposing condition.8

At an initial examination, the general health of the patient is often already clearly compromised but, nevertheless, the local condition is not severe. Bilateral suprahyoid swelling is observed, with a hard, cardboard-like consistency. It is non-fluctuating and painful on palpation. The mouth hangs somewhat open and the tongue is in contact with the palate, with clear oedema of the floor of the mouth. There is difficulty in swallowing and breathing, which are the most salient presenting clinical features of the illness, and this is due to cellulitis, aided by the awkwardness resulting from the position of the tongue.7,9 It can also highlight erythema and redness of the skin area in front of the neck.

The diagnosis in patients with Ludwig’s angina is based on clinical findings. Panoramic radiography can help to discover the origin of the dental infection, while a cervico-thoracic CT scan can help to determine its extent, especially when there is abscess formation.10,6

Microbiological investigations are useful to assess the most effective antibiotic therapy. A common cause of Ludwig’s angina is a mixture of aerobic and anaerobic bacteria, including, predominately, normal oral flora.3

The management of Ludwig’s angina involves antibiotics and maintenance of a secure airway to prevent asphyxia, and surgical drainage if necessary.1,2,11 Intravenous penicillin G, clindamycin, and metronidazole are the antibiotics recommended for use prior to obtaining culture and antibiogram results. Some authors also recommend the use of gentamicin.13,14,6 Other studies are based on the fact that infections caused by aerobic Gram-negative organisms are uncommon in deep neck abscesses. Thus, the use of gentamicin is not recommended as a first choice in the initial treatment by some authors.7,15

Ludwig’s angina is potentially fatal, if it obstructs the airways2,16 and if it is not treated with appropriate antibiotic therapy.7 Its mortality rate can reach up to 50%.5 The odontogenic infections that may cause Ludwig’s angina can largely be prevented by timely interventions and periodic dental care.17
Case report

A 16-year-old female was referred to the author’s practice with pain, swelling and difficult swallowing for 1 day. The patient reported that another dentist had performed a pulpotomy and administered a medication with non-specified materials. The patient was taking 1 g amoxicillin per day.

A clinical examination revealed extra-oral bilateral swelling, especially on the right side of the face (Fig. 1). The skin of the perioral tissue and of the neck was red and hot. The temperature of the patient was about 38 °C. The patient had difficulties in opening her mouth. The lateral cervical lymph nodes were positive on palpation. During the visit, there was an increase in breathing frequency (26 breaths per minute) and subsequent increasing difficulty in breathing. Given the severe clinical situation, the patient was referred to the emergency department of Oral and Maxillofacial Surgery where she stayed for 7 days and treated with intravenous antibiotic therapy. During the hospitalization, an orthopantomography and CT scans with and without contrast liquid were performed to visualize the size of the lesion and its relationship with the surrounding anatomical structures (Figs. 2 and 3).

After the acute phase, initially the extraction of the right lower second molar was suggested because the poor endodontic therapy caused the severe clinical situation. A more accurate clinical examination revealed that the tooth had a temporary restoration, the clinical and radiography analysis showed a good residual structure and that extraction was not necessary.

The patient and her parents were advised of the technical difficulties and potential risks of endodontic treatment, of potential new swelling and of the uncertainty recovery. The parents gave written consent for the proposed treatment.

The treatment plan included cleaning of the canal space, endodontic obturation with gutta-percha and direct reconstruction with composite. A preoperative periapical radiographic examination (Soredx, Digora, MI, Italy) (Fig. 4A) showed an abnormal previous access to the endodontic space.

From the initial pre-operative radiograph (Fig. 4A) in not evident a big periapical lesion but we remember that the patient had an abscess that required hospitalization for 7 days (Fig. 1).

At the first session, after a mouth rinse with 0.2% chlorhexidine gluconate (Curasept, Curaden Healthcare, Sarono, VA, Italy) the tooth was anaesthetised with inferior alveolar nerve block and buccal infiltration of 2% articaine containing 1:100,000 epinephrine (Ubistesin 3M ESPE, Neuss, Germany). The tooth was isolated with a rubber dam (Nictone Manufacturera Dental Continental, Zapopan, Jalisco, Mexico). The occlusal access cavity was modified with diamond bur D6C Intensiv (Intensiv, Lugan, Switzerland).

The tooth had three canals: two mesial and one distal. Root canals were cleaned and then the electronic working length was taken with an apex locator (Morita Denta Port ZX, Dietzenbach, Germany). The canals were instrumented using a crown-down technique with ProTaper Universal files (Dentsply Sirona Endodontics, Ballaigues, Switzerland) up to a size F3 (Fig. 4B) and abundant irrigation with 5.25% sodium hypochlorite at 50 °C (Niclor Ogna, Muggio, MB, Italy) was performed. Calcium hydroxide was placed as interappointment dressing (Stomidros Funo, BO, Italy) and the access cavity was temporarily sealed with Cavit G (3M ESPE, Neuss, Germany).

After 7 days, the root canals were irrigated with EDTA (17%, Ogna, Muggio) and 5.25% sodium hypochlorite. The root canals were dried with calibrated absorbent paper points and the canal was obturated with gutta percha and Pulp Canal Sealer (SybornEndo, Amersfoort, Netherland) using the warm vertical compaction with heated pluggers and condensers (Hu-Friedy, MI, Italy). At the next clinical session, the coronal access was adhesively restored with a fibre post (D.T. Light Post, Dentsply, Rome, Italy) resin cement and composite (All Bond 2, Bisco, Schaumburg, IL, USA; Clearfil SA Cement, Kuray, Hattersheim am Main, Germany; Fitlek, 3M ESPE, Neuss, Germany) and an immediate postoperative radiograph was taken (Fig. 4C). All the treatment was performed under magnification (4.3 x; Zeiss, Oberkochen, Germany).

After the therapy, the patient moved to another city. After 3 years, the patient came back to the author’s practice with a CBCT (Fig. 5A and B) and she gave her consent to take a periapical radiograph (Fig. 5C). The radiological examination revealed no periapical lesions around tooth 47, the presence of lamina dura (Fig. 6A–C) and showed the confluence of the mesial canals (Fig. 7).

After 5 years, another periapical control radiograph was taken, revealing a normal periapical status (Fig. 8).
Figure 3  (A—D) Cervico-thoracic CT scan with and with-out contrast fluid showing the extension of cellulitis, the occlusion of esophagus and the deviation of trachea.

Figure 4  (A) Pre-operative periapical radiograph showing a good residual structure and small periapical lesions; (B) working length with gutta-percha points; (C) final periapical radiograph showing a good compaction of endodontic obturation.

Figure 5  (A and B) Axial CBCT cross-sections showing good endodontic obturation and healing of the bone. (C) Periapical radiograph 3 years after the therapy showing absence of periapical lesions.

Figure 6  Axial CBCT cross-sections showing of the mesial root (A) and the distal root (B) the absence of periapical lesions around tooth 47 and the presence of lamina dura. (C) Sagittal cross-sections confirm the presence of lamina dura, the absence of material extrusion of root canal obturation and the proximity of the apical root to the mandibular canal.
Ludwig's angina usually presents in patients with poor dental hygiene, which accounts for approximately 75—95% of cases. The clinical presentation consists of malaise, dysphagia, bilateral cervical swelling, neck tenderness, dysphonia, elevation and swelling of the tongue, pain in the floor of the mouth, swelling below the inferior border of the mandible, asymmetric bulging of the pharyngeal walls, and trismus or pain out of proportion to the amount of swelling. A cervicotoracic CT scan, with or without contrast fluid, can help to determine the extent of the infection, especially when there is abscess formation. Antimicrobial therapy for odontogenic infections has been described in many other references and is not the focus of this article.

Although many authors recognise the importance of surgical drainage, in this case it was not considered necessary by the maxillofacial surgeons, who focused on the antibiotic therapy and on the evaluation of the vital signs of the patient.

In the literature, there is no previous case of Ludwig's angina with an endodontic origin that has been treated with endodontic therapy, with follow-up.

Conclusions

Ludwig's angina is a rare and not very well known disease that can rapidly progress and can be potentially fatal. This aggressive infection may often be undervalued and this may cause dangerous consequences to the patient's life. The infection can be prevented by timely interventions and periodic dental care, which can avoid odontogenic infections. In the case of Ludwig's angina, early diagnosis is fundamental to save the patient's life. After the initial antibiotic therapy and once the life of the patient is no longer at risk, appropriate endodontic therapy can be considered a valid therapy for this disease.

Conflict of interest

The authors decline any conflicts of interest.

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References


CASE REPORT/CASO CLINICO

Home management of crown fractures of two central incisors complicated by exposure of the pulp

Gestione domiciliare delle fratture della corona di due incisivi centrali complicata dall’esposizione della polpa

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KEYWORDS
Capping materials; Complicated crown fracture; Dental injuries; Pulp capping; Pulp exposure; Pulp vitality.

Abstract
Aim: As dental trauma is an unpredictable event, the patient is sometimes unable to receive dental care immediately in case of tooth fracture complicated by exposure to the pulp. It is conceivable that a long wait may favor bacterial contamination that can lead to necrosis of the pulp. The aim of this paper is to present a clinical case in which the pulp has been protected domiciliary to reduce post-traumatic hypersensitivity and the risk of pulpal necrosis.

Materials and methods: In the presented clinical case, the nail polish was used as an emergency material for the direct capping of the pulp of two fractured incisors. In this way it was possible to protect the pulp and seal the dentinal tubules for 5 days, such it is the time between trauma and therapy.

Results: The application of the nail polish led to a reduction in hypersensitivity; at 2-year follow-up both teeth were still vital.

Conclusions: Based on this experience, it is suggested the possibility to recommend the use of nail polish as a protective material for the pulp and for reducing symptoms in case of complicated and uncomplicated fractures, if the dentist is consulted by telephone and the patient is not in condition to reach it quickly.

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Materiale per incappucciamento; Frattura complicata della corona; Trauma dentale; Incappucciamento pulpare; Esposizione pulpare; Vitalità pulpare.

Riassunto
Scopo: Poiché il trauma dentale è un evento imprevedibile, a volte il paziente non è in grado di ricevere immediatamente una cura odontoiatrica in caso di frattura del dente complicata dall’esposizione della polpa. È immaginabile che una lunga attesa possa favorire la contaminazione batterica che può portare alla necrosi della polpa. Lo scopo del presente articolo è quello di presentare un caso clinico nel quale la polpa è stata protetta domiciliaramente per ridurre la ipersensibilità post-traumatica e allontanare il rischio della necrosi pulpare. Materiali e metodi: Nel caso clinico presentato, lo smalto per unghie è stato usato come materiale di emergenza per l’incappucciamento diretto della polpa di due incisivi fratturati. In questo modo è stato possibile proteggere la polpa e sigillare i tubuli dentinali per 5 giorni, tale è il tempo trascorso tra il trauma e la terapia. Risultati: L’applicazione dello smalto ha determinato una riduzione della ipersensibilità; a 2 anni di follow-up entrambi i denti erano ancora vitali. Conclusioni: Sulla base di questa esperienza viene suggerita la possibilità di consigliare l’uso dello smalto per unghie come materiale protettivo per la polpa e per ridurre i sintomi in caso di fratture complicate e non complicate, qualora il dentista sia consultato telefonicamente e il paziente non sia nella condizione di poterlo raggiungere rapidamente.
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Introduction
Traumatology is an important branch of pediatric dentistry and often involves tooth pulp. The peculiarity of a trauma is that it may happen in any circumstance, even in a moment in which it is not possible to immediately reach the care of a doctor. The early management of the dental emergency is able to improve the prognosis, so generally it is essential to manage the patient as soon as possible. This is particularly true in the case of avulsive traumas, but this can also be extended to those traumas involving the pulp, in order to maintain its vitality and to reduce the high sensitivity following the trauma. Some studies about the factors influencing the maintenance of pulpal vitality observed that the subluxation associated with complicated or uncomplicated coronal fractures influences pulp vitality resulting in an increased risk of pulp necrosis, because vital pulp with a regular and functional blood circulation would appear to be more resistant to invasion of bacteria.\(^1\)\(^2\) Also the root formation stage and the depth of the fracture significantly influence the pulp vitality; the immature elements show less probability of developing pulp necrosis than the elements with fully formed roots and deep fractures evolve more easily towards necrosis. In the teeth with complicated fracture the time interval between the trauma and the therapy seems also to influence the maintenance of pulpal vitality,\(^1\)\(^3\)\(^4\) but some author found no significant differences between the time elapsed before treatment and the appearance of pulpal necrosis.\(^5\)\(^6\) The quality of the marginal seal is also important\(^7\) and it underlines the importance of protecting the pulp from bacterial contamination. All these factors suggest the need for a rapid emergency treatment.

Report
This case report describes the personal experience of the 9 years old son of the author.

The child slipped on the edge of a water slide, bumping into the upper central incisors and fracturing them. The teeth fractures were both complicated by pulp exposure. The fragments have been recovered. The child has experienced a high dentinal sensitivity after the trauma.

The trauma occurred during the Easter holidays and all dentists were unavailable.

It was impossible to provide a professional treatment before 5 days, thus it was mandatory to find a material to perform an emergency pulp capping and a nail polish was used for this purpose.

Nail polish was carefully applied after drying the tooth with a paper towel; there was a micro-bleeding of the pulp immediately after applying the first coat of nail polish on one of the two teeth. After waiting a minute a second layer of nail polish was applied. Following application, all the pulp and dentin were protected up to the cavity edge in enamel. Sensitivity was immediately diminished after applying nail polish. The pulp has always remained protected and no longer exposed until the therapeutic session was performed (Fig. 1).

The fractured fragments were stored in saliva, changed daily after rinsing the fragments under running water.

After 5 days from the trauma, the therapeutic treatment was performed. The vitality was tested before anesthesia and was positive. Nail polish was removed from the teeth with an excavator. Immediately after the removal of the nail polish...
there was a slight bleeding of the pulp that stopped spontaneously in a few seconds. With a margin trimmer the enamel prisms not supported by dentin were removed, both on the cavity edge and on the fractured fragment. Then, in accordance with the guidelines of the IADT (International Association for Dental Traumatology),8 a direct pulp capping was performed using calcium hydroxide and protected with a very thin layer of glass-ionomer cement. On the side of the fragments a small removal of dentinal tissue was performed in order to compensate for the increase in volume due to the capping. The reattachment of the fragments was carried out with the common methods of adhesion (Fig. 2): etching of the cavities and fragments, application of a layer of bonding agent and application of flowable composite on the fragments, which, once repositioned, squeezed out the excess of composite material. This excess of composite was removed with a micro-brush before curing. After the polymerization, a polishing with a silicone rubber was performed.

The vitality test was repeated quarterly for up to two years and was always positive. The radiograph done two years after the trauma showed the reattached fragments in position and no periapical lesion accordingly to the positive vitality test (Fig. 3). The root apexes are still open accordingly to the age of the child.

Discussion

The unpredictability of a trauma can cause delay in the appropriate therapy even when it would be important to intervene in a short time. The motivation is that the more rapid the intervention, the lower the bacterial invasion; also the improvement of the symptoms and the patient’s comfort is greater if the time interval between trauma and treatment is smaller.

Some interventions should be managed at the site of the trauma even by rescuers who are not operators in the dental sector, perhaps under the directives of their dentist. This is especially true in the case of traumas such as dental avulsions,9 but also the early protection of an exposed pulp can help to maintain the vitality of the tooth and reduce the high sensitivity following the trauma. Traumatology is usually considered a dental emergency, therefore it is desirable that the therapy could be performed within a few hours from the trauma (cut off point 3 h) in the acute phase compared to intervention in the subacute phase (within 24 h) or delayed (over 24 h).10

In the case described in the present report, the vitality was still present at a distance of two years from the trauma, even though 5 days passed before performing the therapy. Most of the factors were favorable because the teeth had not undergone a subluxation and because the apexes were still open; also the area of exposure of the pulp was not particularly extensive. Without the emergency protection of the pulp, the risk of necrosis would have increased and the patient’s discomfort would have been greater.

In an emergency situation, a nail polish could be easily found and may provide an early pulp protection and a temporary seal for the dentinal tubules, while waiting for the patient to go to the dentist for the appropriate treatment.

Conclusion

It is reasonable to provide protection to the pulp exposed by a trauma in the shortest possible time in order to maintain the vitality and reduce the sensitivity. In an emergency condition, it is possible that the pulp capping and the restoration performed by the dentist should be post-poned and alternative materials available at home or on holiday may represent a resource for protecting the pulp. In this case report, nail polish was used as emergency material and it allowed to maintain the vitality of the tooth and reduce symptoms even if 5 days passed after the trauma to perform the appropriate dental intervention. Therefore, even considering the limitations of a case report, the nail polish can be recommended as a material to perform an emergency home pulp capping when the patient is not able to reach the dentist quickly.
Clinical relevance

An emergency material for home capping is useful for protecting the pulp and reducing the symptoms. Nail polish can be suggested to this purpose.

Conflict of interest

The author declare that he has no conflict of interest.

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References

Apical preparation size after repetitive pecking to the working length using different endodontic file systems

DimENSIONE DI PREPARAZIONE APICALE DOPO RIPETUTI MOVIMENTI DI PREPARAZIONE ALLA LUNGHEZZA DI LAVORO UTILIZZANDO DIVERSI SISTEMI ENDODONTICI

Aim: The purpose of this study was to determine and evaluate the apical preparation size resulting from different pecking times to the working length (WL) with five different file systems. Materials and methods: Fifty standard simulated endodontic J-shaped blocks were instrumented using ProTaper NEXT (PTN), WaveOne (WO), WaveOne Gold (WOG), OneShape (OS) and the Self-Adjusting File (SAF) (n = 10) with different pecking times (1, 2 and 4) to the WL. For the SAF group, instrumentation was done till WL according to the time, i.e. 1, 3 and 4 min. On completion of each stage, silicone impression material was used to take canal impressions for comparison and evaluation of the apical size preparation, using a stereomicroscope. Two-way analysis of variance was applied to determine differences between groups and pecking times.

Keywords: Apical preparation size; Nickel—titanium; Reciprocating files; Rotary files; Self-Adjusting File.
Apical preparation size after repetitive pecking to the WL

**Introduction**

Preservation of the integrity and location of apical canal anatomy is crucial during root canal preparation. However, this is not always possible, because files have a tendency to straighten themselves inside the root canal. As a result, over-preparation toward the outer curve in apical areas can occur. However, a root canal does not have a single curve and it changes in different planes of the root canal curvature. Thus, the root canal preparation from curved root canals results in asymmetric dentin removal, which can lead to canal transportation. CT increases the risk of iatrogenic damage, and prevents canals from being adequately cleaned, with the potential outcome of persistent apical lesions. Nickel—titanium (NiTi) instruments are widely used in endodontics and their increased flexibility permits a safe mechanical preparation of curved canals. This has reduced the risk of possible iatrogenic errors compared with stainless steel. Nevertheless, it can still lead to an insufficient preparation of the apical area. Apical size is necessary to be identified after canal preparation for a hermetic seal obturation. NiTi instruments tend to straighten in the canal, which may cause apical transportation causing unintended apical preparation size. Although manufacturers recommend a single peck to the working length, clinicians especially unexperienced, might tend to peck more times to the working length, even for retreatment or removal of intracanal medicament.

The ProTaper Next (Dentsply Sirona Endodontics, Ballaigues, Switzerland) is a multiple file system manufactured using m-wire with a quadrangular cross-section and an offset mass of rotation that (according to the manufacturer) reduces the file engagement during root canal preparation.

The recently introduced single-file instruments have considerably reduced root canal preparation time compared with multiple file systems, while maintaining the root canal anatomy. The WaveOne and WaveOne Gold nickel-titanium (NiTi) file systems (Dentsply Sirona Endodontics, Ballaigues, Switzerland) are reciprocating single-file systems designed to shape the root canal completely. WaveOne is made from m-wire and WaveOne Gold from what is commercially known as gold-wire technology. In addition, the stress on the instrument is relieved through unequal bi-directional reciprocating motion, thereby increasing the resistance to cyclic fatigue in comparison with continuous rotary systems.

The One Shape file system (Micro-Mega, Besancon Cedex, France) is also a NiTi single-file system used in continuous rotation. It has a triangular cutting edge in the apical part and a cross-section that progressively changes from 3 to 2

**Results:** After four pecking times, a significant increase was observed in the apical diameter of four test groups compared to SAF ($P < 0.05$), which was not associated with increased apical preparation at all times.

**Conclusion:** A greater apical enlargement occurs with increasing pecking times; however, SAF instrumentation exhibits the minimum changes in the apical preparation after 1, 3 and 4 min. WO, WOG and OS are able to prepare the apical size similar to their tip at a single peck to the WL.

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cutting edges between the apical and coronal parts. This is supposed to give the file an optimal cutting action causing less micro-cracks compared with conventional rotary systems.\textsuperscript{13}

The Self-Adjusting File system (SAF) (ReDent-Nova, Ra’anana, Israel) is a single-file system that has a hollow lattice-like cylindrical structure with no metal core that scrub the dentinal wall by vibrations. The hollow design allows the file to three dimensionally adapt to the root canal system\textsuperscript{14} permitting continuous irrigation while simultaneously shaping the canal.\textsuperscript{14,15}

A study by Jeon et al.\textsuperscript{7} found no differences between two reciprocating files (WO and Reciproc) in apical enlargement after different pecking motions. However, to date, no study has evaluated the effect of different pecking times with 3 different motion systems. Thus, the purpose of this study was to evaluate and compare differences between different systems regarding apical enlargement after one, two and four pecking times to the working length (WL) and after 1 and 3 min with the SAF system. The null hypothesis tested was that there are no differences between systems regarding the size of the final apical preparation after different pecking times.

**Materials and methods**

Fifty standard simulated endodontic training blocks (ReDent-Nova, Ra’anana, Israel) with a J-shaped canal were used. These were divided into 5 groups according to the instruments used for canal preparation (n = 10):

- **Group 1**: ProTaper Next X2 (Dentsply Sirona Endodontics, Ballaigues, Switzerland).
- **Group 2**: WaveOne Primary (Dentsply Sirona Endodontics, Ballaigues, Switzerland).
- **Group 3**: WaveOne Gold Primary (Dentsply Sirona Endodontics, Ballaigues, Switzerland).
- **Group 4**: OneShape\textsuperscript{10} (Micro Mêga, Besançon, France).
- **Group 5**: Self Adjusting File 1.5 mm (ReDentNova, Ra’anana, Israel).

A #10 K-file (Dentsply Sirona Endodontics, Ballaigues, Switzerland) was introduced in the canals in the acrylic block until it was visible at the apical foramen. The WL was determined by subtracting 0.5 mm from this measurement. A rubber stop for each file was fixed with cyanoacrylate adhesive (Loctite; Henkel, Düsseldorf, Germany) at the WL to accurately maintain it for every file. Hand instrumentation with K-files up to ISO #20 was performed in each block. Rotary preparation was performed according to the manufacturers’ instructions for each system using an endodontic torque control motor (X-Smart Plus; Dentsply Sirona Endodontics, Ballaigues, Switzerland) for ProTaper Next, WaveOne, WaveOne Gold and OneShape file systems while the Endostation System (ReDentNova, Ra’anana, Israel) for the SAF.

For OneShape (25/0.06) and ProTaper NEXT, X1 (17/0.04) & X2 (25/0.06) were used in continuous rotation to the WL. WaveOne primary (25/0.08) and WaveOne Gold (25/0.07) were used in reciprocation with a pecking (in-and-out) motion until the WL. For the SAF group, the 1.5 mm diameter file was used in a light pecking-motion up to the WL for 1, 3 and 4 min. A single operator with previous experience in all systems performed the canal preparation.

Patency was confirmed with a #10 K-file after each pecking movement until the WL was reached, followed by copious irrigation with saline. Following the methodology from Jeon et al.,\textsuperscript{16} a resin block and light body silicon impression (Aquasil, Dentsply Sirona Endodontics) material were used to make an impression of the prepared canal for evaluation. Impressions were made after the first, second and fourth repetitive pecking times to the WL. The apical 3 mm of the impression replicas were zoomed and focused to evaluate preparation size at the D\textsubscript{0} level under a stereomicroscope (Zeiss Stero Discovery V8, Carl Zeiss, Oberkochen, Germany.). A gutta-percha gauge (Dentsply Sirona Endodontics, Ballaigues, Switzerland) was used before measuring any impression to calibrate the stereomicroscope and to have accurate measurements. In addition, ten simulated canal blocks were used as a control group and canal impressions were made without instrumentation to evaluate homogeneity and measurement accuracy. As there was a 0.5 mm uninstrumented canal from the working length, each impression was evaluated using this tapering end under the stereomicroscope for distortion immediately after removal of the material from the canal. If found, impressions were repeated until accuracy was achieved (Fig. 1).

The Shapiro–Wilk test was used to determine result distribution (P = 0.0011). As no normal distribution was observed, the non-parametric tests, Mann–Whitney U-test or the Kruskal–Wallis test, were used to evaluate differences among groups for the apical diameter of the canal preparation, with the number of peckings and the different systems being considered as two sources of variation. Significance was set at P < 0.05. Statistical analysis was performed using

![Figure 1 Impression after instrumentation verified by the tapering shape at the apex showing differences between uninstrumented and instrumented area.](image-url)
Results

No instrument separation of any file occurred during the study. The apical diameter of the simulated canals was of 150 μm (D₀), which was confirmed by the impression replicas. Table 1 shows the median apical preparation size of the file systems used after the different number of pecking times to the WL.

The apical preparation with all the systems evaluated showed a statistically significant increase after every pecking movement to the WL (P < 0.05) (Table 1).

After one peck to the WL, no significant differences were observed in the apical preparation size between WO, WOG and OS (P > 0.05). Instrumentation with ProTaper Next resulted in a higher apical preparation, compared with WO, WOG and OS (P < 0.05).

After the second peck to the WL, no significant differences were observed in the apical preparation size between WO, WOG and OS (P > 0.05), and ProTaper Next instrumentation still resulted in an increased apical preparation (P < 0.05).

After the fourth peck to the WL, no significant differences were observed in the apical preparation size between PT Next, WOG and OS (P > 0.05), but instrumentation with WO resulted in a smaller apical preparation compared with the other systems (P < 0.05).

When comparing with the SAF, after 1 min of canal shaping to the WL, SAF resulted in an increased apical preparation size compared with the other systems after the first peck to the WL (P < 0.05), but in the second peck a significant difference was observed only with PT Next (P < 0.05) and not with other file systems (P > 0.05) (Table 1).

After 3 min, canal shaping with SAF produced an apical enlargement significantly higher as compared with all the other groups at the first, second and fourth peck to the WL (P < 0.05). (Table 1)

Canal preparation with SAF after 4 min resulted in an apical diameter preparation of 352.3 (±2.6 mm), similar to an ISO #35 as claimed by the manufacturer (Table 1).

Discussion

The main goals of root canal preparation are to clean and shape the root canal system with minimal procedural errors while maintaining the original canal configuration.16,17 The alternating motion could be beneficial in the shaping of root canals by reducing the screwing effect.18 This effect is often associated with the continuous rotary motion and may result in over instrumentation beyond the apical constriction, which sometimes causes apical transportation.18 Although several studies have compared the efficacy and preparation sizes of reciprocating and rotary file systems,7,17 to the author’s knowledge no study has assessed and compared the apical preparation sizes after using different types of instruments by increasing the number of pecking times to the WL.

The purpose of this study was to evaluate the apical preparation size of five different file systems according to the number of pecking times (motions) to the WL. Four of the file systems evaluated, have an identical tip diameter of #25 (Wave One, WaveOne Gold, OneShape and ProTaper Next) but with differences in file design and movement. Both ProTaper NEXT and OneShape showed similar values after two and four pecking motions to the working length. However, instrumentation with PTN resulted in a larger apical preparation size. These differences may be due to the different cross sections of the systems themselves. Where two instruments reached the WL for the final preparation, significant differences were found after the first peck to the WL.

Capar et al.11 compared 6 different systems, including continuous and reciprocating motion and concluded that all the systems produced straightening of canal curvature, but better results were observed with Reciproc R25 (VDW) file system. However, Jeon et al.7 found no differences in apical size preparation between Waveone and Reciproc (P < 0.05). Thus, only WO was used for study comparison or for the single-file reciprocating system group. WaveOne Gold was included in the study due to its different cross section, alloy and that WaveOne being discontinued by the manufacturer. Similar results were obtained in our study after canal preparation with WO, which corroborates both our results and this methodology for comparison.

The results of different studies comparing the canal transportation with rotary and reciprocating files15,19 conclude that there are no significant differences between systems and that the canal transportation was within the safety limit. Stern et al.20 reported that use of PU instrument showed similar dentin removal with rotation or reciprocating motions. Significantly higher difference was found between WaveOne and WaveOne Gold in the 4th peck and interestingly WaveOne Gold had similar results to ProTaper Next in this section. It is important to note that ProTaper Next and WaveOne Gold have similar cross section but different taper and kinematics. It is not clear how the increase of apical preparation occurs from the file tip diameter, although with

Table 1 Mean size (μm) and standard deviation (SD) of the apical diameter after different pecking times of the different systems.

<table>
<thead>
<tr>
<th>System</th>
<th>Number of pecking times or minutes to the WL</th>
<th>Single or 1 min SAF Mean ± SD (μm)</th>
<th>Double or 1 min SAF Mean ± SD (μm)</th>
<th>Double or 3 min SAF Mean ± SD (μm)</th>
<th>Four or 3 min SAF Mean ± SD (μm)</th>
<th>4 min SAF Mean ± SD (μm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WaveOne</td>
<td></td>
<td>251 ± 3.53</td>
<td>271.05 ± 3.53</td>
<td>271.05 ± 3.53</td>
<td>285.95 ± 2.33</td>
<td>–</td>
</tr>
<tr>
<td>Waveone Gold</td>
<td></td>
<td>250.04 ± 5.64</td>
<td>270.04 ± 4.93b</td>
<td>270.04 ± 4.93b</td>
<td>299.23 ± 9.01</td>
<td>–</td>
</tr>
<tr>
<td>OneShape</td>
<td></td>
<td>251.1 ± 0.42</td>
<td>273.3 ± 9.05</td>
<td>273.3 ± 9.05</td>
<td>305.8 ± 5.23</td>
<td>–</td>
</tr>
<tr>
<td>Pro Taper NEXT</td>
<td></td>
<td>258.85 ± 2.05</td>
<td>277 ± 3.67</td>
<td>277 ± 3.67</td>
<td>303.45 ± 3.04</td>
<td>–</td>
</tr>
<tr>
<td>SAF</td>
<td></td>
<td>268.85 ± 3.74</td>
<td>268.85 ± 3.74</td>
<td>314.95 ± 1.20</td>
<td>314.95 ± 1.20</td>
<td>352.3 ± 1.83</td>
</tr>
</tbody>
</table>
regards to these studies it can be said that different cross sections of the file systems may be responsible rather than different kinematics. However when comparing the single-file instruments (continuous rotation vs. reciprocation) in the present study (WO, WOG and OS), no differences were found in the apical size preparation after one or two pecking motions to the working length \((P > 0.05)\). Nevertheless, canal instrumentation with OS resulted in a larger apical preparation after the fourth peck. Thus, it can be concluded that an alternating motion may be safer for apical size diameter when performing more than two pecking motions.

The SAF is also a single-file shaping system such as the WO, WOG and OS but the cross section, design and action are completely different. SAF adapts to the natural anatomy of the canal and shapes it by vertical scrubbing with simultaneous irrigation. Siqueira et al., comparing different file systems, including reciprocating, rotary and SAF, found no differences in root canal shaping ability. However, this study is difficult to understand since the authors compared different systems with a final apical preparation of \#25 (Reciproc and Twisted files) with \#35 (SAF 1.5 mm). As in our study, Siqueira et al., used the smallest file tip in the system \((1.5 \text{ mm of diameter})\) and according to the manufacturer, the final preparation size after 4 min of preparation would be an ISO \#35. According to the findings of the present study the SAF was able to enlarge the apical diameter to an ISO 35 after 4 min of pecking time.

In the present study all the four files, except the SAF, have an ISO \#25 available in their systems. The SAF does not have a \# 25 file size. The smallest file of the SAF system has a tip diameter of 1.5 mm which produces an apical preparation size of ISO \#35 after 4 min, according to the manufacturer. This fact limited the comparison between SAF and the other systems evaluated which is one of the limitations of this study. Thus, for a better comparison the apical preparations of the other systems were compared with 1 and 3 min of SAF preparation.

When preparing canals with WO and Reciproc (VDW) the apical preparation size increases with the increase in the number of peckings to the WL. This is in agreement with the results in our study, where the four systems evaluated produced a statistical increase in the apical diameter \((P > 0.05)\) under the same conditions after every pecking motion to the WL, except the SAF, which resulted in a similar apical preparation after different pecking motions to the WL. This may be due to the hollow lattice structure of the SAF, which prevents excessive cutting even after continuous pecking motions.

The use of simulated resin blocks allows standardization of degree, location and radius of root canal curvature in three dimensions. Thus, a direct comparison of the final canal degree, location and radius of root canal curvature in three motions.

Canal transportation and deviation may readily occur during the shaping procedure, especially in curved canals, because of the file’s tendency to revert to its original shape along with the reaction torque to the canal wall. This mechanical phenomenon may occur particularly during repetitive pecking motions. Although apical enlargement has been proven to mechanically remove up to more than 90% of bacterial cells from the root canal, in order to obtain a predictable apical preparation size, clinicians must avoid repetitive pecking motions and rather select a bigger instrument size for this purpose.

Conclusion

With the limitations of this study it can be concluded that WO, WOG and OS were able to prepare the apical size similar to their tip at a single peck and significant difference was found with ProTaper Next. SAF, even after 4 min of pecking time, produced the desirable size. Nevertheless, more number of pecking times may result in a larger diameter of the apical area than the file itself. Therefore, the clinician must be careful in choosing the appropriate system to prepare the canals and must confirm the apical gauge before obturating the canal space.

Clinical relevance

More number of pecking times may result in a larger diameter of apical area than the file itself. Clinicians must be careful in choosing appropriate system to prepare the canals and must confirm the apical gauge before obturating.

Conflict of interest

The authors deny any conflicts of interest.

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References

Tooth autotransplantation. What’s the limit of our possibilities in conservative treatments?

Autotrasplantazione autologo. Qual'è il limite delle nostre possibilità conservative?

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Abstract

Aim: When an extraction is necessary, it is possible to choose a donor tooth and transplant it into the site of the previous extraction. Aim of the present article is to present a series of cases of tooth autotransplantation to demonstrate how it is possible to preserve natural teeth and avoid or delay implant therapy.

Summary: In the 3 cases presented the donor site was initially selected and the compatibility of the roots was evaluated. Then the compromised tooth was atraumatically extracted and the donor tooth was replanted in the receiving site; after 2 weeks the sutures were removed and 2 or 3 months later root canal therapy was performed. The results show medium/long-term success with controls from 4 to 12 years without any primary or secondary complication.

Key learning points: Tooth autotransplantation allowed to completely restore the original functional and morphological condition of patient. Even if implantology is the most common therapy for replacing missing teeth, tooth autotransplantation should be considered as the elective treatment if a donor tooth is available.

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Introduction

The prognosis of a natural tooth, even if compromised due to periodontal or endodontic disease, may be longer than the one of an implant substitute. On the other hand, sometimes tooth periodontal or endodontic disease, may be longer than the one

The earliest reports of tooth transplantation involve slaves in ancient Egypt who were forced to give their teeth to their pharaohs. In the late 18th and early 19th century transplants of teeth between people were relatively common at specialist dental practices in London. Surprisingly tooth allotransplants have been found to last 6 years on average. In Scandinavia during the 1950s and 1960s transplantation of teeth began to be carried out under increasingly controlled conditions. High success and survival rates have been reported for autotransplantation, which consists in extracting and repositioning a tooth into a different site in the mouth of the same patient. A successfully transplanted tooth offers several advantages compared to a dental implant, given the preservation of the periodontal ligament: the proprioceptive function is maintained, the alveolar bone volume is preserved, orthodontics can be included in the treatment plan and dento-facial development is not impaired. Moreover, pulp regeneration and continued root development can be expected when a donor tooth with incomplete root formation is chosen and infection of the necrotic pulp tissue is prevented.

Tooth transplantation has been carried out for centuries. The earliest reports of tooth transplantation involve slaves in ancient Egypt who were forced to give their teeth to their pharaohs. In the late 18th and early 19th century transplants of teeth between people were relatively common at specialist dental practices in London. Surprisingly tooth allotransplants have been found to last 6 years on average. In Scandinavia during the 1950s and 1960s transplantation of teeth began to be carried out under increasingly controlled conditions. High success and survival rates have been reported for autotransplantation, which consists in extracting and repositioning a tooth into a different site in the mouth of the same patient. A successfully transplanted tooth offers several advantages compared to a dental implant, given the preservation of the periodontal ligament: the proprioceptive function is maintained, the alveolar bone volume is preserved, orthodontics can be included in the treatment plan and dento-facial development is not impaired. Moreover, pulp regeneration and continued root development can be expected when a donor tooth with incomplete root formation is chosen and infection of the necrotic pulp tissue is prevented.

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Case 1 (Figs. 1 and 2)

Left upper second molar from a 19 years old woman was compromised because of severe decay and extraction was mandatory. Patient did not have the economical possibilities to replace it with an implant and asked for a possible alternative therapy to maintain masticatory function.

There was a presence of the left upper third molar that may be used as donor; anatomy of the roots was compatible with the receiving site, even if the donor tooth showed longer roots. After local anesthesia with 2% mepivacaine with 1:100,000 adrenaline, the left upper second molar was atraumatically extracted. Initially with a 15c surgical blade the periotomy was realised and then tooth was extracted after separating the roots to avoid unnecessary trauma to the alveolar bone. Then the donor left upper third molar was extracted after periotomy as described before and transplanted in the adjacent site. Because of the slight differences in roots anatomy it was necessary to remove the intraradicular bone sectum of the receiving site to allow tooth positioning, and a plastic of donor tooth crown was performed to maintain it not in occlusion. Antibiotics (Amoxicillin/clavulanic acid per os 1 g, 2 times a day for 5 days) were prescribed, along with rinses with 0.2% chlorexidine. Tooth was maintained stable with sutures and, after the removal at two weeks, tooth showed a good stability and a positive adaptation of soft tissue was observed. At two months the root canal treatment was performed and controls showed positive results both radiographically and in terms of function. Patients did not show any adverse event neither in initial phase nor in mid-term 4 year control.

Case 2 (Figs. 3 and 4)

The left lower second molar of a 35 years old woman was compromised because of a vertical root fracture and a large periapical lesion was present. After explanations and informed consent, the treatment was scheduled. The right lower third molar was preferred as a donor to the left lower third molar because of a more compatible anatomy and for an easier stabilisation. After local anaesthesia at both the donor and the recipient sites with 2% mepivacaine and 1:100,000 adrenaline, the left lower second molar was extracted and the alveolus debrided. Then, the donor tooth was atraumatically extracted, quickly repositioned in the recipient site and stabilised with sutures at about 1.5—2 mm of infraocclusion. Antibiotics (Amoxicillin/clavulanic acid per os 1 g, 2 times a day for 5 days) and painkillers (ibuprofen 600 mg, 2 times a day for 5 days) were prescribed, along with rinses with 0.2% chlorexidine. Sutures were removed after 2 weeks and endodontic treatment was performed after 3 months. The periapical lesion healed and the tooth is still in full functional after 12 years.

Case 3 (Fig. 5)

A right lower first molar tooth from a 16 years old woman with heavily structural damage was extracted after explanation, informed consent and the mandibular block with 3% mepivacaine. The receiving site was debrided, the right lower
third molar was atraumatically extracted, positioned in the alveolus and stabilised with sutures. Antibiotics (Amoxicillin/clavulanic acid per os 1 g, 2 times a day for 5 days) and painkillers (ibuprofen 600 mg, 2 times a day for 5 days) were prescribed, along with rinses with 0.2% chlorhexidine. Sutures were removed after 2 weeks and the endodontic treatment was performed after 2 months. Tooth is still in full function after 11 years.

Discussion

Autotransplantation gives to the clinicians the possibility to successfully recreate all the pre-existent anatomical and functional conditions without any complication. In the radiographic controls presented in the present article, the presence of a new formed periodontal ligament is clearly visible on the entire surfaces of the roots, even if literature reported some cases of failure for ankylosis or root resorption in less than the 10% of cases. Andreasen in 1990 had a survival rate superior to 95% over 370 cases, with a follow-up period up to 13 years. In a recent meta-analysis, the survival rate at 5 years was approximately 98% for teeth with incomplete root formation and 90% for teeth with complete root formation.

The ideal recipient site should be free of inflammation. Unfortunately, a hopeless tooth scheduled for extraction often presents periapical lesions, but if other prognostic criteria were met, (age, general health, shape of third molar root, keratinised tissue, easy extraction), autotransplantation may be evaluated. The cases presented in this article demonstrated a good prognosis of the one-step approach despite the presence of periapical pathosis, as suggested by Shim. On the contrary, Nimfenko suggested extraction of the diseased tooth two weeks before the transplant.
Conclusion

The substitution of an extracted tooth with autotransplantation allows the clinicians to entirely recreate the organic complexity of the natural tooth. In the cases presented, therapeutic phases may be summarised as follows:
1) pre-operative evaluation of compatibility between root anatomies;
2) atraumatic extraction of the compromised tooth;

Figure 4  Case 2. Clinical images of the autotransplantation procedure showing the pre-operative situation, the extracted fractured tooth, the transplanted tooth in position stabilised with sutures and the healing after 2 weeks.

Figure 5  Case 3. Pre-operative radiograph showing periapical lesion and structural damage of the right lower first molar, periapical radiograph 3 months after tooth transplantation, 2-years (lower left) and 11 years (lower right) controls.
3) atraumatic extraction of the donor tooth;  
4) osteoplastic, if necessary, of receiving site;  
5) donor tooth insertion in the new site and stabilisation with sutures;  
6) sutures removal after 2 weeks;  
7) root canal treatment after 2 or 3 months.  
8) follow-ups.

Clinical relevance

Even if implantology is the most common therapy to replace extracted teeth, it is not able to adapt to the craniofacial and occlusal modification occurring during patients’ growth. For these reasons autotransplantation may be a valid treatment alternatives, especially in young patients.

Conflict of interest

The authors declare no conflict of interest.

References

LETTERA DEL PRESIDENTE

Carissimi,

Si avvicina il nostro Congresso Internazionale di Milano.

L’internazionalizzazione è da sempre uno degli obiettivi della SIE e che il Consiglio Direttivo ha fortemente spinto negli ultimi anni, infatti sempre più numerosi sono i nostri Soci conosciuti ed apprezzati all’estero.

- Il Corso Pre-Congresso sarà tenuto da Arnaldo Castellucci ed Augusto Molentacca e intitolato “Problem solving within the scope and challenges of endodontic procedures”;

- Un programma innovativo e di sempre altissimo livello, vedrà susseguirsi Relatori Italiani e Stranieri nella Sala Auditorium: Pio Bertani, Giuseppe Cantatore, Filippo Cardinali, Antonios Chaniotis, Vittorio Franco, Massimo Giavaruso, Salvatore Sauro, Francesco Mannocci, Wadid Nehme, Mohammad Hossein Nekoofar, Francesco Riccitiello, Katia Greco, Patrick Sequeira-Byron, Stephane Simon;

- Avremo una Sala apposita che fungerà da rimando all’interno della quale verranno proiettate tutte le conferenze della Sala principale, per far sì che tutti i numerosissimi partecipanti iscritti possano godersi nel totale comfort il Congresso;

- La Sessione Premi SIE intitolati a Garberoglio, Riitano e Lavagnoli hanno riscosso un successo incredibile all’estero e non abbiamo mai avuto così tante submission come quest’anno.

- La Sessione Poster vedrà come di consueto l’affissione del manifesto per tutte le conferenze della Sala poster; per l’interesse che tutti noi nutriamo per la nostra splendida disciplina: L’ENDODONZIA.

- Quest’anno introdurremo una nuova modalità di partecipazione per tutti i congressisti a cui abbiamo dato il nome di Teatro Clinico: realizzeremo tre teatri, ed abbiamo scelto tre argomenti di sicuro interesse che saranno completamente svi-scercenere da bravissimi Soci Attivi SIE;

- verranno organizzate le Tavole Cliniche Sponsorizzate che anno dopo anno diventano un momento importante per gli sponsor, che hanno così la possibilità di mostrare le ultime uscite sul mercato e farle provare direttamente ai congressisti;

- Posso anticiparVi che già fin dai primi mesi dell’anno l’interesse per il Congresso da parte delle Aziende Sponsor era così elevato che abbiamo già definito la maggior parte delle postazioni;

- Il Congresso sarà accreditato ECM, come tutti i nostri eventi e avremo, per agevolare sia italiani che stranieri, la traduzione simultanea...

...tutto questo per raccontare una volta di più la passione che tutti noi della SIE ci mettiamo per accrescere ogni anno l’aggiornamento scientifico in campo endodontico e invogliarVi ancor di più a partecipare ad un evento che già di Suo non ha bisogno di presentazioni, perché di sicuro imperdibile!

Concludere il mio mandato con il Congresso Internazionale di Milano e passare il testimone al Presidente eletto - Vittorio Franco, è il miglior viatico per un futuro radioso della SIE. Abbiamo fatto tanto anche se con non poche difficoltà: un grazie all’esperienza del Past President - Pio Bertani e dell’entusiasmo del mio Vice Presidente - Maria Teresa Sberna, alla quale devo grande riconoscenza per la sua capacità nella realizzazione del Congresso al San Raffaele. Il lavoro che questo consiglio ha concretizzato è stato un rigoroso controllo delle spese e questo grazie ad un attento lavoro della Segreteria e del Tesoriere - Filippo Cardinali, che ringrazio per il lavoro svolto.

La risoluzione di piccoli problemi fiscali ma soprattutto l’aver aumentato il numero degli sponsor, portando a 5 i Main Sponsor per questo Congresso, è motivo di grande soddisfazione. Aver vissuto quasi in simbiosi questi due anni con il Segretario - Roberto Fornara, al quale chiedo pubblicamente scusa, per le mie telefonate ad ore improbabili della mattina, ma con il quale abbiamo lavorato sempre nell’interesse della Società e dei Soci. Un grazie al Coordinatore della Comunicazione - Italo Di Giuseppe ed al Coordinatore culturale - Mauro Rigolon per il loro lavoro, ma permettetemi di ringraziare Katia Greco e Alberto Rieppi i nostri Revisori dei Conti, sempre presenti ai nostri consigli anche senza diritto di voto.

Un grandissimo bacio va a Gaia preziosissima collaboratrice, lei rappresenta la vera anima della Società e non potevamo fare migliore scelta.

Devo ora ringraziare tutti Voi che avete voluto darmi l’onore di essere il vostro Presidente per questo biennio, incarico che ho portato avanti mettendo il mio massimo impegno per l’ amore e per l’interesse che tutti noi nutriamo per la nostra splendida disciplina: L’ENDODONZIA.

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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 forniscono 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 il quale dovrà aver esaminato e approvato la documentazione. Quest’ultimo è responsabile della correttezza clinica e formale della documentazione. 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.

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 forniscono 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 il quale dovrà aver esaminato e approvato la documentazione. Quest’ultimo è responsabile della correttezza clinica e formale della documentazione presentata.

DOCUMENTAZIONE 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 ad 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 Aggregato. La documentazione clinica verrà valutata considerando la classificazione ANVUR delle Riviste Scientifiche, i documenti scientifici dovranno essere tutti di pertinenza endodontica.

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, ininterrotta 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 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 5 Membri di indiscussa esperienza clinica, 4 Soci Attivi con almeno 5 anni di anzianità in questo ruolo eletti ad ogni scadenza elettorale dall’Assemblea dei Soci Attivi ed Onorari e uno dei Past President della Società incaricato dal CD ad 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 verranno valutati non più di 5 candidati a Socio Attivo. Resta libero, invece, il numero dei candidati a Socio Aggregato valutabili in una singola riunione della CAS. 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 2018**

Past President della Società
Dott. Mario Mancini
Dott. Franco Ongaro
Dott. Andrea Polesel
Dott. Pier Luigi Schirosa
ONE CURVE, IL DNA DELL’ENDODONZIA

One Curve è lo strumento unico per la sagomatura canalare progettato per rispondere al meglio a tutte le esigenze cliniche.

L’innovativo trattamento termico del Nichel-Titano rende lo strumento molto più flessibile e riduce significativamente il rischio di frattura, rendendo più semplice e sicura la preparazione del canale. È inoltre possibile precurvare lo strumento per permettere un accesso facilitato anche ai canali complessi e una migliore eliminazione delle interferenze.

Insieme al movimento di rotazione continua, la sezione variabile conferisce un’ottima efficacia di taglio così come una centratura perfetta nel canale e una buona messa in sicurezza della zona apicale.

L’utilizzo di un unico strumento monouso riduce inoltre il rischio di contaminazione crociata e agevola il lavoro del personale assistente grazie all’eliminazione delle procedure di sterilizzazione.

One Curve è uno strumento affidabile, sicuro e performante, come è tradizione degli strumenti NiTi Micro-Mega. Adatto sia agli utilizzatori più esperti, sia a chi si approccia per la prima volta allo strumento unico, One Curve garantisce un’elevata qualità della preparazione canalare, migliorando le possibilità di disinfezione e consentendo un’adeguata chiusura tridimensionale del canale.
I coni master di gutta-percha con tecnologia Conform Fit™ a conicità variabile.

La precisa corrispondenza di forme e dimensioni ottimizza il trattamento
Una delle maggiori sfide nell’otturazione canalare è ottenere un appropriato tug back apicale. Per raggiungere la lunghezza di lavoro, è necessario procedere all’eliminazione dei detriti ed all’irrigazione. Tuttavia, a dispetto di queste precauzioni, l’abilità a raggiungere la lunghezza di lavoro è fortemente influenzata dalla sagomatura del canale e dalla compatibilità tra la gutta-percha e la strumentazione usate. In caso contrario si può incorrere nella falsa sensazione di un’aderenza sicura.

Aderenza apicale superiore con il tug back desiderato
I coni master di guttaperca con tecnologia Conform Fit prodotti da Dentsply Sirona sono i primi ad avere una conicità variabile per adattarsi con precisione agli strumenti corrispondenti. L’avanzata formulazione micronizzata utilizza una moderna tecnica di produzione per creare una forma e un adattamento con il 40% in più di conformità rispetto alla guttaperca tradizionale. Il conseguente adattamento apicale migliorato permette di avvertire la precisa risposta di tug back a differenza della guttaperca tradizionale, che sembra adattarsi perfettamente, ma in realtà può non corrispondere all’esatta misura dell’apice.

Priva di lattice, può essere usata a temperature di lavoro inferiori
Studiata per ottenere un’otturazione completa, la formula micronizzata offre caratteristiche termiche avanzate che permettono una migliore fluidità ed il trasferimento del calore fino a 4 mm. Questa formulazione migliore continua ad assicurare l’ottimale radiopacità e la facilità di ritrattamento. Mentre la guttaperca tradizionale è realizzata in lattice di gomma naturale, quella prodotta con l’esclusiva formulazione di Dentsply Sirona è priva di lattice per una migliore sicurezza del paziente.

Una soluzione globale
I coni master di guttaperca con tecnologia Conform Fit™ fanno parte di una soluzione globale che facilita l’operatività grazie al preciso adattamento. Forniti di una pratica linguetta identificativa per una facile gestione, i coni master sono disponibili per i sistemi WaveOne Gold®, Protaper Gold® e Protaper Next®.

Per saperne di più visita il sito www.dentsplysirona.com o contatta Simit Next al numero 0376.267811
EDDY® è il sistema sonico d’irrigazione canalare sicuro, efficace e clinicamente testato.

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 compresa 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.

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 anatomiche complesse tanto efficacemente quanto l’irrigazione ultrasonica passiva, risultando più delicata sulle pareti canalari grazie alla morbidezza e flessibilità 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.

F22 ALIGNER: L’allineatore trasparente
Invisibile, confortevole, preciso, efficace

Il sistema F22, frutto di 25 anni di esperienza e di 14 anni di ricerche della Scuola di Specializzazione in Ortognatodonzia dell’Università di Ferrara, è composto da una serie di sottili apparecchi ortodontici rimovibili (allineatori), su misura, realizzati nei moderni ed evoluti reparti produttivi di Sweden & Martina utilizzando un esclusivo materiale plastico trasparente; essi consentono lo spostamento graduale e progressivo dei denti verso la posizione ottimale, grazie ad un monitoraggio continuo, raggiungendo un’occlusione esteticamente gradevole e funzionalmente valida.

La programmazione di F22 differisce sostanzialmente da quella degli altri allineatori disponibili nel mercato. Il team di ortodontisti della Scuola di Specializzazione, guidato dal direttore, il Professor Giuseppe Siciliani, studia analiticamente ogni singolo caso e guida il medico fino alla fine del trattamento: insieme al prodotto, quindi, è offerta una consulenza gratuita estremamente qualificata anche a medici non specialisti in ortodonzia, seguendo puntualmente criteri biomeccanici estremamente precisi.

Grazie al Setup digitale e al visualizzatore 3D è possibile analizzare e visualizzare ogni singolo step di trattamento, per condividerlo con i pazienti, illustrando facilmente il piano approvato.

Rispetto agli altri allineatori disponibili, F22 Aligner ha dei plus enormi: il 20% in più di trasparenza; fitting ottimale e ritenzione perfetta (lo spazio tra allineatore e denti è inferiore a 40 micron); il 20% in più di elasticità, grazie alla quale sono trasmesse forze leggere e costanti; una superficie eccezionalmente liscia e margini arrotondati per un maggiore comfort del paziente; elevata resistenza alla rottura.

F22 Aligner è indicato per il trattamento di affollamenti, diastemi, discrepanze dell’indice di Bolton che necessitano di restauri protesici o di stripping per una completa correzione, festonature gengivali irregolari in pazienti con denti usurati o irregolari, morsi aperti o morsi profondi di lieve o moderata entità.

L’invio e lo studio dei casi avviene online, fino all’approvazione del set-up virtuale, sul quale saranno realizzati i modelli e gli allineatori trasparenti F22 per ciascuna fase del piano di trattamento del paziente.
Il progetto Komet Academy, coordinato dal Prof. Massimo Gagliani dell’Università di Milano, è nato con l’obiettivo di migliorare la salute orale dei pazienti mediante la diffusione di contenuti clinici e tecnici di alto livello.

Il blog www.kometacademy.it espone Case Report di sicuro interesse per i lettori, grazie anche alla presenza di chiare foto esplicative e, in alcuni casi, di video clinici molto curati. Tali Case Report sono il frutto della ricerca e del lavoro di odontoiatri esperti appartenenti al panel di Komet Academy.

Per quanto riguarda l’endodonzia, nel mese di giugno sono stati pubblicati due casi clinici del Dr. Alessandro Fava, il primo sulla rimozione di un file danneggiato e sul successivo ritrattamento endodontico; il secondo riguardante un trattamento endodontico seguito da un trattamento restaurativo. Presto verranno pubblicati dei Case Report anche del Dr. Giuseppe Squeo: uno inerente pulpite irreversibile di un primo molare inferiore curata con solo due strumenti, un secondo caso riguarderà un ritrattamento endodontico eseguito con nuovi e innovativi strumenti per la rimozione dei materiali presenti all’interno dei canali.

Komet, leader mondiale di strumenti rotanti ed oscillanti sonici, conferma con il suo blog l’impegno ad approfondire paradigmi specifici di condotta clinica che prevedano l’utilizzo di strumenti selezionati all’interno del proprio ampio catalogo.

Il blog è facilmente consultabile anche da smartphone e tablet e tutti gli articoli possono essere facilmente individuati tramite comode ricerche e filtri che permettono, per esempio, di restringere l’ambito clinico (conservativa, protesi, chirurgia/implantologia, endodonzia, profilassi, parodontologia). Nel blog kometacademy.it sta riscuotendo grande interesse la sezione dedicata agli eventi dove è possibile consultare una lista numerosi corsi teorici e pratici programmati lungo un ampio orizzonte temporale; tramite l’integrazione con Google Maps viene fornito anche il percorso per raggiungere le location.

Il blog, nato per la diffusione e la condivisione delle idee e delle informazioni, permette inoltre di commentare e condividere gli articoli sulle principali piattaforme social.
TriAuto ZX2
Massima precisione e sicurezza per il canale radicolare

Il nuovo sistema endodontico aumenta l’efficienza e la sicurezza

In Endodonzia la necessità di lavorare su strutture minuscole, in spazi molto limitati ed anche le particolari situazioni anatomiche coinvolte pongono richieste straordinarie alle competenze del dentista, richiedendo sforzi speciali per garantire la sicurezza dei pazienti. Pioniere nel campo della Endodonzia, Morita ha sempre offerto soluzioni di alta qualità per i dentisti per molti decenni, puntando all’efficienza, comfort e sicurezza. Un esempio di questo è il nuovo TriAuto ZX2, un motore endo cordless, con localizzatore apicale integrato che ora include una funzionalità innovativa per una maggiore sicurezza: la funzione Ottimale Glide Path (OGP) mira a procedure ancora più precise all’interno del canale radicolare e guida i dentisti e i pazienti al successo del trattamento, “seguendo percorsi sicuri”.

L’Endodonzia ha svolto un ruolo fondamentale in più di 100 anni di storia di Morita. Già nel 1991, è stato introdotto il primo Apex Locator del mondo che ha utilizzato le misure di impedenza, il Root ZX. Il passo successivo in questo sviluppo è stato il sistema modulare DentaPort ZX che grazie alla possibilità di integrazione con il Motore Endo, ha facilitato la preparazione del canale radicolare. Con il ZX2 TriAuto, Morita ora presenta un nuovo motore endo con localizzatore apicale integrato. Il successore del TriAuto ZX, è l’unico sistema endodontico sul mercato che combina entrambe le funzioni in un unico manipolo. Un display LCD mostra misure precise e fornisce un feedback perfetto dall’interno del canale radicolare. Oltre a questo, il ZX2 TriAuto presenta due caratteristiche di sicurezza innovative - quali l’Optimum Torque reverse (OTR) e l’Optimum Glide Path (OGP). La funzione OTR consente di cambiare la direzione di rotazione del file quando viene superato il livello massimo di coppia. Combinata con la piccolissima rotazione angolare, il rischio di rotture di file e microfessure è minimizzato. Inoltre, il sistema conserva il canale radicolare originale e assicura la rimozione affidabile dei detriti. La nuova funzione OGP semplifica la creazione del percorso canale, rendendolo veloce e sicuro e automatico. In più, il motore può realizzare la pervietà apicale usando una lima #20 o più piccola. Possono essere utilizzati Niti file di dimensioni #20 o più piccoli e file in acciaio dalla dimensione #15. La funzione OGP in combinazione con quella OTR permette allo strumento endodontico di essere portato alla lunghezza di lavoro più velocemente di quanto precedentemente possibile, senza blocco o formazione di scalini. Inoltre, TriAuto ZX2 conserva la struttura del dente naturale e rende il trattamento ancora più economico a causa di un ridotto consumo di file. Il display LCD mostra tutti i parametri importanti a colpo d’occhio, fornendo il controllo completo durante il trattamento. Un’altra caratteristica chiave del sistema endodontico è la piccola testina e il basso peso (140 g.), che permettono una migliore vista del campo di trattamento. Il fatto di essere cordless migliora significativamente la flessibilità di trattamento e ottimizza il flusso di lavoro. Il funzionamento semplice ed intuitivo e le funzioni automatizzate garantiscono risultati affidabili in ogni momento. La maggiore efficienza riduce anche la durata del trattamento, fornendo tempo supplementare per il risciacquo e la disinfezione del canale radicolare.
Anche quest’anno, dopo Giugno 2017, la SIE ha scelto la suggestiva sede del Grand Hotel di Rimini come location per il classico appuntamento del Closed Meeting. All’interno del parco Federico Fellini, dal 15 al 17 Giugno, numerosi Soci Attivi hanno potuto partecipare ad un evento, che rappresenta ormai da anni un perfetto mix di aggiornamento, pianificazione dell’attività societaria e convivialità; contribuendo a consolidare il senso di appartenenza alla più importante Società Italiana in campo endodontico.

I membri del Consiglio Direttivo si sono dati appuntamento già dalla sera di Giovedì 14 per una cena informale, mentre il Closed Meeting vero e proprio ha avuto inizio Venerdì 15 con la consueta riunione programmatica che si protrasse per diverse ore a partire dalle 9:00.

Questo ha dato la possibilità ai Soci di arrivare con calma nella stessa mattinata, per poi partecipare, dalle ore 15:00, all’interessantissima lezione dal titolo: “Comunicazione efficace con il paziente” tenuta da Lapo Baglini, esperto di programmazione neurolinguistica, invitato dal direttivo per un pomeriggio di aggiornamento ai principi della programmazione neurolinguistica.

Il giorno successivo, sabato 16 giugno, mattinata interamente dedicata alle riunioni delle diverse commissioni:
- la CAS: con i dottori Mario Mancini, Franco Ongaro, Andrea polesel, Pier Luigi Schirosa e il Past-President Pio Bertani;
- la Commissione Culturale: presieduta dal dottor Massimo Giovarruscio;
- la Commissione per la Ricerca: coordinata dal professor Giuseppe Cantatore;
- quella per la Comunicazione: condotta dal dottor Italo Di Giuseppe, con il web master dottor Augusto Malentacca, la responsabile Social Network dott.ssa Denise Pontoriero e la collaborazione del dottor Massimo Calapaj;
- e la consueta riunione dei Segretari Regionali: presieduta dal coordinatore culturale dottor Mauro Rigozzi, iniziate con il Coordinatore delle Sezioni Regionali dottor Cristian Coraini; per effetto dell’imminente entrata in vigore delle 4 Macro-Aree, presenti anche i 4 loro Coordinatori.

Mattinata molto intensa quindi, ma pomeriggio di solo relax ed attività sportive, con il torneo di beach volley e quello di tennis, con il dottor Marco Colla ad aggiudicarsi il titolo sul Segretario dottor Roberto Fornara, presso il circolo Tennis Rimini.

La giornata terminava con l’attesa Cena di Gala presso il ristorante Club Nautico, a pochi passi dal Grand Hotel: una piacevolissima serata sulla magica terrazza del locale, con vista a 360° sul ridente lido di Rimini.

E infine, la Domenica mattina, tutto il tempo per una prima colazione con più calma, un tuffo in piscina e poi i saluti, con un arrivederci per tutti a Milano, in occasione del prestigioso III Congresso Internazionale SIE dal titolo: “Endodontics: Clinical Solutions” in programma dall’8 al 10 Novembre 2018.
VITA SOCIETARIA

IL PHOTO BOOT AL BEACH PARTY

LA CENA DI GALA SUL MARE

IL PRESIDENTE PREMIA LA DOTT.SSA PONTORIERO COME VINCITRICE DEL TORNEO DI BEACH VOLLEY

SOCI SIE ALLA CENA DI GALA
Con il quinto incontro svolto il 18 settembre 2018, si è concluso a Brescia, presso l’Hotel Ambasciatori, la terza edizione dell’Endodontic Course a cura della Sezione Lombarda della SIE.

Come nelle precedenti edizioni, anche quest’anno il successo del Corso è stato decretato, non solo dal folto numero di partecipanti ma anche dal loro grande interesse dimostrato in ogni incontro. Numerosissimi i giovani, sia studenti che neo-laureati, ma anche professionisti determinati nell’apprendere i più moderni orientamenti in Endodonzia.

Si sono succeduti come Relatori, alcuni Soci Attivi della nostra società, sempre pronti a prodigarsi nel mettere a disposizione degli iscritti la loro esperienza clinica. Il Dr. Cavalli e il Dr. Piferi, nel primo incontro, hanno affrontato la diagnosi e il piano di trattamento in Endodonzia.

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Il Dr. Venturi ha affrontato l’importanza dell’utilizzo della diga di gomma, con relativa esercitazione pratica e il Dr. Gaffuri ha trattato l’argomento dell’esecuzione di una corretta cavità di accesso. Il Dr. Tonini si è occupato della detersione del sistema radiologico proponendo nuovi protocolli operativi. Il Dr. Cecchinato nel successivo appuntamento, ha trattato la sagomatura dei canali mentre l’otturazione è stata argomento a cura del Dr. Gaffuri e del Dr. Venturi.

Il Dr. Coraini, come nelle precedenti edizioni ha trattato magistralmente l’importante tema della ricostruzione post-endodontica.

Il quinto incontro ha visto come relatori il Dr. Fornara che ha spiegato l’importanza e la chiave di lettura dell’immagine radiografica in 3D ottenuta con la CBCT e il Dr. Gaffuri ha concluso l’incontro con i Ritrattamenti ortogradri e retrogradri.

Vanno ringraziate, per la loro preziosa partecipazione, gli Sponsor Simit Next, J Morita e Komet, Sweden e Martina, Dentalica che hanno svolto per i discenti e loro workshop offrendo ai partecipanti la possibilità di testare strumenti e motori dedicati all’Endodonzia moderna.
Nel contesto delle strutture Universitarie del padiglione n.4 dell’Ospedale San Martino di Genova, si sono portate a termine le lezioni e le relative parti pratiche della prima edizione dell’Endodontic Course Advance SIE 2018.

I numerosi corsisti (alcuni di loro provenienti anche da altre regioni, uno addirittura dalla Puglia!) hanno approfondito tematiche ed argomenti relativi ai ristramenti endodontici, sfruttando anche l’opportunità che i numerosi workshop hanno potuto offrire loro per mettere in pratica ciò che si è imparato durante le relazioni. Un particolare ringraziamento è doveroso all’Università di Genova, specie nella figura del Prof. Stefano Benedicenti, per la gentile concessione delle aule per le attività didattiche teorico-pratiche.
1. GENERAL

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 periapical region, and their relationship with systemic wellbeing and health. Original scientific articles 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 GIE web site gi-endodonzia.com for further information on the preparation and submission of articles and figures.

2. ETHICAL GUIDELINES

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

2.1. 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 acquisition of data or analysis and interpretation of data, 2) drafting the article or revising it critically for important intellectual content. A statement 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.

Acknowledgements:

Under acknowledgements please specify contributors to the article other than the authors accredited. Please also include specifications of the source of funding for the study and any potential conflicts of interest if appropriate.

2.2. Ethical Approvals

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.

2.3 Clinical Trials

Clinical trials should be reported using the guidelines available at www.consort-statement.org.

A CONSORT checklist and flow diagram (as a Figure) should also be included in the submission material.

The Giornale Italiano di Endodonzia encourages authors submitting manuscripts reporting from a clinical trial to register the trials in any of the following free, public clinical trials registries: www.clinicaltrials.gov, http://clinicaltrials.ifpma.org/clinicaltrials/, http://isrctn.org/. The clinical trial registration number and name of the trial register will then be published with the paper.

2.4 Systematic Reviews

Systematic reviews should be reported using the PRISMA guidelines available of http://prisma-statement.org/. A PRISMA checklist and flow diagram (as a Figure) should also be included in the submission material.

2.5 Conflict of Interest and Source of Funding

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. Please include the information under Acknowledgements.

2.6 Appeal of Decision

The decision on a paper is final and cannot be appealed.

2.7 Permissions

If all or parts of previously published illustrations are used, permission must be obtained from the copyright holder concerned. It is the author’s responsibility to obtain these in writing and provide copies to the Publishers.

3. MANUSCRIPT SUBMISSION PROCEDURE

Manuscripts should be submitted electronically by email: editor.giornale@endodonzia.it

3.1. Manuscript Files Accepted

Manuscripts should be uploaded as Word (.doc) or Rich Text Format (.rtf) files (not write-protected) plus separate figure files. GIF, JPEG, PCT or Bitmap files are acceptable for submission, but only high-resolution TIF or EPS files are suitable for printing.

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. Manuscripts should be formatted as described in the Author Guidelines below.

3.2. Blinded Review

Manuscript that do not conform to the general aims and scope of the journal will be returned immediately without review.

All other manuscripts will be reviewed by experts in the field (generally two referees).

Giornale Italiano di Endodonzia aims to forward referees’ comments and to inform the corresponding author of the result of the review process.

Manuscripts will be considered for fast-track publication under special circumstances after consultation with the Editor.

Giornale Italiano di Endodonzia uses double blinded review. The names of the reviewers will thus not be disclosed to the author submitting a paper and the name(s) of the author(s) will not be disclosed to the reviewers.

To allow double blinded review, please submit your main manuscript and title page as separate files.

3.3. E-mail Confirmation of Submission

After submission you will receive an email to confirm receipt of your main...
5. MANUSCRIPT FORMAT AND STRUCTURE

5.1. Format

Language: The language of 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.

Presentation: Authors should pay special attention to the presentation of their research findings or clinical reports so that they may be read 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. 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.

Abbreviations: Giornale Italiano di Endodoncia adheres to the conventions outlined in Units, Symbols and Abbreviations: A Guide for Medical and Scientific Editors and Authors. When non-standard terms appearing 3 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.

5.2. Structure

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

Title Page: The title page should bear: (i) Title, which should be concise as well as descriptive; (ii) Initial(s) and last (family) name of each author; (iii) Full postal address, telephone, fax number and e-mail address of author responsible for correspondence.

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.
- **Methods:** 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 review strategy and clear conclusions.

Abstract for Case Reports 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.

**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 and questions of the investigation. Assignment of appropriate methodologies.

**Material and Methods:** should 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 an ethical 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 its amendments in relation 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:** 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 usually 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 and their implications back to the original problem. Where applicable, results should be compared with previous work in the field. The Discussion section 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.

**Conclusion:** 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 understand- ing. Search strategies must be described and the use of state-of-the-art evidence-based systematic approaches is expected. The use of well 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. The Introduction section should briefly intro- duce the subject matter and justify the need and timeliness of the literature review. The Review section should be divided into logical subsections to enhance readability and understanding and may be supported by up to 5 tables and figures. Search strategies must be described and the use of state-of-the-art evidence-based systematic approaches is expected. The Conclusions section should present clear statements/recommendations and suggestions for further work. The manuscript, including references and figure legends should not normally exceed 4000 words.

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

Acknowledgements: Giornale Italiano di Endodontia 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. Acknowledg- edgments should be brief and should not include thanks to anonymous refer- ees and editors.

5.3. References
It is the policy of the Journal to encour- age reference to the original papers rather than to literature reviews. Au- thors should therefore keep citations of reviews to the absolute minimum.

We recommend the use of a tool such as EndNote or Reference Manager for reference management and formatting. EndNote reference styles can be searched for here: www.endnote.com/support/enstyles.asp. Ref- erence Manager reference styles can be searched for here: www.refman.com/support/rnstyles.asp

In the text: a number in order of cita- tion is the reference inside the manus- script; example (1) Reference list: All references should be brought together at the end of the paper in numerical order and should

be in the following form. * Names and initials of up to six au- thors. When there are seven or more, list the first three and add et al.
* Full title of paper followed by a full stop (.)
* Title of journal abbreviated (es. Jour- nal of Endodontics: J Endod)
* Year of publication followed by ;
* Volume number
* Issue number in parenthesis (es.: (5)) followed by;
* First and last pages

Examples of correct forms of refer- ence follow:

Standard journal article

Corporate author

Journal supplement

Books and other monographs
Personal author(s)

Chapter in a book

Published proceedings paper

Agency publication
Rancky AL Surgical Operations in Short-Stay Hospitals. United States-1975 (1978). DHEW publi- cation no. (PHS) 78-1785 (Vita) and Health Statistics; Series 13; no. 34.) Hyattsville, MD, USA: National Cen- tre for Health Statistics.

Dissertation or thesis

URLs Full reference details must be given along with the URL, i.e. authorship year, title of document/report and URL. If this information is not availa- ble, the reference should be removed and only the web address cited in the text.


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Tables: Tables should be double- spaced with no vertical rulings, with a single bold ruling beneath the column titles. Units of measurements must be indicated in the first column.

Figures: All figures should be planned to fit within either 1 column width (8.0 cm), 1.5 column widths (13.0 cm) or 2 column widths (17.0 cm), and must be suitable for photocopy reproduction. Figures should be numbered and title of the manuscript. Lettering on figures should be in a clear, sans serif typeface (e.g. Helvetica); if possible, the same typeface should be used for all figures in a paper. After reduction for publication, upper-case text and numer- bers should be at least 1.5-2.0 mm high (10 point Helvetica). After reduc- tion, symbols should be at least 2.0- 3.0 mm high (10 point). All half-tone photographs should be submitted at final reproduction size. In general, multi-part figures should be arranged as they would appear in the final ver- sion. Reduction to the scale that will be used on the page is not necessary, but any special requirements (such as the separation distance of stereo pairs) should be clearly specified.

Unnecessary figures and parts (panel- els) of figures should be avoided: data presented in small tables or his- tograms, for instance, can generally be stated briefly in the text instead. Figures should not contain more than one panel unless the parts are logical- ly connected; each panel of a mul- tipart figure should be sized so that the whole figure can be reduced by the reproduction. Size of the whole figure will be reduced by the reproduction and must be suitable for photocopy printing. Figures should be sized so that the whole figure can be reduced by the reproduction. Size of the whole figure will be reduced by the reproduction. Size of the whole figure will be reduced by the reproduction. Size of the whole figure will be reduced by the reproduction. Size of the whole figure will be reduced by the reproduction. Size of the whole figure will be reduced by the reproduction. Size of the whole figure will be reduced by the reproduction.

Figures should be on a white back- ground, and should avoid excessive boxing, unnecessary colour, shading and/or decorative effects (e.g. 3-di- mensional skyscraper histograms) and highly pixelated computer drawings. The vertical axis of histograms should not be truncated to exaggerate small differences. The line spacing should be wide enough to remain clear on reproduction to the minimum acceptable printed size.

Figures divided into parts should be labelled with a lowercase, boldface, roman letter, a, b, and so on, in the same type size as used elsewhere in the figure. Lettering in figures should be in lower-case type, with the first letter capitalized.

Figures should be sent in a single space between the number and the unit, and follow SI nomenclature or the nomenclature common to a particular field. Scale bars should be used rather than magnification factors, with the length of the bar defined in the legend rather than on the bar itself. In general, visual cues (on the figures themselves) are preferred to verbal explanations in the legend (e.g. broken line, open red triangles etc.).

Figure legends: Figure legends should begin with a brief title for the whole figure and continue with a short description of each panel and the symbols used; they should not contain any details of methods.

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For scanned images, the scanning resolution (at final image size) should be as follows to ensure good repro- duction: linear: >600 dpi; halftones (including gel photographs): >300 dpi; figures containing both halftone and line images: >600 dpi.

6. AFTER ACCEPTANCE

Upon acceptance of a paper for publication, the manuscript will be forwarded to the Production Editor who is responsible for the production of the journal.

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Hard copies of all figures and tables are required when the manuscript is ready for publication. These will be requested by the Editor when re- quired. Each Figure copy should be marked on the reverse with the figure number and the corresponding au- thor’s name.
6.2 Proof Corrections
The corresponding author will receive an email alert containing a link to a web site. A working email address must therefore be provided for the corresponding author. The proof can be downloaded as a PDF (portable document format) file from this site. Acrobat Reader will be required in order to read this file. This software can be downloaded (free of charge) from the following Web site: www.adobe.com/products/acrobat/readstep2.html. This will enable the file to be opened, read on screen, and printed out in order for any corrections to be added. Further instructions will be sent with the proof. Hard copy proofs will be posted if no email address is available; in your absence, please arrange for a colleague to access your email to retrieve the proofs.
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