DESIO 15-NOVEMBRE 2025

Endodonzia ed Innovazione Tecnologica

Dr Gianluca Fumei

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"Odontoiatria Conservativa ed Endodonzia 2"
CLOPD Università dell'Insubria Varese

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specialist member

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Webinar di ShapeIT

ALESSANDRO MINNITI

La tecnica MTG nella gestione del complesso sovracrestale

WEBINAR

LIVE

Progetti Online IL BLOG

Condividi:

Evoluzione della terminologia diagnostica in endodonzia: dalle definizioni AAE 2009 alle nuove proposte AAE–ESE 2025

SHAPEIT 8 Ottobre 2025

BLOG

PARTIAMO...


ENDODONZIA

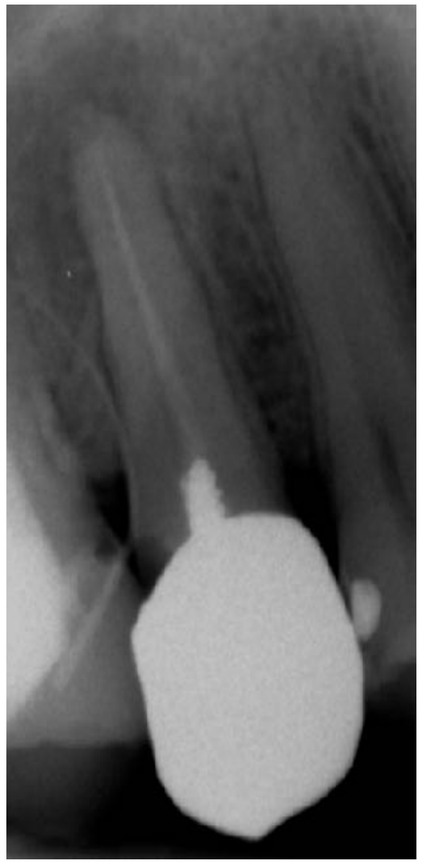
OBIETTIVO

Il recupero dell'elemento dentario

affetto da patologia pulpare o periradicolare

ed il ripristino della sua funzione.

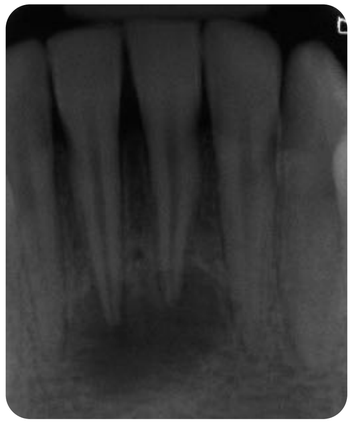
OBIETTIVO

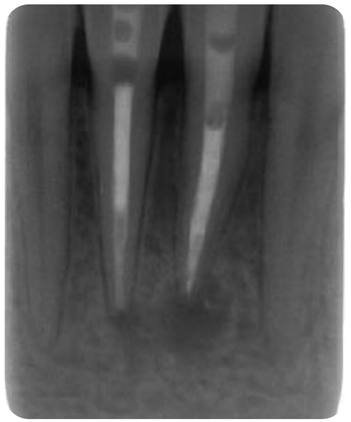



6 ANNI

European Society of Endodontology

graphic criteria. The European Society of Endodontology's (2006) suggest a clinical and radiographic follow-up after at least 1 year with annual recall for up to 4 years before a case is judged a failure. The American Association of Endodontists suggests clinical and radiographic evaluation for a 4- to 5-year period,


2005 2008 2010 2011 2012 2014

CONCETTI BASE IN ENDODONZIA

DIAGNOSI

IMPOSSIBILE CORRELARE STATO INFIAMMATORIO PULPARE CON LE MANIFESTAZIONI CLINICHE

CLINICAMENTE/DIAGNOSI

La differenza tra pulpite reversibile e irreversibile è funzionale e clinica:

Si basa sulla qualità e durata del dolore e si diagnostica utilizzando i test di sensitività pulpare

I BATTERI SONO I RESPONSABILI DELLE LESIONI ENDODODNTICHE

KAKEHASCHI 1965

L’endodonzia e’ la detersione di spazi anatomici complessi.

LE TECNICHE E LE STRATEGIE POSSONO ESSERE DIVERSE

Requisito Fondamentale

L’isolamento del campo operatorio

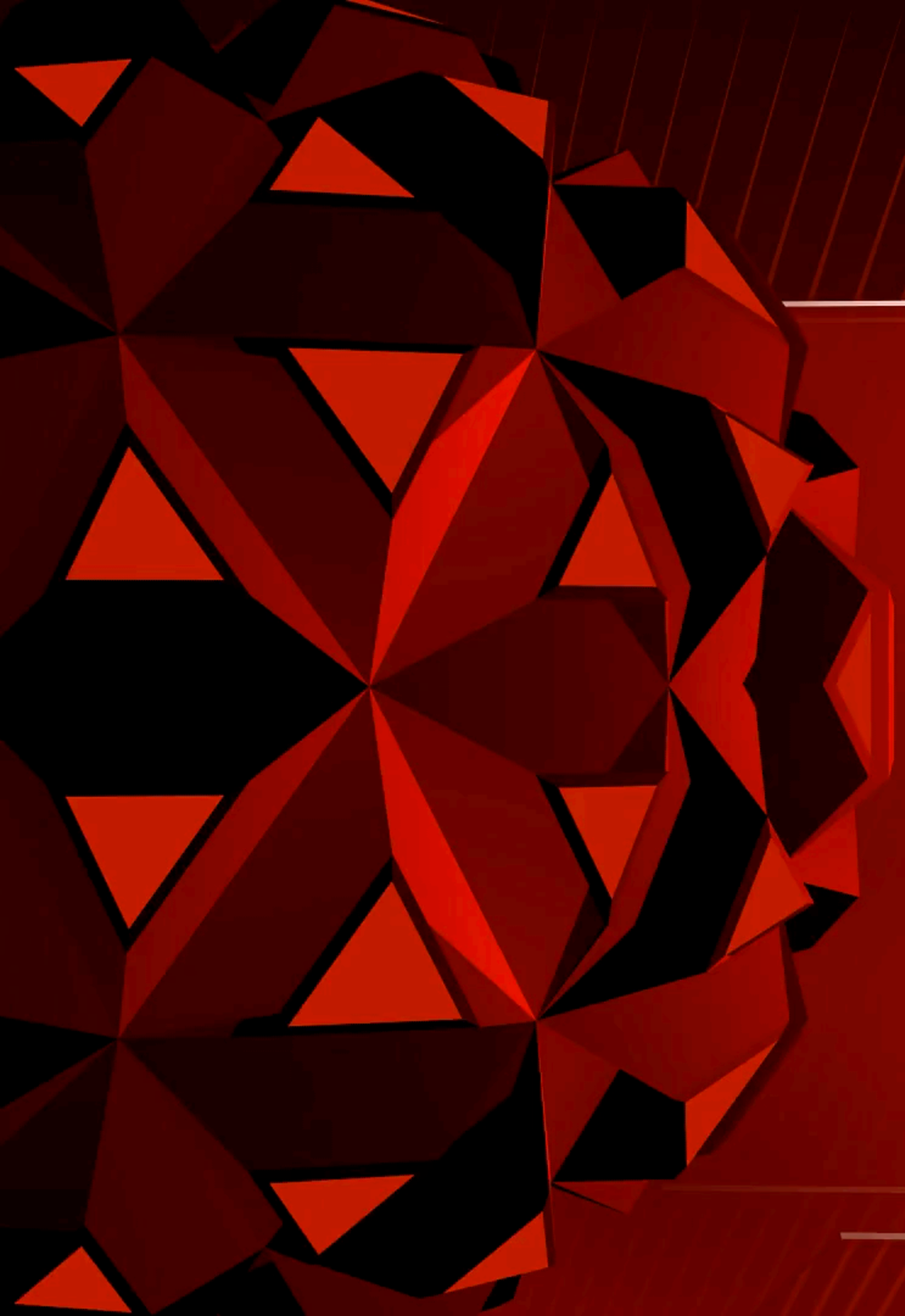

Passi clinici
da
compiere?

RADIOLOGIA BIDIMENSIONALE

GOLD STANDARD IN ENDODONZIA

PRIMO ESAME RX IN ENDODONZIA

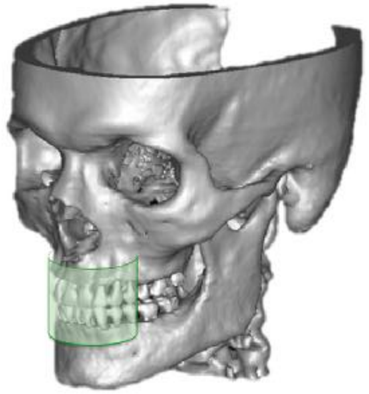
REGOLA DI CLARK



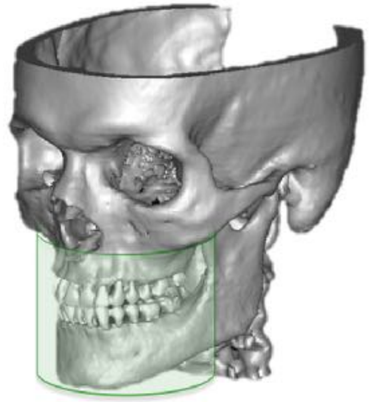
Think 3D

Work 3D

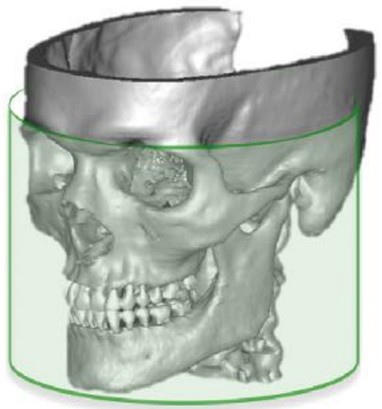
Diagnosi e Progettazione



FOV small
(es:4x4mm)



FOV Medio
(es:8x8mm)



FOV Large
(es:16x16mm)

CBCT

Conclusioni

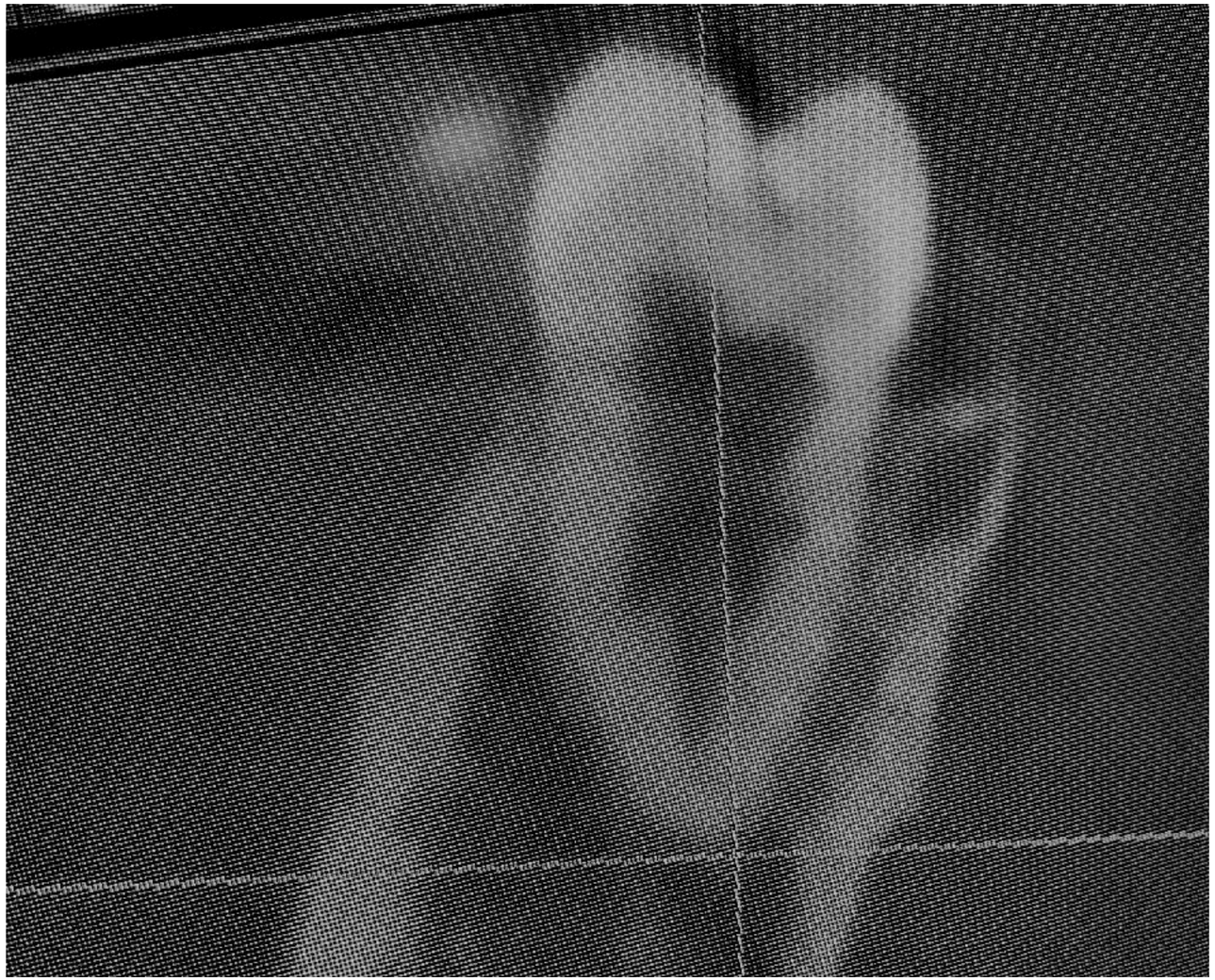
- La CBCT influenza la capacità del clinico nella formulazione della diagnosi e nella scelta terapeutica nei casi fallimenti endodontici.

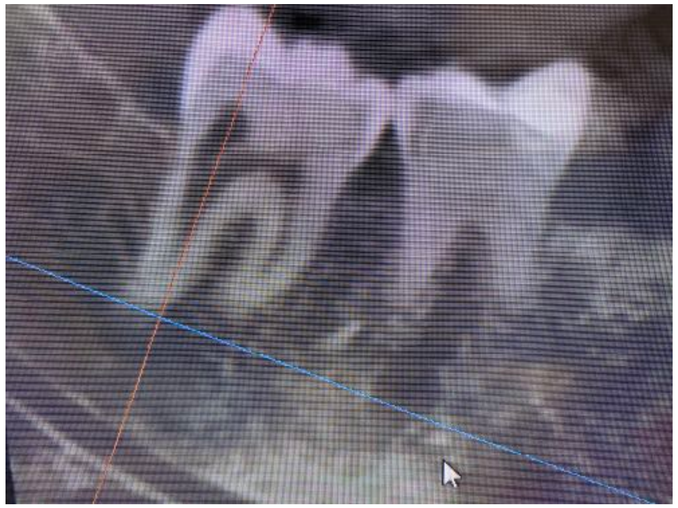
- L’aumento in percentuale della decisione di estrarre l’elemento dentale potrebbe essere dovuto alla maggior capacità della CBCT d’individuare circostanze che si associano ad una prognosi negativa.

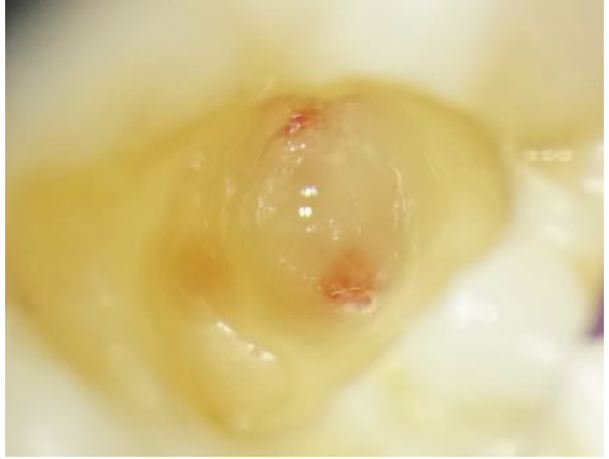
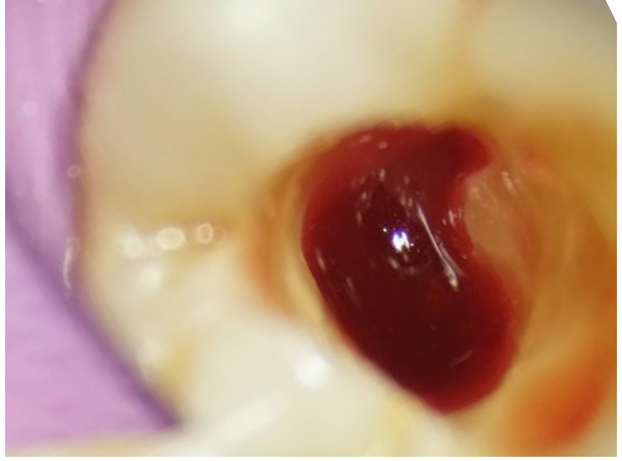
- Il ricorso alla CBCT deve essere giustificato.

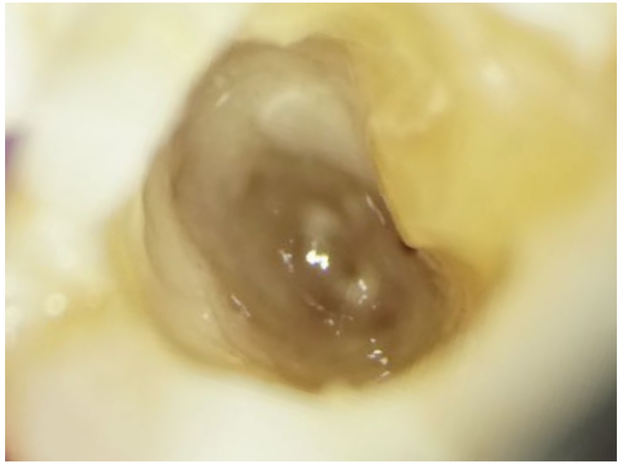
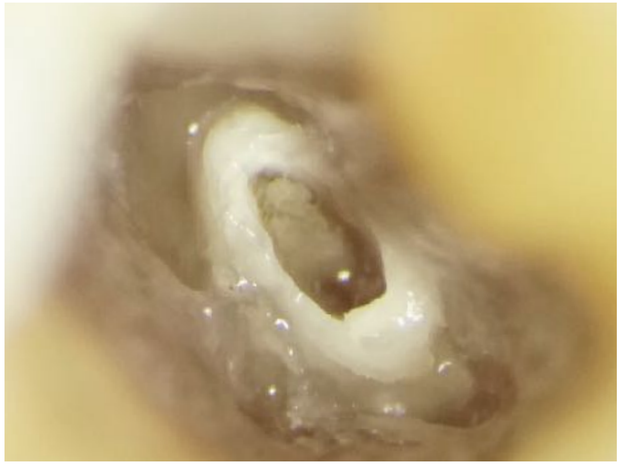
RIASSORBIMENTO CERVICALE

Casi complessi in Endodonzia

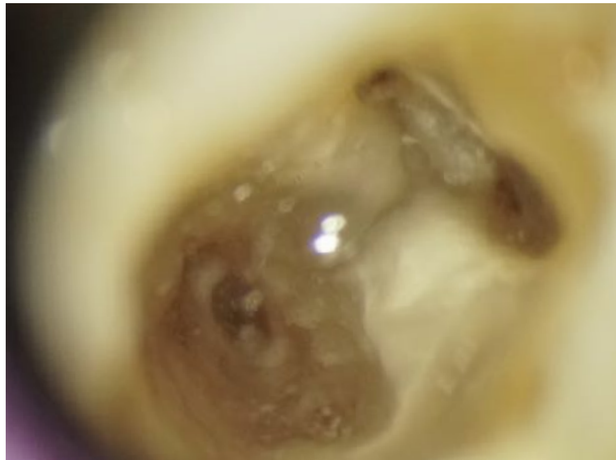


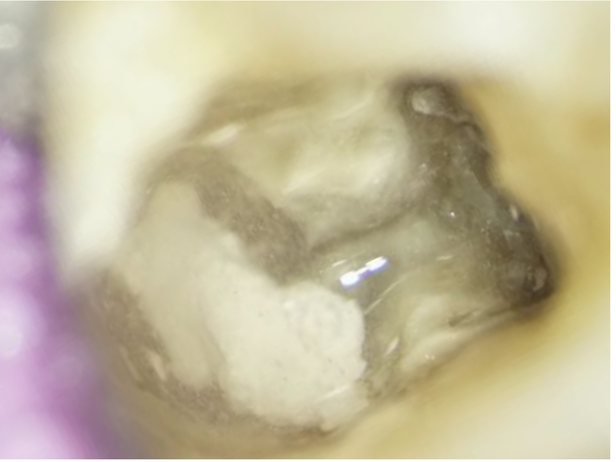


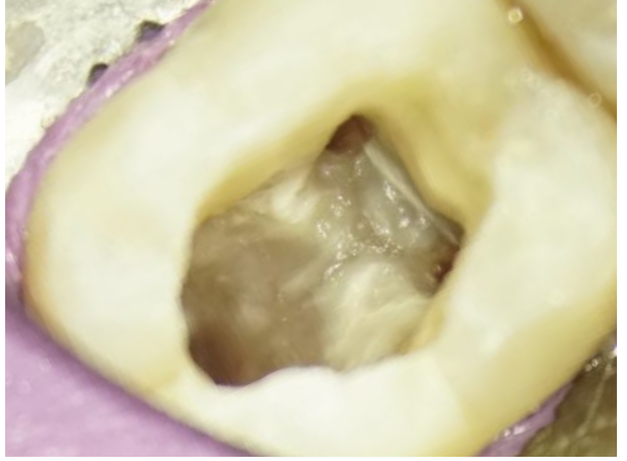




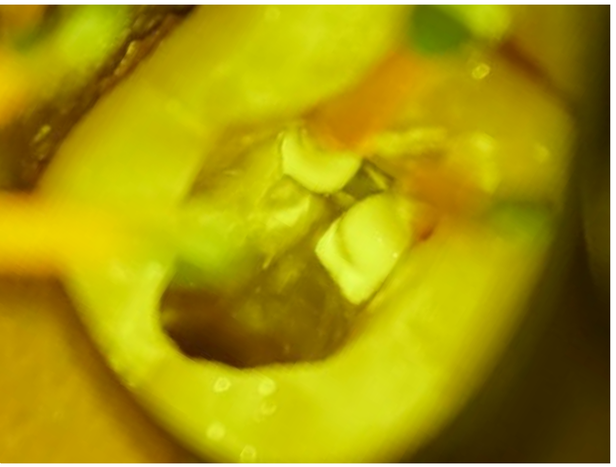




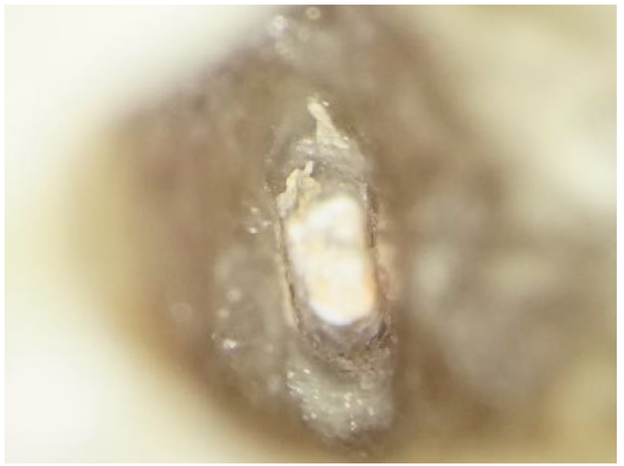
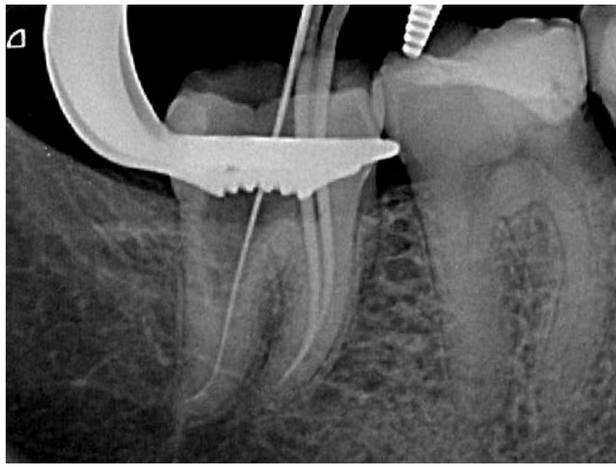
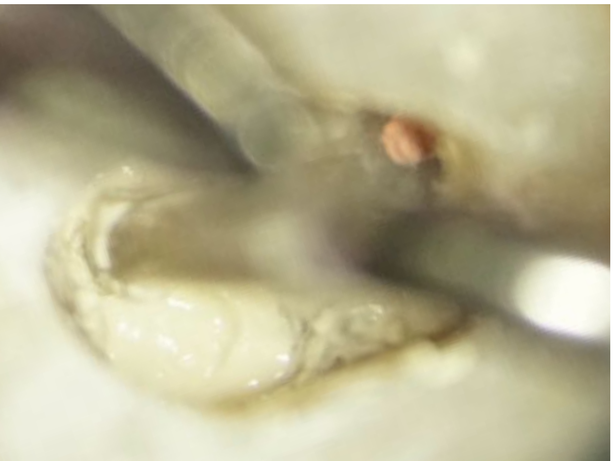






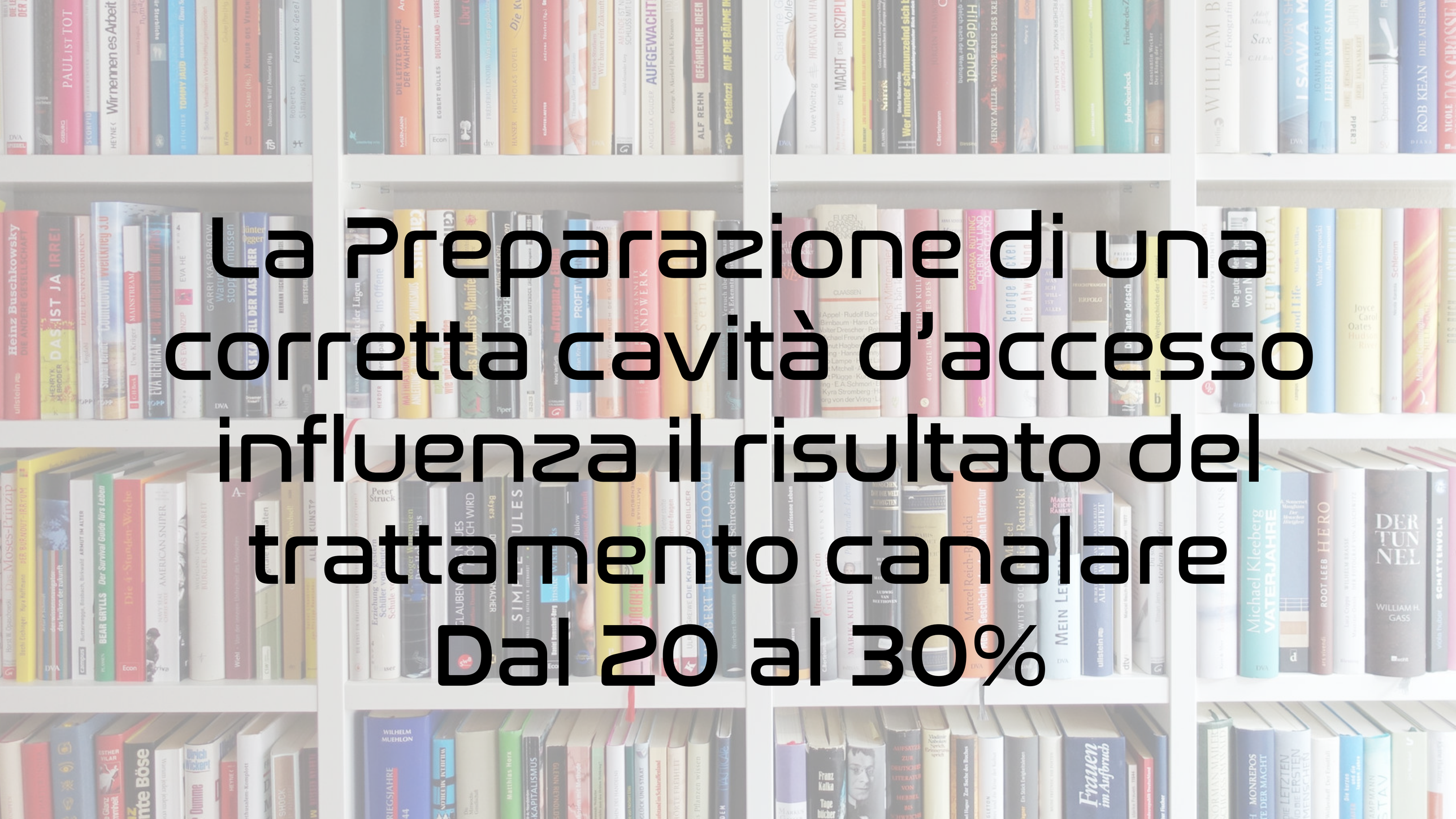



…le fa

Prossimo step?

APERTURA DI CAMERA


La Preparazione di una corretta cavità d'accesso influenza il risultato del trattamento canalare
Dal 20 al 30%

CORSI ECM A DISTANZA 2018

La cavità d'accesso in endodonzia: razionali clinici e operativi

RESPONSABILE SCIENTIFICO

Gianluca Fumei

Responsabile per l'Endodonzia, Reparto di Riabilitazione Orale Università di Milano c/o Istituto Stomatologico Italiano

Modulo 1
Dall'anatomia dell'endodonto agli esami strumentali per una corretta diagnosi preoperatoria

Autori: A. Santoro, G. Ferretti, R. Rapetti, G. Fumei

GIUGNO 2018

Modulo 2
L'apertura della camera pulpare: considerazioni cliniche e isolamento del campo operatorio

LUGLIO 2018

Modulo 3
Dall'apertura di camera al reperimento degli imbocchi canalari: strumentario e fasi operative

SETTEMBRE 2018

Modulo 4
La gestione dell'apertura di camera nei casi complessi

OTTOBRE 2018

Modulo 5
Dall'apertura al sigillo della camera pulpare: Nuove tendenze

NOVEMBRE 2018

Tecniche Nuove SpA
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APERTURA DI CAMERA

RIMUOVERE TX CARIATO

RIMUOVERE TETTO CAMERALE

VISIONE DIRETTA IMBOCCHI CANALARI

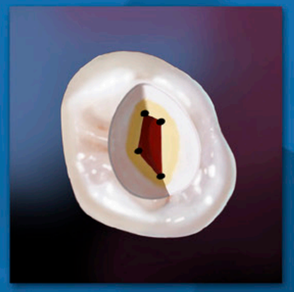
ACCESSO RETTILINEO AL III APICALE

CONTENERE IRRIGANTI

PRESERVARE STRUTTURA DENTALE

RITENERE OTT PROVVISORIA

ENDODONTICS



Colleagues for Excellence

Spring 2010

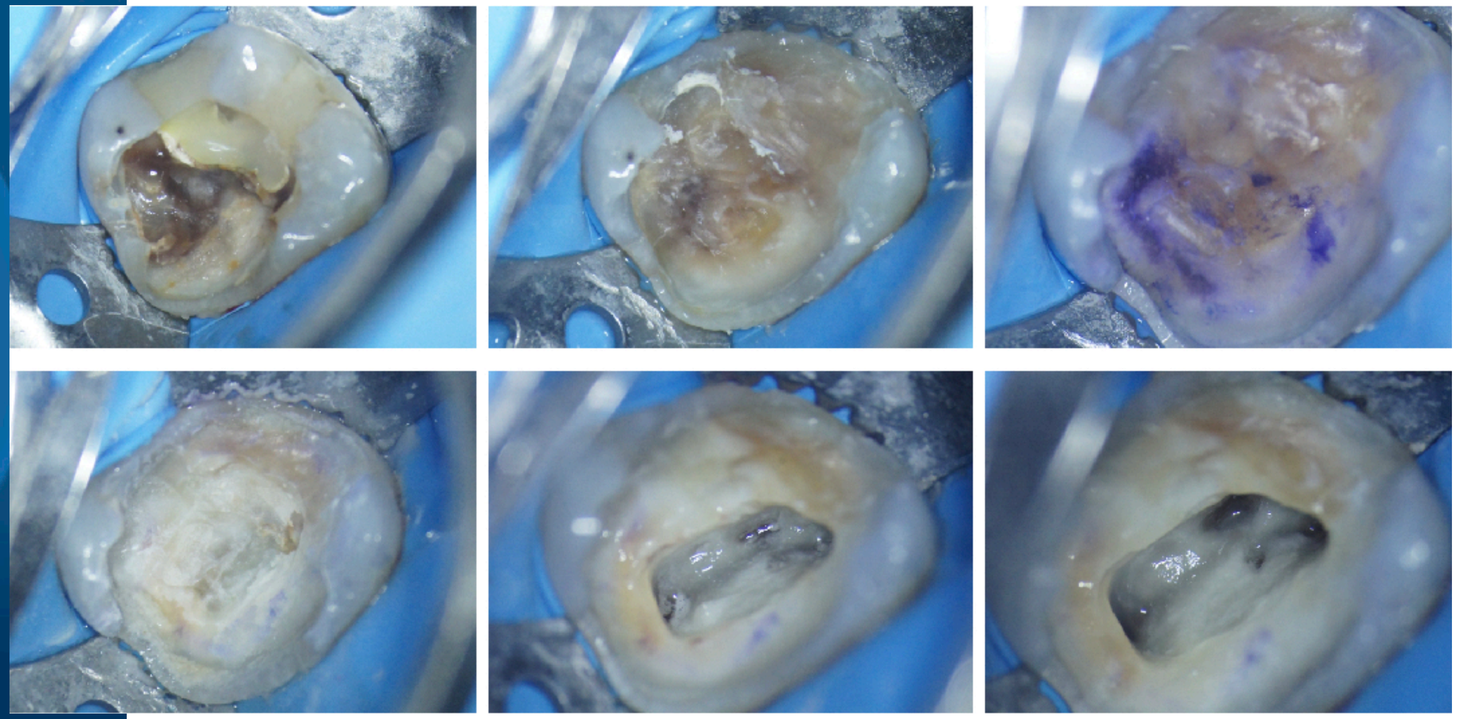
Access Opening and Canal Location

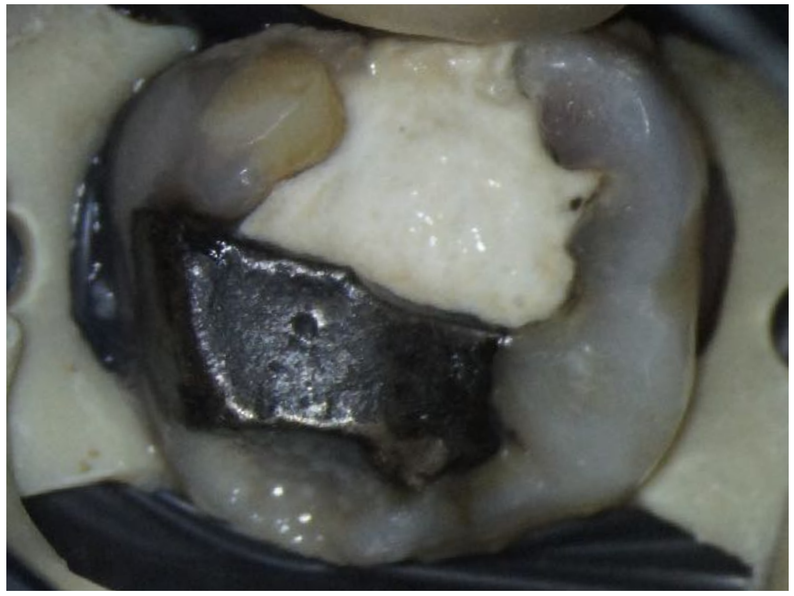
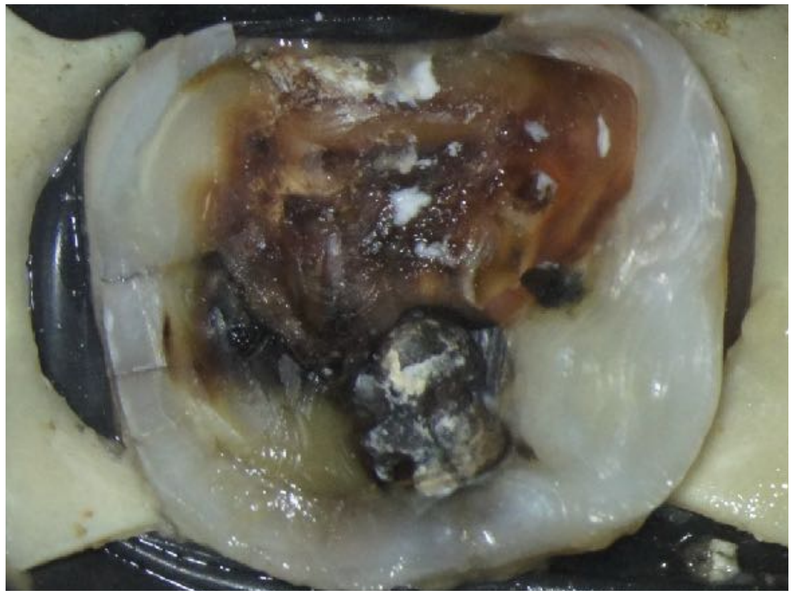
Published for the Dental Professional Community by the
American Association of Endodontists

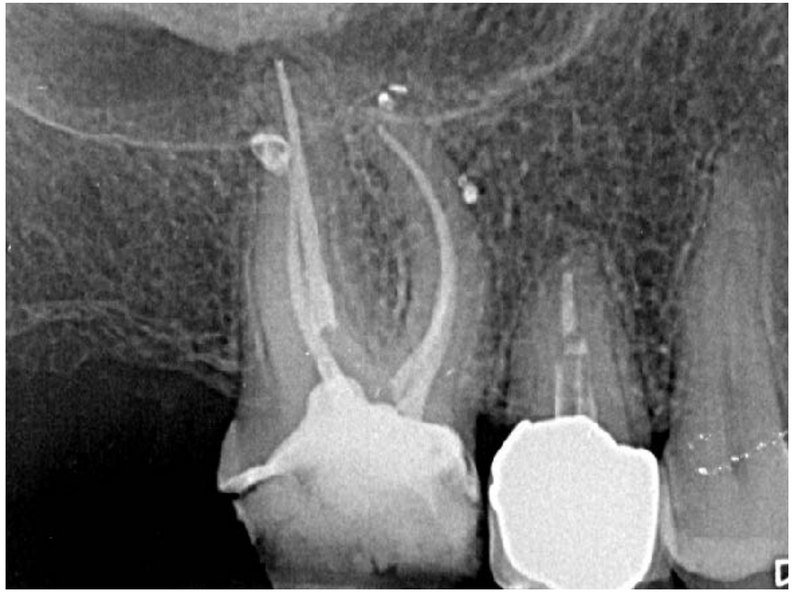
Cover artwork: Rusty Jones, MediVisuals, Inc.

LA INCOMPLETA RIMOZIONE DI TESSUTO CARIATO AUMENTA NOTEVOLMENTE IL RISCHIO DI CONTAMINAZIONE DELL'ENDODONTO DURANTE LE FASI DEL TRATTAMENTO.

L'AAE CONSIDERA LA RIMOZIONE DI RESTAURI INCONGRUI E DEL TESSUTO CARIATO, CONDIZIONI IMPRESCINDIBILI PER UNA PROGNOSI FAVOREVOLE DELLA TERAPIA.




Missed anatomy is the first cause of failures:

La bibliografia internazionale descrive l'incapacità di localizzare e di conseguenza trattare i canali come la causa principale degli insuccessi endodontici

Missed anatomy is associated with 42% of failures in endodontic

Journal of Endodontics

CLINICAL AID

Orifice Locating with a Microscope

Maria Cristina Coelho de Carvalho and Mario Luis Zuolo

The purpose of this study was to determine whether the use of the dental operating microscope (DOM) could increase the number of root canal orifices located in mandibular molars. Ninety-three first and 111 second extracted mandibular molars were used. With the naked eye, all access cavities were prepared and the number of canals in each root was recorded. Using a DOM with ×8–×13 magnification, all teeth had the access cavity preparations again examined. With the naked eye, a total of 641 canals were seen in all teeth. After the DOM examination, 50 more canals could be visualized, representing a 7.8% increase in the total number of located canals. From these canals, 35 were located in the first molars and 15 in the second molars. The use of the DOM increases the number of root canal orifices located.

Routine endodontic treatment involves the removal of the damaged pulp tissue, followed by cleaning and shaping of the root canal space and its subsequent obturation (1). Clinical studies evaluating the success rate after endodontic therapy have pointed out that mandibular molars can be considered difficult teeth on which to perform root canal treatment (2, 3). Complex anatomical features are frequently associated with endodontic failure in these teeth (4, 5).

modified access form, rectangular in shap… the fourth canal in the distal root of the ma… Campos (9) suggested eliminating the den… mesial wall and exploring the isthmus be… and mesiolingual orifices.

Recently, the dental operating micros… introduced to enhance the results of con… endodontic interventions (12, 13). Magn… ×3 to ×20, and intense illumination are t… this device.

The purpose of this study was to deter… the DOM in access preparation could incr… canal orifices located in the mandibular m…

Original Research

By Dr T. Schwarze, Dr C. Baethge, Dr T. Stecher, Professor W. Geurtsen
Department of Conservative Dentistry & Periodontology, Medical University, Hannover, Germany.

Address for correspondence: T. Schwarze, DDS, Dr.med.dent., Department of Conservative Dentistry & Periodontology, Medical University Hannover, D-30625 Hannover, Germany.

Identification Of Second Canals In The Mesiobuccal Root Of Maxillary First And Second Molars Using Magnifying Loupes Or An Operating Microscope

Abstract

Various authors have investigated the frequency of second canals (MB2) in the mesiobuccal roots of maxillary molars, predominantly first molars. Further, it has been reported that the percentage of MB2 canals that are treated during routine endodontic therapy is much lower than the number of second canals identified *in vitro*.

It was the purpose of this study to investigate whether the use of an operating microscope … improve the diagnosis of MB2 canals in mesiobuccal … maxillary molars. The canal orifices … maxillary first and second molars (50 … each) were … examined by Examiner I using individual … adapted x2 magnifying loupes. Subsequently, all teeth were examined by a second investigator using an operating microscope (OPM) with x8 magnification. Finally, the mesiobuccal roots of all teeth were separated. Then, the sections were analysed histologically and by SEM. The histological investigation revealed a total number of 63 MB2 canals, 39 in first, and 24 in second molars. Only 26 (41.3%) of those canals were identified using magnifying loupes, whereas 59 (93.7%) were found by means of an operating microscope.

Figure 1: The original … of this pulp cavity … the mesio-buccal root of a maxillary first m… is partly calcified caus… separation … two canals (SEM, x100).

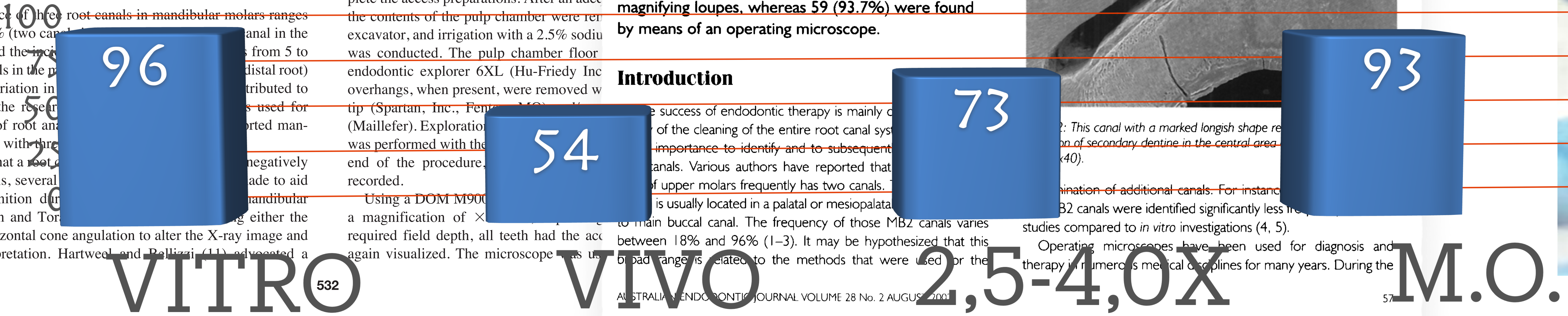
…: This canal with a marked longish shape re… of secondary dentine in the central area … x40).

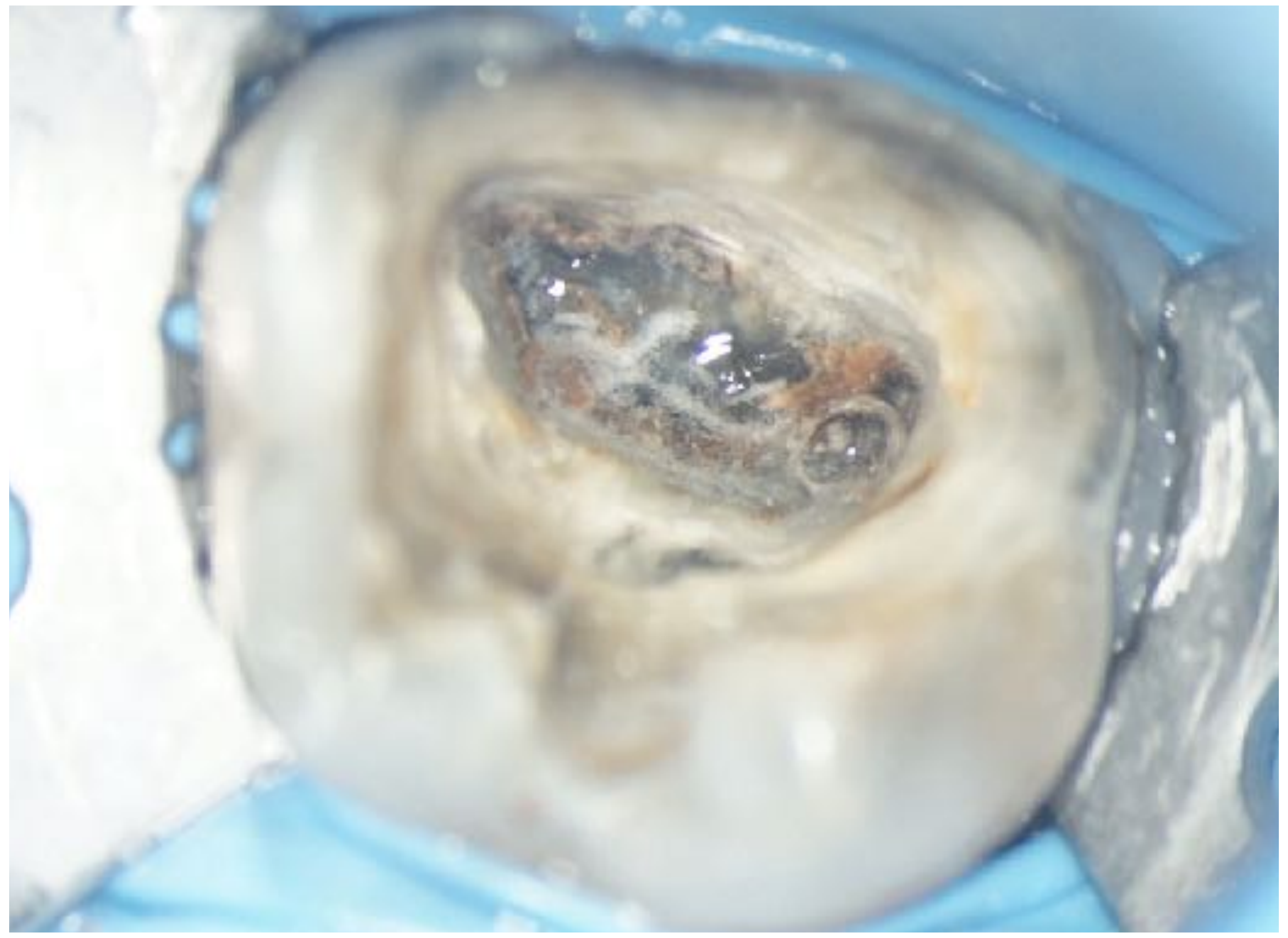
Introduction

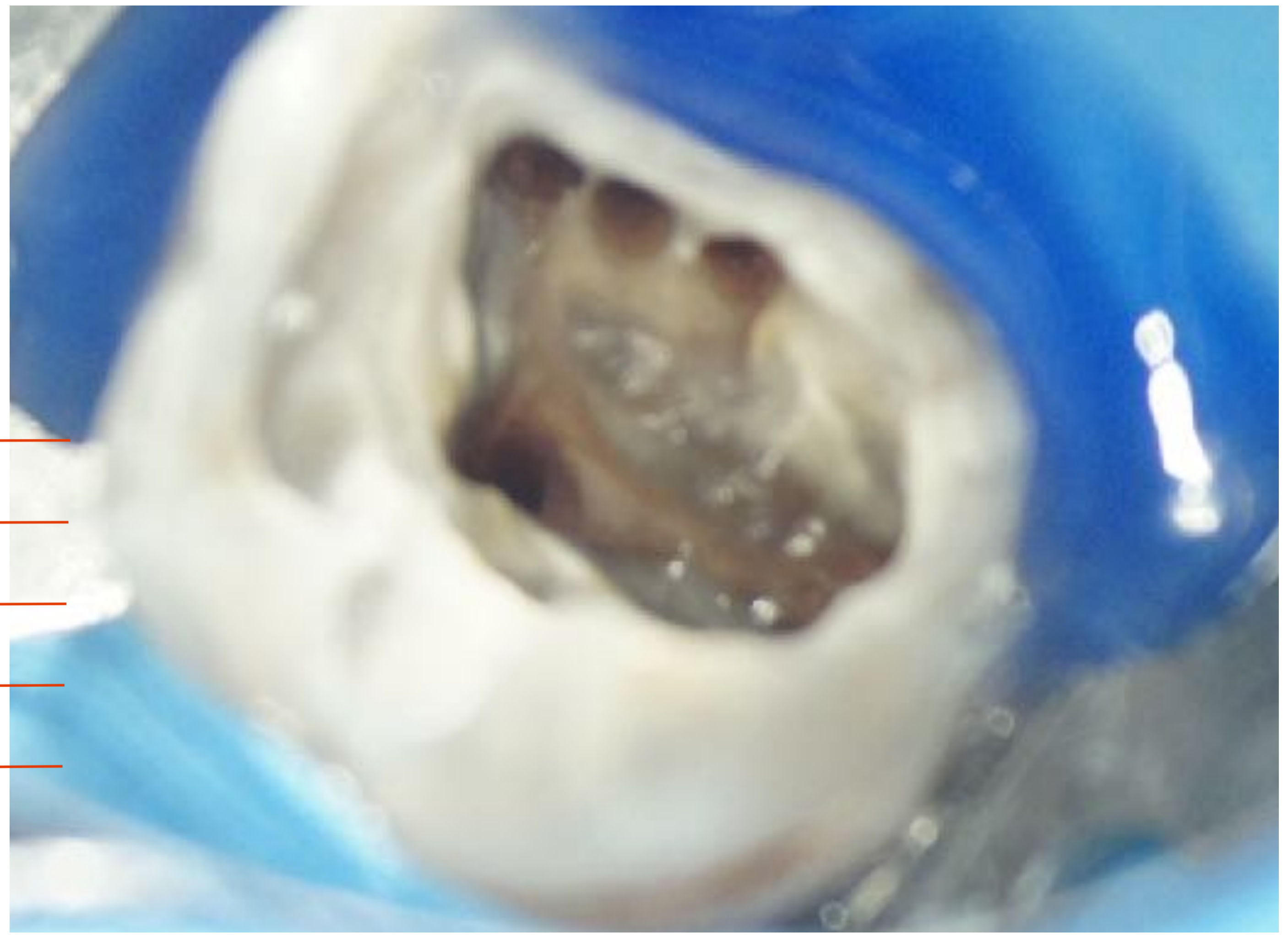
…e success of endodontic therapy is mainly … of the cleaning of the entire root canal syst… importance to identify and to subsequent… canals. Various authors have reported that … of upper molars frequently has two canals. … is usually located in a palatal or mesiopalata… main buccal canal. The frequency of those MB2 canals varies between 18% and 96% (1–3). It may be hypothesized that this broad range is related to the methods that were used for the …ination of additional canals. For instance … MB2 canals were identified significantly less fre… studies compared to *in vitro* investigations (4, 5).

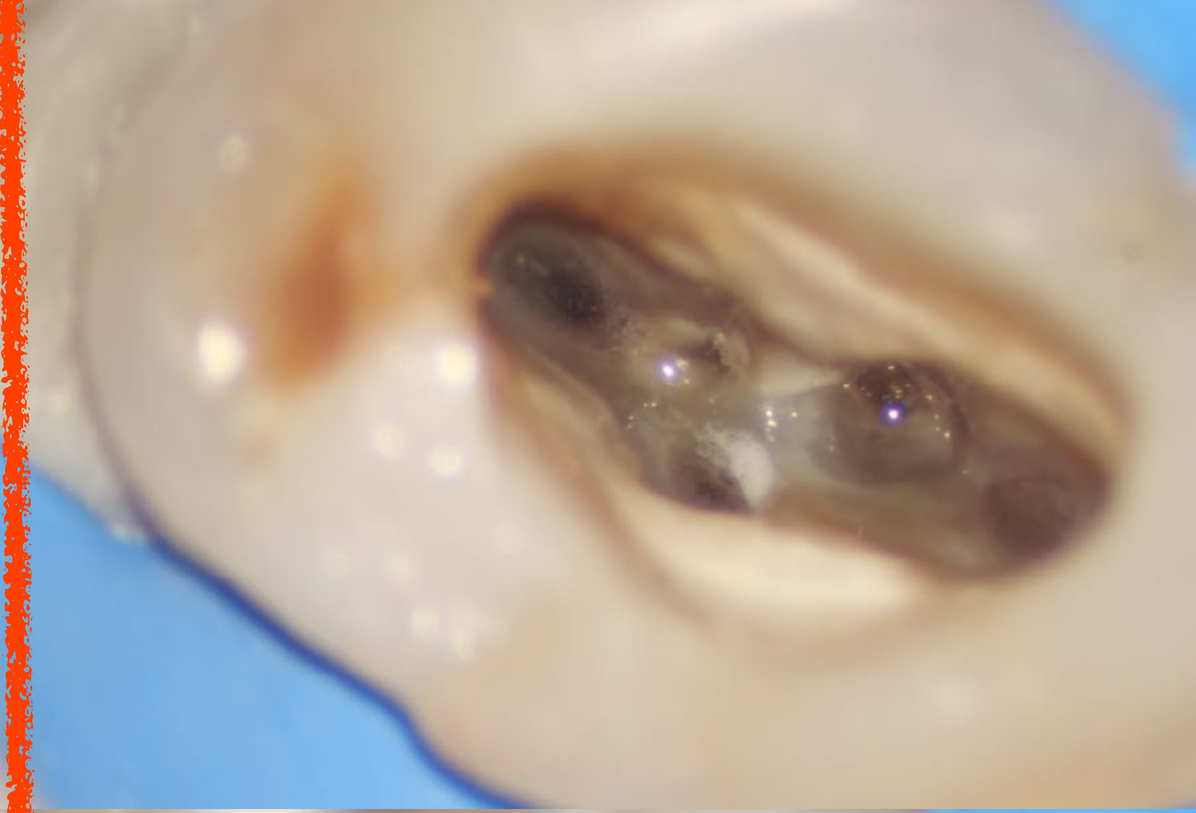
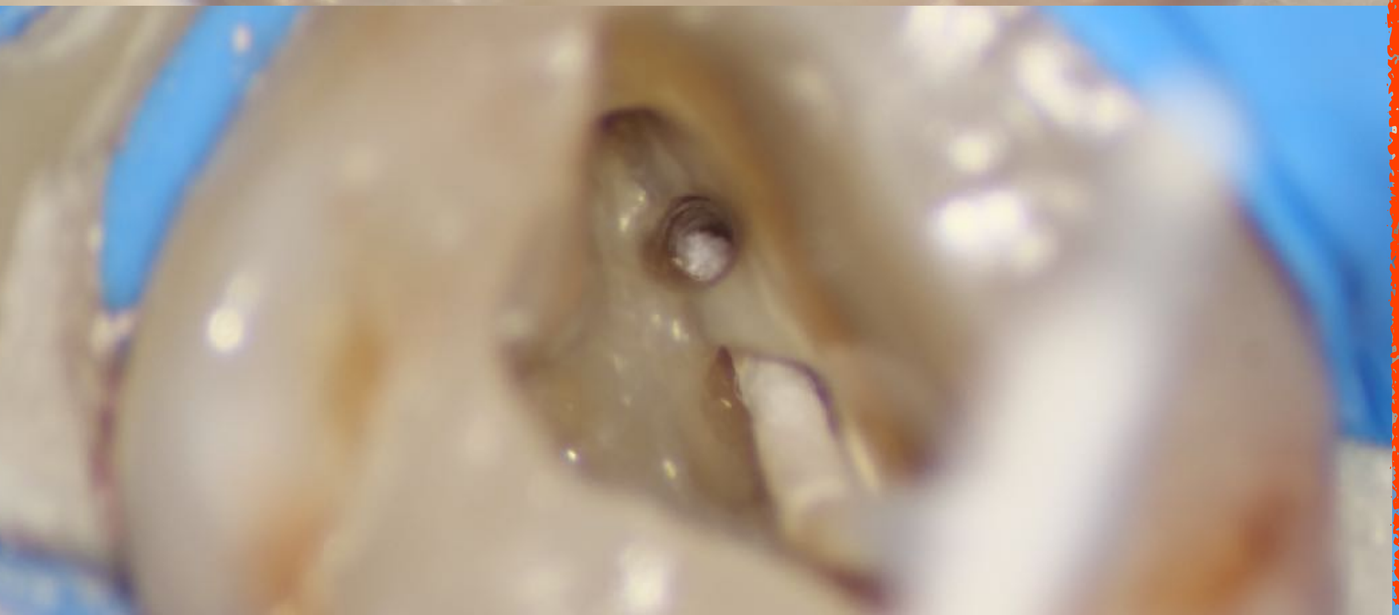
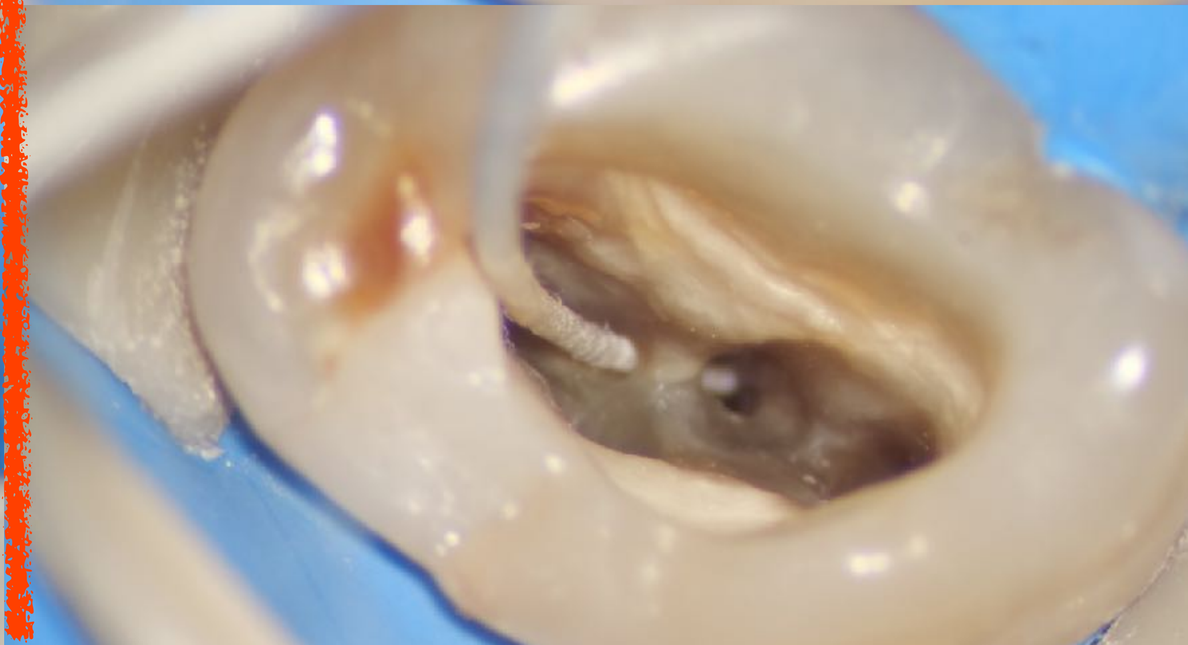
Operating microscopes have been used for diagnosis and therapy in numerous medical disciplines for many years. During the

MB2(16-26)



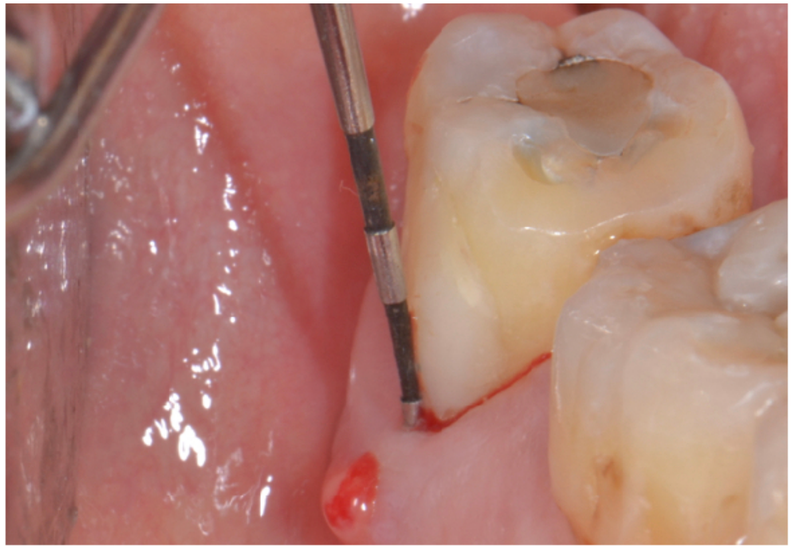
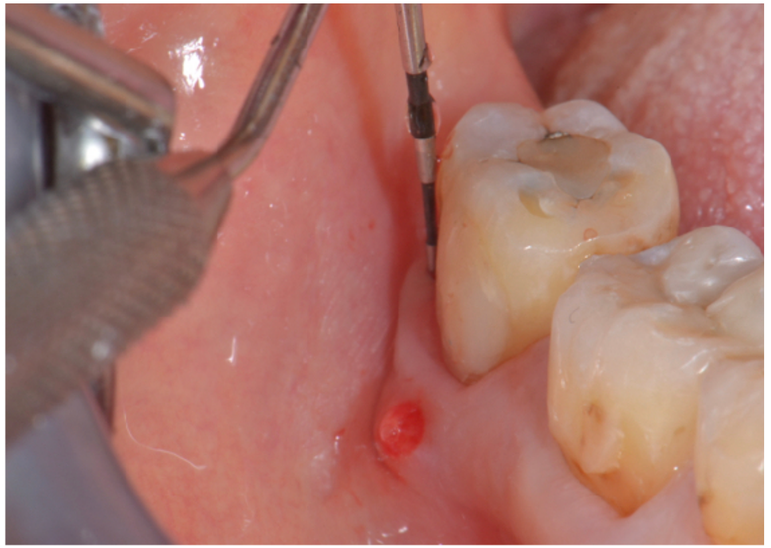




Strumentario Idoneo

SONDAGGIO GAC

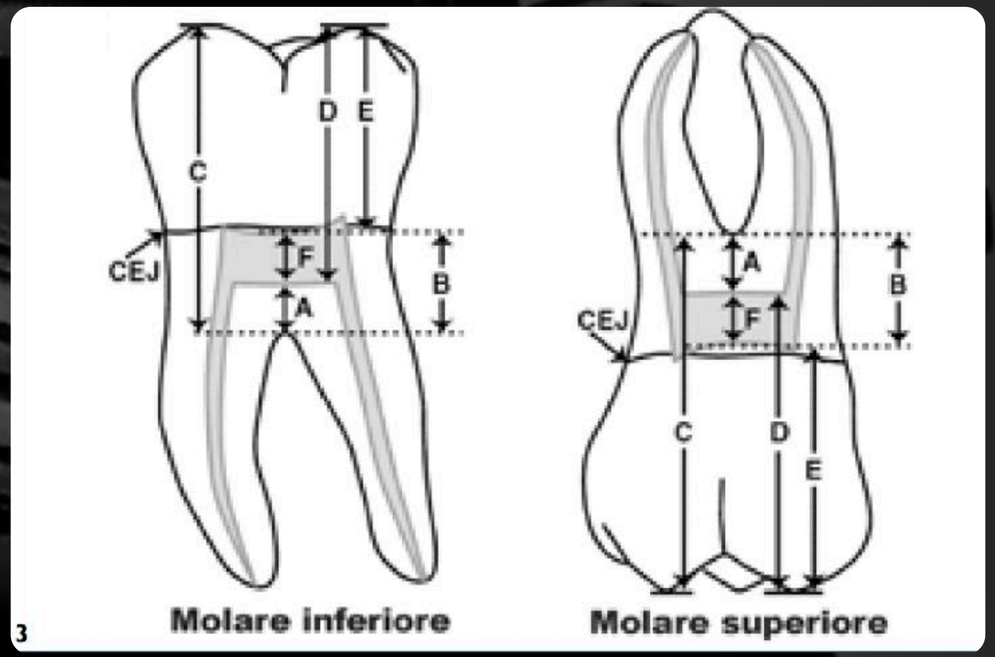

DR.SSA RAPETTI & DR AIUTO

CENTRALITA' DELL'ENDODONTO

Letture consigliate:

MORFOLOGIA DELLA CAMERA PULPARE
DALLA RICERCA DI BASE ALLA METODOLOGIA CLINICA

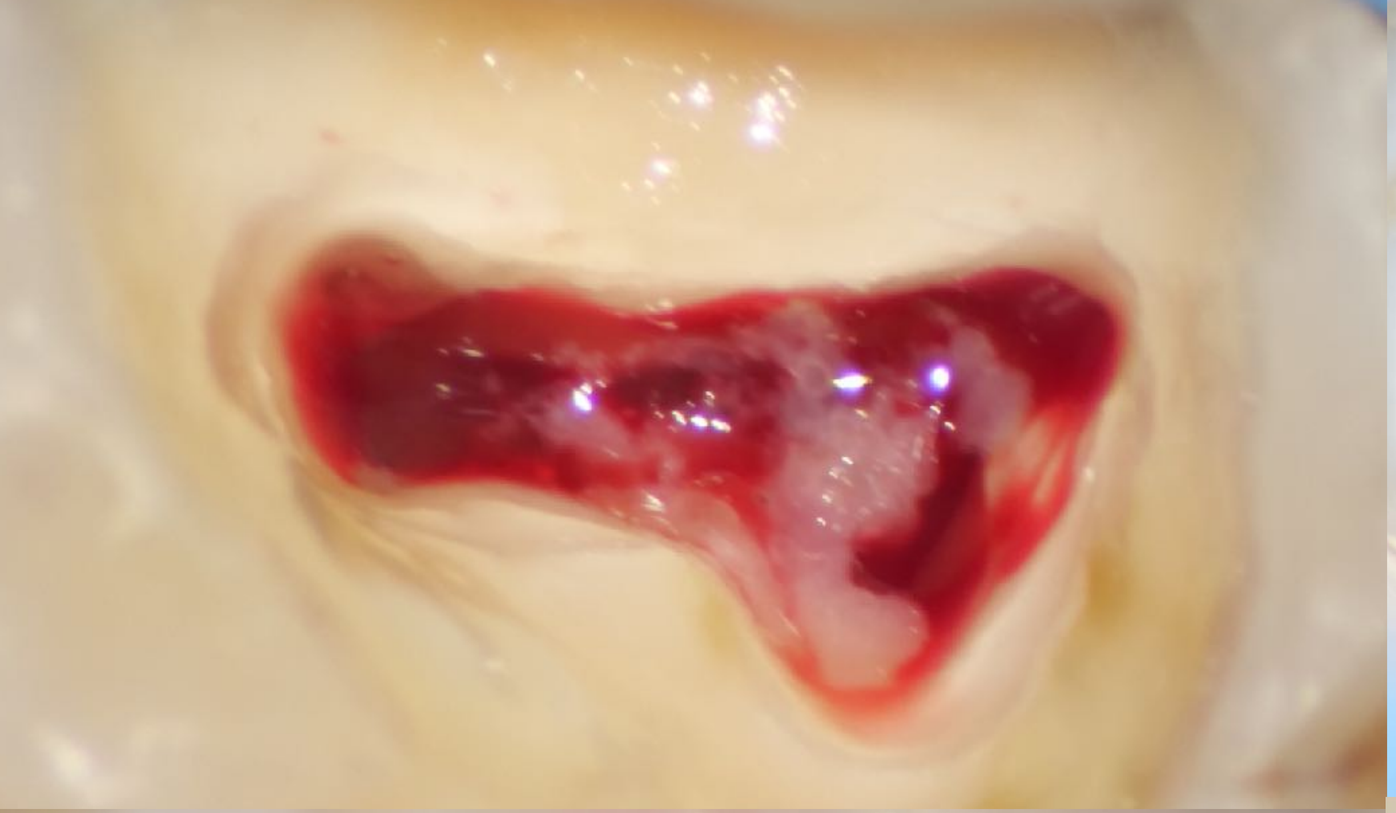
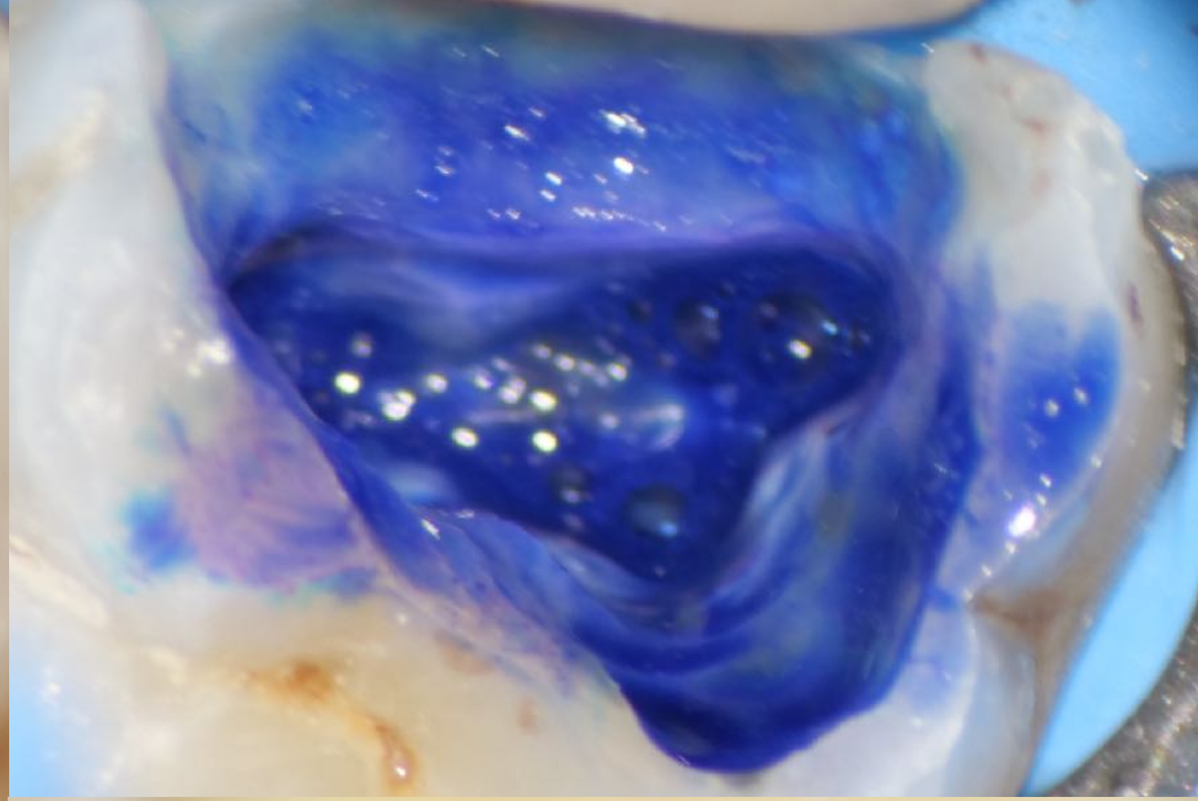
ALLAN S. DEUTSCH

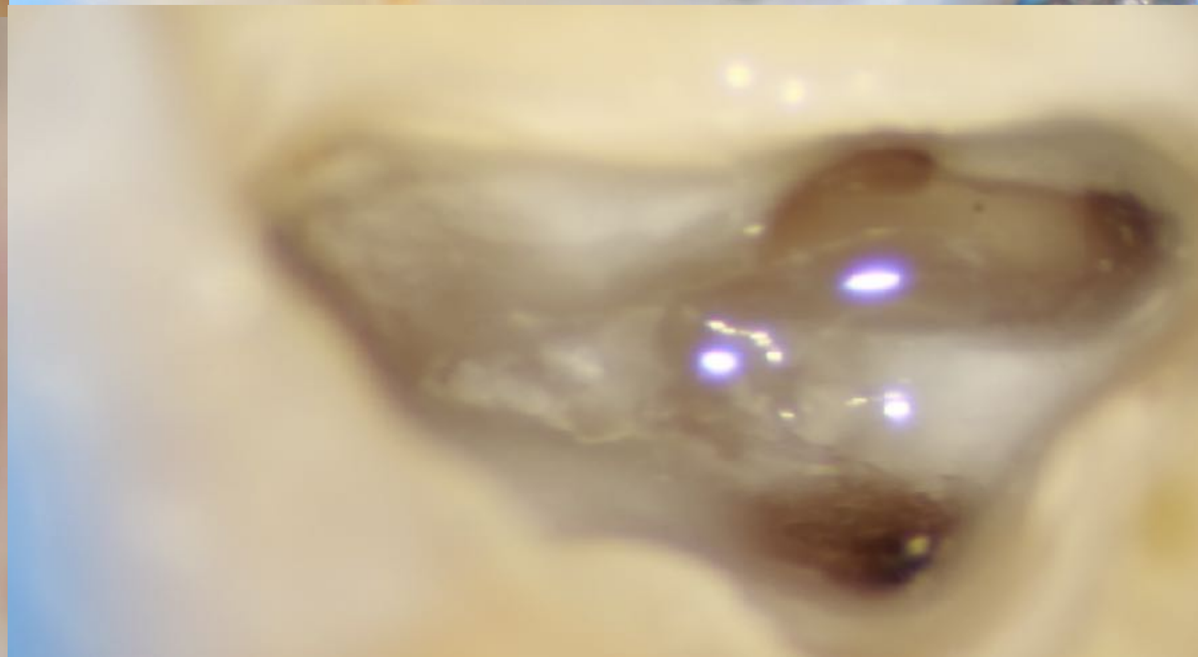


MISURE MEDIE IN MM PER I MOLARI MASCELLARI E MANDIBOLARI

N=100	A	B	C	D=(C-A)	E=(C-B)	F=(B-A)
Media (max)	3,05	4,91	11,15	8,08	6,24	1,88
(mand)	2,96	4,57	10,90	7,95	6,36	1,57
SD (max)	0,79	1,06	1,21	0,88	0,88	0,69
(mand)	0,78	0,91	1,21	0,79	0,93	0,68
Variazione %	25,80	21,60	10,90	10,9	14,11	36,50
(mand)	26,00	20,00	11,10	9,94	14,60	43,00

*INFORMATORE ENDODONTICO. VOL 8
NUMERO 1 2005



Condividi:

Regole per il Reperimento degli Imbocchi Canalari

SHAPEIT

29 Ottobre 2024

Regole per il Reperimento degli Imbocchi Canalari

scarica il pdf

BLOG

Modern Molar Endodontic Access and Directed Dentin Conservation

David Clark, DDS[a,*], John Khademi, DDS, MS[b]

KEYWORDS
• Molar • Endodontic • Access • Dentin

During patient treatment, the clinician needs to consider many factors that will affect the ultimate outcome. In simple terms, these factors can be grouped into 3 categories: the operator needs, the restoration needs, and the tooth needs. The operator needs are the conditions the clinician needs to treat the tooth. The restoration needs are the prep dimensions and tooth conditions for optimal strength and longevity. The tooth needs are the biologic and structural limitations for a treated tooth to remain predictably functional. This article discusses molar access and failures of endodontically treated teeth that occur not because of chronic or acute apical lesions but because of structural compromises to the teeth that ultimately renders them useless. What both authors have discovered in their respective practices through careful observations of failing cases and modes of failure, and observation of the truly long-term (decades) successful cases, is that the current models of endodontic treatment do not lead to long-term success. The authors want to coronally shift the focus to the cervical area of the tooth and create awareness for an endorestorative interface. This article introduces a set of criteria that will guide the clinician in treatment decisions to maintain optimal functionality of the tooth and help in deciding whether the treatment prognosis is poor and alternatives should be considered. This article is not an update on traditional endodontic access, as the authors believe the traditional approach to endodontic access is fundamentally flawed. Traditional endodontic access has been endodontic centric, primarily focused on operator needs, and has been decoupled from the restorative needs and tooth needs. Central to our philosophy is that balance needs to be restored to these 3 needs, which are almost always in conflict when performing complete cusp-tip to root-tip treatment.

Disclosure: Drs Clark and Khademi will receive a royalty from the sales of CK Endodontic Access burs. http://www.sswhiteburs.com.
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Dent Clin N Am 54 (2010) 249–273
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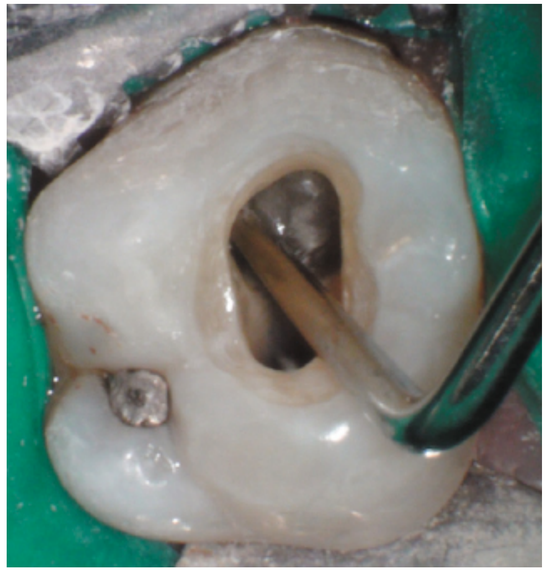
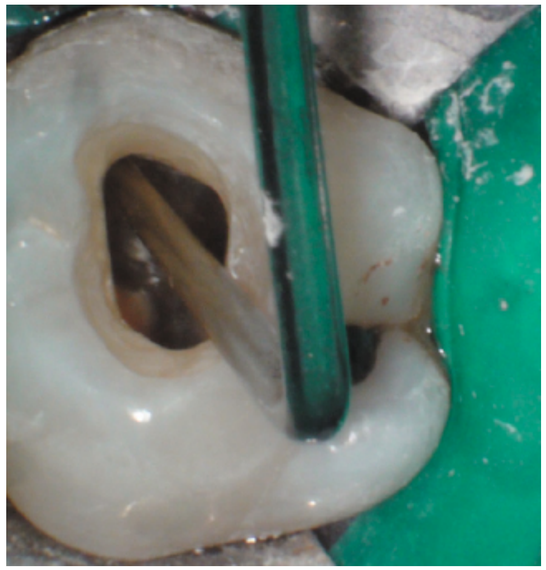
dental.theclinics.com
0011-8532/10/$ – see front matter

DENT CLIN N AM 54 (2010) 249-73





Minimally Invasive Endodontics

Bürklein S, Schäfer E. Minimally invasive endodontics. Quintessence Int. 2015 Feb;46(2):119-24

"Minimally Invasive Endodontics aims to preserve the maximum of tooth structure during root canal therapy "

TAMSE 2006

Endodontic Topics 2006, 13, 84–94
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Vertical root fractures in endodontically treated teeth: diagnostic signs and clinical management

AVIAD TAMSE

A most frustrating complication to root canal therapy is vertical root fracture (VRF) in an endodontic
tooth. Prognosis most often is hopeless and differential diagnosis from other pathoses may be dif
Nevertheless, proper diagnosis is critical to distinguish a fracture complication from clinical
periodontal and endodontic diseases. This review emphasizes the importance of the corr
scribes the more typical clinical and radiographic features of this disorder, and sum
factorial etiology.

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VRF) is an untoward complica-
that often calls for tooth
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se of stress factors
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VRF

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endod
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"I fattori predisponenti includono la perdita di sostanza dentale sana, ... che aumenta il rischio di crepe nel corpo della dentina che possono poi propagarsi fino alla frattura"

"...tagliare la dentina in linea retta lungo le curvature indebolisce la struttura radicolare...
Soprattutto nei canali radicolari infetti, si dovrebbe quindi ricercare un equilibrio tra la necessità di rimuovere la dentina infetta e il mantenimento di uno spessore radicolare sufficiente a resistere alle forze della masticazione."

"Si dovrebbe prestare particolare attenzione al mantenimento di una quantità sufficiente di dentina residua sui denti e sulle radici più suscettibili alla frattura, vale a dire i premolari mascellari e mandibolari e le radici mesiali dei molari mandibolari"

APPROCCIO CONSERVATIVO

PreServare la dentina

- ACCESSO CAMERALE
- STRUMENTAZIONE CANALARE
- PREPARAZIONE POST-SPACE
- REALIZZAZIONE RESTAURO

J Prosthet Dent. 2008 Apr;99(4):267-73. doi: 10.1016/S0022-3913(08)60059-1.

Residual dentin thickness in bifurcated maxillary first premolars after root canal and post space preparation with parallel-sided drills.

Pilo R, Shapenco E, Lewinstein I.

Int Endod J. 2009 Dec;42(12):1071-6. doi: 10.1111/j.1365-2591.2009.01632.x.

Micro-computed tomography of tooth tissue volume changes following endodontic procedures and post space preparation.

Ikram OH, Patel S, Sauro S, Mannocci F.

J Endod. 2006 Mar;32(3):202-5.

Residual dentin thickness in bifurcated maxillary premolars after root canal and dowel space preparation.

Katz A, Wasenstein-Kohn S, Tamse A, Zuckerman O.

Obiettivi restaurativi

- Minimizzare costo biologico
- Odontoiatria adesiva

CONFUSIONE

TIPI DI CAVITA’- ESTENSIONE-EFFICACIA

Differenti tipi di Cavità di Accesso

Sumo

VS

Ninja

Influence of Access Cavity Design on Root Canal Detection, Instrumentation Efficacy, and Fracture Resistance Assessed in Maxillary Molars

Gabriela Rover, DDS, MSc, Felipe Gonçalves Belladonna, DDS, MSc,† Eduardo Antunes Bortoluzzi, DDS, MSc, PhD,* Gustavo De-Deus, DDS, MSc, PhD,† Emmanuel João Nogueira Leal Silva, DDS, MSc, PhD,‡§ and Cleonice Silveira Teixeira, DDS, MSc, PhD**

Abstract

Introduction: The aim of this study was to assess the influence of contracted endodontic cavities (CECs) on root canal detection, instrumentation efficacy, and fracture resistance assessed in maxillary molars. Traditional endodontic cavities (TECs) were used as a reference for comparison. **Methods:** Thirty extracted intact maxillary first molars were scanned with micro–computed tomographic imaging at a resolution of 21 μm, assigned to the CEC or TEC group (n = 15/group), and accessed accordingly. Root canal detection was performed in 3 stages: (1) no magnification, (2) under an operating microscope (OM), and (3) under an OM and ultrasonic troughing. After root canal preparation with Reciproc instruments (VDW GmbH, Munich, Germany), the specimens were scanned again. The noninstrumented canal group at 5 mm from the apical end ($P < .05$). There was no difference regarding fracture resistance among the CEC (996.30 ± 490.78 N) and TEC (937.55 ± 347.25 N) groups ($P > .05$). **Conclusions:** The current results did not show benefits associated with CECs. This access modality in maxillary molars resulted in less root canal detection when no ultrasonic troughing associated to an OM was used and did not increase fracture resistance. *(J Endod 2017;43:1657–1662)*

Key Words

Endodontic cavity, fracture resistance, instrumentation efficacy, micro–computed tomography, minimally invasive intervention

Traditional endodontic cavities (TECs) emphasize straight-line pathways into root canals to increase

Significance

The influence of CECs on root canal preparation outcomes and fracture resistance remains limited

CONCLUSIONI: I RISULTATI ATTUALI NON HANNO MOSTRATO BENEFICI ASSOCIATI ALLE CEC. QUESTA MODALITÀ DI ACCESSO NEI MOLARI MASCELLARI HA COMPORTATO UNA MINORE INDIVIDUAZIONE DEL CANALE RADICOLARE QUANDO NON È STATA UTILIZZATA LA TECNICA DI ACCESSO ULTRASONICA ASSOCIATA A UN MO E NON HA AUMENTATO LA RESISTENZA ALLA FRATTURA.

From the *Department of Dentistry, Federal University of Santa Catarina, Florianópolis, Santa Catarina; †Department of Endodontics, Fluminense Federal University, Niterói, Rio de Janeiro, Brazil; ‡Department of Endodontics, School of Dentistry, Grande Rio University, Duque de Caxias, Rio de Janeiro, Brazil; and §Department of Endodontics, Rio de Janeiro State University, Rio de Janeiro, Rio de Janeiro, Brazil.

Address requests for reprints to Dr Cleonice Silveira Teixeira, Rua Haroldo Soares Glavan, 929/16, CEP 88050-005, Cacupé, Florianópolis, Santa Catarina, Brazil. E-mail address: cleotex@uol.com.br

0099-2399/$ - see front matter

http://dx.doi.org/10.1016/j.joen.2017.05.006

The Effect of Endodontic Access Cavities on Fracture Resistance of First Maxillary Molar Using the Extended Finite Element Method

Yiyi Zhang, PhD, DDS, Yuxuan Liu, DDS, Yabu She, DDS, Ye Liang, PhD, DDS, Fei Xu, PhD, DDS, and Changyun Fang, PhD, DDS

Abstract

Introduction: The purpose of this study was to predict the fracture resistance of an endodontically treated first maxillary molar with diverse access cavities using the extended finite element model (XFEM). **Methods:** Based on micro–computed tomographic data of first maxillary molars, the model of a natural tooth and 3 endodontically treated teeth with conservative endodontic cavity, modified endodontic cavity, and traditional endodontic cavity were generated. Four static loads (800 N in total) were applied vertically to the contact points. The distributions of von Mises stress and maximum principal stress were calculated. XFEM was performed to simulate crack initiation and propagation in enamel and dentin. **Results:** In the cervical region, larger stress concentration areas were found in the

Increasing the long-term success of endodontically treated teeth is still a great challenge because of their reduced fracture resistance. Recently, tooth structural integrity was considered as the dominant factor impacting the fracture resistance of endodontically treated teeth (1). To preserve the maximum tooth structure and the optimized biomechanical behavior of endodontically treated teeth, minimally invasive endodontics (MIE) was proposed (2).

Significance

The conservative endodontic cavity reduced the stress concentration in the cervical region and increased the fracture load of dentin. Reducing the removal of dental hard tissue is a practical approach to increase the fracture resistance of endodontically treated teeth.

Following the trend of MIE, Clark and Khademi (3) reported a conservative endodontic cavity (CEC) focusing on minimizing tooth structure removal. Unlike the traditional endodontic cavity (TEC), which required removal of the entire chamber roof and

CIRCA IL 43,52% E IL 34,39% DI TESSUTO CORONALE AGGIUNTIVO E' STATO PRESERVATO DALLA CEC E DALLA MEC RISPETTO ALLA TEC. D'ALTRO CANTO, LA CEC HA AUMENTATO LA CURVATURA DELLO STRUMENTO ENDODONTICO. LA CEC È UN'ARMA A DOPPIO TAGLIO. HA PRESERVATO IL TESSUTO DURO DENTALE A SCAPITO DELL'AUMENTO DELLA CURVATURA DEGLI STRUMENTI ENDODONTICI. QUANDO GLI ANGOLI DEI CANALI RADICOLARI SONO AMPI, LA CEC DOVREBBE ESSERE RICONSIDERATA.

From the Department of Stomatology, Xiangya Hospital, Central South University, Changsha, Hunan, China.

Address requests for reprints to Dr Changyun Fang, Department of Stomatology, Xiangya Hospital, Central South University, 87# Xiangya Road, Changsha, Hunan, China. E-mail address: fangcy@csu.edu.cn

0099-2399/$ - see front matter

https://doi.org/10.1016/j.joen.2018.12.006

Influence of Contracted Endodontic Access on Root Canal Geometry: An *In Vitro* Study

... WE create a double curvature

at canal orifice ...

ALOVISI 2018

Forma o Sostanza ?

TROVARE IL GIUSTO
EQUILIBRIO TRA
"TROPPO" E
"NON ABBASTANZA"

REVIEW

The ferrule effect: a literature review

N. R. Stankiewicz[1] **& P. R. Wilson**[2]

[1]General Dental Practice, Bath, UK; [2]School of Dental Science, The University of Melbourne, Melbourne, Australia

Abstract

Stankiewicz NR, Wilson PR. The ferrule effect: a literature review. *International Endodontic Journal*, **35**, 575–581, 2002.

Literature review A ferrule is a metal ring or cap used to strengthen the end of a stick or tube. It has been proposed that the use of a ferrule as part of the core or artificial crown may be of benefit in reinforcing root-filled teeth. A review of the literature investigating this effect is presented. The literature demonstrates that a ferrule effect occurs owing to the artificial crown bracing against the dentine extending coronal to the crown margin. Overall, it can be concluded that a ferrule is desirable, but should not be provided at the expense of the remaining tooth/root structure.

Keywords: dental prosthesis design, ferrule, post and core, tooth.

Received 30 November 2001; accepted 1 March 2002

Introduction

Successful restoration of root-filled teeth requires an effective coronal seal, protection of the remaining tooth, restored function and acceptable aesthetics. A post-retained crown may be indicated to fulfil these requirements. However, one mode of failure of the post-restored tooth is root fracture. Therefore, the crown and post preparation design features that reduce the chance of root fracture would be advantageous.

A ferrule is a metal ring or cap intended for strengthening. The word probably originates from combining the Latin for iron (ferrum) and bracelets (viriola) (Brown 1993). A dental ferrule is an encircling band of cast metal around the coronal surface of the tooth. It has been proposed that the use of a ferrule as part of the core or artificial crown may be of benefit in reinforcing root-filled teeth. A protective, or 'ferrule effect' could occur owing to the ferrule resisting stresses such as functional lever forces, the wedging effect of tapered posts and the lateral forces exerted during the post insertion (Sorensen & Engelman 1990).

Correspondence: Associate Professor Peter R. Wilson, School of Dental Science, 711 Elizabeth Street, Melbourne, Vic 3000, Australia (Tel.: +613 9341 0275; fax: +613 9341 0339; e-mail: prwilson@unimelb.edu.au).

A literature search was conducted using the Medline database to find papers that have examined the ferrule effect or made reference to it. Papers were found by searching for the word 'ferrule'. Those pertaining to dentistry were then obtained and read to see whether they contributed in examining the ferrule effect. Some of the references used in these papers provided further articles of interest.

Laboratory-based investigation of the ferrule effect

Most research investigating the ferrule effect has been conducted in the laboratory. The complexity of the oral environment prevents clear extrapolation owing to the simplicity of the experiments.

Studies without use of artificial crowns

The concept of an extracoronal 'brace' has been proposed (Rosen 1961) and defined as a "... subgingival collar or apron of gold which extends as far as possible beyond the gingival seat of the core and completely surrounds the perimeter of the cervical part of the tooth. It is an extension of the restored crown which, by its hugging action, prevents shattering of the root."

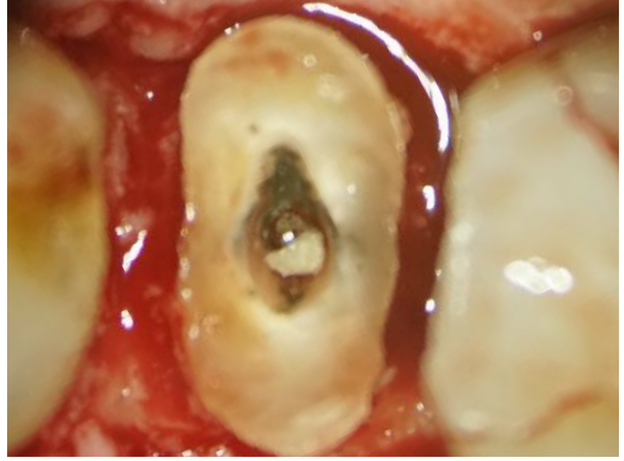
Ferula

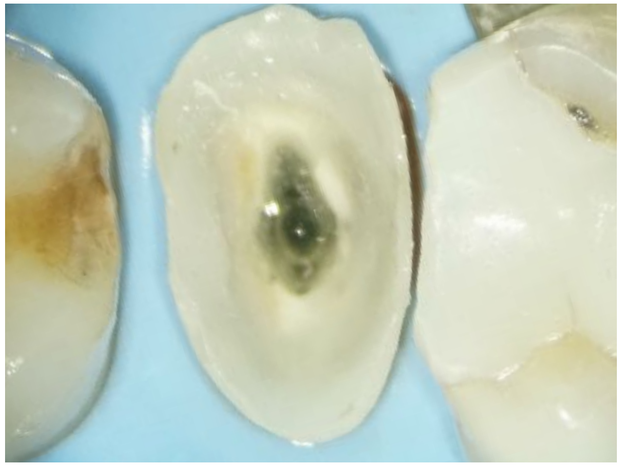
Conclusions

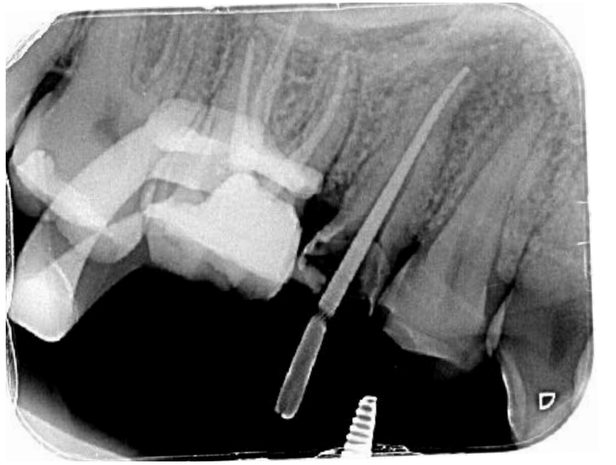
Laboratory evidence shows in some circumstances that a ferrule effect occurs owing to the crown bracing against the dentine extending coronal to the crown margin. Furthermore, a significant increase in resistance to failure in single rooted teeth is observed where this dentine extends at least 1.5 mm. However, the cost of getting this support in teeth with no coronal dentine is loss of tooth tissue. When assessing a tooth prior to root treatment and subsequent restoration with a crown (if needed), a ferrule would be desirable but not at the expense of the remaining tooth/root structure.

STANKIEWICZ & P. R. WILSON. 2002





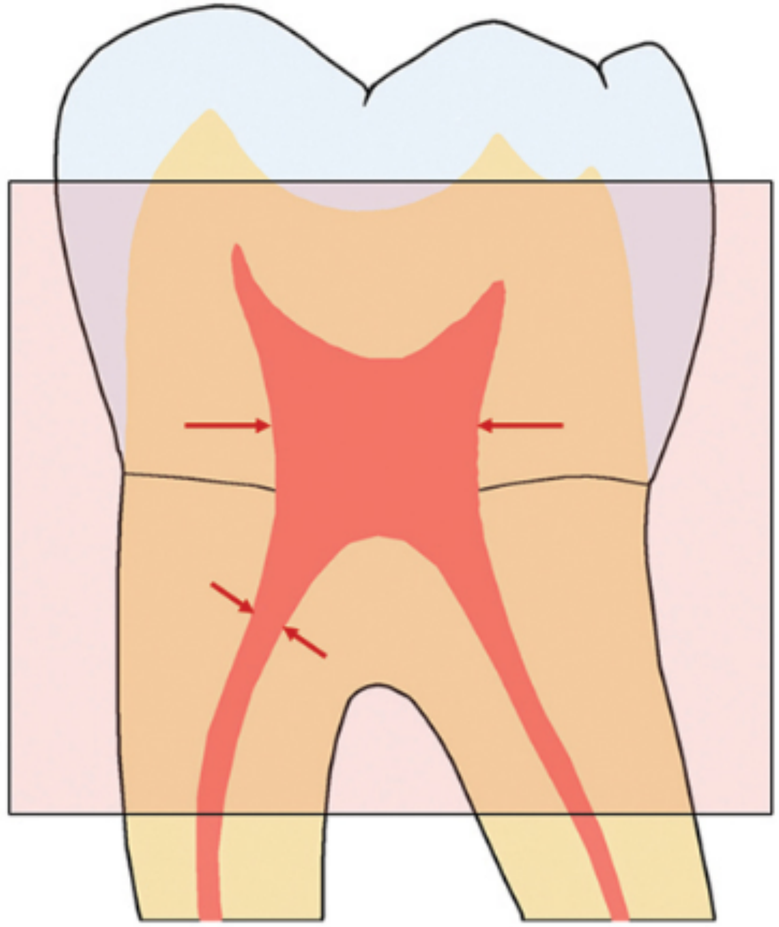





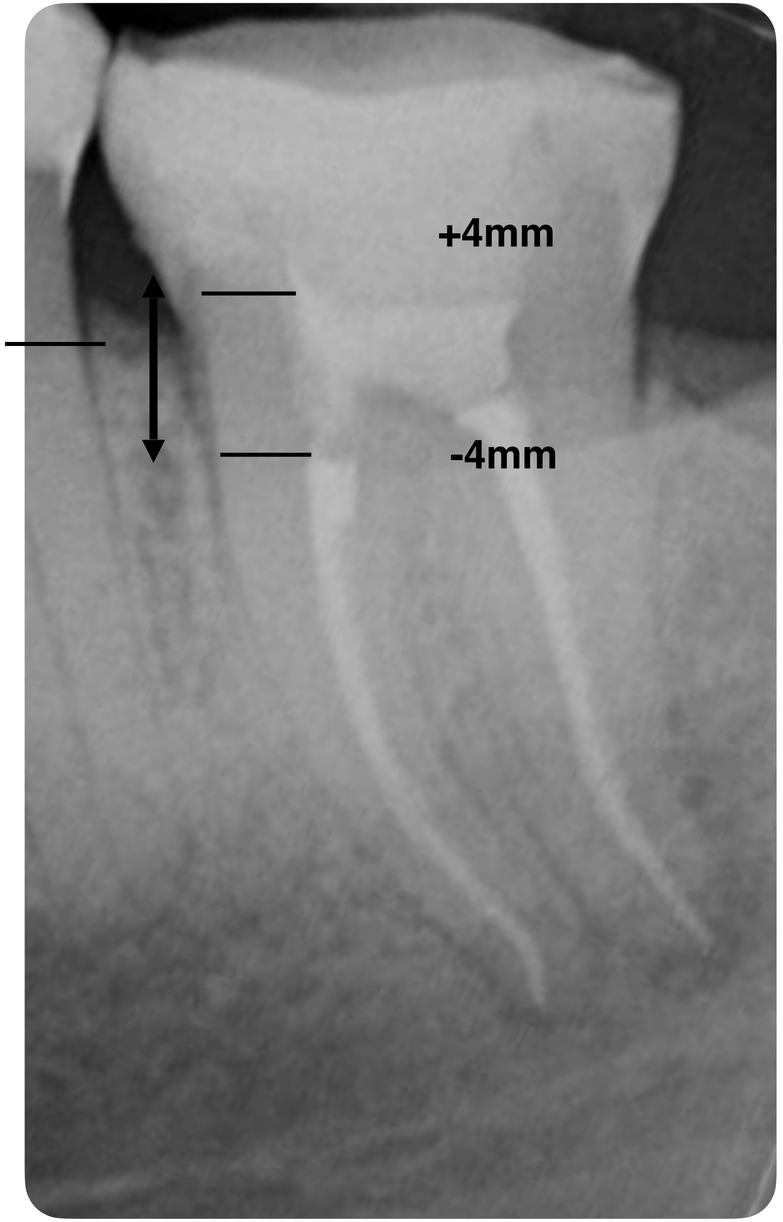


CONSERVAZIONE DELLA

DENTINA PERICERVICALE



1. LA DENTINA PERICERVICALE È LOCALIZZATA GENERALMENTE A 4MM CORONALMENTE E APICALMENTE ALLA CRESTA ALVEOLARE
2. LA DENTINA PERICERVICALE È INSOSTITUIBILE



diagnosis

new technologies

Structure

tools

Tips &tricks

Preservation

skills

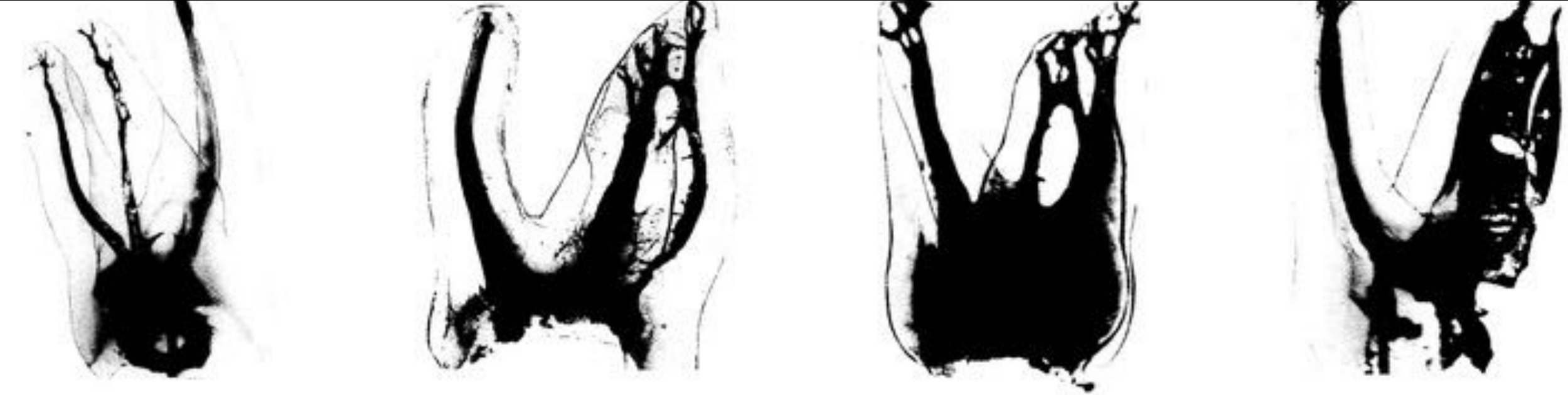
knowledge

research

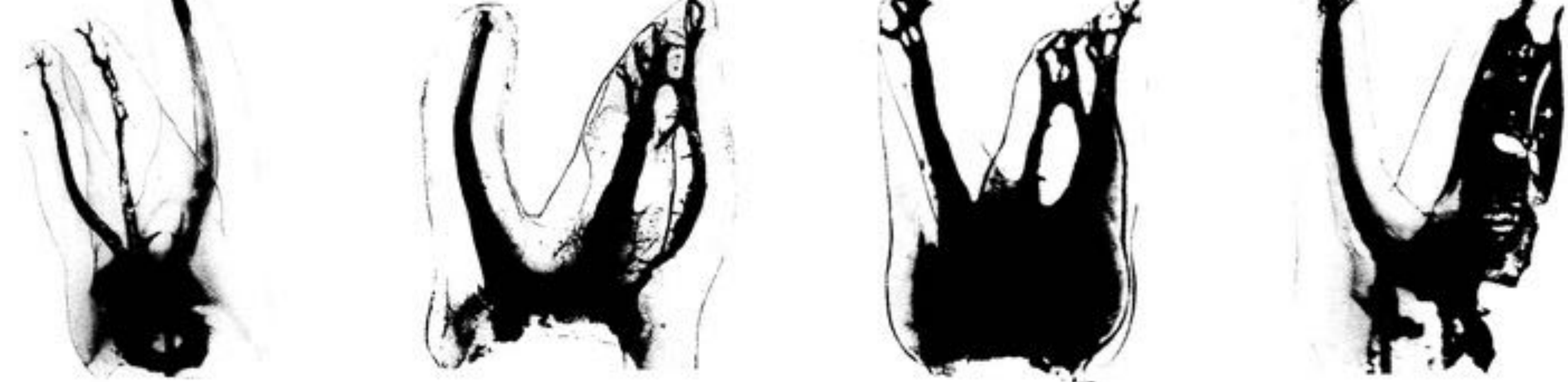
new materials

longevity


Treatment Plan
ANATOMY
diagnosis
knowledge
skills
Tips &tricks
Structure Preservation
tools
longevity
new technologies
research

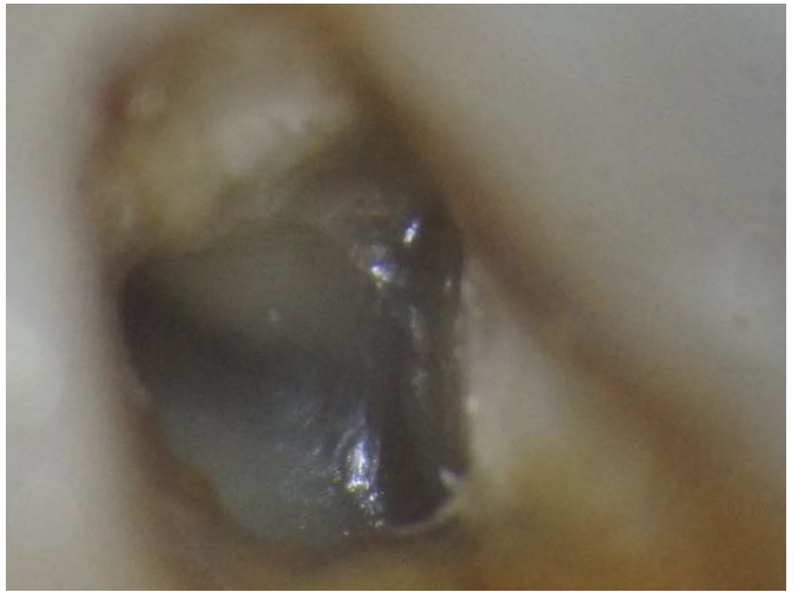
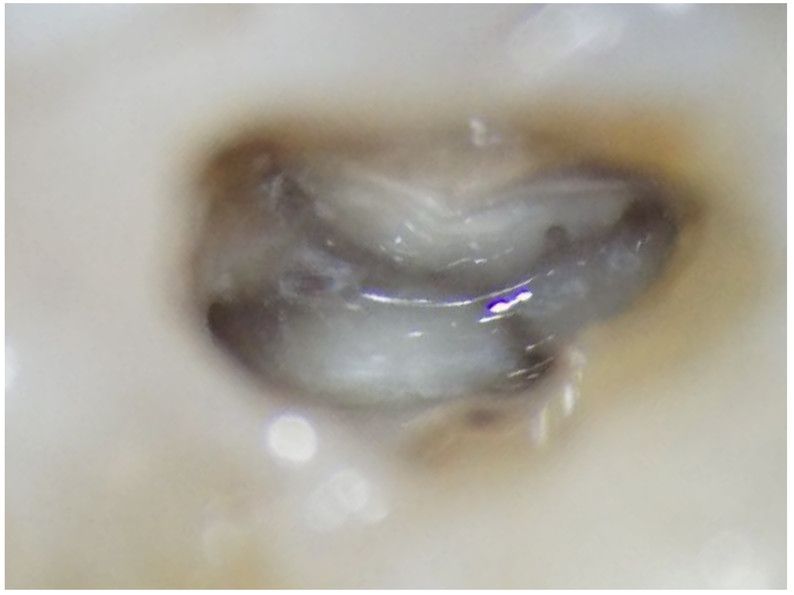
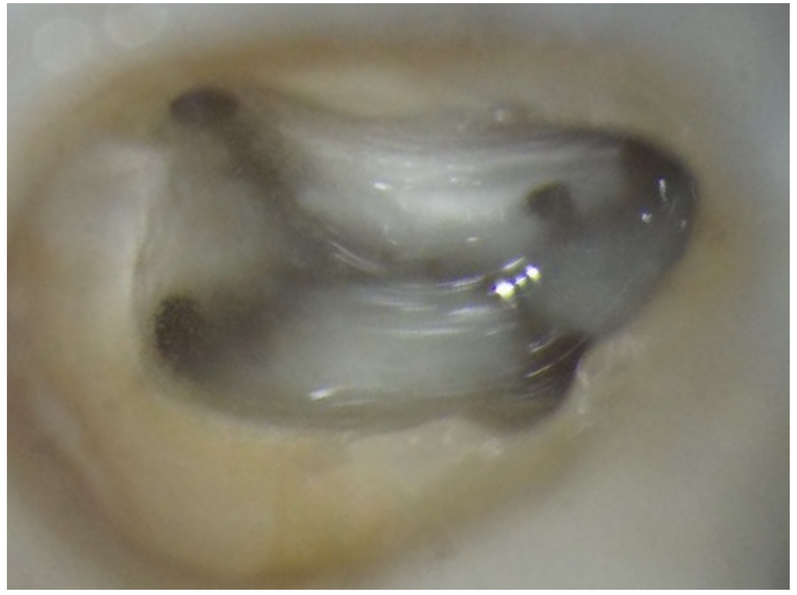


ROOT CANAL ANATOMY VARIETY



EXPECTING THE UNESPECTED Partnoy 2005




ATTENZIONE... UNA ANATOMIA COMPLESSA

J Endod. 2002 Mar;28(3):211-6.

Roentgenographic investigation of frequency and degree of canal curvatures in human permanent teeth.

Schäfer E[1], Diez C, Hoppe W, Tepel J.

Author information

Abstract

Canal curvatures of 700 permanent human teeth were determined by measuring the angle and the radius of the curvatures and the length of the curved part of the canal. For each type of tooth (except third molars) 50 were selected at random and were investigated. Size 08 silver points were inserted into the canals, and the teeth were radiographed from a facial and proximal view by using a standardized technique. All radiographs were analyzed by a computerized digital image processing system. Of the 1163 root canals examined, 980 (84%) were curved and 65% showed an angle < or = 27 degrees with radii < 40 mm. Thirteen percent displayed angles between 27 degrees and 35 degrees with radii not greater than 15 mm, and 9% of all canals that were investigated had curves > 35 degrees with the greatest radius of 13 mm. The greatest angle of all the teeth was 75 degrees with a radius of 2 mm. To define the canal curvature mathematically and unambiguously, the angle, the radius, and the length of the curve should be given.

J Endod. 2002 Mar;28(3):211-6.

Roentgenographic investigation of frequency and degree of canal curvatures in human permanent teeth.

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Author information

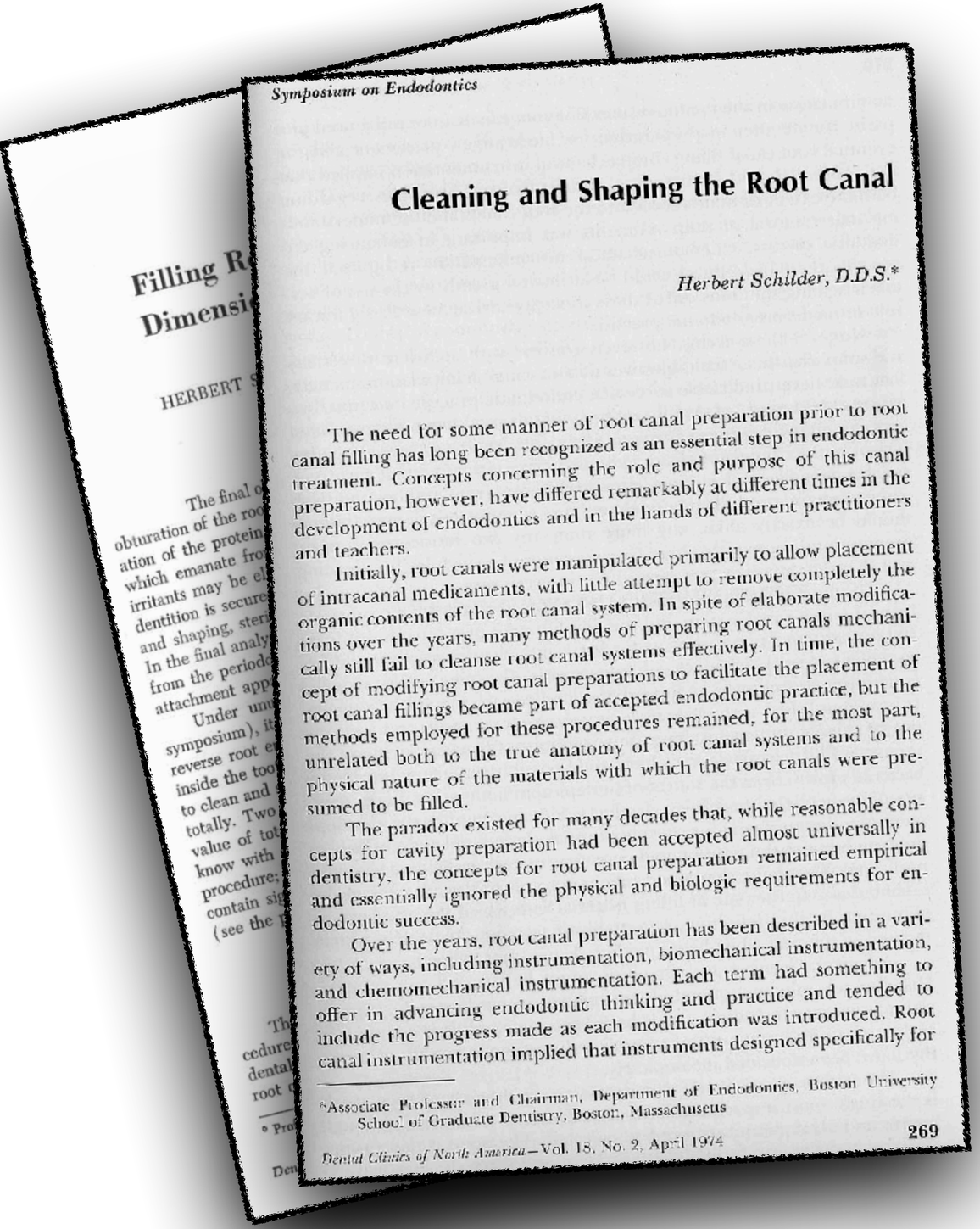
Abstract

Canal curvatures of 700 permanent h… …e curvatures and the length of the curved part of the canal. For each type of toe… …ed. Size 08 silver points were inserted into the canals, and the teeth were ra… …nique. All radiographs were analyzed by a computerized digital image processin… …d 65% showed an angle < or = 27 degrees with radii < 40 mm. Thirteen percent … …ter than 15 mm, and 9% of all canals that were investigated had curves > 35 de… …eth was 75 degrees with a radius of 2 mm. To define the canal curvature mather… …curve should be given.

1163 roots examined:
980 (84%) curved

65% angle <27°
30% angle 27-35°
9% angle > 35°

DAILY PRACTICE



Symposium on Endodontics

Cleaning and Shaping the Root Canal

*Herbert Schilder, D.D.S.**

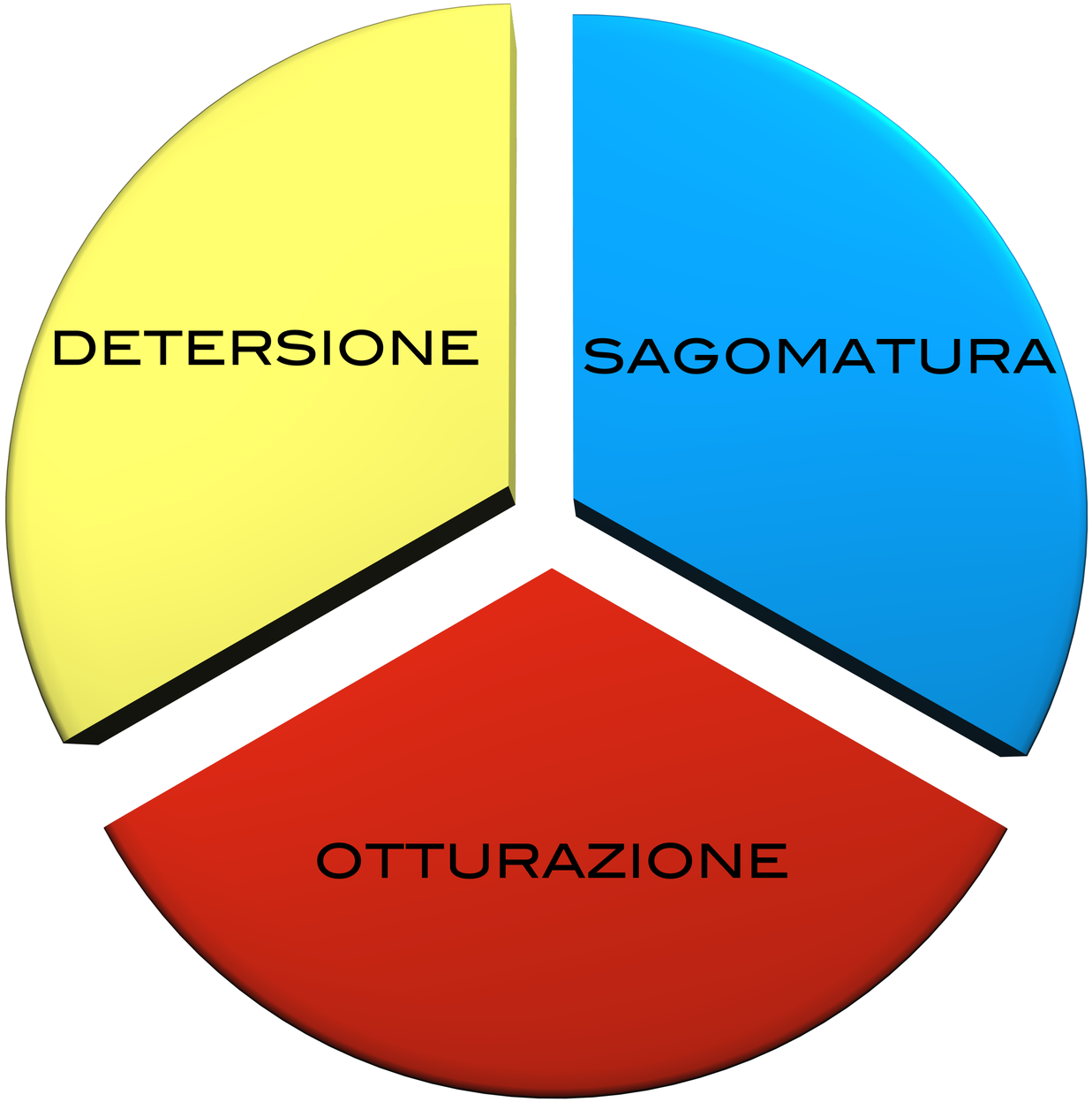
The need for some manner of root canal preparation prior to root canal filling has long been recognized as an essential step in endodontic treatment. Concepts concerning the role and purpose of this canal preparation, however, have differed remarkably at different times in the development of endodontics and in the hands of different practitioners and teachers.

Initially, root canals were manipulated primarily to allow placement of intracanal medicaments, with little attempt to remove completely the organic contents of the root canal system. In spite of elaborate modifications over the years, many methods of preparing root canals mechanically still fail to cleanse root canal systems effectively. In time, the concept of modifying root canal preparations to facilitate the placement of root canal fillings became part of accepted endodontic practice, but the methods employed for these procedures remained, for the most part, unrelated both to the true anatomy of root canal systems and to the physical nature of the materials with which the root canals were presumed to be filled.

The paradox existed for many decades that, while reasonable concepts for cavity preparation had been accepted almost universally in dentistry, the concepts for root canal preparation remained empirical and essentially ignored the physical and biologic requirements for endodontic success.

Over the years, root canal preparation has been described in a variety of ways, including instrumentation, biomechanical instrumentation, and chemomechanical instrumentation. Each term had something to offer in advancing endodontic thinking and practice and tended to include the progress made as each modification was introduced. Root canal instrumentation implied that instruments designed specifically for

*Associate Professor and Chairman, Department of Endodontics, Boston University School of Graduate Dentistry, Boston, Massachuseus



SHILDER 1974

Sagomatura

Detersione

Otturazione

SHILDER 1974

Obiettivi del Trattamento

Meccanici

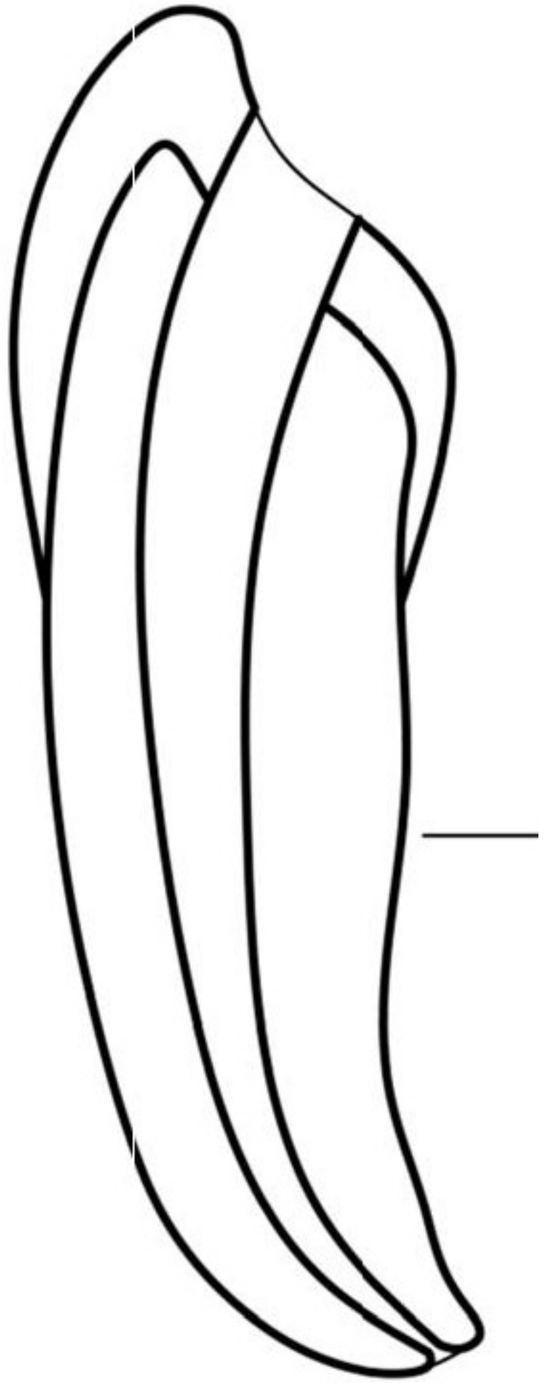
* Conicità continua da corona ad apice
* Preservare le curvature del canale
* Preservare il diametro apicale

Biologici

* Rimuovere la polpa malata
* Ridurre la carica batterica

OBIETTIVI MECCANICI

* Conicità continua da corona ad apice
* Preservare le curvature del canale
* Preservare il diametro apicale



SHILDER 1974

Strumentazione Endodontica

LA STRUMENTAZIONE NON MODIFICA I PRINCIPI BASE DELL' ENDODONZIA

MANUALI IN ACCIAIO

ROTANTI IN ACCIAIO

FILE ROTANTI IN NI-TI

FASI DELLA STRUMENTAZIONE CANALARE

- **Negoziazione** (Scouting, Preflaring, Glide path)
- **Sagomatura** (Preparazione troncoconica del canale)
- **Rifinitura** (Determinazione diametro apicale e Preparazione finale)

SONDAGGIO MANUALE ?

- Sondaggio iniziale
- Glide Path
- Sondaggio terzo apicale

FEEDBACK TATTILE: LA SENSIBILITA' DELL'ACCIAIO NELLO SCOUTING

- Anatomia
- Lunghezza
- Difficoltà del caso
- Scelta della sistematica idonea

PREFLARING

- Elimina le interferenze coronali che impediscono ai fili di lavorare correttamente
- Facilita la rilevazione della anatomia e la valutazione della LL
- Minimizza i cambiamenti dimensionali della L durante le fasi di preparazione canalare

Influence of cervical preflaring on apical file size determination

J. D. Pecora[1], A. Capelli[1], D. M. Z. Guerisoli[1], J. C. E. Spanó[1] & C. Estrela[2]

[1]Ribeirão Preto Dental School, University of São Paulo, Ribeirão Preto, SP, Brazil; and [2]Department of Endodontics, Federal University of Goias, Goiânia, GO, Brazil

Abstract

Pecora JD, Capelli A, Guerisoli DMZ, Spanó JCE, Estrela C. Influence of cervical preflaring on apical file size determination. *International Endodontic Journal*, **38**, 430–435, 2005.

Aim To investigate the influence of cervical preflaring with different instruments (Gates-Glidden drills, Quantec Flare series instruments and LA Axxess burs) on the first file that binds at working length (WL) in maxillary central incisors.

Methodology Forty human maxillary central incisors with complete root formation were used. After standard access cavities, a size 06 K-file was inserted into each canal until the apical foramen was reached. The WL was set 1 mm short of the apical foramen. Group 1 received the initial apical instrument without previous preflaring of the cervical and middle thirds of the root canal. Group 2 had the cervical and middle portion of the root canals enlarged with Gates-Glidden drills sizes 90, 110 and 130. Group 3 had the cervical and middle thirds of the root canals enlarged with nickel-titanium Quantec Flare series instruments. Titanium-nitrite treated, stainless steel LA Axxess burs were used for preflaring the cervical and middle portions of root canals from group 4. Each canal was sized using manual K-files, starting with size 08 files with passive movements until the WL was reached. File sizes were increased until a binding sensation was felt at the WL, and the instrument size was recorded for each tooth. The apical region was then observed under a stereoscopic magnifier, images were recorded digitally and the differences between root canal and maximum file diameters were evaluated for each sample.

Results Significant differences were found between experimental groups regarding anatomical diameter at the WL and the first file to bind in the canal ($P < 0.01$, 95% confidence interval). The major discrepancy was found when no preflaring was performed (0.151 mm average). The LA Axxess burs produced the smallest differences between anatomical diameter and first file to bind (0.016 mm average). Gates-Glidden drills and Flare instruments were ranked in an intermediary position, with no statistically significant differences between them (0.093 mm average).

Conclusions The instrument binding technique for determining anatomical diameter at WL is not precise. Preflaring of the cervical and middle thirds of the root canal improved anatomical diameter determination; the instrument used for preflaring played a major role in determining the anatomical diameter at the WL. Canals preflared with LA Axxess burs created a more accurate relationship between file size and anatomical diameter.

Keywords: apical file size determination, coronal flaring, instrument type.

Received 21 May 2003; accepted 10 January 2005

Introduction

Current standards in root canal treatment are based on cleaning and shaping the root canal prior to filling (West & Roane 1998). Some authors suggest that the amount of apical enlargement to be achieved during shaping of the canal should be based on the estimation of initial apical diameter and by three file sizes greater

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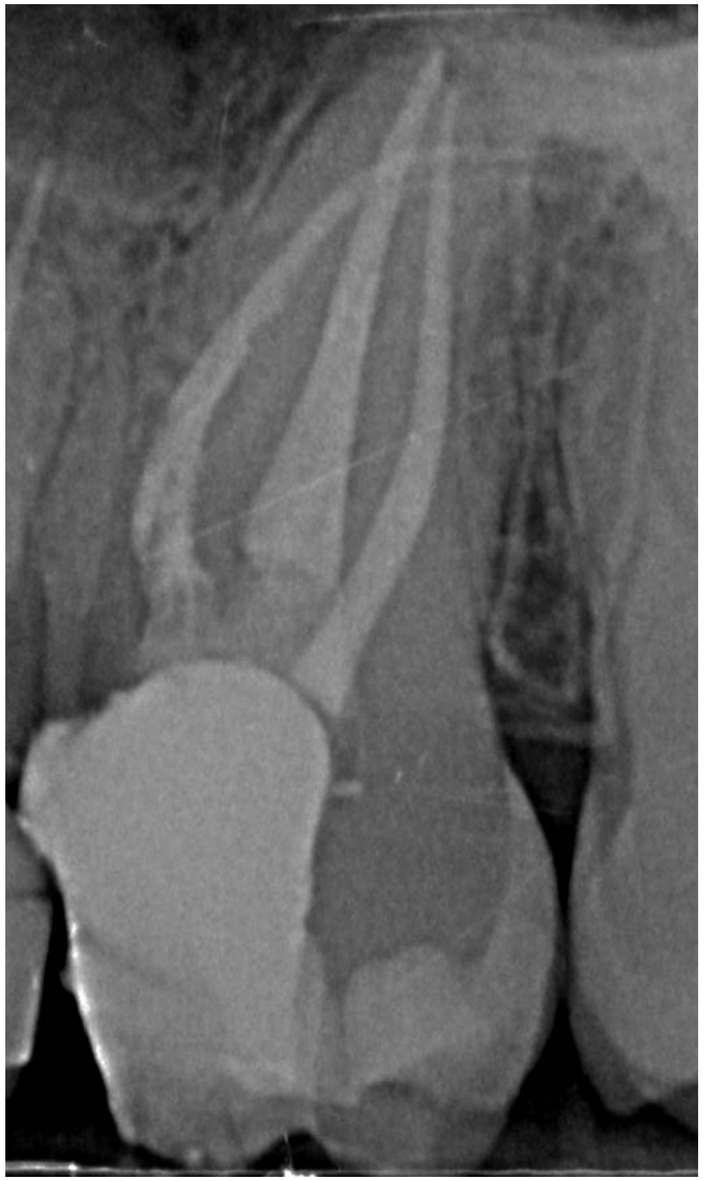
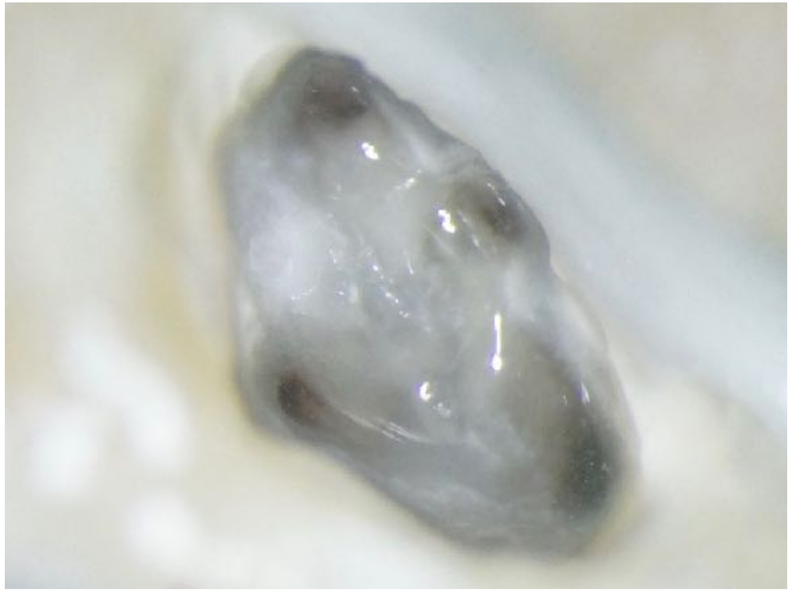
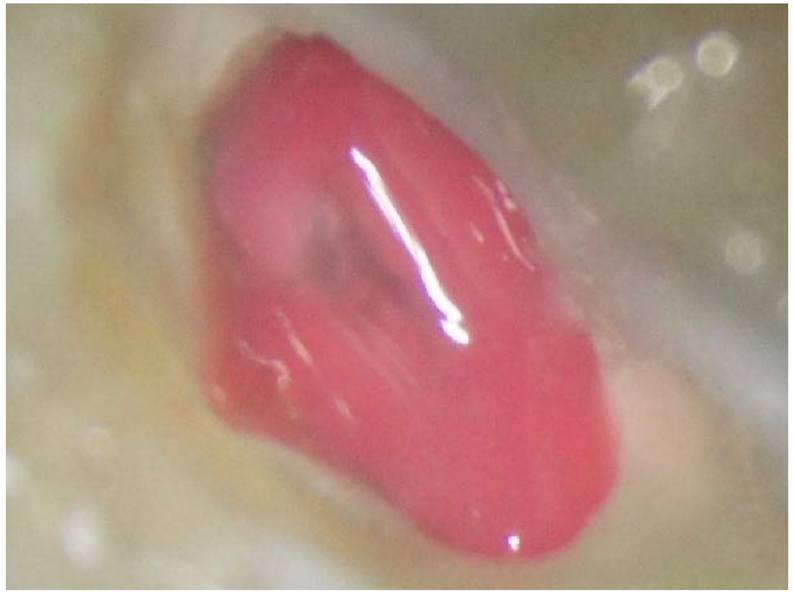
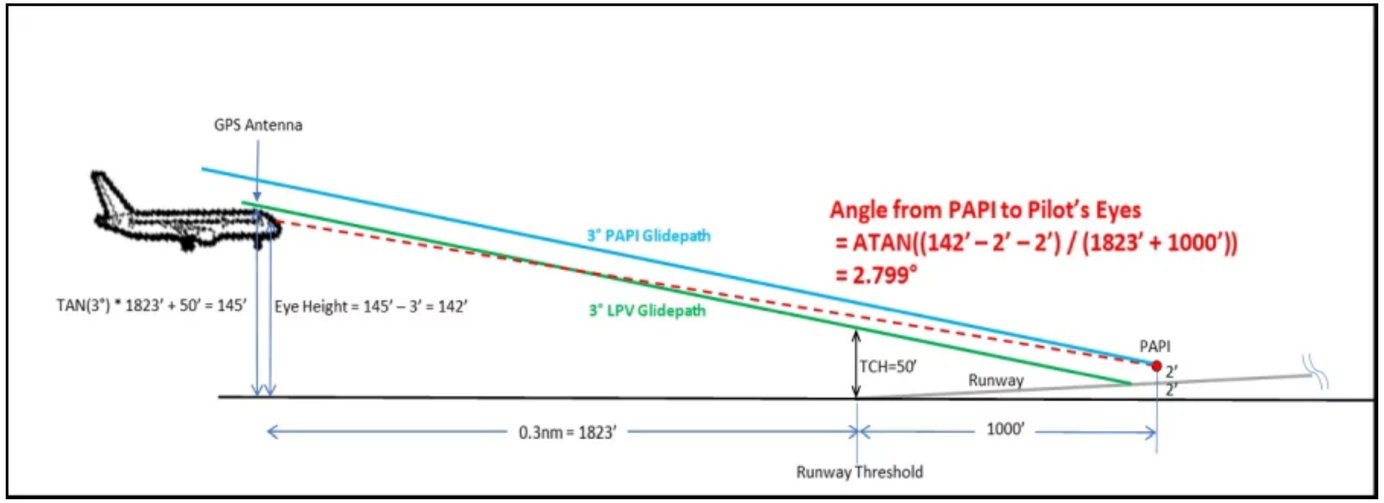






GLIDEPATH

- Un sentiero agevole di scorrimento dall'imbocco del canale alla costrizione apicale
- Permette agli strumenti di progredire senza impedimenti in direzione corono apicale



GLIDEPATH

Comparative Study > J Endod. 2009 Mar;35(3):408-12. doi: 10.1016/j.joen.2008.11.021.

Use of nickel-titanium rotary PathFile to create the glide path: comparison with manual preflaring in simulated root canals

Elio Berutti [1], Giuseppe Cantatore, Arnaldo Castellucci, Giorgio Chiandussi, Francesco Pera, Giuseppe Migliaretti, Damiano Pasqualini

"the inexpert clinician produced more conservative shaping with Pathfiles than did the expert with manual preflaring"

Glide Path Enlargement of Mandibular Molar Canals by Using K-files, the ProGlider File, and G-Files: A Comparative Study of the Preparation Times

Farzana Paleker [1], Peet J van der Vyver [2]

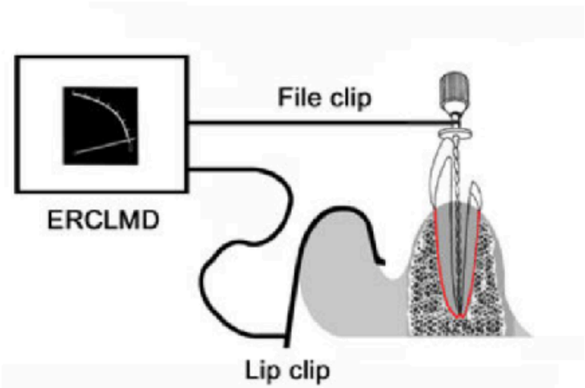
Conclusions: Glide path preparation times with the rotary instrument groups were significantly faster than with stainless steel manual K-files.

PERCHE' NON SI ARRIVA IN APICE ?

- Lo strumento si incastra perchè il suo diametro è superiore a quello del canale
- Interferenze nelle porzioni più coronali non rimosse con pre allargamento
- Curvatura apicale accentuata. Lo strumento non avanza ma risulta libero nel canale
- Canale non deterso adeguatamente e conseguente presenza di detriti dentali

LUNGHEZZA DI LAVORO

I localizzatori elettronici dell'apice nascono sostanzialmente come "ohmetri". L'ohmetro è uno strumento che misura la resistenza al passaggio di una corrente elettrica. Nel caso dell'impiego dentale il passaggio di corrente avviene nel contesto dei tessuti: un elettrodo del dispositivo è applicato ad uno strumento canalare che percorre il canale, l'altro ad un piccolo gancio metallico che è in contatto con la mucosa orale (Fig. 1).



Dr. Venturi Website

Rilevatore Apicale

SHAPING/SAGOMATURA

- Fase di sagomatura per la creazione di uno spazio detergibile ed otturabile
- Gli strumenti rotanti Ni-ti facilitano le procedure, riducendo gli errori

Ni-ti in endodonzia

0099-2399/88/1407-0346/$02.00/0
JOURNAL OF ENDODONTICS

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An Initial Investigation of the Bending and Torsional Properties of Nitinol Root Canal Files

Harmeet Walia, BDS, MDS, MS, MS, William A. Brantley, BS, MS, PhD, and Harold Gerstein, BS, DDS

Root canal files in size #15 and triangular cross-sections were fabricated from 0.020-inch diameter arch wires of Nitinol, a nickel-titanium orthodontic alloy with a very low modulus of elasticity. A unique manufacturing process was used in which the fluted structure of a K-type file was machined directly on the starting wire blanks. The Nitinol files were found to have two to three times more elastic flexibility in bending and torsion, as well as superior resistance to torsional fracture, compared with size #15 stainless steel files manufactured by the same process. The fracture surfaces for clockwise and counterclockwise torsion were observed with the scanning electron microscope and exhibited a largely flat morphology for files of both alloy types and torsional testing modes. It was possible to permanently pre-curve the Nitinol files in the manner often used by clinicians with stainless steel files. These results suggest that the Nitinol files may be promising for the instrumentation of curved canals, and evaluations of mechanical properties and in vitro cutting efficiency are in progress for size #35 instruments.

It is well known by clinicians that inadvertent procedural errors can occasionally arise during the instrumentation of curved canals. These misfortunes include ledge or zip formation, perforation of the canal, and separation or fracture of the instrument (1). As a consequence, the root canal morphology is adversely altered, a violation of the basic principle that endodontic preparation is to retain the original shape of the canal. Clinicians have adopted various methods to circumvent problems with the preparation of curved canals, such as precurving instruments and using a telescopic filing technique (1–3). Weine (4) has suggested that clinicians might remove the tips of instruments at chairside to make intermediate sizes for use in the preparation of curved canals.

The procedural errors which may occur during the instrumentation of curved canals have a common genesis: the basic stiffness of the stainless steel alloys (5) utilized for the manufacture of root canal files and reamers. Moreover, there is a substantial rise in instrument stiffness with increasing instrument size (6). For example, with the stainless steel files and reamers, the smaller sizes of instruments have considerably greater flexibility and can conform much better to the morphology of curved canals.

While manufacturers have recently marketed a number of new instruments based upon different cross-sectional shapes, design concepts, and fabrication procedures, in a quest for improved cutting efficiency (7) and flexibility (8), all of these brands have been fabricated from stainless steel. In this article we report the first use of an entirely new metallurgical system, Nitinol nickel-titanium orthodontic wire alloy (9), for the fabrication of endodontic files. The Nitinol alloy has a very low modulus of elasticity, only one-fourth to one-fifth the value for stainless steel, and a very wide range for elastic deformation.

The purposes of this initial study were to investigate the feasibility of manufacturing root canal files from Nitinol and to evaluate the bending and torsional properties of these instruments. The results of our laboratory study suggest the possibility of a new generation of files, possessing a degree of flexibility which may be ideally suited for instrumenting curved canals.

MATERIALS AND METHODS

Standard preformed Nitinol arch wire blanks, 0.020 inch in diameter, were obtained (Unitek Corp., Monrovia, CA), and two 2-inch straight segments from each arch wire were used for instrument fabrication. A unique file manufacturing process was used (Quality Dental Products, Johnson City, TN), in which the fluted cross-sectional shape was machined directly on the wire blank, rather than the conventional (10) manufacturing procedure of twisting the ground and tapered blank. For this initial feasibility study, experimental Nitinol root canal files were fabricated in size #15 and triangular cross-sections, for comparison to size #15 stainless steel files with the same cross-sectional shape and manufactured by the same process, which served as the controls.

The Nitinol and stainless steel files were evaluated in the three mechanical testing modes of cantilever bending, clockwise torsion, and counterclockwise torsion, following the experimental methods previously used by Krupp et al. (8). Values of bending and torsional moment were measured with a sensitive torque meter (model 783-C-1; Power Instruments, Inc., Skokie, IL), using a manual-loading experimental procedure and an apparatus based upon the original form of American Dental Association specification no. 28 (11). All specimens were subjected to bending or twisting at a point 3

The forms of the bending curves in Fig. 5 indicate that permanent deformation of the 3-mm apical regions of the stainless steel files began at a bend angle of approximately 30 degrees, but that the apical regions of the Nitinol files were undergoing largely elastic deformation even at bend angles of 90 degrees. The latter was supported by visual observations of the Nitinol files after unloading, where very little, if any, permanent bends were evident.

The Nitinol files also exhibited considerably greater resistance to fracture in torsion than the stainless steel files. For

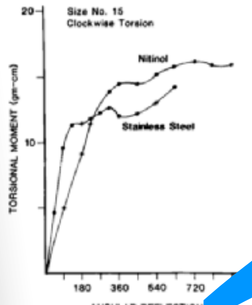
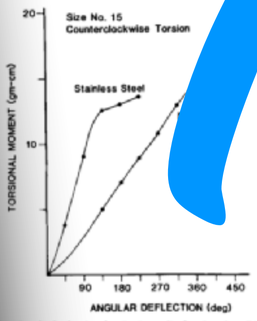


Fig 6. Clockwise torsion test results for the size #15 N
stainless steel files.



ounterclockwise torsion test results for the size #15 Nitinol
nless steel files. The two initial data points for the Nitinol files
t be determined with the torque meter, and the two plots
s drawn to intersect the origin. Both of these considerations
nounced in Figs. 5 and 6.

1988

WALIA ET AL JOE

1988

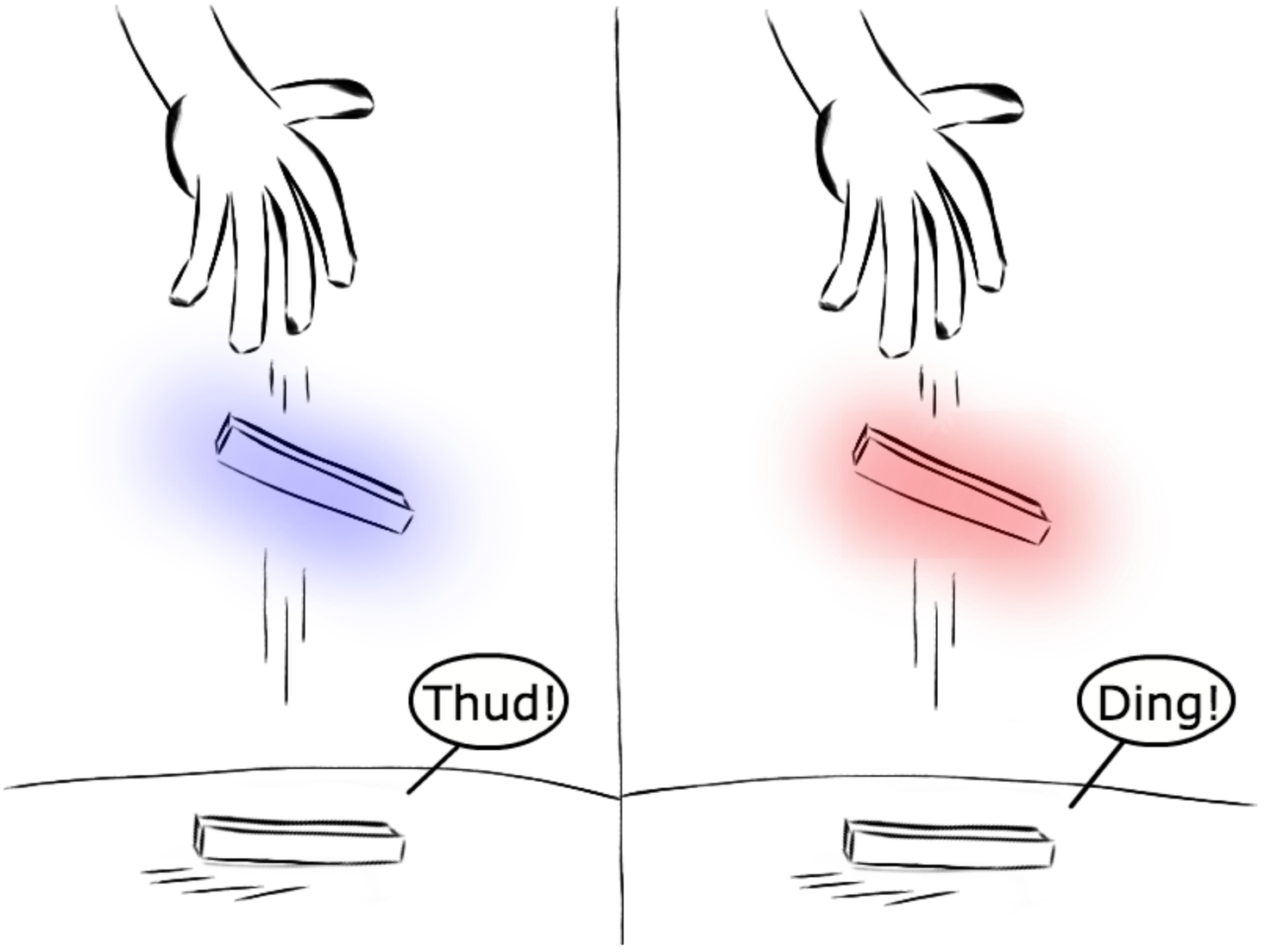
WALIA et AL

Nitinol

Nitinol

Nickel **Ti**tanium **N**aval **O**rdnance **L**aboratory

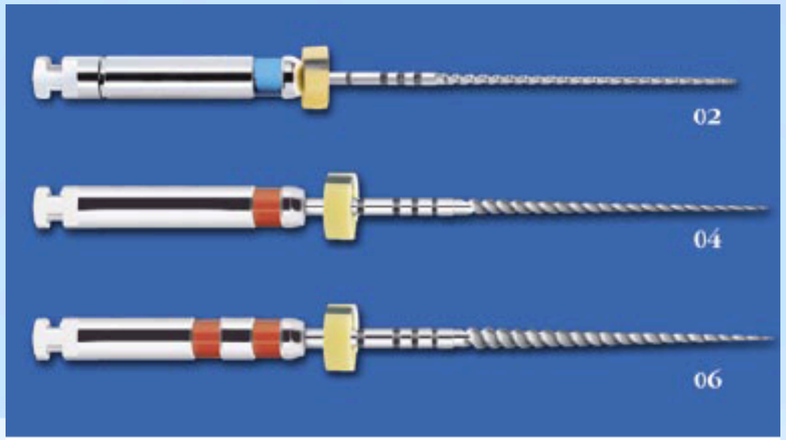
William J Buehler -1963- US Navy Polaris Project

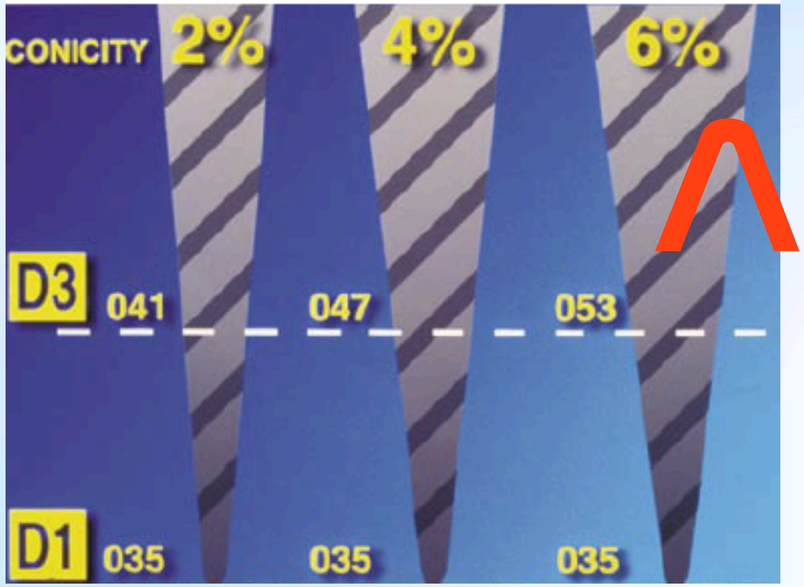

Thud!
Ding!

Ni-Ti in endodontics

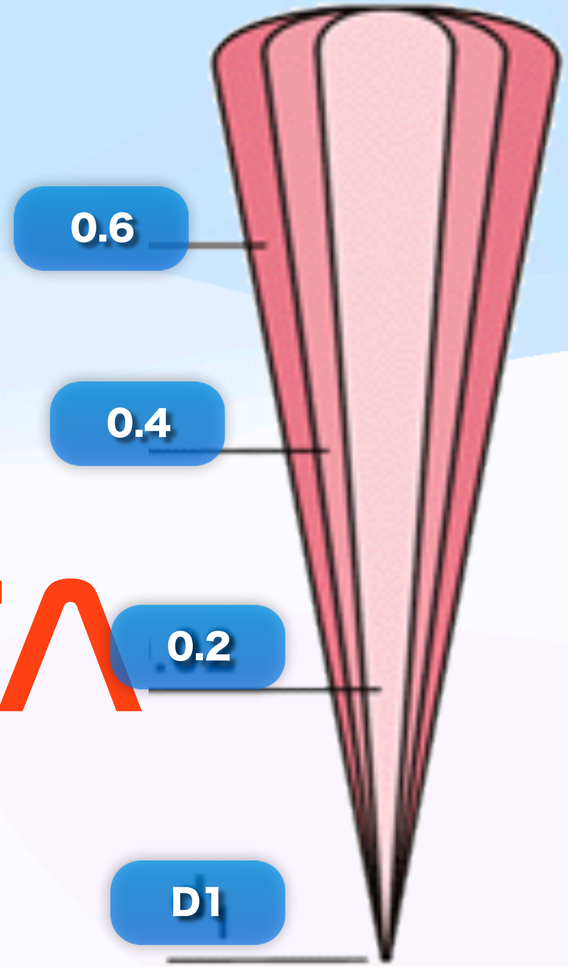
+30 years

VANTAGGIO NI-TI





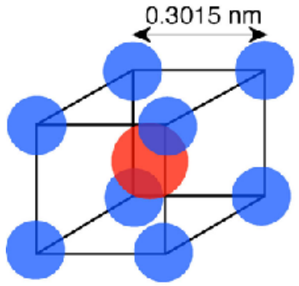
CONICITA' AUMENTATA



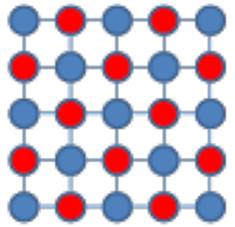
NI-TI

Composto binario intermetallico ed equiatomico

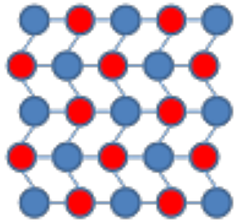
55-45



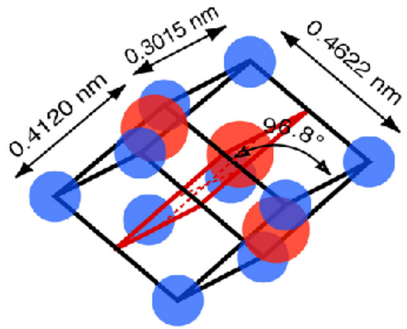
Austenite



La lega può avere due conformazioni atomiche : l'Austenite è la forma più "Rigida e Stabile "a reticolo cubico. La Martensite è la forma meno stabile e più plastica a reticolo esagonale compatto.

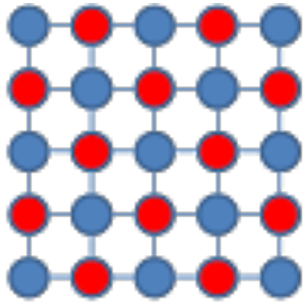


Martensite

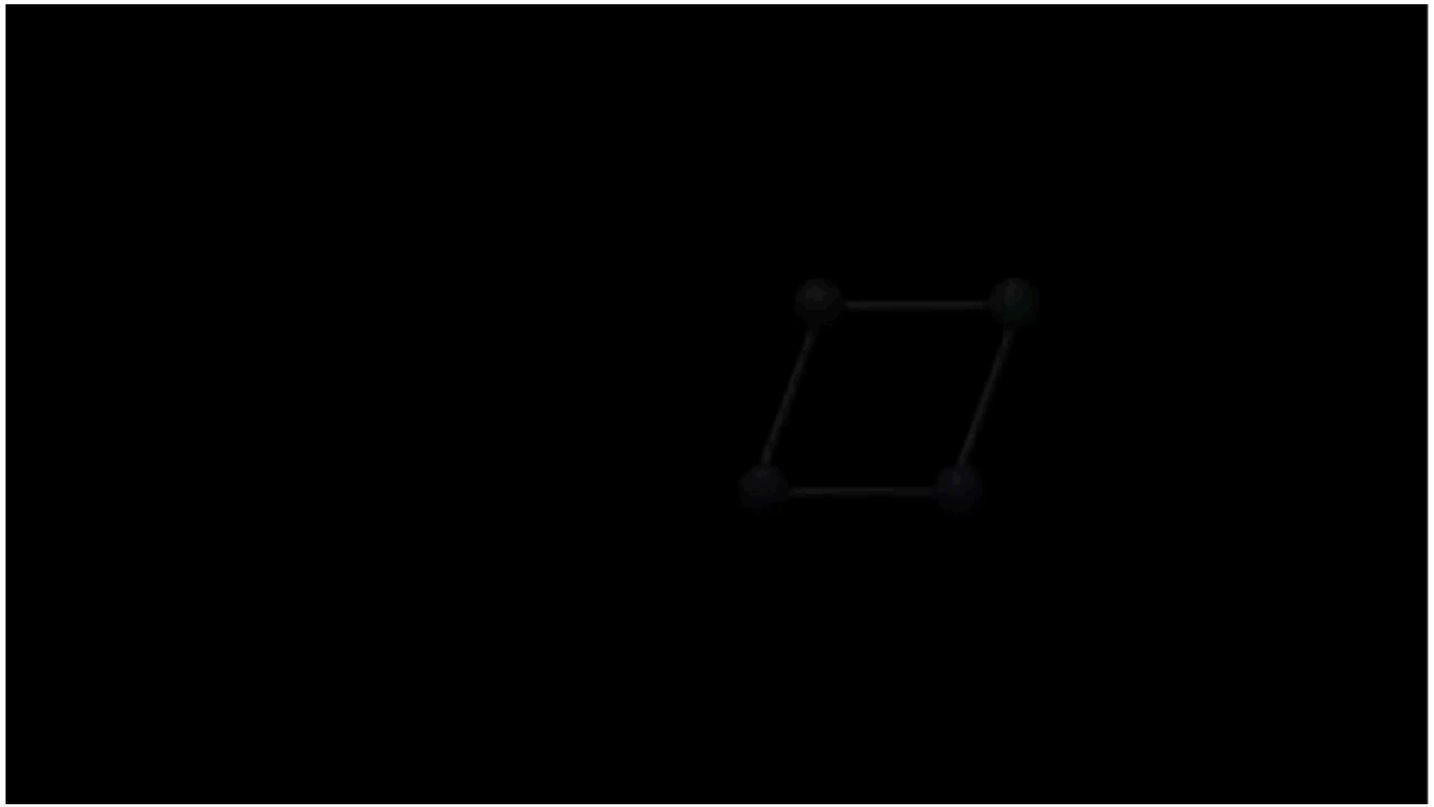


LEGA NI-TI

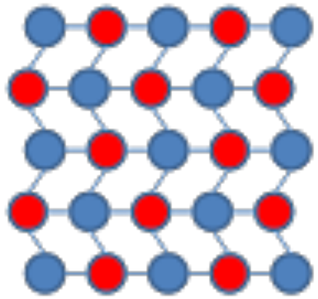
Austenite



RIGIDA



Martensite

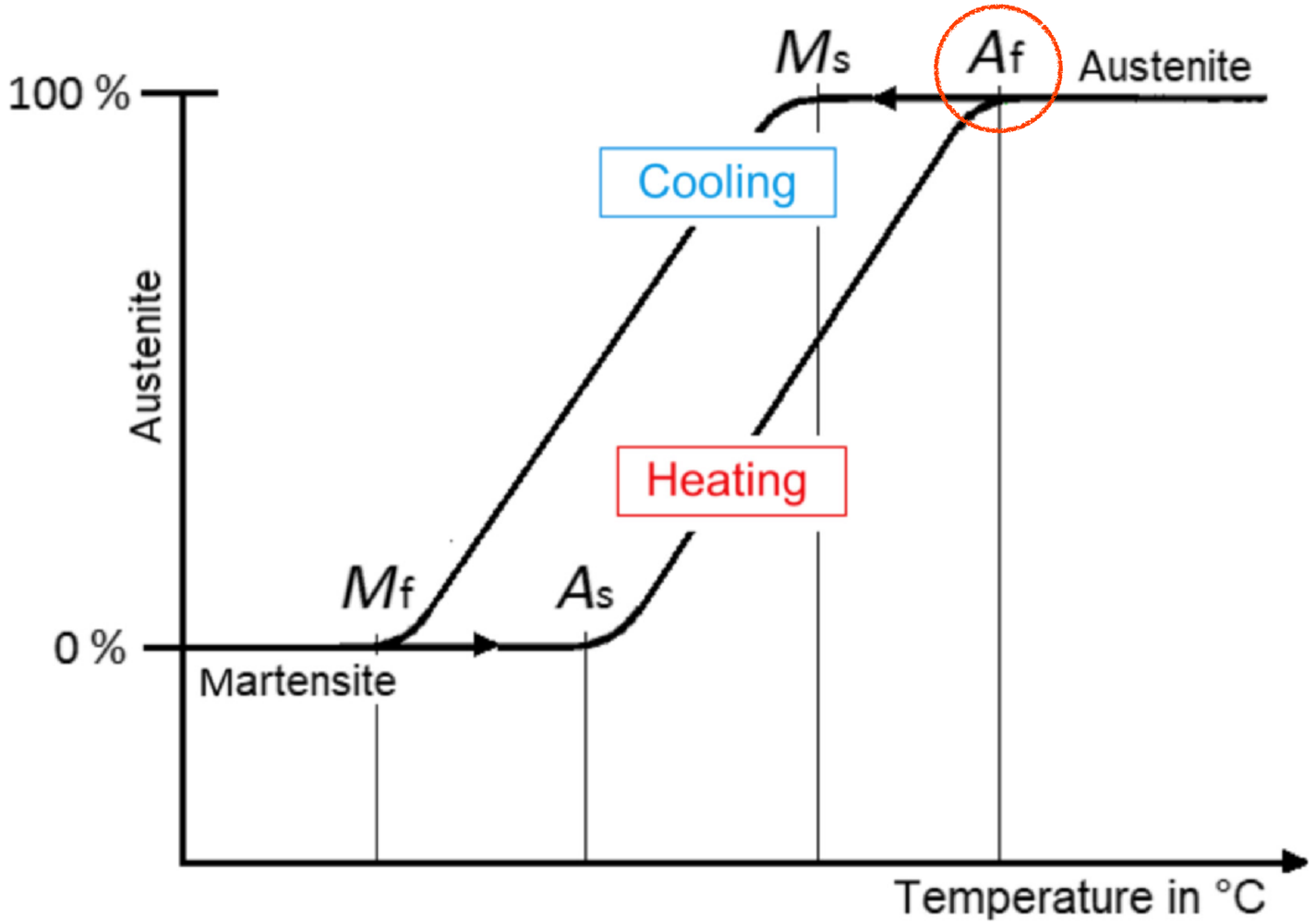


FLESSIBILE

Due differenti fasi cristalline che cambiano le proprietà meccaniche della lega

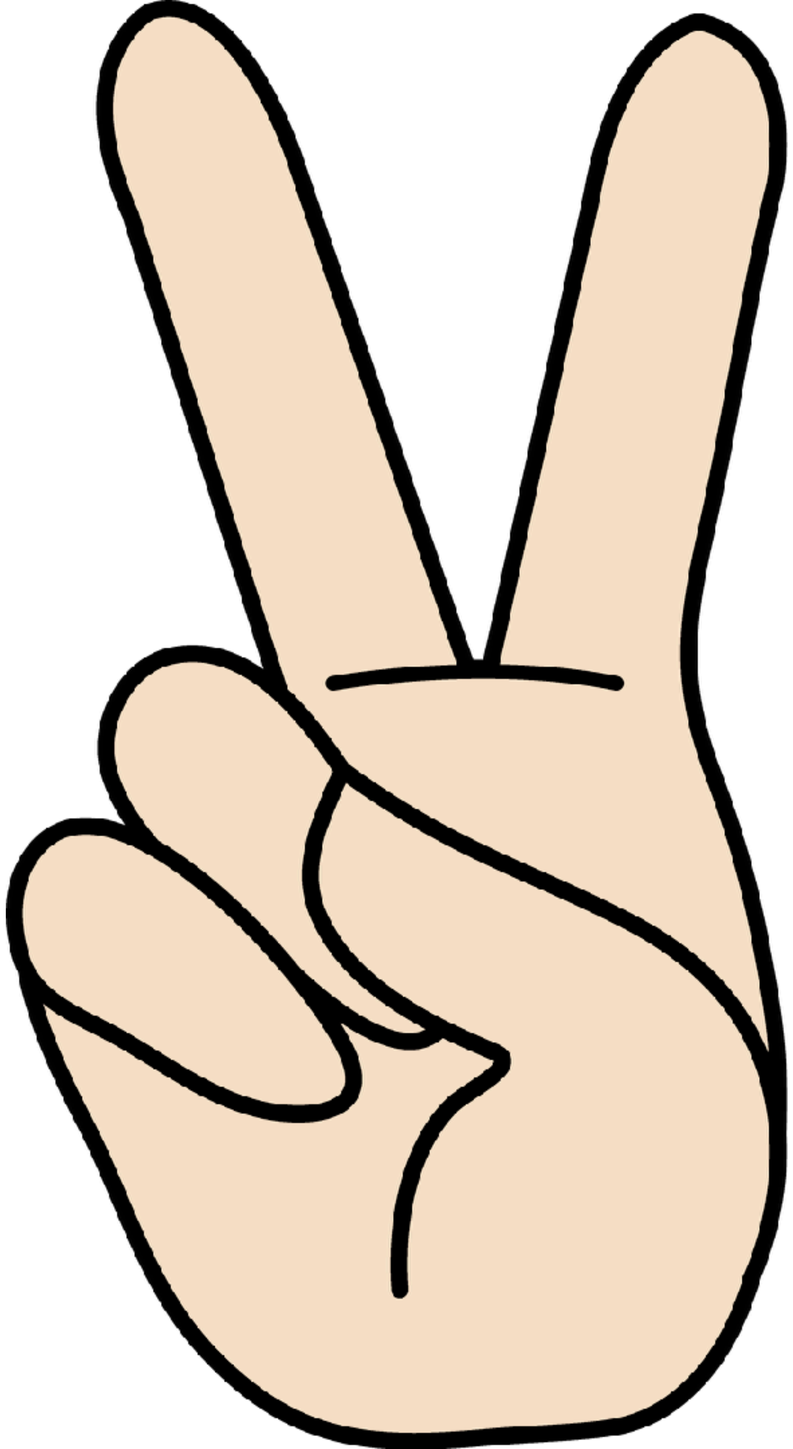
TRANSIZIONE AUSTENITE-MARTENISTE

- L’importanza della Af

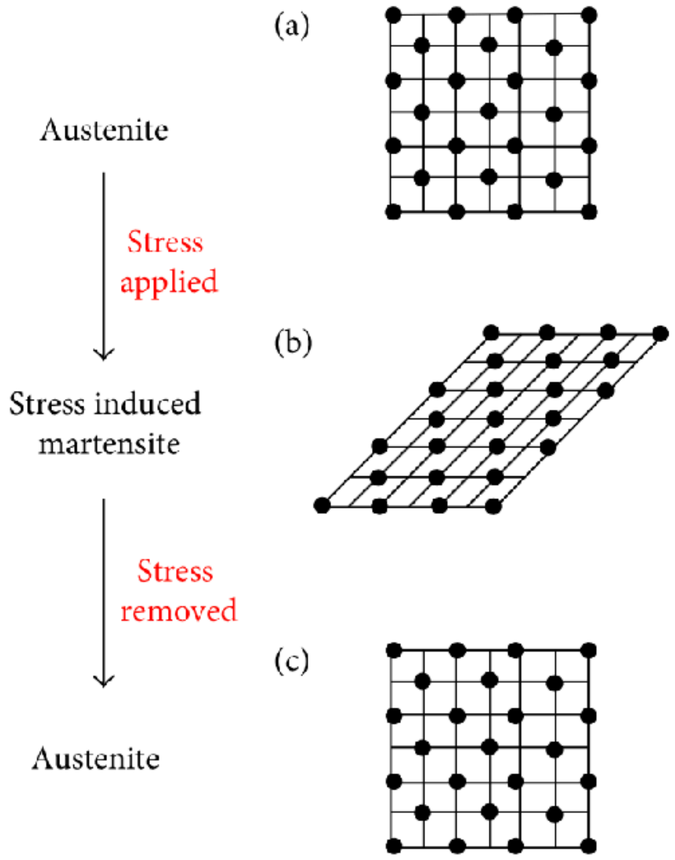


NITINOL

- Pseudoelasticità o Superelasticità
- Memoria di forma



TRANSIZIONE AUSTENITE-MARTENSITE
INDOTTA DA STRESS (SIM)
TEMPERATURA AMBIENTE >Af



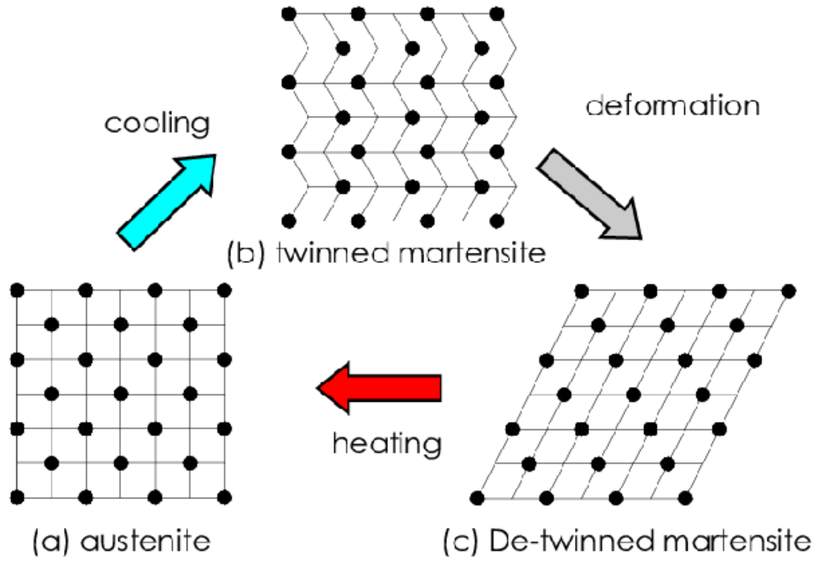
SUPERELASTICITÀ' O PSEUDOELASTICITA'

- La lega può subire ampie deformazioni reversibili in campo elastico, sotto carico costante, per un cambiamento della struttura cristallina (8%)
- La temperatura alla quale avviene la transizione è maggiore della Af (lega completamente in fase autentica)
- Il Carico determina una transizione da Austenite a martenite indotta da stress (SIM)
- Alla rimozione dello stress la martensite, instabile ad una temperatura ambientale superiore ad Af, ritorna alla fase autentica rilasciando energia con un movimento rapidissimo (restoring force/spring back)

MEMORIA DI FORMA

- Quando la lega Ni-ti vine portata a bassa temperatura, assume una configurazione di tipo martensitico (TA < AF)
- La lega in fase martensitica ha un basso limite di snervamento, ossia è facilmente deformabile
- Con il riscaldamento, la lega riarrangia la sua struttura cristallina, ritorna in una configurazione autentica riassumendo la forma iniziale (es sterilizzazione)
- La temperatura alla quale la lega ricorda la sua forma primitiva può essere modificata attraverso appropriati trattamenti termici

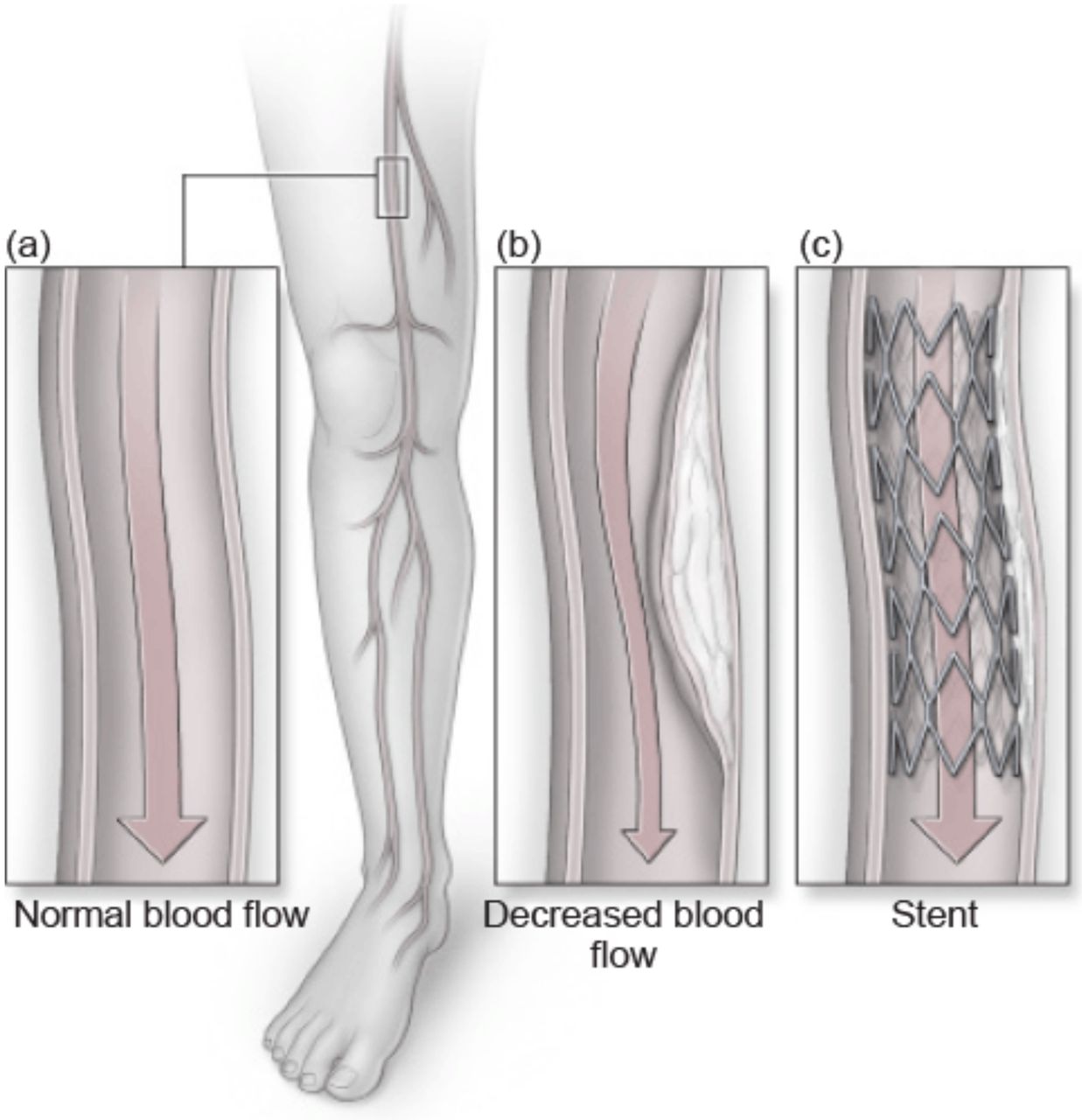
TRANSIZIONE AUSTENITE-MARTENSITE INDOTTA DALLA TEMPERATURA (TIM)
TEMPERATURA AMBIENTE < AF



TRANSIZIONE AUSTENITE-MARTENSITE INDOTTA DALLA TEMPERATURA

MEMORIA DI FORMA -MARTENSITE

UTILIZZI DELLA LEGA A MEMORIA DI FORMA



- La memoria di forma ha reso il Nitinol un materiale ideale in ambiti diversi, dalle missioni spaziali agli stent vascolari per garantire il flusso sanguigno nelle arterie otturate

NEL
DENTE?

Nitinol vs Stainless Steels

Nitinol

More Flexibile

More Resistant

vs

Stainless Steels

DENTAL OFFICE fino al 2010

Af T° (±0)

INFERIORE ALLA

T° AMBIENTE

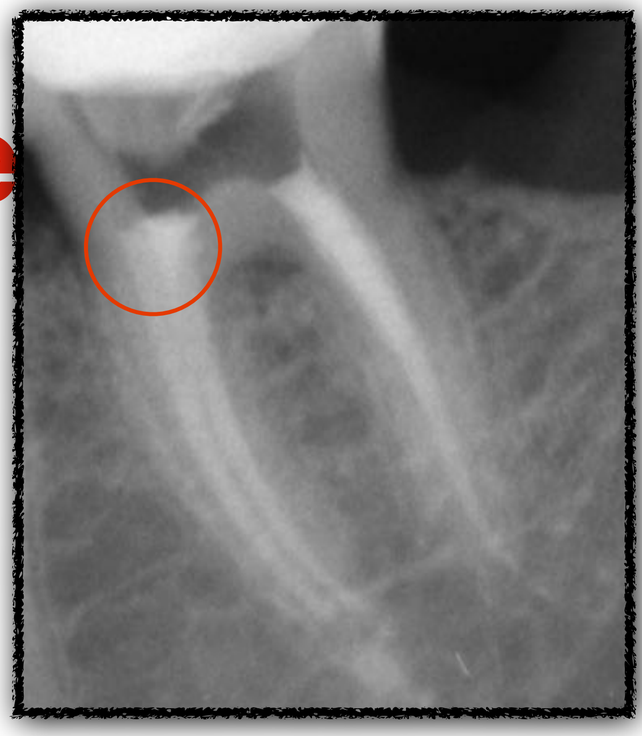
Ni-Ti SONO IN

AUSTENITIC

PHASE

Endodontic Ni-Ti Rotary Files < 2010

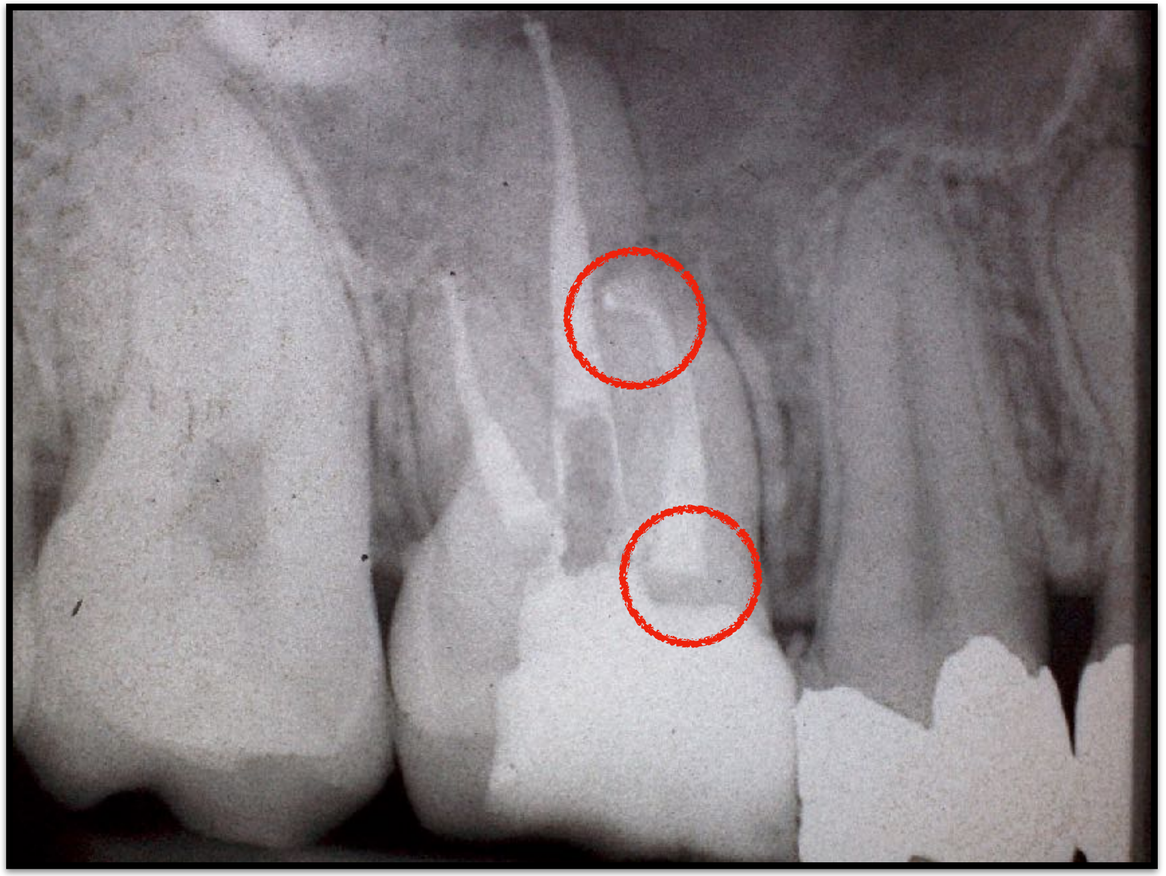
- **Stress Induced Martensite**
- **T° Ambiente > Af**
- **Superelasticità**



Endodontic Ni-Ti Rotary Files < 2010

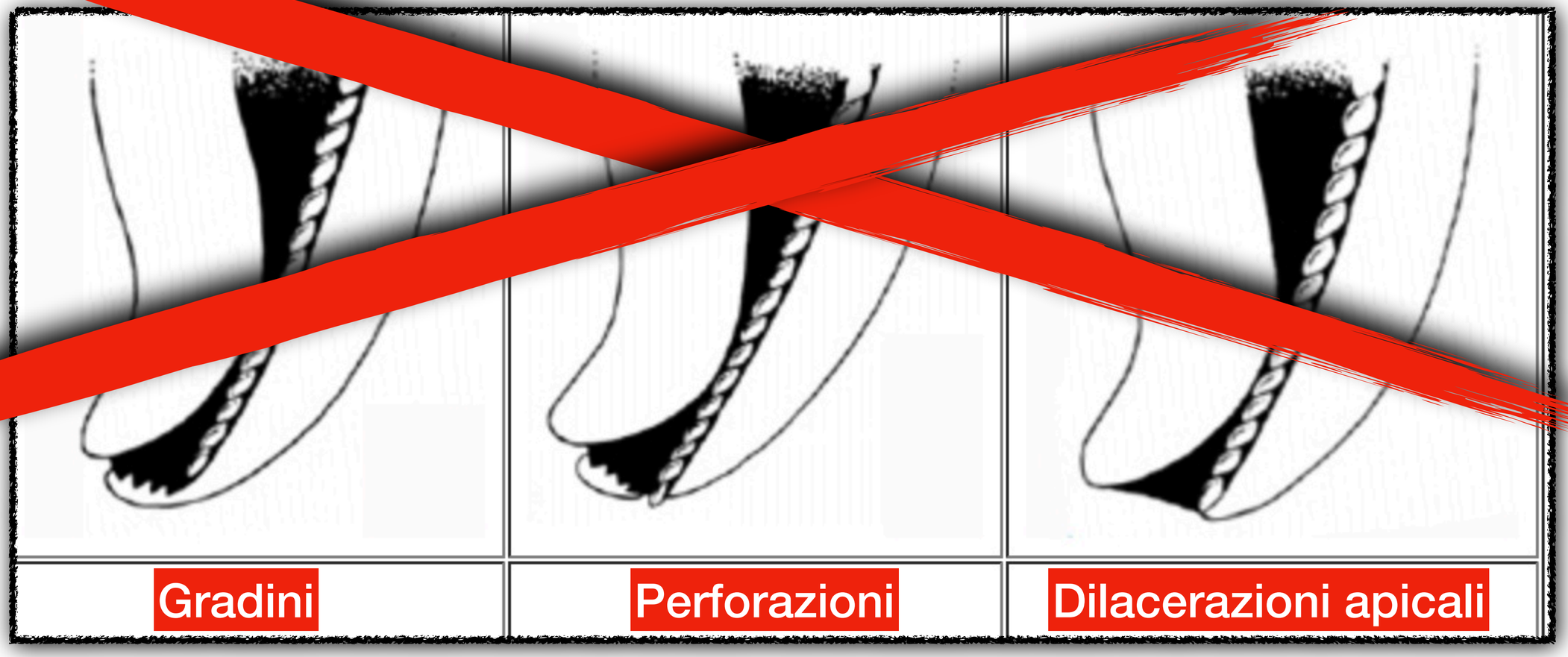
- **Mantenimento Anatomia**
- **Centralità nel canale**
- **Efficenza di taglio**
- **Minor numero di File**

Superelastic Ni-Ti Rotary Files

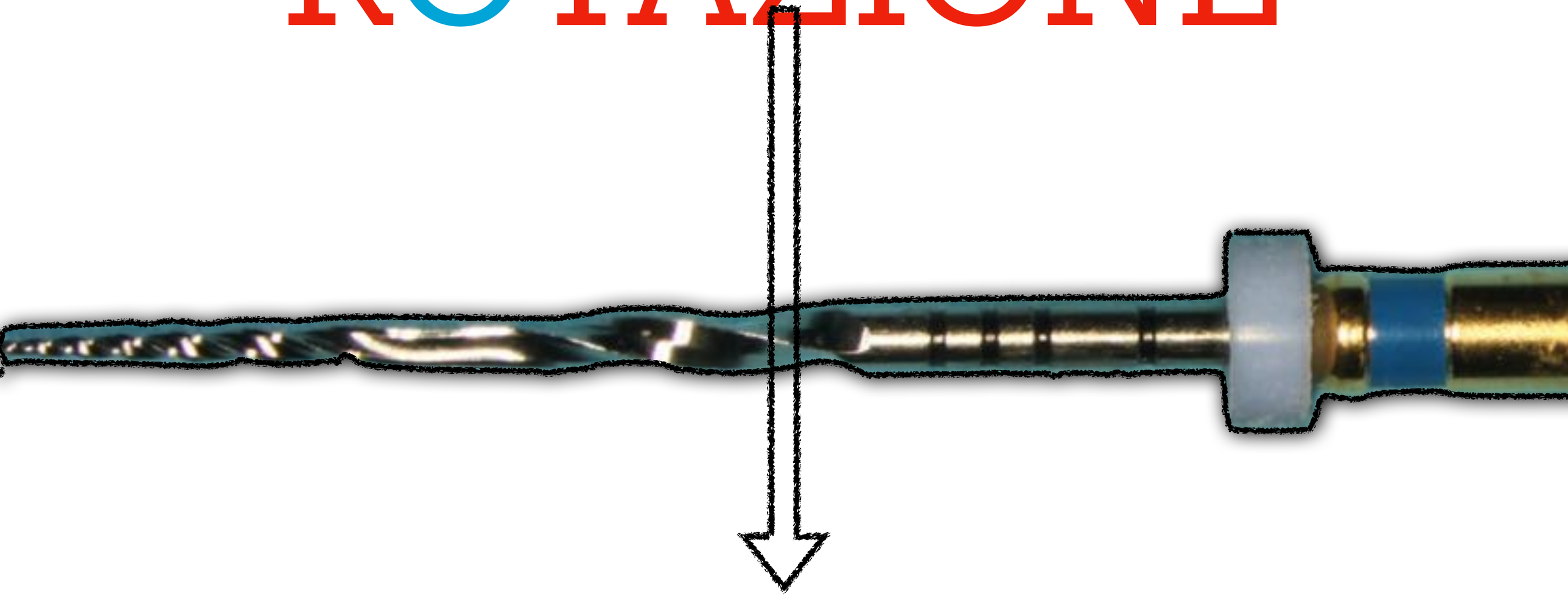


ACCESS CAVITY

Meno Errori rispetto all'Acciaio



ROTAZIONE



I FILE POSSONO FRATTURARSI

Factors Influencing Ni-ti File Separation

- Anatomia dello spazio endodontico
- Torque/coppia e velocità
- Selezione del file
- Numero di utilizzi
- Design del file

Pruett et Al JOE 1997

Gambarini et Al JOE 2001

Parashos et Al JOE 2004

Meccanismi di frattura

TORSIONE ⟷ FATICA CICLICA

FRATTURA TORSIONALE

FRATTURA DA FATICA CICLICA

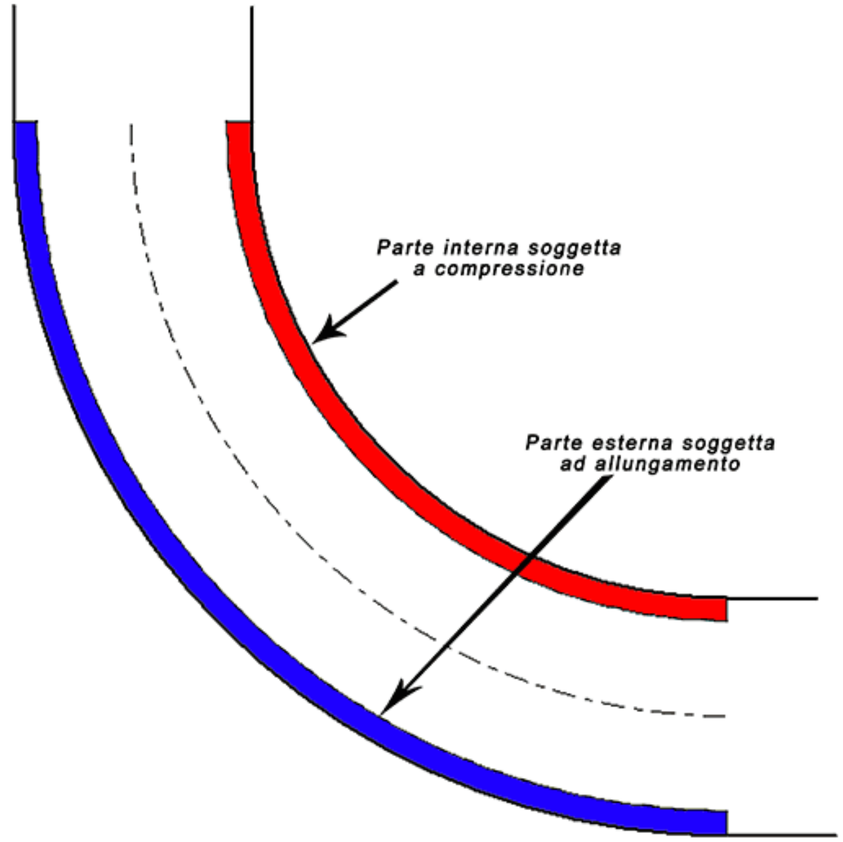
FRATTURA DA TORSIONE

- Si realizza quando una parte dello strumento rotante (solitamente la punta) si blocca e la restante parte continua a ruotare alla velocità preimpostata per azione del torque del motore endodontico.

- Strumenti Piccoli (core o dimensioni)
- Strumenti Poco Taglienti
- Strumenti *M*olto Conici - Taper Lock
- Canali Calcificati o Ritrattamenti

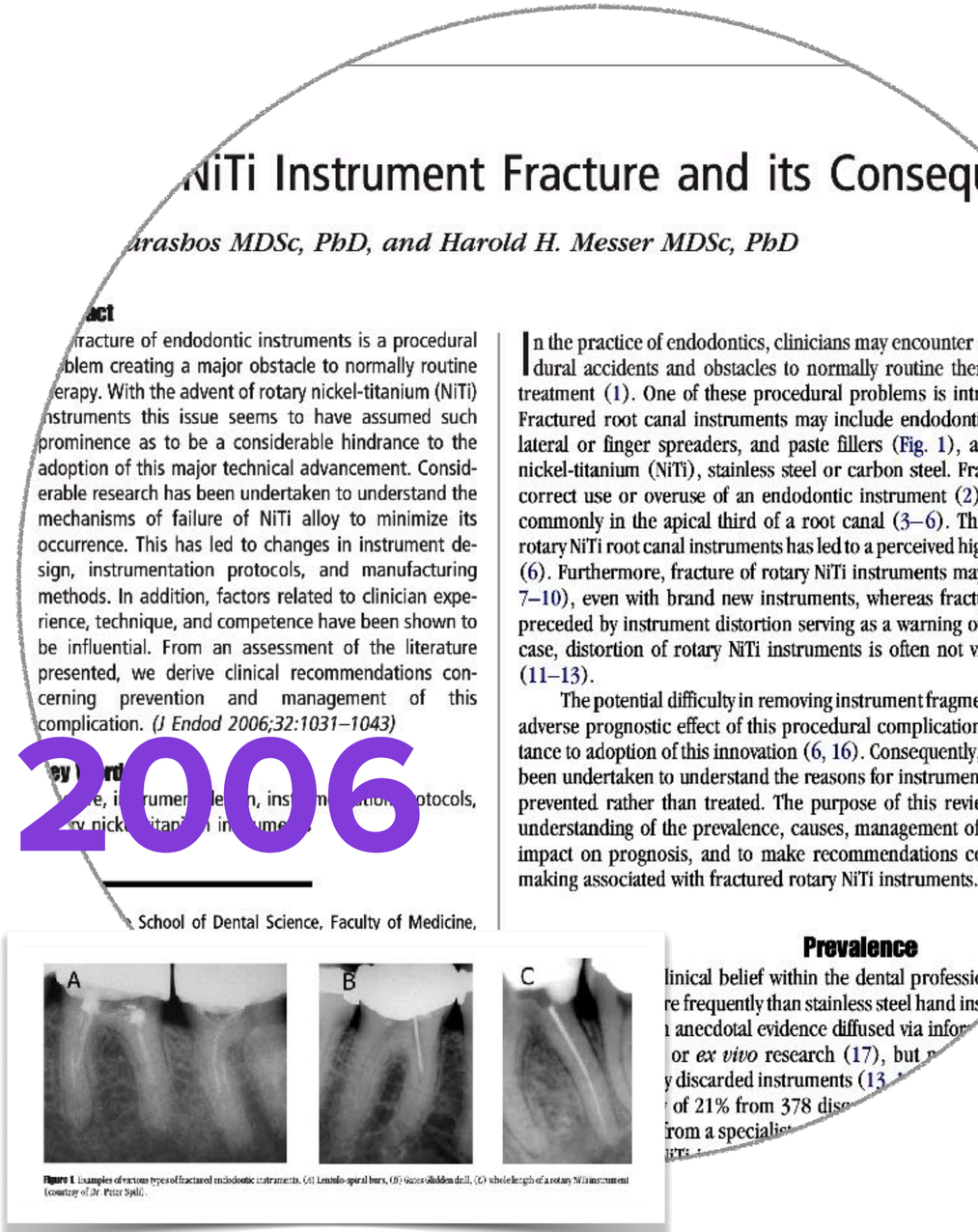
FRATTURA DA FATICA CICLICA

- Strumenti grandi (dimensioni, Taper, core)
- Strumenti con eccessivo numero di utilizzi



Rotary NiTi Instrument Fracture and its Consequences

Ciò ha portato a cambiamenti nella progettazione degli strumenti, nei protocolli di strumentazione e nei metodi di produzione.
Inoltre, è stato dimostrato che fattori legati all'esperienza, alla tecnica e alla competenza del medico sono influenti



NiTi Instrument Fracture and its Conseq

arashos MDSc, PhD, and Harold H. Messer MDSc, PhD

act

racture of endodontic instruments is a procedural blem creating a major obstacle to normally routine erapy. With the advent of rotary nickel-titanium (NiTi) nstruments this issue seems to have assumed such prominence as to be a considerable hindrance to the adoption of this major technical advancement. Considerable research has been undertaken to understand the mechanisms of failure of NiTi alloy to minimize its occurrence. This has led to changes in instrument design, instrumentation protocols, and manufacturing methods. In addition, factors related to clinician experience, technique, and competence have been shown to be influential. From an assessment of the literature presented, we derive clinical recommendations concerning prevention and management of this complication. *(J Endod 2006;32:1031–1043)*

2006

n the practice of endodontics, clinicians may encounter dural accidents and obstacles to normally routine ther treatment (1). One of these procedural problems is intr Fractured root canal instruments may include endodont lateral or finger spreaders, and paste fillers (Fig. 1), a nickel-titanium (NiTi), stainless steel or carbon steel. Fra correct use or overuse of an endodontic instrument (2) commonly in the apical third of a root canal (3–6). Th rotary NiTi root canal instruments has led to a perceived hig (6). Furthermore, fracture of rotary NiTi instruments ma 7–10), even with brand new instruments, whereas fract preceded by instrument distortion serving as a warning o case, distortion of rotary NiTi instruments is often not v (11–13).

The potential difficulty in removing instrument fragme adverse prognostic effect of this procedural complication tance to adoption of this innovation (6, 16). Consequently been undertaken to understand the reasons for instrumen prevented rather than treated. The purpose of this revie understanding of the prevalence, causes, management of impact on prognosis, and to make recommendations co making associated with fractured rotary NiTi instruments.

School of Dental Science, Faculty of Medicine,

Prevalence

linical belief within the dental professi re frequently than stainless steel hand ins anecdotal evidence diffused via infor or *ex vivo* research (17), but discarded instruments (13 of 21% from 378 disc from a specialist

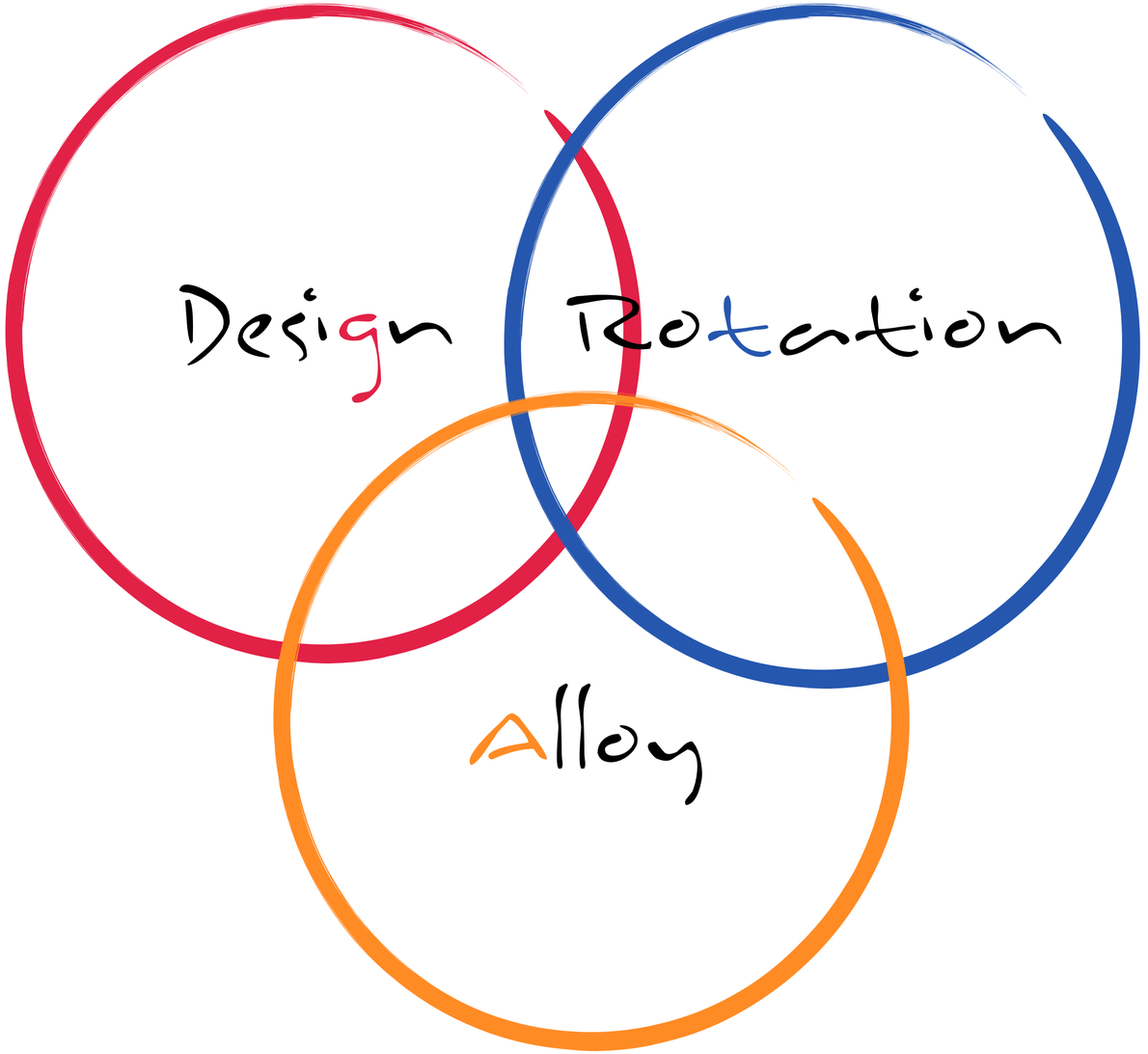
Figure 1. Examples of various types of fractured endodontic instruments. (A) Lentulo-spiral burs, (B) Gates-Glidden drill, (C) whole length of a rotary NiTi instrument (courtesy of Dr. Peter Split).

Peter Parashos and Harold H. Messer 2006

IMPORTANZA DEI MOTORI ENDODONTICI

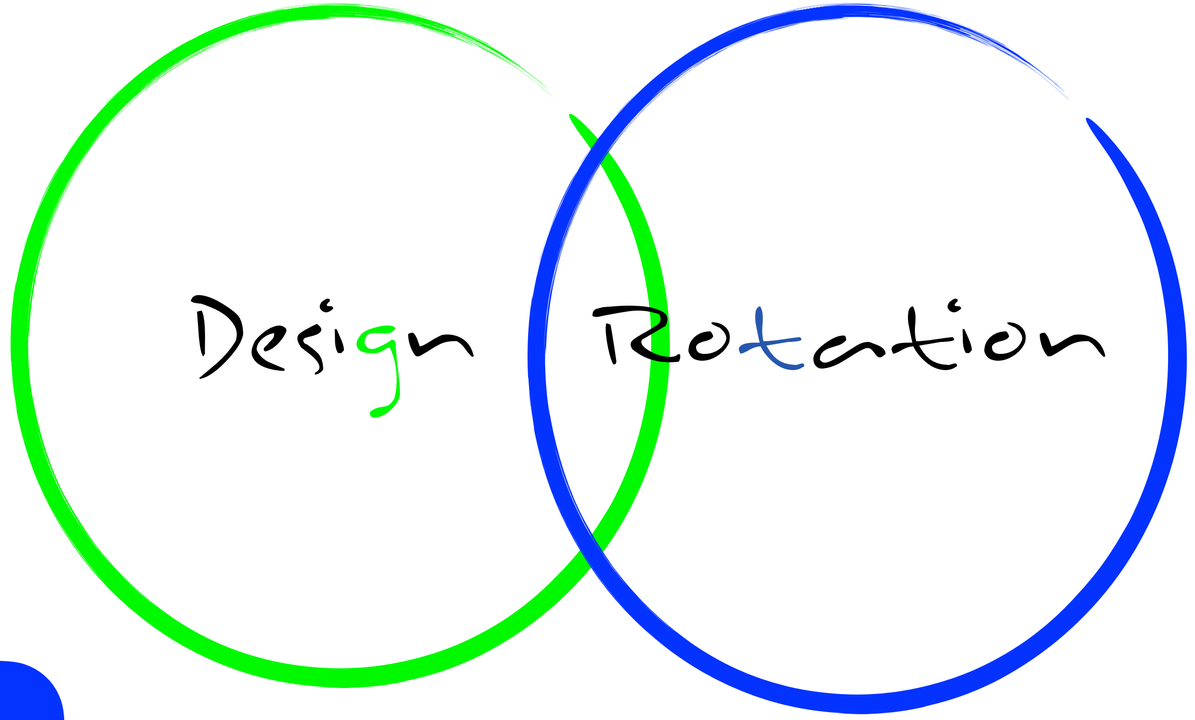
- MANTENERE LA VELOCITA' DI ROTAZIONE COSTANTE
- GESTIONE DEL TORQUE DI AVANZAMENTO DEL FILE
- OTTENERE UN CARICO COSTANTE SUL FILE

Cambiamento nella sagomatura



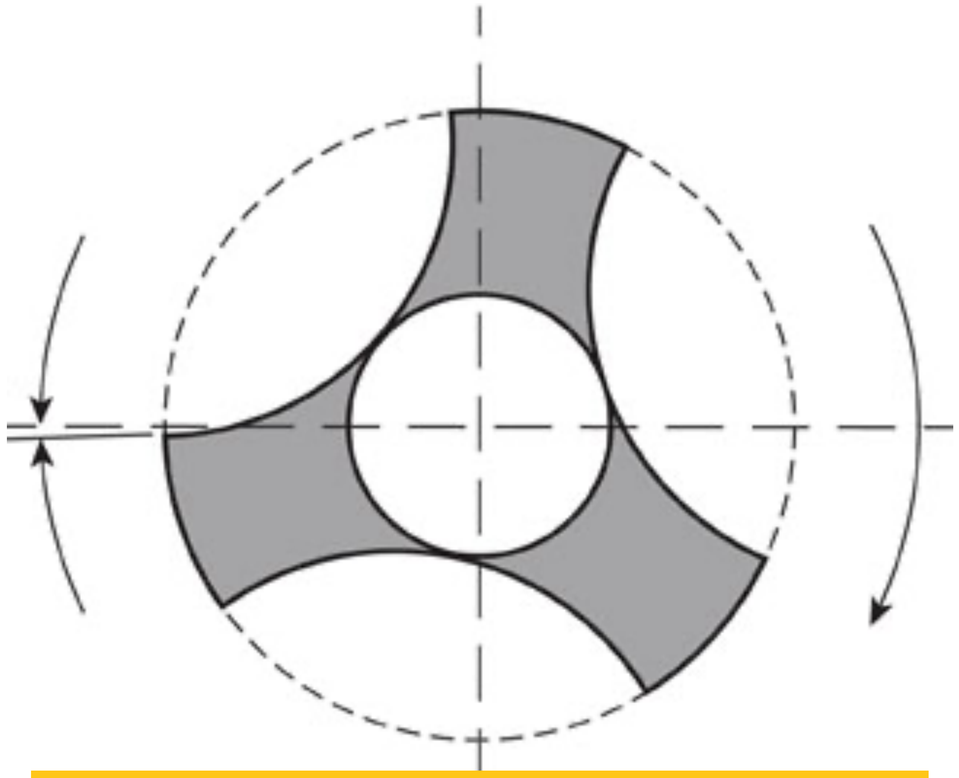
MAXIMIZE EFFICENCY & AVOID BREAKAGE

1

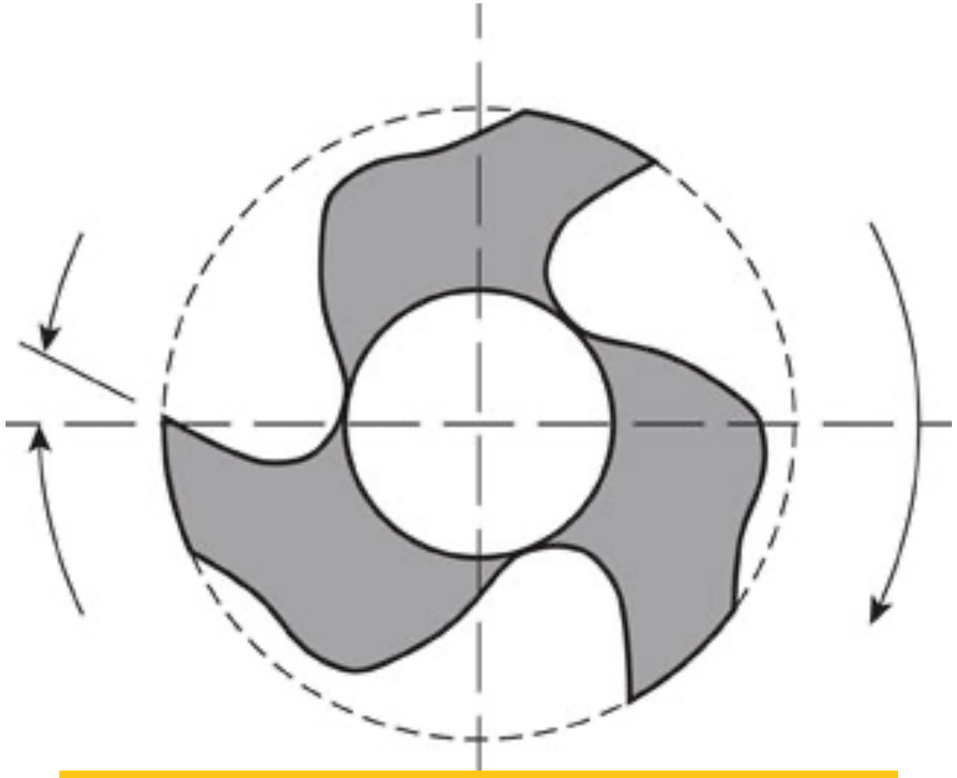


2

EVOLUZIONE DEL DESIGN: DISEGNO DELLE LAME

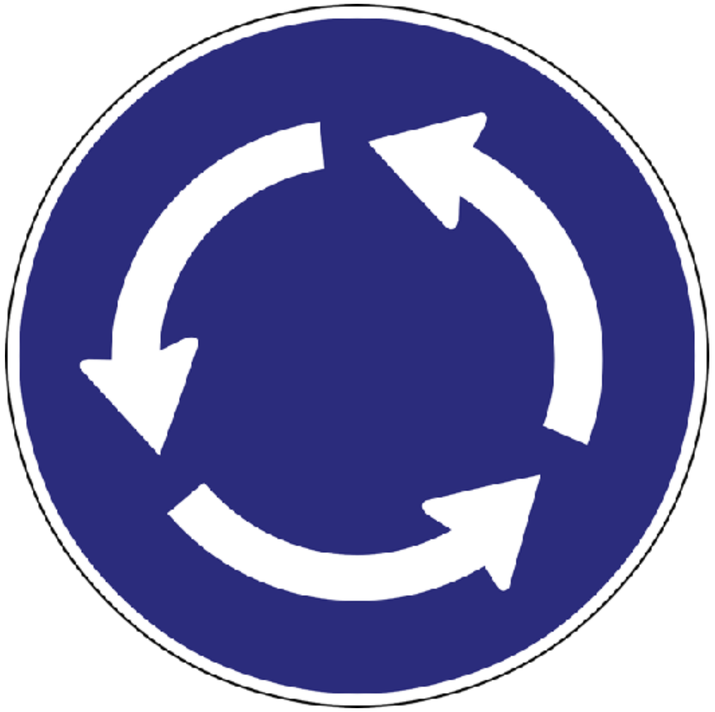


PROFILE CROSS SECTION, NEGATIVE RAKE ANGLE



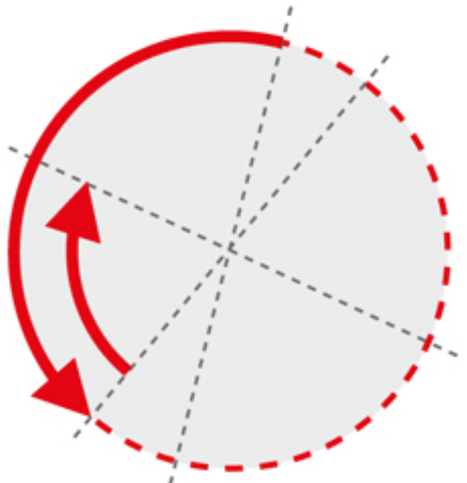
K3 FILE CROSS SECTION POSITIVE RAKE ANGLE

EVOLUZIONE DEI MOVIMENTI- MOTORI ENDODONTICI



ROTAZIONE

RECIPROCAZIONE



EVOLUZIONE DEI MOVIMENTI- MOTORI ENDODONTICI

Adaptive Motion Technology

Rotary: 600°clockwise and 0° counterclockwise file motion when no load is applied.

Reciprocation: 370°clockwise and up to 50° counterclockwise file motion when load is applied.

MAXIMIZE EFFICENCY & AVOID BREAKAGE

3

2011

ESE ROME 2011

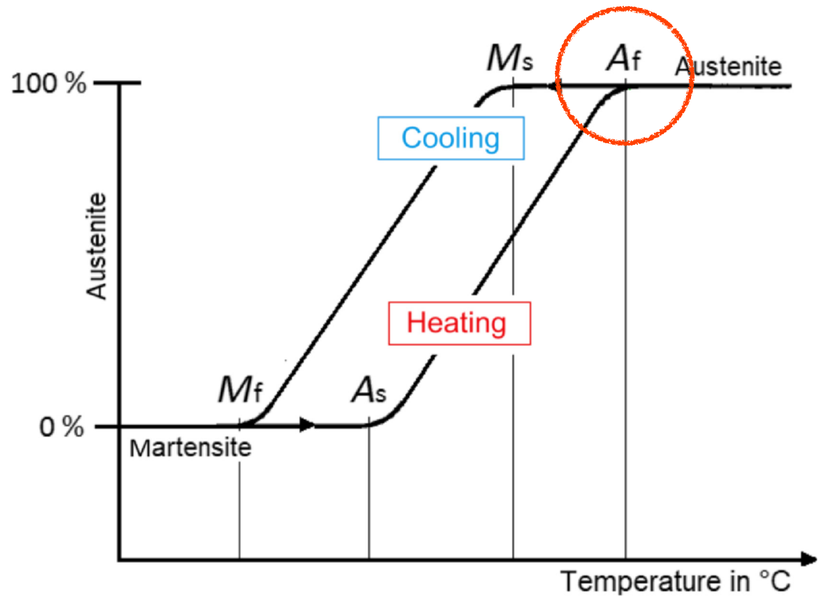
NOT ONLY ROOTS

15TH BIENNIAL CONGRESS
OF THE EUROPEAN SOCIETY
OF ENDODONTOLOGY

ROME - 2011, SEPTEMBER 14TH - 17TH

COLTENE CAMBIA IL DNA DEL NITI

I nuovi trattamenti mirano a modificare la temperatura
alla quale la lega "ricorda"
la sua forma primitiva per poter sfruttare
al meglio la flessibilità del materiale



VARIAZIONE DELLA T° DI TRANSIZIONE...
MAGGIORE DELLA T° AMBIENTE

DENTAL OFFICE dopo il 2010

I FILE TRATTATI TERMICAMENTE A T° AMBIENTE SONO IN FASE Martensitica

- Ridotto ritorno elastico (restoring force)
- Memoria di forma attivata dal calore

Le caratteristiche geometriche e il trattamento termico potrebbero influenzare le proprietà meccaniche e le prestazioni cliniche degli strumenti NiTi, come l'incidenza della separazione del file e la distribuzione dello stress attraverso la parete dentinale durante la sagomatura del canale radicolare.

Shen 2012-2013; Gambarini 2011

CLINICAMENTE

- PRECURVABILE
- SAGOMARE CURVATURE IMPORTANTI
- CENTRATO NEL CANALE

Endodontic Heat Treated Ni-Ti Rotary Files

Cyclic Fatigue

Torsional Stress

300-400

TORQUE
FORCE

Low
1,5-2,5 N/cm

Il caso HyFlex™ CM

Dr. Mario Marrone, Palermo

Dr. Mario Marrone
www.mariomarrone.it

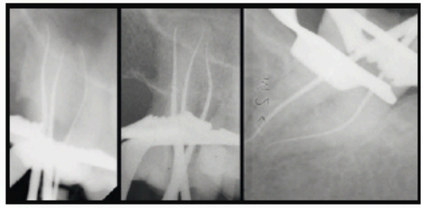
Endodonzia con HyFlex CM, gli strumenti Ni-Ti che si rigenerano

Una delle più importanti innovazioni in campo endodontico è stata l'introduzione della lega Nichel-Titanio (NiTi) nel 1988 e l'immissione in commercio di molti strumenti con differenti disegni delle lame, angolo di taglio, punte e conicità ma la qualità e le caratteristiche delle leghe sono rimaste, in questi anni, sostanzialmente invariate.
Solo recentemente sono stati introdotti strumenti con lega NiTi a memoria di forma denominata CM-wire (controlled memory-wire): gli HyFlex CM sono privi del ritorno elastico e hanno la capacità di adattarsi all'anatomia del canale.

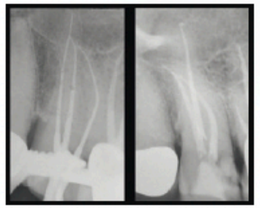
HyFlex CM è uno strumento che raggiunge rapidamente la lunghezza di lavoro senza generare troppi detriti e ha la capacità di sagomare i canali in modo

spire) che permette il disimpegno dello strumento e lo preserva dalle fratture. Inoltre, caratteristica unica della lega CM-wire è il self-restoring (rigenerazione): lo strumento recupera la forma originaria con il trattamento termico. La sterilizzazione in autoclave agisce quindi da indicatore del grado di usura: quando non si ha più il recupero di forma lo strumento va scartato.
Altra caratteristica unica del 'self-restoring' è la capacità di rigenerarsi anche in termini di resistenza alla fatica ciclica, caratteristica che sembrerebbe far aumentare la resistenza alla frattura. (1)

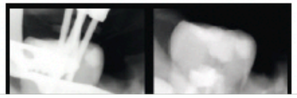
HyFlex CM è precurvabile e questo consente l'ingresso semplificato in situazioni complesse, senza dover estendere eccessivamente la cavità d'accesso. (fig.5)



(fig. 1) Le radiografie con gli HyFlex CM nei canali evidenziano la grande flessibilità di questi strumenti: questa permette il rispetto dell'anatomia endodontica e l'utilizzo di un numero ridotto di strumenti per la sagomatura anche di casi complessi.

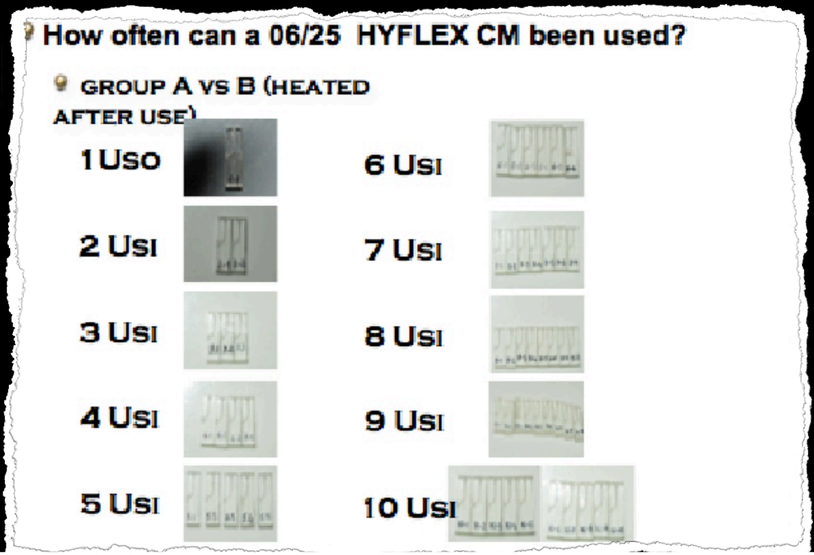


(fig. 2) Molare superiore con radici lunghe (24-26 mm) e curvature accentuate. Lunghezza di lavoro con l'IL che mostrano l'adattamento degli strumenti all'anatomia canalare.



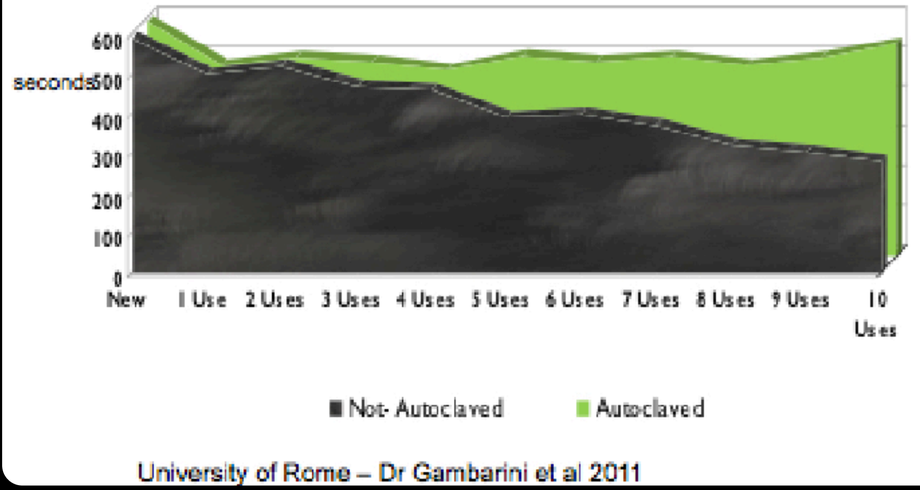
15.04 25.06 2 FILE

Capacità rigenerativa



Regenerative properties

Heat treatment → regained the instruments morphology
Heat treatment → regains lost instruments strength



University of Rome – Dr Gambarini et al 2011

CLINICAMANTE:DESPIRALIZZAZIONE

evita l'impegno canalare dello strumento

LA STERILIZZAZIONE IN AUTOCLAVE O CON PALLINE DI QUARZO PUO' RIPORTARE LO STRUMENTO ALLA SUA FORMA ORIGINARIA

HT Ni-Ti VISUAL CHECKING

NEW

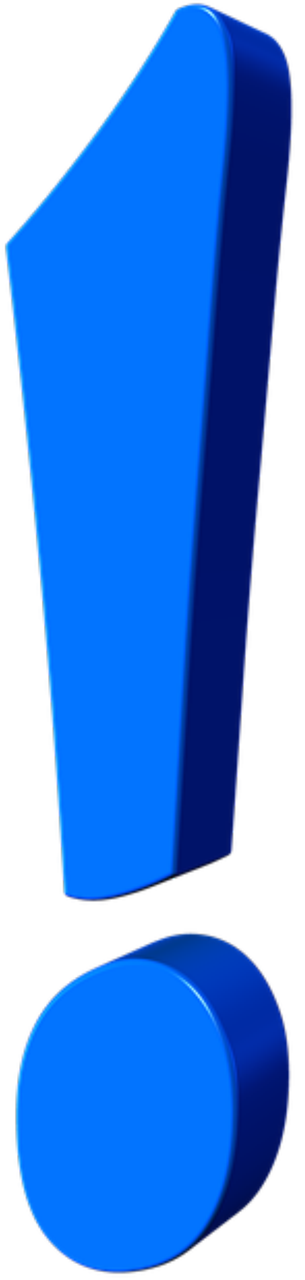
AFTER USE

HEAT

READY

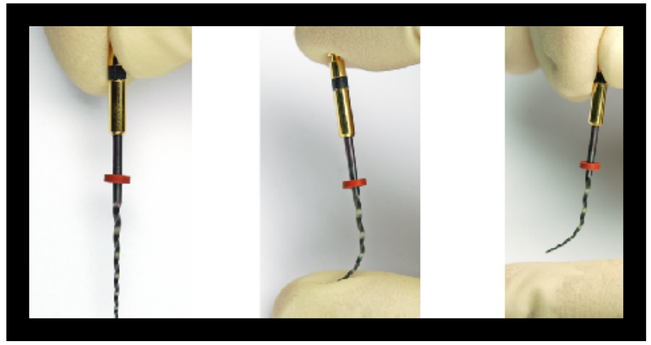
THE "HOT WATER" TRICK TO REGENERATE FILES

VISUAL CHECKING



CM WIRE

- Elevata flessibilità
- Memoria di forma controllata
- Capacità rigenerativa
- Elevata resistenza alla fatica ciclica



2013

Current Challenges and Concepts of the Thermomechanical Treatment of Nickel-Titanium Instruments

Ya Shen, DDS, PhD, Hui-min Zhou, DDS, PhD,† Yu-feng Zheng, PhD,‡ Bin Peng, DDS, PhD,§ and Markus Haapasalo, DDS, PhD**

Abstract

Introduction: The performance and mechanical prop-

Key Words

Controlled memory wire, endodontic instrument, fatigue, heat treatment, M-wire, nickel-titanium, R-phase, torque

Over the past 2 decades, nickel-titanium (NiTi) instruments have become an impor-
tant part of the armamentarium for root canal treatment. They are increasingly
ists and specialists to facilitate the cleaning and shaping of root canals.
orable qualities, there is a potential risk of "unexpected"
Even though there have been considerable
methods on endodontic rotary
paration caused by
curvatures
the relative
Heat treatment
oward adjusting
ing the fatigue
hermomechanical
l to optimize the
ocessed endodontic
yahoga Falls, OH),
ntsply Tulsa Dental
Blue (Dentsply Tulsa
YPHOON Infinite Flex
ford, CT), Twisted Files
Maillefer, Ballaigues,
different raw materials
me even more imperative
rument and achieving the

TABLE 1. A List of Literature on the Mechanical Properties of Thermomechanically Treated NiTi Instruments with Continuous Rotation

	Phase transformation	Flexible property	Cyclic fatigue	Torsional fracture
CM Wire (HyFlex CM, TYPHOON Infinite Flex NiTi)	Shen et al, 2011 (44)	Testarelli et al, 2011 (105); Zhou et al, 2012 (42)	Shen et al, 2011 (39); Shen et al, 2012 (40); Peters et al, 2012 (92)	Casper et al, 2011 (95); Peters et al, 2012 (92)
M-Wire (ProFile GT Series X, ProFile Vortex, Vortex Blue)	Alapati et al, 2009 (47); Shen et al, 2011 (44); Ye and Gao, 2012 (45)	Gao et al, 2012 (41)	Gambarini et al, 2008 (66); Johnson et al, 2008 (68); Larsen et al, 2009 (69); Kramkowski and Bahcall, 2009 (90); Gao et al, 2010 (38); AlHadlaq et al, 2010 (67); Hilfer et al, 2011 (84); Gao et al, 2012 (41); Plotino et al, 2012 (86)	Johnson et al, 2008 (68); Kramkowski and Bahcall, 2009 (90); Casper et al, 2011 (95); Bardsley et al, 2011 (100); King et al, 2012 (96); Gao et al, 2012 (41)
R-phase wire (K3XF, TFs)	Hou et al, 2011 (43); Shen et al, 2011 (44)	Gambarini et al, 2008 (48); Hou et al, 2011 (43)	Gambarini et al, 2008 (66); Larsen et al, 2009 (69); Kim et al, 2010 (70); Bhagabati et al, 2011 (71); Rodrigues et al, 2011 (72); Pedullà et al, 2011 (73); Hilfer et al, 2011 (84)	Gambarini et al, 2009 (98); Park et al, 2010 (93); Gambarini et al, 2010 (97); Casper et al, 2011 (95); King et al, 2012 (96)

into a single process. The newly developed thermomechanical treatment of NiTi files gives them better flexural fatigue resistance than files of similar design and size made from conventional NiTi alloy. The unique material properties make them particularly suited for endodontic treatment. Although the details of the thermomechanical

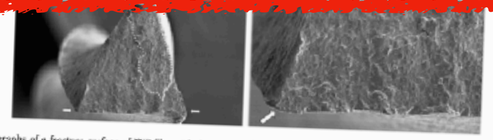


Figure 2. Photomicrographs of a fracture surface of TYP files with the region of fatigue crack propagation and dimple area outlined (*dotted line*) with crack origins (*arrows*). (*A*) The overall view of the TYP file (N_f = 345, dimple area is 69%). (*B*) A high-magnification view of the crack origin (*arrow*). (*C*) An overall view of the TYP CM file with 2 crack origins (*arrows*) (N_f = 1280, dimple area is 56%). (*D*) A high-magnification view of 1 crack origin (*arrow*).

YA SHEN et AL

NI-TI ROTARY FILE

- I file Ni-Ti “Austenici” hanno un ritorno elastico e veloce della forma (memoria meccanica) che maschera le deformazioni che subiscono. rimane una parte della deformazione. (non visibile all’esterno) non si ha un completo ritorno austenitico con irrigidimento dello strumento e riduzione della sua resistenza alla frattura

NI-TI ROTARY FILE

- I file Ni-Ti trattati termicamente se non hanno subito deformazioni plastiche irreversibili, possono recuperare la loro forma memorizzata durante i processi di fabbricazione (es durante la sterilizzazione)
- I file Ni-ti trattati termicamente permettono di verificare visivamente la deformazione che ha subito il file durante la strumentazione canalare

I denti che presentano canali con una curvatura maggiore di 45 gradi non possono essere trattati con successo senza dover ricorrere al chirurgia

Grossman 1967

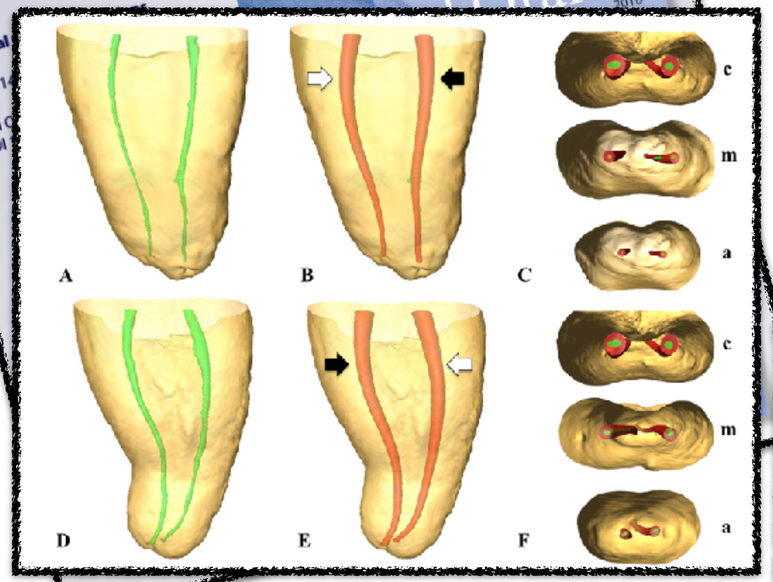
“Non ci sono curve in cui non si possa passare”

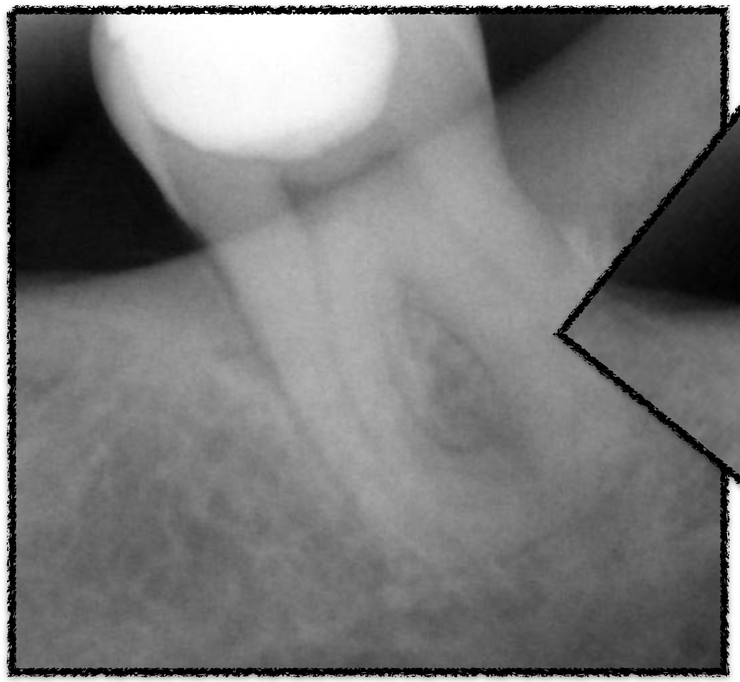
A. SENNA

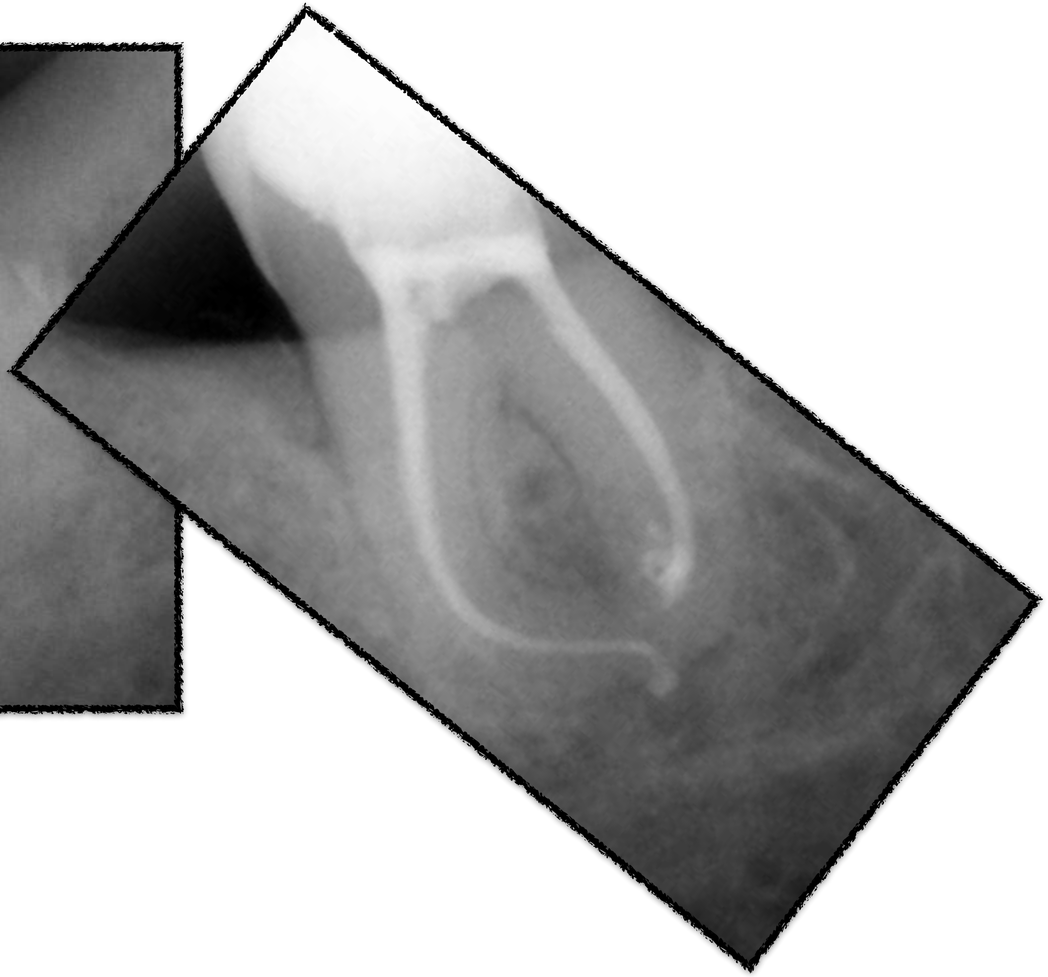
Shaping ability of two nickel–titanium instruments activated by continuous rotation or adaptive motion: a micro-computed tomography study

E. Pedullà, G. Plotino, N. M. Grande, G. Avarotti, G. Gambarini, E. Rapisarda & F. Mannocci

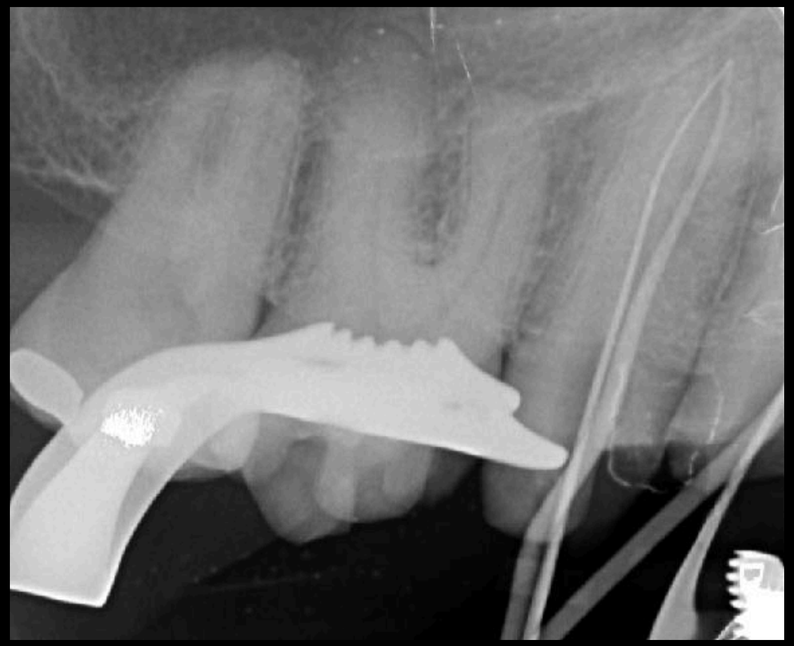
ONLINE FIRST

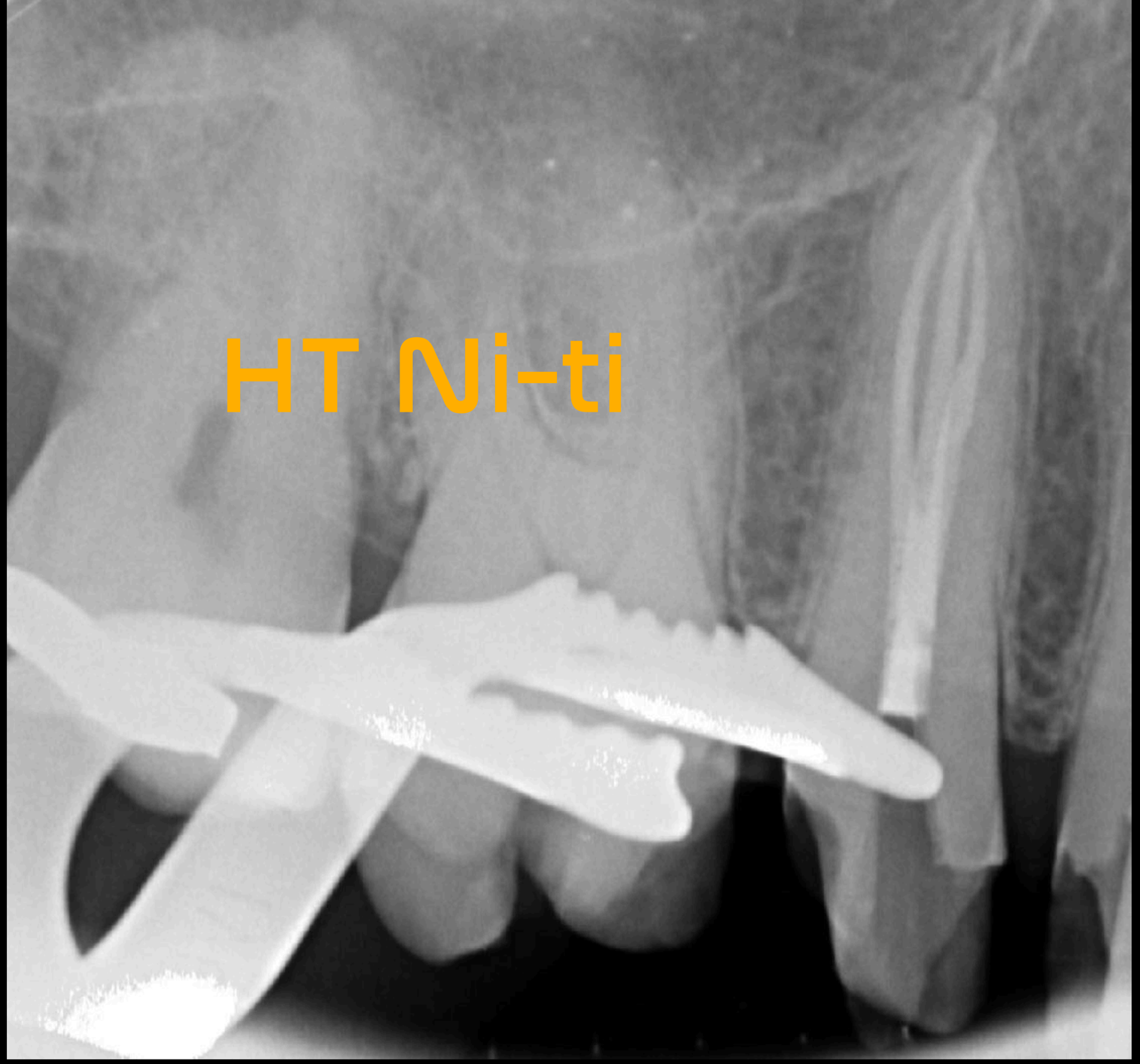






Clinical relevance The use of NiTi files made by heat-treated alloy and/or adaptive motion could improve the qualities of root canal shaping rather than the use of conventional NiTi instruments and/or continuous rotation in the coronal and middle thirds of the root canals, but not in the apical one.



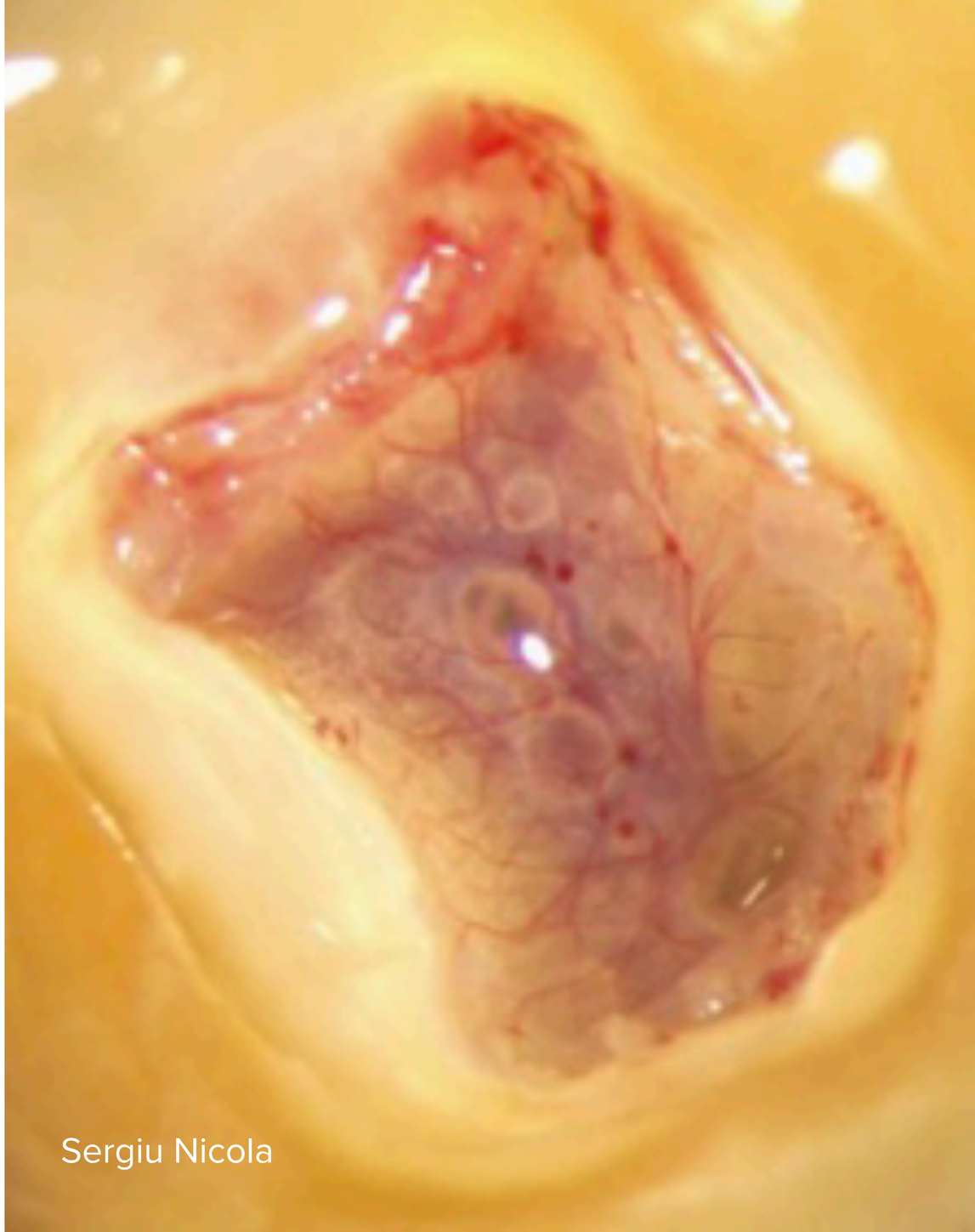

HT Ni-ti

OBIETTIVI MECCANICI

* Conicità continua da corona ad apice
* Preservare le curvature del canale
* Preservare il diametro apicale

OBBIETTIVI BIOLOGICI

- Rimuovere la polpa malata
- Ridurre la carica batterica



Irrigazione Canalare

STRUMENTIAMO 60-80% DEL SISTEMA CANALARE

PETERS 2001 IEJ

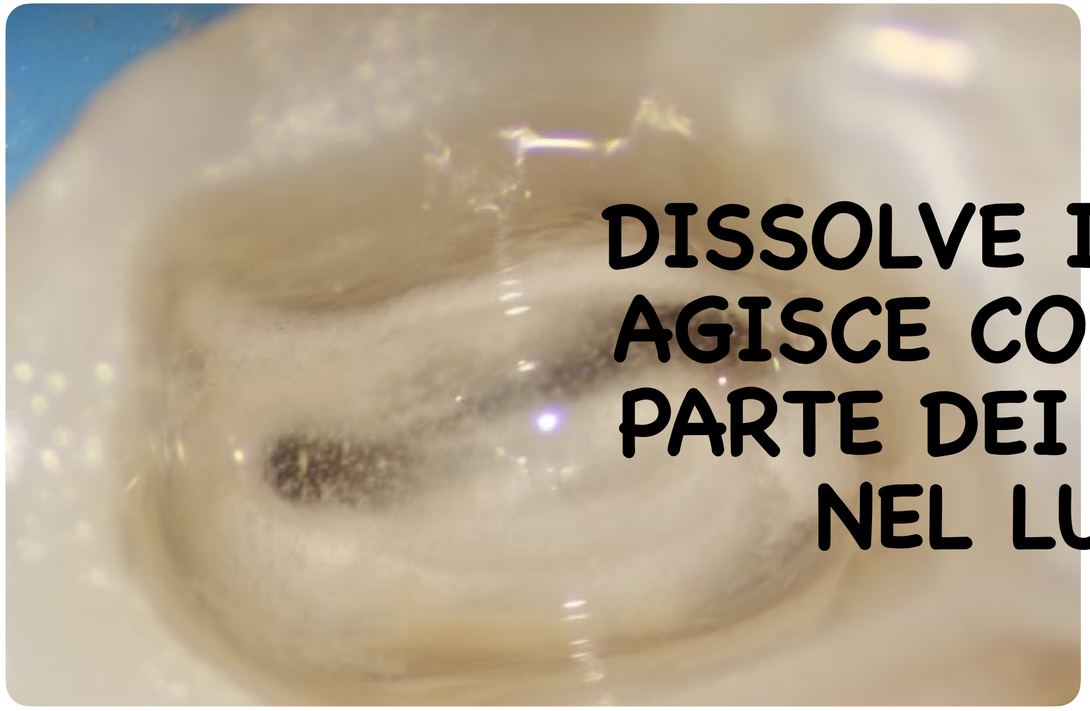

LA SFIDA E' CON
L'ANATOMIA E CON I
BATTERI

Disinfection Protocol to Reduce the bacterial Load Beneath A Subcritical threshold

Siqueira et AL. Braz Dent Journ. 2007

Irrigazione Canalare

IPOCLORITO DI SODIO

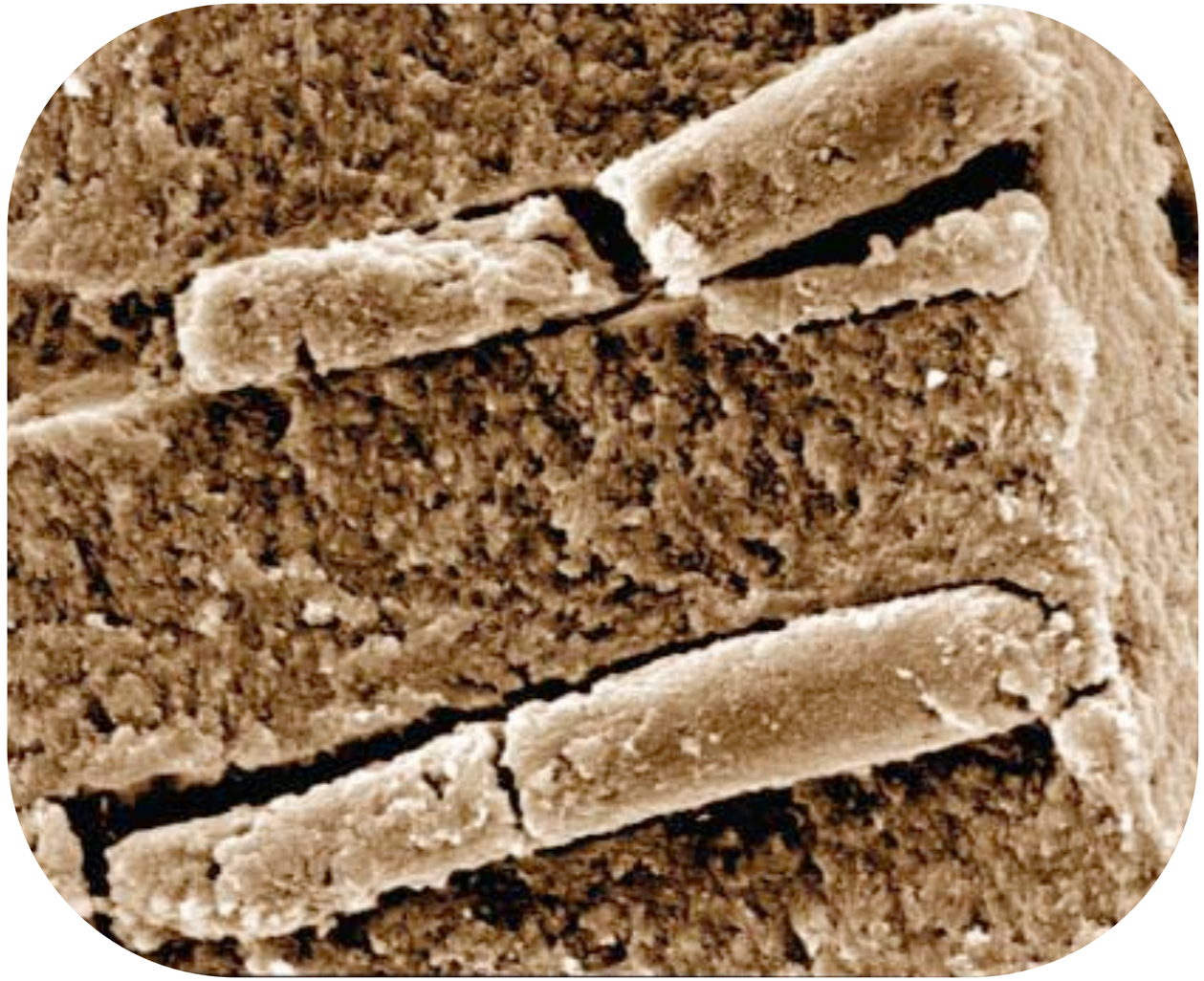


DISSOLVE IL TX ORGANICO ED AGISCE CONTRO LA MAGGIOR PARTE DEI BATTERI PRESENTI NEL LUME CANALARE

ATTIVAZIONE IPOCLORITO

SMEAR LAYER

La parte macroscopica dei detriti creatisi con la sagomatura del canale VIENE già asportatA dagli stessi strumenti sagomanti, tanto più quanto il passo tra le loro spire è ampio.



MA....

Una quota di residui della strumentazione aderiranno sempre alla dentina appena lavorata, creando così lo strato del cosiddetto FANGO DENTINALE (Endodontic Smear Layer)

Sinergia tra gli Irriganti canalari

Ipoclorito di sodio

EDTA

INTERNATIONAL ENDODONTIC JOURNAL

doi:10.1111/iej.12370

REVIEW

Master apical file size – smaller or larger: a systematic review of healing outcomes

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[1]Department of Endodontics, Case School of Dental Medicine, Cleveland, OH; and [2]Dental School, UMKC, Kansas City, MO, USA

two reviewers independently selected the relevant articles. Four articles were identified that met the inclusion criteria. There were no studies that evaluated ... and healing outcome using ... The results of the

Review

The Role of Apical Instrumentation in Root Canal Treatment: A Review of the Literature

Dean Baugh, DDS, and James Wallace DDS, MDS, MSD, MS

Abstract

The issue of final apical preparation size remains controversial despite considerable clinical and in vitro research. The astute clinician must be aware of this research before choosing any instrumentation system because the informed clinician's decision must be guided by the best available evidenced-based information. This review article generated a Medline-based search strategy to disclose these studies and provides a critique and summary of the results.

From the University of Pittsburgh School of Dental Medicine, Pittsburgh, Pennsylvania.

Address request for reprints to Dean Baugh, DDS. E-mail address: baughdf@yahoo.com.

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The most important objective of root canal therapy is to minimize the number of microorganisms and pathologic debris in root canal systems to prevent or treat apical periodontitis. This process of chemomechanical debridement, or cleaning of the root canal systems, has been described as the removal of all of the contents of the root canal systems before and during shaping. Grossman (1) described mechanical cleaning as the most important part of root canal therapy. Schilder (2) also considered cleaning and shaping as the foundation for successful endodontic therapy.

Thorough instrumentation of the apical region has long been considered to be an essential component in the cleaning and shaping process. It was discussed as a critical step as early as 1931 by Groove (3). Simon (4) later recognized the apical area as the critical zone for instrumentation. Other authors (5, 6) concluded that the last few millimeters that approach the apical foramen are critical in the instrumentation process. Mechanical instrumentation and irrigation are sound endodontic principles and essential components of successful endodontics (7, 8). Research has shown that mechanical instrumentation greatly reduces the number of microorganisms remaining in the root canal system. Mechanical instrumentation (9) has been shown to reduce bacterial count even without irrigants or dressings. A combination of mechanical instrumentation and irrigation (9, 10) further reduced the number of microorganisms by 100 to 1000 times. However, mechanical instrumentation with irrigation does not reliably disinfect an infected root canal system (11–14).

Manufacturers developed nickel-titanium rotary instrumentation systems to facilitate the cleaning and shaping process. They are popular because of their apparent ease of use and reduced number of instruments. However, Spangberg (6) noted that the strong emphasis on reducing the number of instruments and limiting apical preparations to small sizes does not produce clean apical preparations in diseased teeth. Given this controversial and important topic, we conducted a broad-based Medline search of the literature to characterize the major factors involved in apical canal instrumentation. Table 1 provides the Medline search strategy used to identify relevant articles for this review. A secondary search was then conducted using the references from the computer-generated list of articles. We have organized this review to cover the major factors impacting the selection of the final apical size, namely the anatomy of the apical constriction, apical canal diameter, apical instrumentation, and bacteria.

The Apical Constriction

The apical constriction (cementodentinal junction or CEJ) has long been advocated as the terminal end of instrumentation and obturation (3, 4). It is in theory the narrowest part of the canal and the location where the pulp ends and the periodontium begins. Ricucci (15) advocated instrumenting to the apical constriction because impingement outside this junction may delay wound healing or result in adverse effects on the outcome of endodontic therapy. Materials or medications extruded beyond the constriction may promote inflammation and a foreign body reaction. Ricucci and Langeland (16) showed that instrumentation and obturation to the apical constriction gave the best prognosis. A poorer prognosis was observed when obturating material extended beyond the apical constriction. A literature review by Wu et al. (17) agreed with the major findings of Ricucci and Langeland. However, it is worth noting that the apical constriction may not always be present or easily identifiable (4, 18).

JOE — Volume 31, Number 5, May 2005 Apical Preparation 333

Diametro apicale e detersione

Una migliore rimozione microbica e

un'irrigazione più efficace si verificano

quando i canali sono strumentati

a dimensioni apicali maggiori

Aminosharie 2015

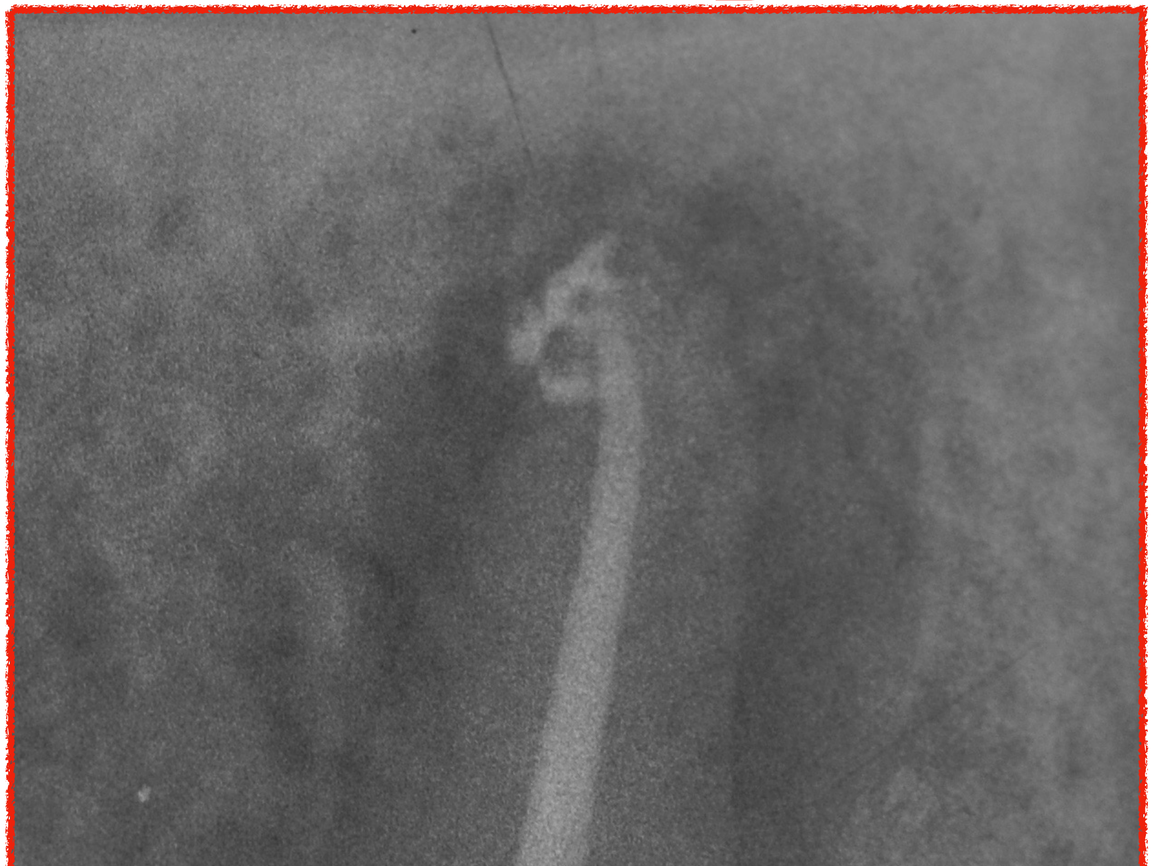
Baugh 2005

DIAMETRO DELLA PREPARAZIONE

Allargamento Apicale

Migliora efficacia irriganti

Migliore disinfezione meccanica



Orstavic 1991. The larger the preparation the higher the efficency in reducting infection

Dalton 1998. There was substantial bacterial reduction with progressive filing. Fewer bacteria remains with larger file size

Siqueira 1999. The most dramatic bacterial reduction was obtained after larger apical preparations

Usman 2004. Instrumented apical 3mm with GT 20/06 vs Gt 40/06. There was significant difference in canal cleanliness between the two sizes

Baugh 2009. Apical sizes kept as small as possible rather than as large as required disregards existing scientific literature and appears to be based primarily upon clinical opinion

Mounce 2009. Larger apical sizes create cleaner canals

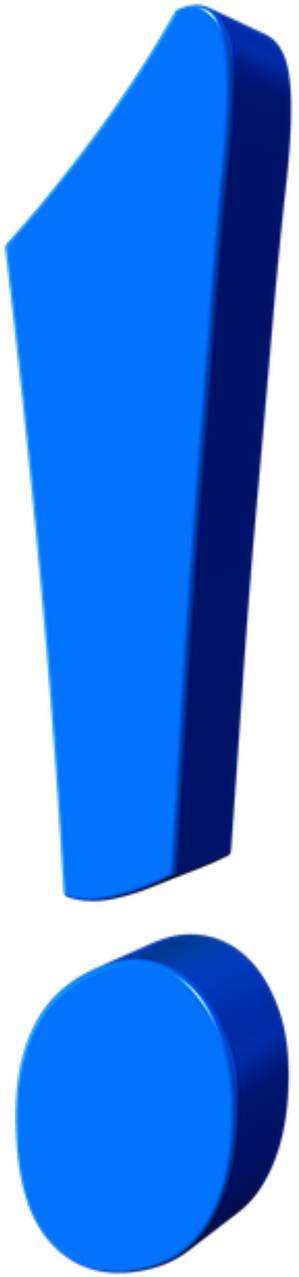
Smaller Apical Preparation in Higly Curved Canals are Safer…

Increased Difficulty to Deliver Irrigant Solution

They May Result in Reduced Disinfection…

Boutsioukis et Al 2010

Di solito, più grande è la curvatura del canale,
maggiore è il rischio di trasporto e frattura inaspettata
...quando si progettano preparazioni apicali più grandi



Shafer 2009

DIAMETRO DELLA PREPARAZIONE

Minimal apical preparation ... Srikanth P et al *Journal of International Oral Health 2015; 7(6):92-96*

Received: 28th January 2015 Accepted: 20th April 2015 Conflicts of Interest: None

Source of Support: Nil

Original Research

Minimal Apical Enlargement for Penetration of Irrigants to the Apical Third of Root Canal System: A Scanning Electron Microscope Study

P Srikanth[1], Amaravadi Gopi Krishna[2], Siva Srinivas[3], E Sujayeendranatha Reddy[4], Someshwar Battu[5], Swathi Aravelli[1]

Conclusion: Minimal apical enlargement for penetration of irrigants to the apical third of root canal system is #30 size.

La minima strumentazione necessaria per la penetrazione degli irriganti nel terzo apicale è **#30 - 35.**

DETERSIONE MECCANICA

DETERSIONE CHIMICA

SUCCESSO MICROBIOLOGICO

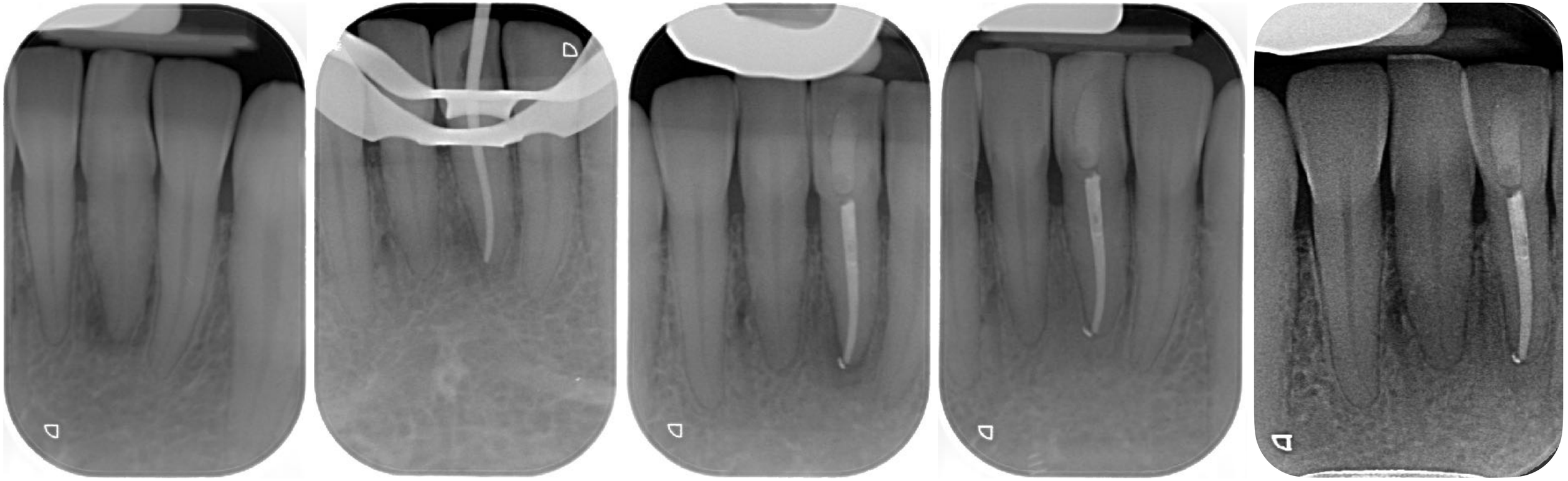
TRATTAMENTO TERMICO DEL NI-TI

TRATTAMENTO TERMICO DEL NI-TI

Increasing diameter

Decreasing taper

Niti Trattato termicamente



2019

50.3

2025

Aumento diametro e riduzione conicità

DIST:50.3

PAL:60.2

MB1: 30.4

MB2: 30.4

Non adattiamo
l'anatomia
alla sequenza di file

Adattiamo la
sequenza
di file all'anatomia

“Tailored” Endodontics

OBIETTIVI DELLA SAGOMATURA

- Conicità continua da corona ad apice
- Preservare le curvature del canale
- Preservare il diametro apicale

- Rimuovere la polpa malata
- Ridurre la carica batterica

ALCUNE SISTEMATICHE NI-TI

INTERNATIONAL ENDODONTIC JOURNAL
The official journal of the British Endodontic Society and the European Society of Endodontology

REVIEW | Open Access

Present status and future directions: Canal shaping

Ana Arias, Ove A. Peters

First published: 04 February 2022 | https://doi.org/10.1111/iej.13698

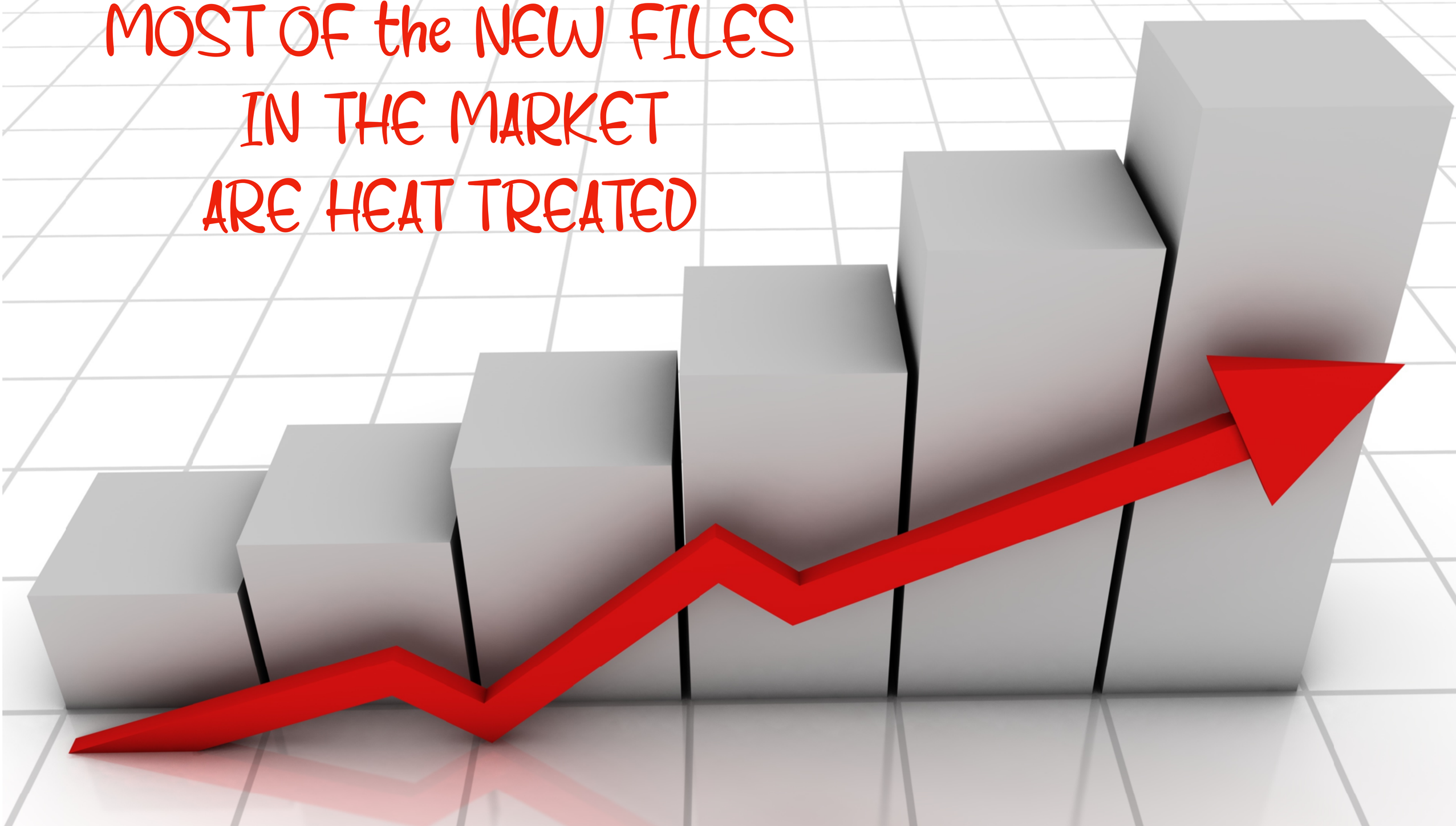
Funding information

Open access publishing facilitated by The University of Queensland, as part of the Wiley - The University of Queensland agreement via the Council of Australian University Librarians. WOA Institution: The University of Queensland Blended DEAL: CAUL 2022

-Generations of nickel-titanium instruments for canal preparation-

There are currently more than 250 brands of instrument systems marketed for root canal preparation.

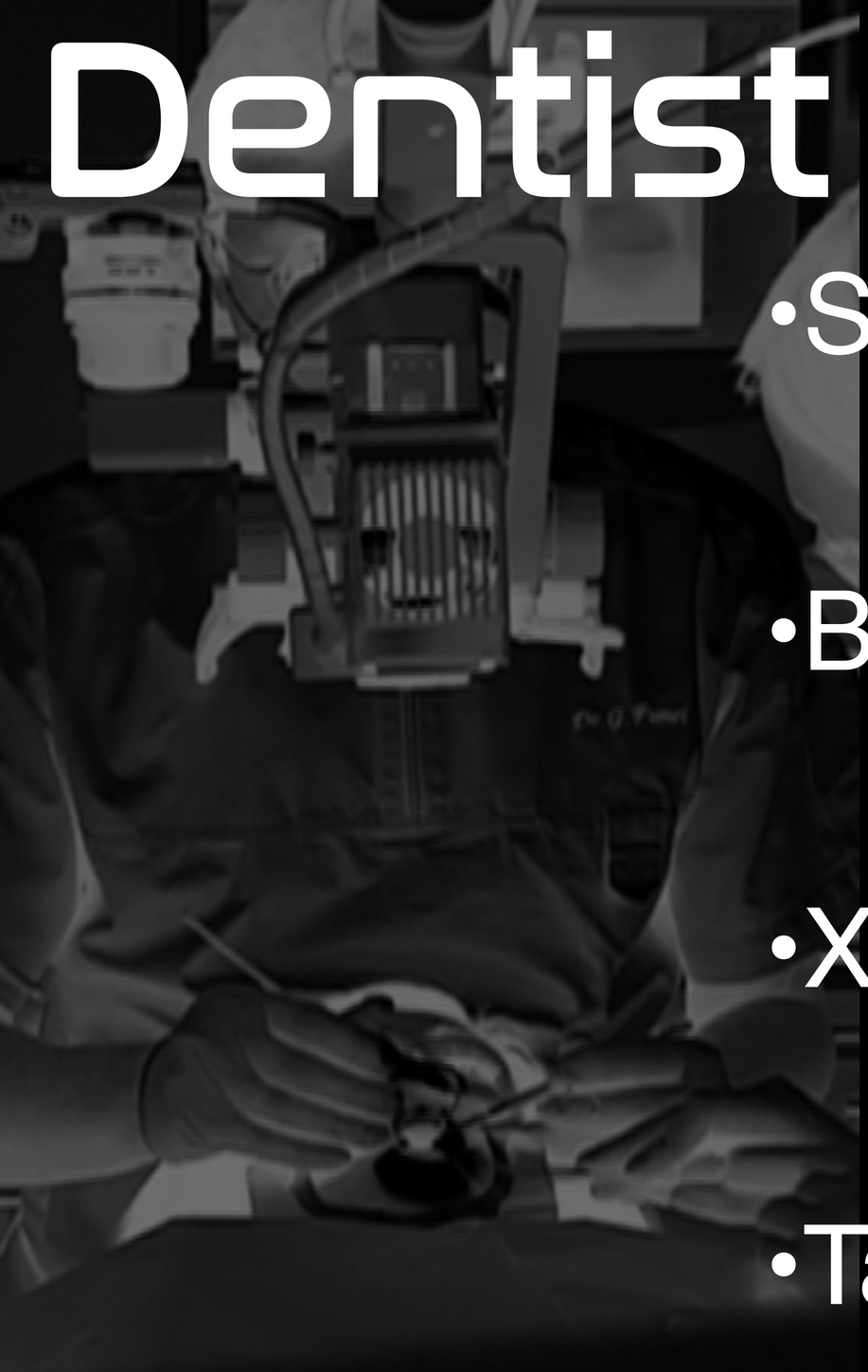
MOST OF the NEW FILES
IN THE MARKET
ARE HEAT TREATED



What about Criteria Selection ?

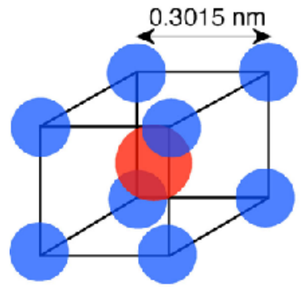
Questi criteri sono dedotti dalle informazioni che ricaviamo dall'analisi del paziente secondo la letteratura scientifica

Dentist Point Of View

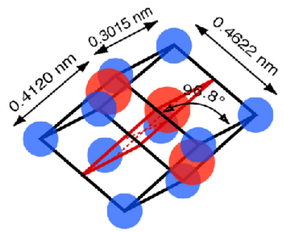


- Shaping Objectives
- Biological Objectives
- X-Ray Evaluation
- Tactile feedback

l'Austenite in virtù della sua maggiore rigidità avrà una maggiore resistenza allo sforzo torsionale.



La *Martensite* avendo una disposizione atomica con atomi orientati diversamente rispetto all'Austenite presenta una maggiore resistenza alla fatica ciclica.



NI-TI ROTARY FILES: TIPS AND TRICKS

CANALI CALCIFICATI

- 1° scelta Austenite.
- 2° manuali e martensite. I manuali (preflaring e glidepath) preparano la stada ai rotanti allargando e riducendo lo stress torsionale

CANALI CURVI

- 1° scelta *M*artensite.
- 2° Austenitici di piccolo diametro e conicità per aumentare la flessibilità del file + rifinitura manuale con Reamers

NI-TI ROTARY FILES: TIPS AND TRICKS

- 2-3 Movimenti con leggera pressione apicale, senza forzare
- Movimenti di spazzolamento in uscita (brushing)
- Pulizia dello strumento dopo ogni fase di utilizzo
- Irrigazione, pervietà col K-10, Irrigazione dopo ogni utilizzo di uno strumento rotante.
- In caso di non progressione dello strumento, cambiare strategia di strumentazione, strumento, o sequenza.

TRATTAMENTO MONOSEDUTA O PLURISEDUTA

E' stato ampiamente dimostrato in letteratura come non ci siano indicazioni per intraprendere di default un approccio pluriseduta per un trattamento endodontico.

Ca(OH)2

la medicazione non è affatto garanzia né di miglioramento della patologia apicale né di ermeticità e mantenimento della pulizia fatta in prima SEDUTA

Outcome of One-visit and Two-visit Endodontic Treatment of Necrotic Teeth with Apical Periodontitis: A Randomized Controlled Trial with One-year Evaluation. Vince A. Penesis et al. J Endod 2008;34:251–257

Effectiveness of single- versus multiple-visit endodontic treatment of teeth with apical periodontitis: a systematic review and meta-analysis. Sathorn C, Parashos P, Messer HH Int Endod J 2005; 38:347–355

CONSORT Randomized Clinical Trial

Success Rate of Single- versus Two-visit Root Canal Treatment of Teeth with Apical Periodontitis: A Randomized Controlled Trial

Jorge Paredes-Vieyra, PhD, and Francisco Javier Jimenez Enriquez, PhD

Abstract

Introduction: The aim of this study was to evaluate the outcome of single- versus 2-visit root canal treatment of teeth with apical periodontitis after a 2-year follow-up period. **Methods:** Three hundred maxillary and mandibular nonvital teeth with apical periodontitis were treated in either a single visit or 2 visits. The main inclu criteria were radiographic evidence of apical periodi tis (minimum size ≥2.0 × 2.0 mm) and a diagnosi pulpal necrosis confirmed by a negative respons hot and cold tests. Radiographically, all teeth sho small and irregular periapical radiolucencies be treatment. The canals were enlarged with L SpeedLSX (Discus Dental, Culver City, CA) root c instruments to a final apical preparation size #60 anterior and premolar teeth and size #45 to #5 show any significant difference between the groups ($P = .05$). **Conclusions:** Several factors play an important role in the decision-making process of 1- versus 2-visit endodontics. Among these are objective factors like preoperative diagnosis, the ability to obtain infection control, root canal anatomy, procedural complications, and subjective factors like patients' signs and symptoms. This study provided evidence that with

TABLE 4. Distribution of Teeth According to Outcome Classification

	1 visit ($n = 146$) (%)	2 visits ($n = 136$) (%)	Total
Healed	141 (96.57)	121 (88.97)	262 (92.90)
Uncertain healing	4 (2.73)	11 (8.08)	15 (5.31)
Not healed	1 (0.68)	4 (2.94)	5 (1.77)
Total	146	136	282

$P = .05$. The chi-square test was used to test trends in the contingency table.

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Key Words

1 visit, 2 visits, pain, periapical lesion, success and failure rate

96% vs 89%

TABLE 4. Distribution of Teeth According to Outcome Classification

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Total	146	136	282

$P = .05$. The chi-square test was used to test trends in the contingency table.

OTTURAZIONE

TECNICHE OTTURAZIONE CANALARE: CVC VS CLF

La qualità dell'otturazione, il risultato a lungo termine, la prevalenza del dolore postoperatorio erano simili tra questi due gruppi.

Risultato dell'otturazione del canale radicolare con guttaperca calda vs condensazione laterale a freddo: meta-analisi. Li Peng ET AL.

J Endod 2007; 33:106 -109

CONDENSAZIONE IDRAULICA 0.4 TAPER

GUTTAFLOW-BIOSEAL

Bioactive Property

Formazione di cristalli di idrossiapatite sulla superficie dopo l'indurimento con possibilita' riparative dell' osso e della dentina

GuttaFlow bioseal

GUTTAFLOW PLUS 40% OF BIOCERAMIC PARTICLES

STUDY SUMMARY

ROEKO GuttaF
Properties of a Novel
Silicate-Bioglass-Cont

Author: Maria Giovanna Gandolfi et a
NeuroMotor Sciences, University of B
Publication: Dent Mater. 2016 May; 3

STUDY AIM

Evaluation of the chemical–physical properti
guttapercha calcium silicate-containing root
(silicon-based, containing calcium silicate par
GuttaFlow2[1], **RoekoSeal**[1] (both silicon-based
resin-based, silicon-based, containing calciu

EXPERIMENTAL SETUP

[1] **Manufacturer:** Coltène/Whaledent AG, Altstatten,
[2] **Manufacturer:** Angulus, Londrina, Parana, Brazil

Available online at www.sciencedirect.com
ScienceDirect
journal homepage: www.intl.elsevierhealth.com/journals/dema
ELSEVIER
dental materials

Properties of a novel polysiloxane-guttapercha calcium silicate-bioglass-containing root canal sealer

M.G. Gandolfi[a,*], F. Siboni[a], C. Prati[b]

[a] Laboratory of Biomaterials and Oral Pathology, Dental School, Department of Biomedical and NeuroMotor Sciences, University of Bologna, Bologna, Italy
[b] Endodontic Clinical Section, Dental School, Department of Biomedical and NeuroMotor Sciences, University of Bologna, Bologna, Italy

Significance. GuttaFlow bioseal showed alkalinizing activity together with negligible solubility and slight calcium release. Therefore, the notable nucleation of apatite and apatite precursors can be related to the co-operation of CaSi particles (Si—OH groups) with polysiloxane (Si—O—Si groups).

The incorporation of a calcium silicate component into polydimethyl polymethylhydrogensiloxane guttapercha sealers may represent an attractive strategy to obtain a bioactive biointeractive flowable guttapercha sealer for moist/bleeding apices with bone defects in endodontic therapy.

rs based on polymethyl hydrogensiloxane or poly-
ha – introduced to improve the quality of conventional
ystems – showed advantages in handiness and clinical

valuare the chemical-physical properties of a novel
licate-containing root canal sealer (GuttaFlow bioseal).
mined and compared with GuttaFlow2, RoekoSeal and
open and impervious porosity and apparent porosity,
release, and alkalinizing activity were evaluated. ESEM-
uls and after soaking in simulated body fluid were also

ained among the materials.
olubility and porosity, high water sorption, moderate
ng activity. MTA Fillapex showed the highest calcium
bility, RoekoSeal the lowest calcium release, no alkalin-
water sorption. Only GuttaFlow bioseal showed apatite
forming ability.

Apatite

Significance. GuttaFlow bioseal showed alkalinizing activity together with negligible solubility and slight calcium release. Therefore, the notable nucleation of apatite and apatite precursors can be related to the co-operation of CaSi particles (Si OH groups) with polysiloxane (Si O Si groups).

The incorporation of a calcium silicate component into polydimethyl polymethylhydrogensiloxane guttapercha sealers may represent an attractive strategy to obtain a bioactive biointeractive flowable guttapercha sealer for moist/bleeding apices with bone defects in endodontic therapy.

I Cementi Bioceramici: la storia

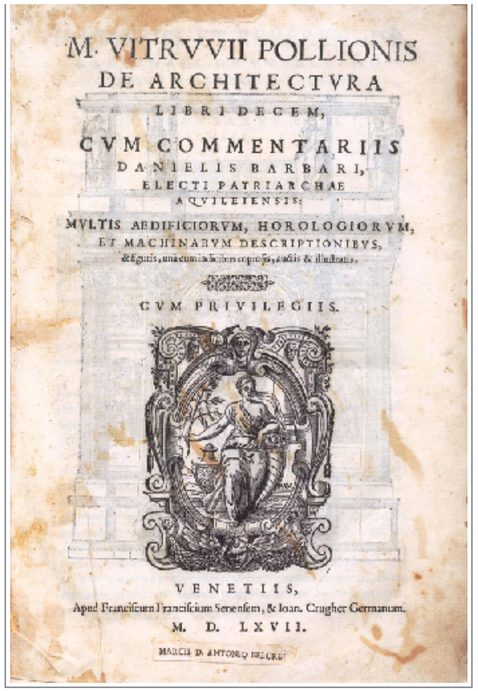
I Cementi Bioceramici: la storia

CALCE VIVA

+

MATERIALE VULCANICO

Vitruvio Marco Pollione.



" LA POZZOLANA DI BAIA O DI CUMA FA GAGLIARDA NON SOLO OGNI SPECIE DI COSTRUZIONE MA IN PARTICOLARE QUELLE CHE SI FANNO IN MARE SOTT'ACQUA".

I Cementi Bioceramici: la storia

MTA

TORABINEJAD 1993

I Cementi Bioceramici: chimica

REAZIONE DI IDRATAZIONE

$$2\,(3CaO.SiO_2) + 6H_2O. \rightarrow 3CaO.2SiO_2 + 3H_2O + 3Ca(OH)_2$$

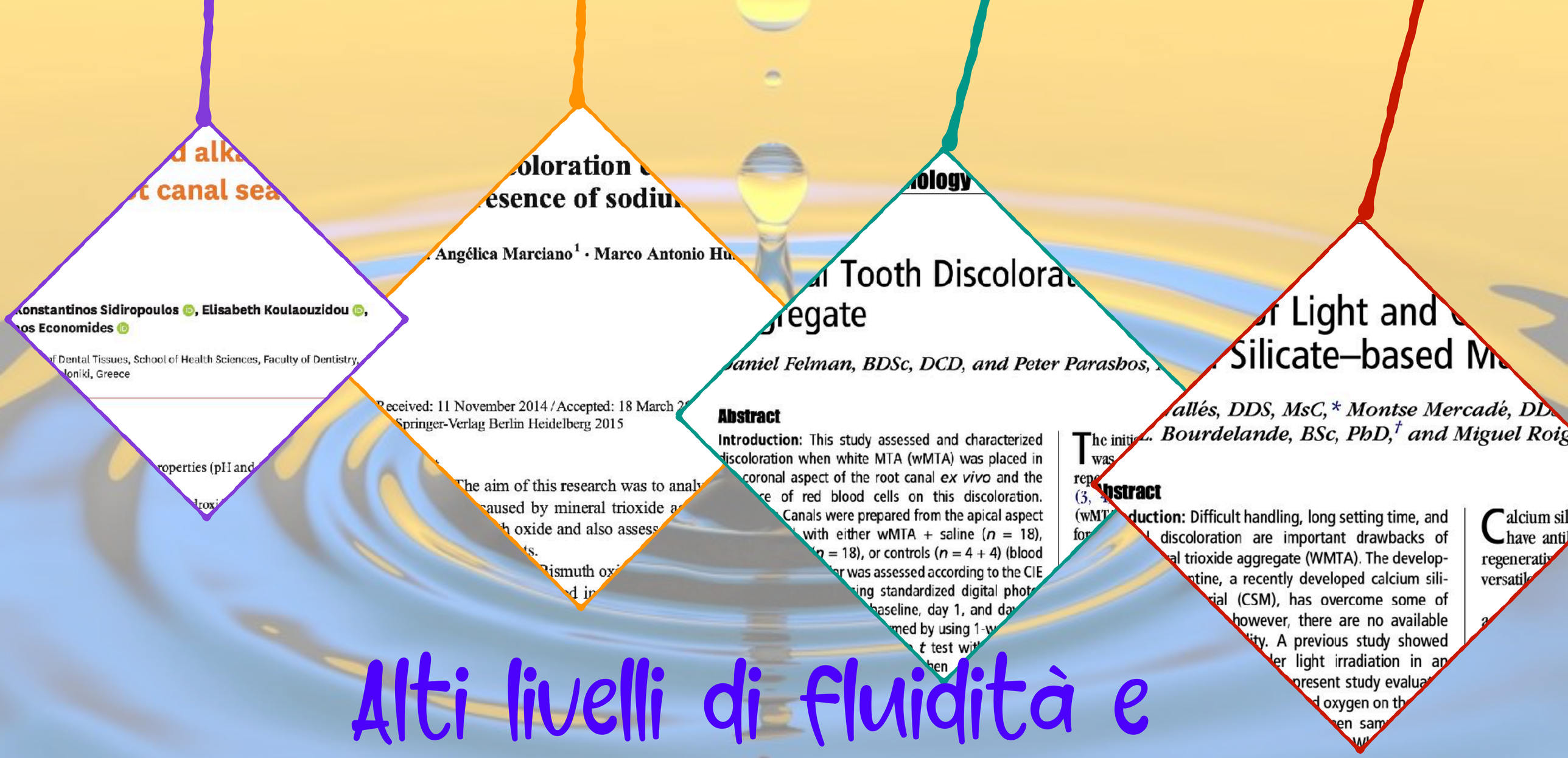
$$2\,(2CaO.SiO_2) + 4H_2O. \rightarrow 3CaO.2SiO_2 + 3H_2O + Ca(OH)_2$$

REAZIONE DI PRECIPITAZIONE

$$7Ca(OH)_2 + 3Ca(H_2PO_4)_2 \rightarrow Ca_{10}(PO_4)_6(OH)_2 + 12H_2O$$

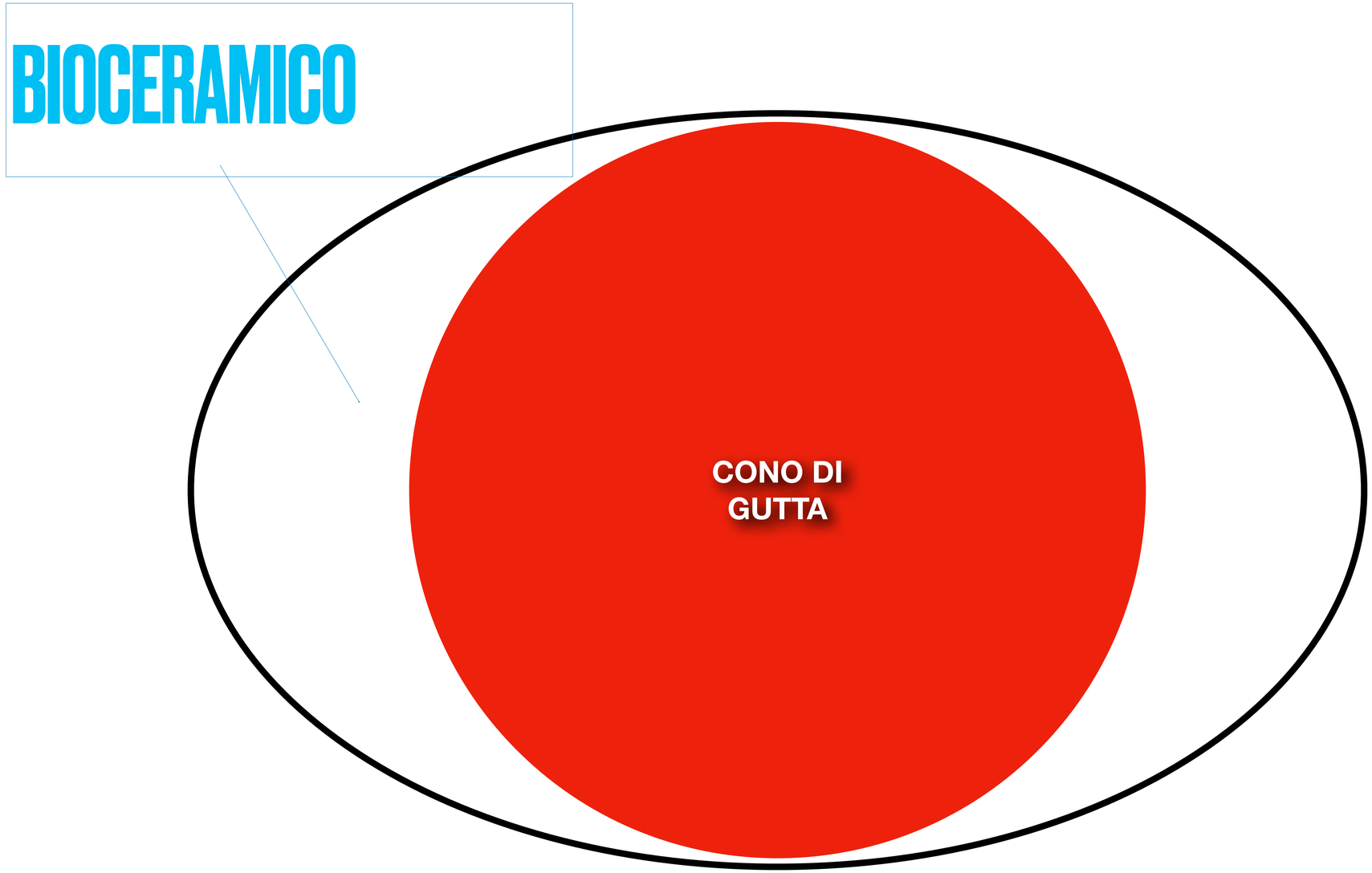
VANTAGGI

Elevata biocompatibilità
Non tossico
Idrofilo
Radiopacità
Adesione alla dentina
Dimensionalmente stabile
Bioattivo e osteoinduttivo
Bassa risposta infiammatoria
Formazione di idrossiapatite
Antibatterico (pH basico)
Facile da usare e maneggiare



Alti livelli di fluidità e penetrazione nei tubuli dentali

Otturazione Canalare: Condensazione idraulica



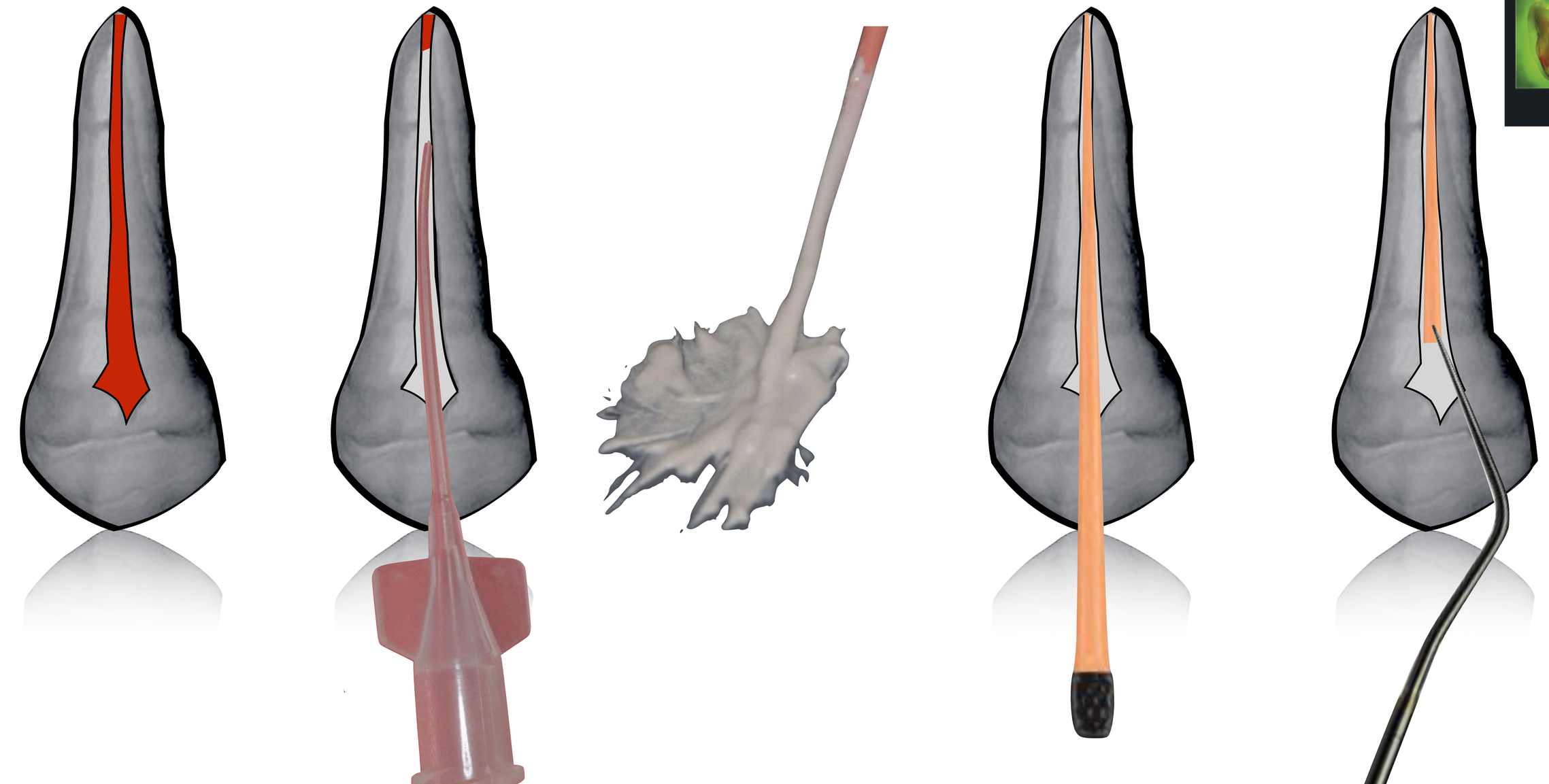
Otturazione Canalare: Condensazione idraulica

BIOCERAMICO

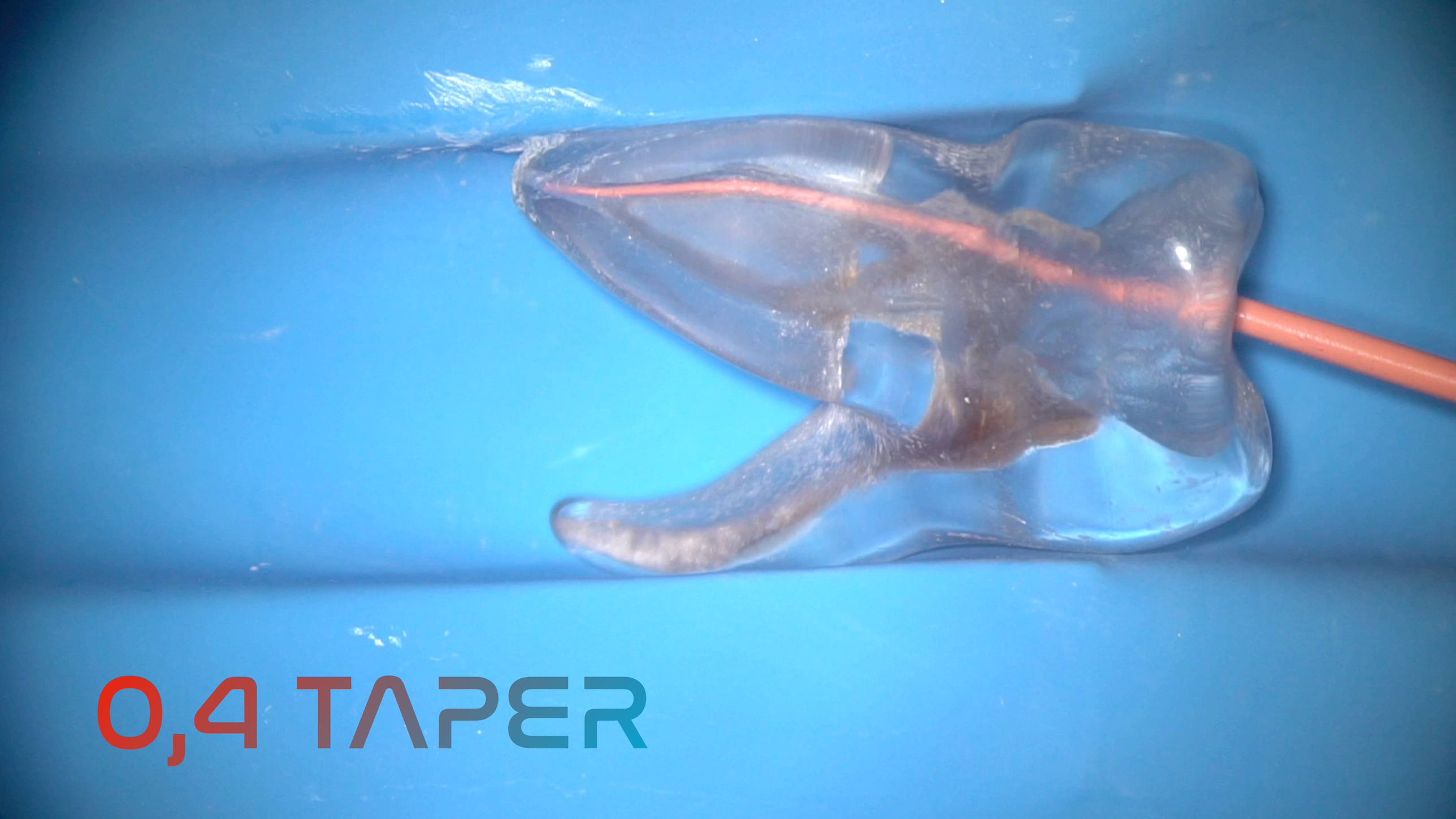
FILLER

CONO DI GUTTA

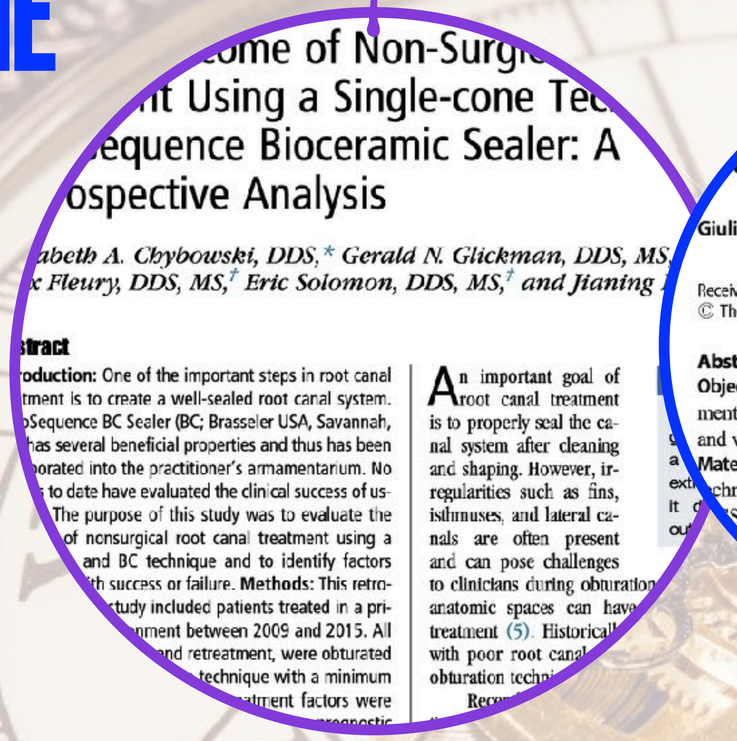
CARRIER




ACCADEMIA ITALIANA DI ENDODONZIA
COLLANA DI MONOGRAFIE
OTTURAZIONE DEL SISTEMA CANALARE
MAURO VENTURI, FEDERICA FONZAR
GIANLUCA FUMEI, CARLO PIANA
Coordinamento scientifico
MAURO VENTURI
PICCIN


0,4 TAPER

OUTCOME



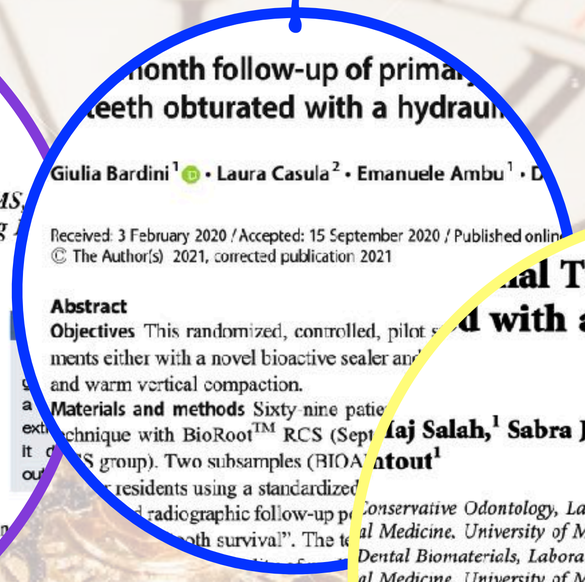
ome of Non-Surgi
nt Using a Single-cone Tec
equence Bioceramic Sealer: A
ospective Analysis

abeth A. Chybowski, DDS,* Gerald N. Glickman, DDS, MS,
x Fleury, DDS, MS,† Eric Solomon, DDS, MS,† and Jianing

tract

roduction: One of the important steps in root canal
tment is to create a well-sealed root canal system.
bSequence BC Sealer (BC; Brasseler USA, Savannah,
has several beneficial properties and thus has been
porated into the practitioner's armamentarium. No
to date have evaluated the clinical success of us-
The purpose of this study was to evaluate the
of nonsurgical root canal treatment using a
and BC technique and to identify factors
th success or failure. **Methods:** This retro-
study included patients treated in a pri-
nment between 2009 and 2015. All
nd retreatment, were obturated
technique with a minimum
atment factors were

An important goal of root canal treatment is to properly seal the canal system after cleaning and shaping. However, irregularities such as fins, isthmuses, and lateral canals are often present and can pose challenges to clinicians during obturation. anatomic spaces can have treatment (5). Historicall with poor root canal obturation techni



onth follow-up of prima
eeth obturated with a hydrau

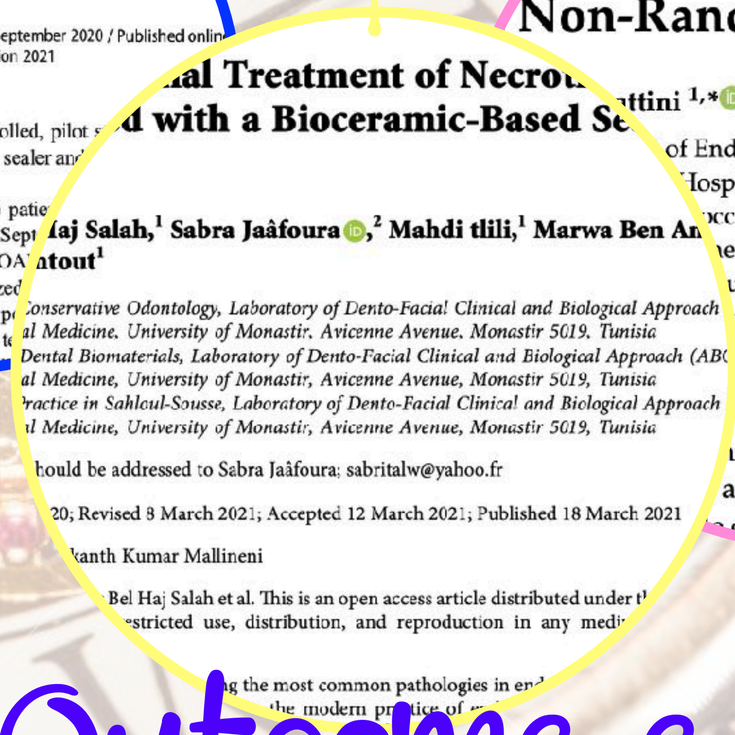
Giulia Bardini [1] · Laura Casula [2] · Emanuele Ambu [1] · D

Received: 3 February 2020 / Accepted: 15 September 2020 / Published onlin
© The Author(s) 2021, corrected publication 2021

Abstract

Objectives This randomized, controlled, pilot s
ments either with a novel bioactive sealer and
and warm vertical compaction.

Materials and methods Sixty-nine patie
chnique with BioRoot™ RCS (Sept
S group). Two subsamples (BIOA
residents using a standardized
radiographic follow-up pe
oth survival". The te



al Treatment of Necrot
d with a Bioceramic-Based Se

**aj Salah,[1] Sabra Jaâfoura,[2] Mahdi tlili,[1] Marwa Ben An
atout[1]**

*Conservative Odontology, Laboratory of Dento-Facial Clinical and Biological Approach
al Medicine, University of Monastir, Avicenne Avenue, Monastir 5019, Tunisia
Dental Biomaterials, Laboratory of Dento-Facial Clinical and Biological Approach (AB
al Medicine, University of Monastir, Avicenne Avenue, Monastir 5019, Tunisia
Practice in Sahloul-Sousse, Laboratory of Dento-Facial Clinical and Biological Approach
al Medicine, University of Monastir, Avicenne Avenue, Monastir 5019, Tunisia*

hould be addressed to Sabra Jaâfoura; sabritalw@yahoo.fr

20; Revised 8 March 2021; Accepted 12 March 2021; Published 18 March 2021

kanth Kumar Mallineni

Bel Haj Salah et al. This is an open access article distributed under t
estricted use, distribution, and reproduction in any medi

g the most common pathologies in en
the modern pr

me of Root Canal
cium Silicate Root Cana
Non-Randomized Clinical

ttini [1,*], Alan Knight [1], Federico Foschi [1]

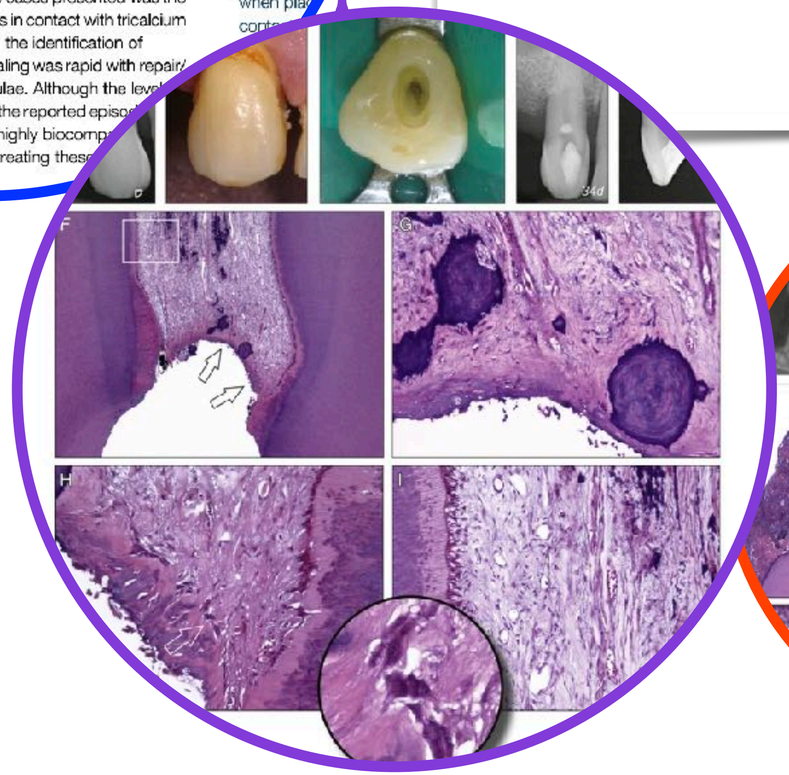
of Endodontics, Faculty of Dentistry, Oral & C
Hospital, London SE1 9RT, UK; eknight@hotm
cci@kcl.ac.uk (F.M.)
herapeutic Dentistry I. M. Sechenov First
ussia
ngelo.zavattini@kcl.ac.uk

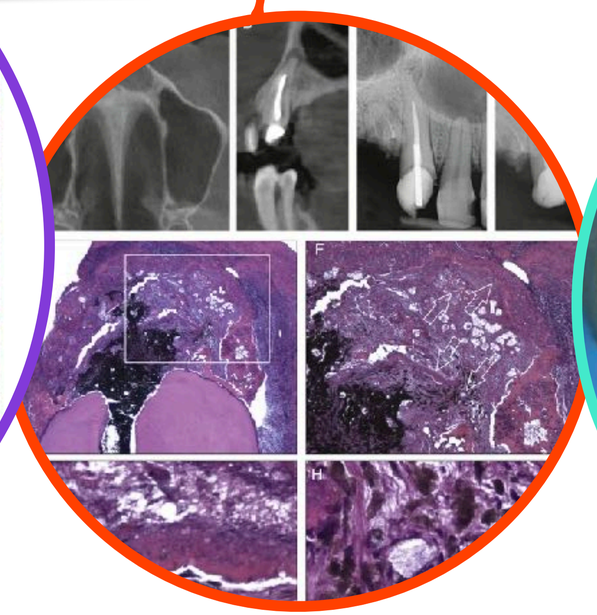
2020; Accepted: 11 March 2020; P

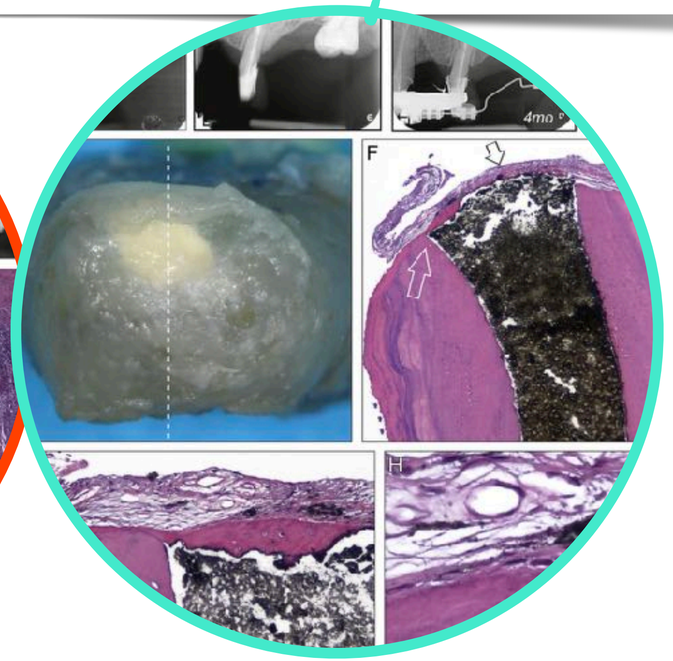
d: The aim of this study w
a calcium silicate root
cement and war

Miglioramento Outcome e Maggior velocità di guarigione

Confirmation of the biocompatibility and bioactivity of the tricalcium Silicate–based materials used in treating the cases reported in this series enables clinicians to use these materials with confidence when placing them in direct contact with pulpal and periapical tissues.







COLTENE IS CAMING

ESE ROME 2011

NOT ONLY ROOTS

15TH BIENNIAL CONGRESS
OF THE EUROPEAN SOCIETY
OF ENDODONTOLOGY

ROME - 2011, SEPTEMBER 14TH - 17TH

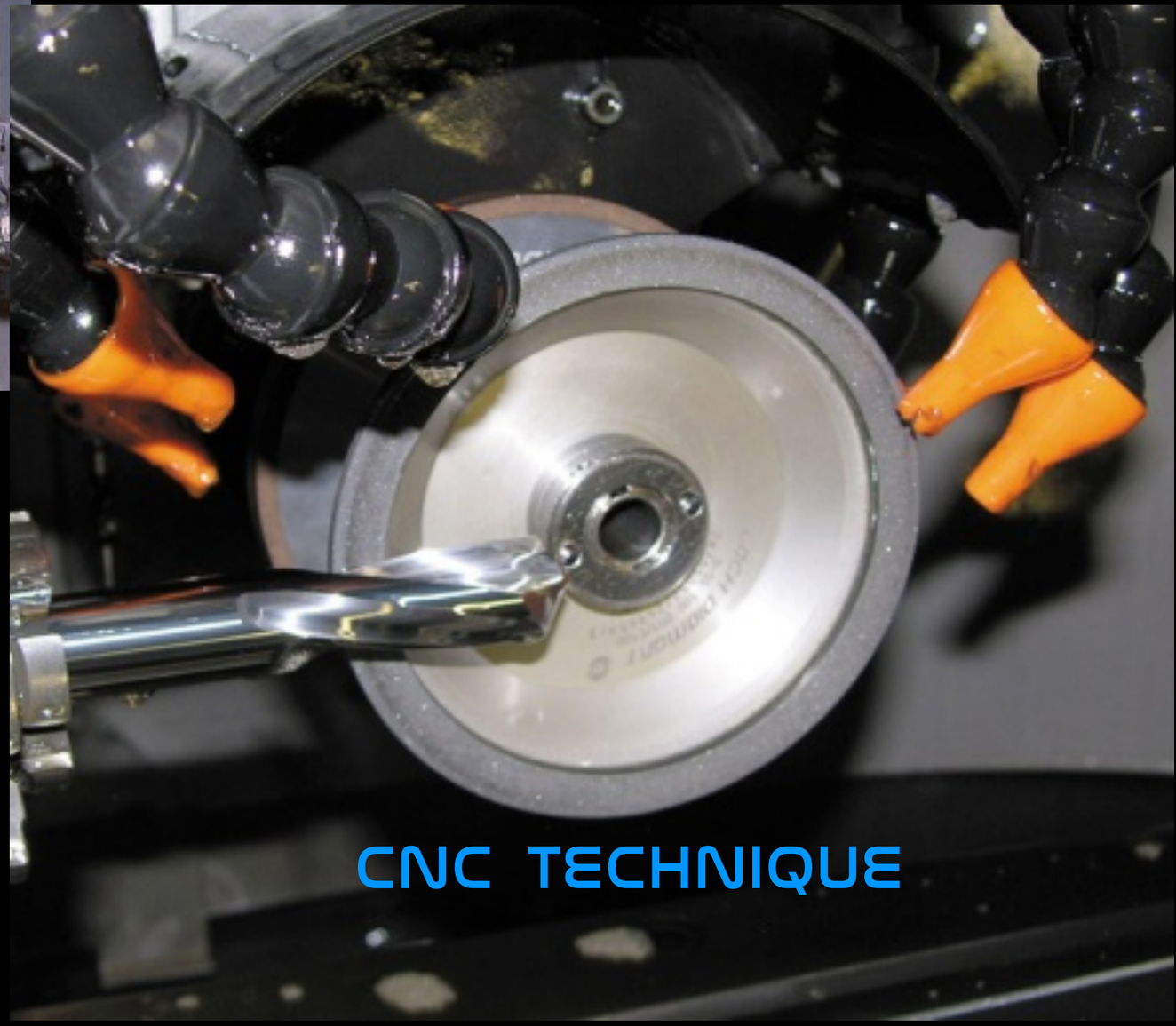
COLTENE

HYFLEX EDM 2015

2015 ELETTROEROSIONE

Ni-Ti

Hyflex CM



CNC TECHNIQUE

EDM

ELECTICAL DISCHARGE
MACHINING

ELETTROEROSIONE

HYFLEX EDM SEQUENCE

CM-wire machined by Electrical Discharge Machining

HyFlex CM (CM-wire)

CM treatment = Martensite = Deformable at room T°

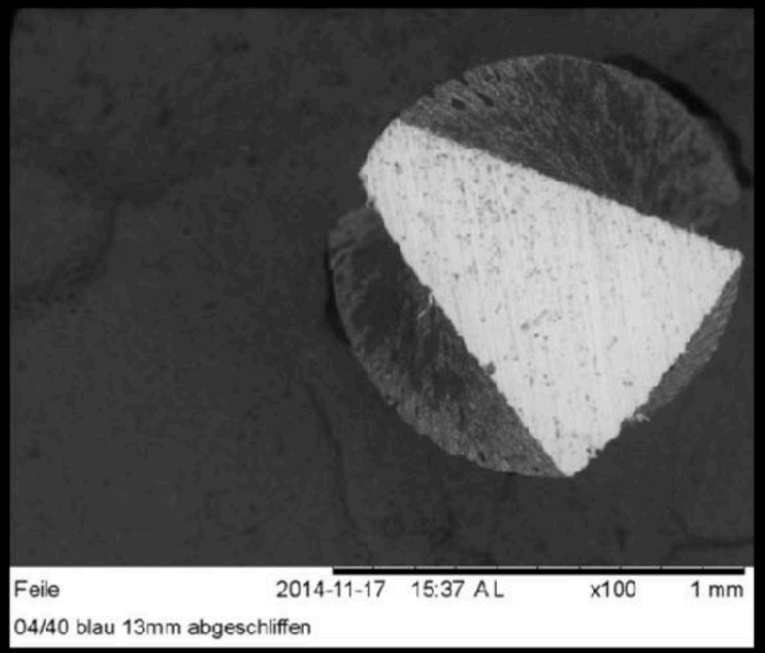
È la scintilla a fare il lavoro.

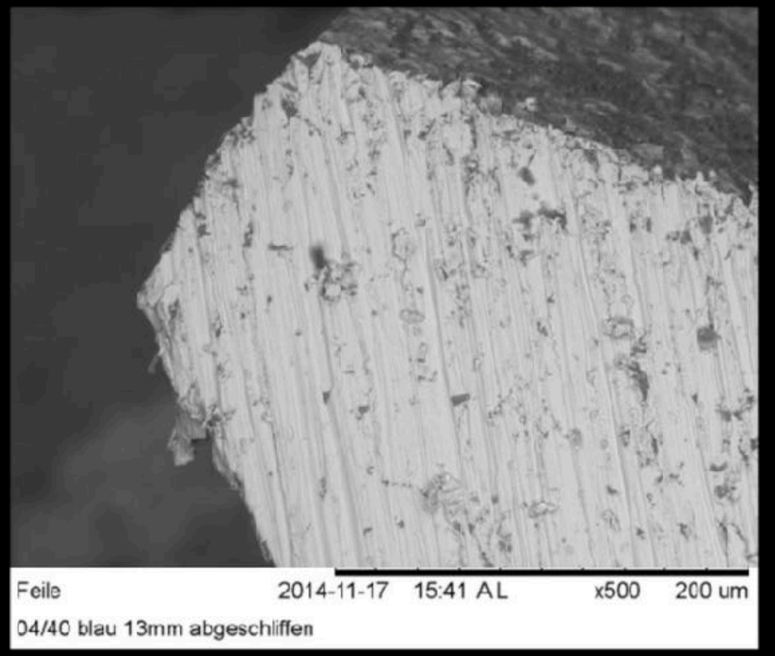
EDM (CM-wire)

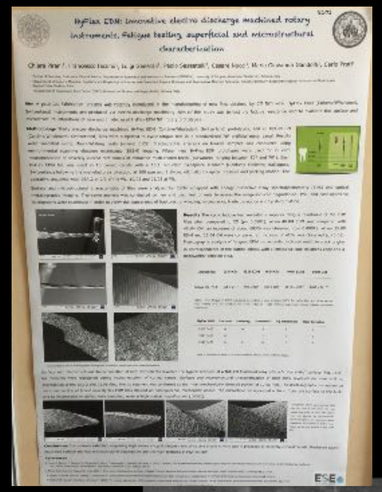
Ni-Ti EDM files

The EDM manufacturing process as well as the CM-wire make the HyFlex EDM files more fracture resistant and improve the cutting efficiency.

parte lavorante individualizzata







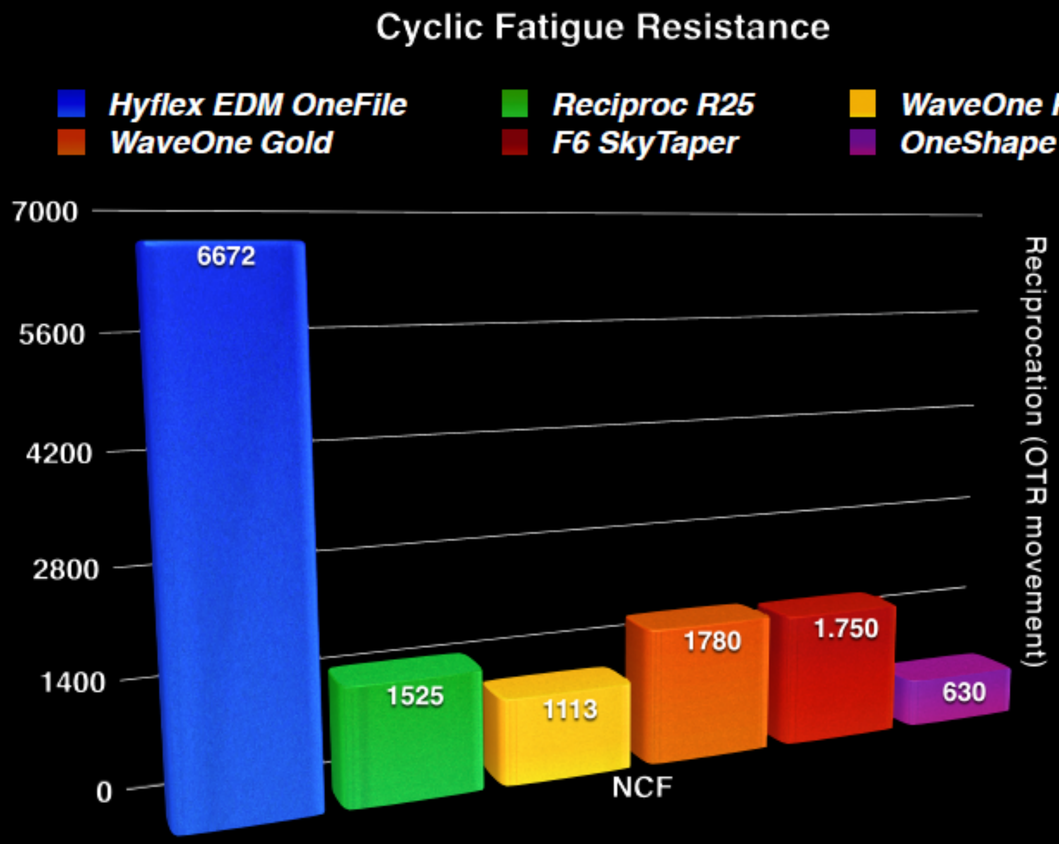
CM vs EDM

SURFACE DIFFERENCES

ALTA DUREZZA DI SUPERFICIE

ALTA EFFICENZA DI TAGLIO

Dr Chiara Pirani & Dr Francesco Iacono
Universita' di Bologna

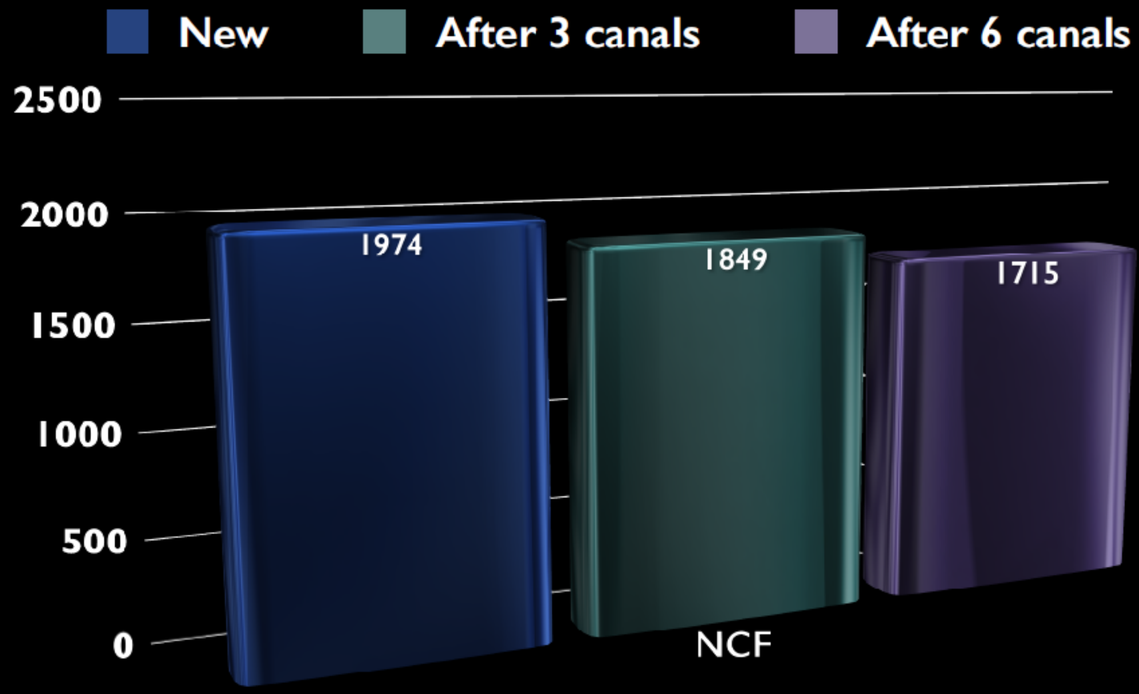


New Dynamic Cyclic Fatigue Test Device

Cyclic Fatigue Resistance

Hyflex EDM 40.04

New or Used



Finishing file

DETERSIONE MECCANICA

40.4 **50.3** **60.2**

HYFLEX EDM OGSF

2024

HyFlex EDM

O rifice Opener: EDM 18/11

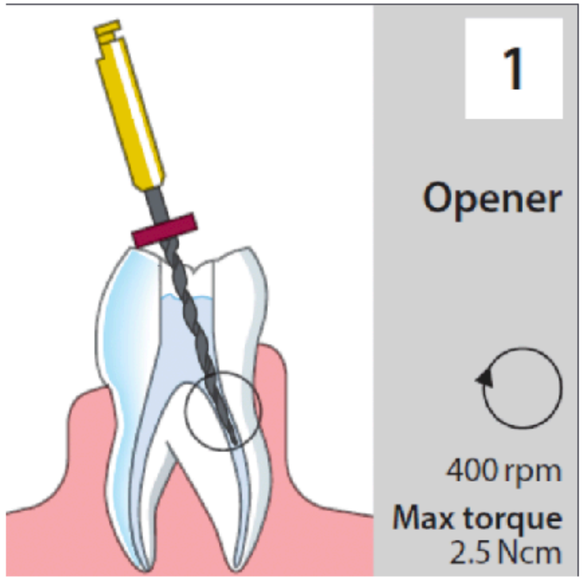
G lider: EDM 15/.03

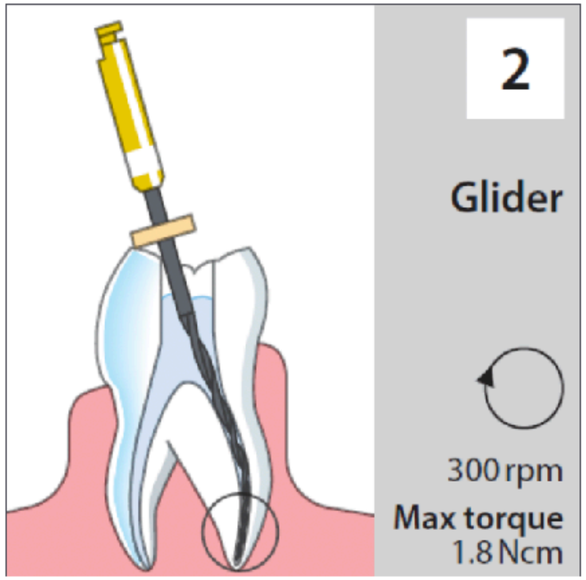
S haping File: EDM 18/.045

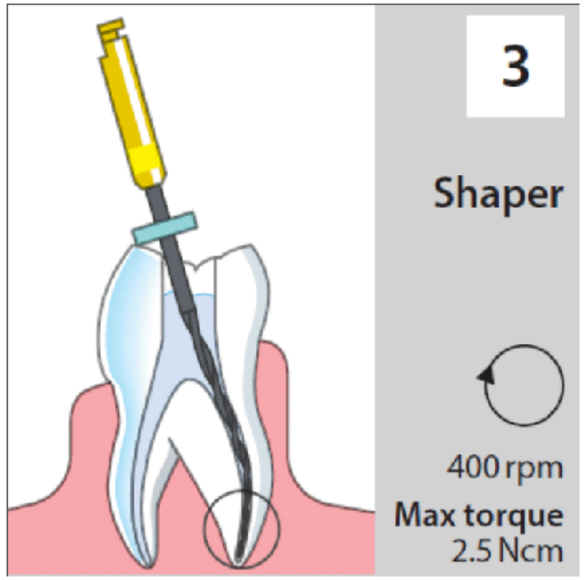
F inishing File: EDM 30/.04

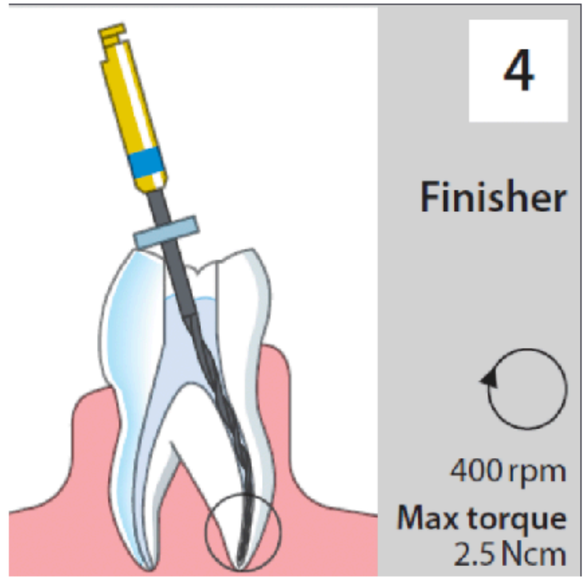
SETTING HYFLEX OGSF

Sequenza di 4 file- 1 file...Sequenza di partenza per ogni caso, indipendentemente dalla difficoltà









Opener

Glider

Shaper

Finisher

EDM 18/11

EDM 15/.03

EDM 18/.045

EDM 30/.04

Science behind the developments:

Orifice opener take out the stress of the other files

18.11

Comparison of the effects from coronal pre-flaring and glide-path preparation on torque generation during root canal shaping procedure

Sang Won Kwak, DDS, MS, PhD[1]; Jung-Hong Ha, DDS, MS, PhD[2]; Ya Shen, DDS, PhD[3]; Markus Haapasalo, DDS, PhD[3]; and Hyeon-Cheol Kim, DDS, MS, PhD[1]

Table 1 The sum and maximum torque generated during the experiment (Ncm) (mean ± SD) (n = 15)

	Group 1 OC	Group 2 OG + OC	Group 3 OF + OC	Group 4 OF + OG + OC
Sum of Torque	14.75 ± 2.98[a]	12.68 ± 2.30[b]	10.79 ± 2.39[c]	10.20 ± 1.91[c]
Maximum Torque	2.63 ± 0.48[a]	2.58 ± 0.54[a]	2.23 ± 0.50[b]	2.06 ± 0.34[b]

Note: [a,b,c]Different lower-case superscripts indicate significant differences amongst the groups in rows (P < 0.05).
Abbreviation: OC, OneCurve; OF, OneFlare; OG, OneG.

BASIC RESEARCH – TECHNOLOGY

Cyclic Fatigue Resistance of Nickel-titanium Rotary Instruments according to the Angle of File Access and Radius of Root Canal

Eugenio Pedullà, DDS, MS, PhD, Giusy Rita Maria La Rosa, DDS,* Chiara Virgilito, DDS,* Ernesto Rapisarda, DDS,* Hyeon-Cheol Kim, DDS, MS, PhD,† and Luigi Generali, DDS‡*

ABSTRACT

Introduction: The aim of this study was to compare the influences from different access angles and curvature radii on cyclic fatigue resistance of nickel-titanium rotary files. **Methods:** Two file systems (2Shape [TS; MicroMega, Besançon, France] and HyFlex CM [HCM; Coltène/Whaledent, Altstätten, Switzerland]) were used. A total of 192 instruments of TS #25/.04 (TS1), TS #25/.06 (TS2), HCM #25/.04, and HCM #25/.06 were evaluated at 3 insertion angles (0°, 10°, and 20°) and 2 radii (5 mm and 3 mm) in 16-mm stainless steel artificial canals with a 60° curvature. Cyclic fatigue resistance was determined by the number of cycles to failure (NCF) using a customized testing device. Data were analyzed statistically with the significance level established at 95%. **Results:** In the 3-mm radius canal, the instruments showed lower cyclic fatigue resistance than in the 5-mm radius canal ($P < .05$). HCM #25/.06 and all .04 taper instruments had a significant NCF reduction at 20° and 10° in the 3-mm radius canal ($P < .05$), whereas TS2 showed no significant differences. In the 5-mm radius of curvature, although .06 taper instruments had no significant NCF reduction for each angle tested, .04 taper files exhibited significant NCF reduction when tested at 20° ($P < .05$). Comparing the same size instruments, HCM had higher NCF than TS ($P < .05$). Instruments with a .04 taper exhibited higher NCF than the .06 ones with the same heat treatment ($P < .05$). **Conclusions:** An inclined insertion into the canals decreased cyclic fatigue resistance of thermal-treated instruments with a .04 taper at all radii of curvature tested. The synergistic effect of a small radius of curvature and access angulation of heat-treated instruments decreases their fatigue resistance. *(J Endod 2020;46:431–436.)*

SIGNIFICANCE

The angulated file access and/or severe curved canal curvature with a small radius could influence (reduce) cyclic fatigue resistance of heat-treated nickel-titanium instruments.

KEY WORDS

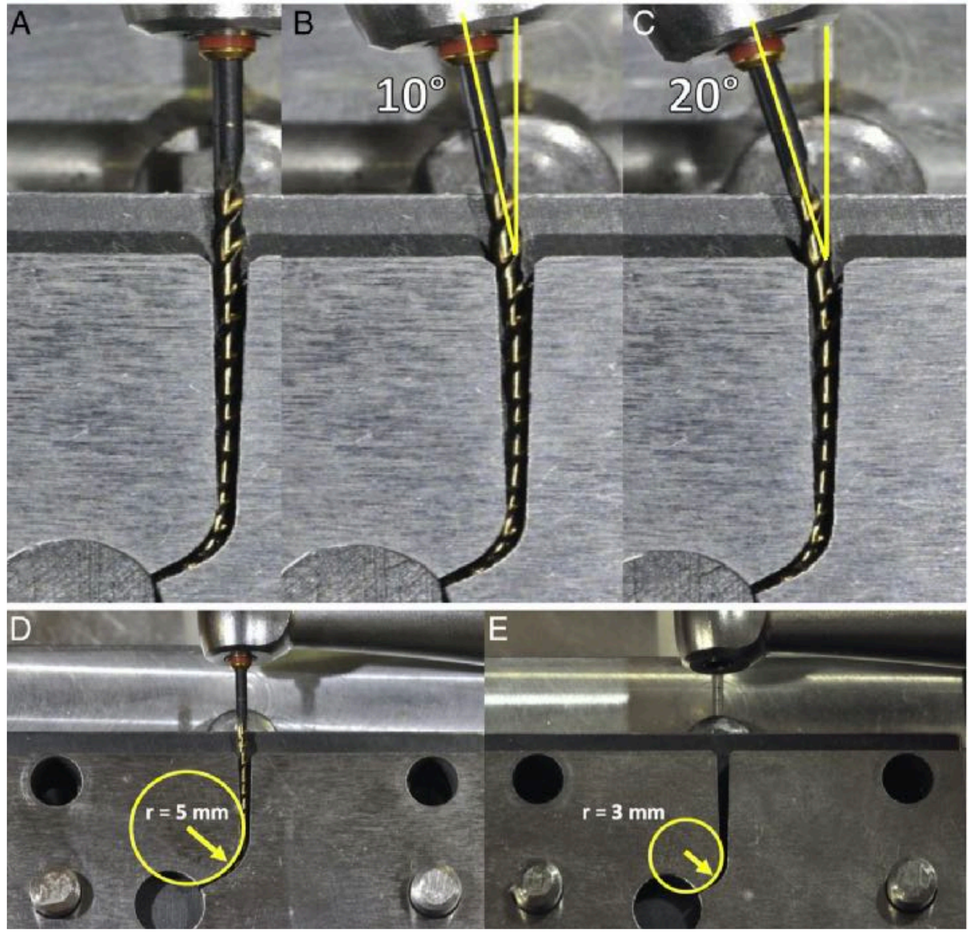
2Shape; angle of file access; canal curvature; canal radius; cyclic fatigue resistance; HyFlex CM

From the *Department of General Surgery and Surgical-Medical Specialties, University of Catania, Catania, Italy; †Department of Conservative Dentistry, School of Dentistry, Dental and Life Science Institute, Dental Research Institute, Pusan National University, Yangsan, Korea; and ‡Department of Surgery, Medicine, Dentistry and Morphological Sciences with Transplant Surgery, Oncology and Regenerative Medicine Relevance (CHIMOMO), University of Modena and Reggio Emilia

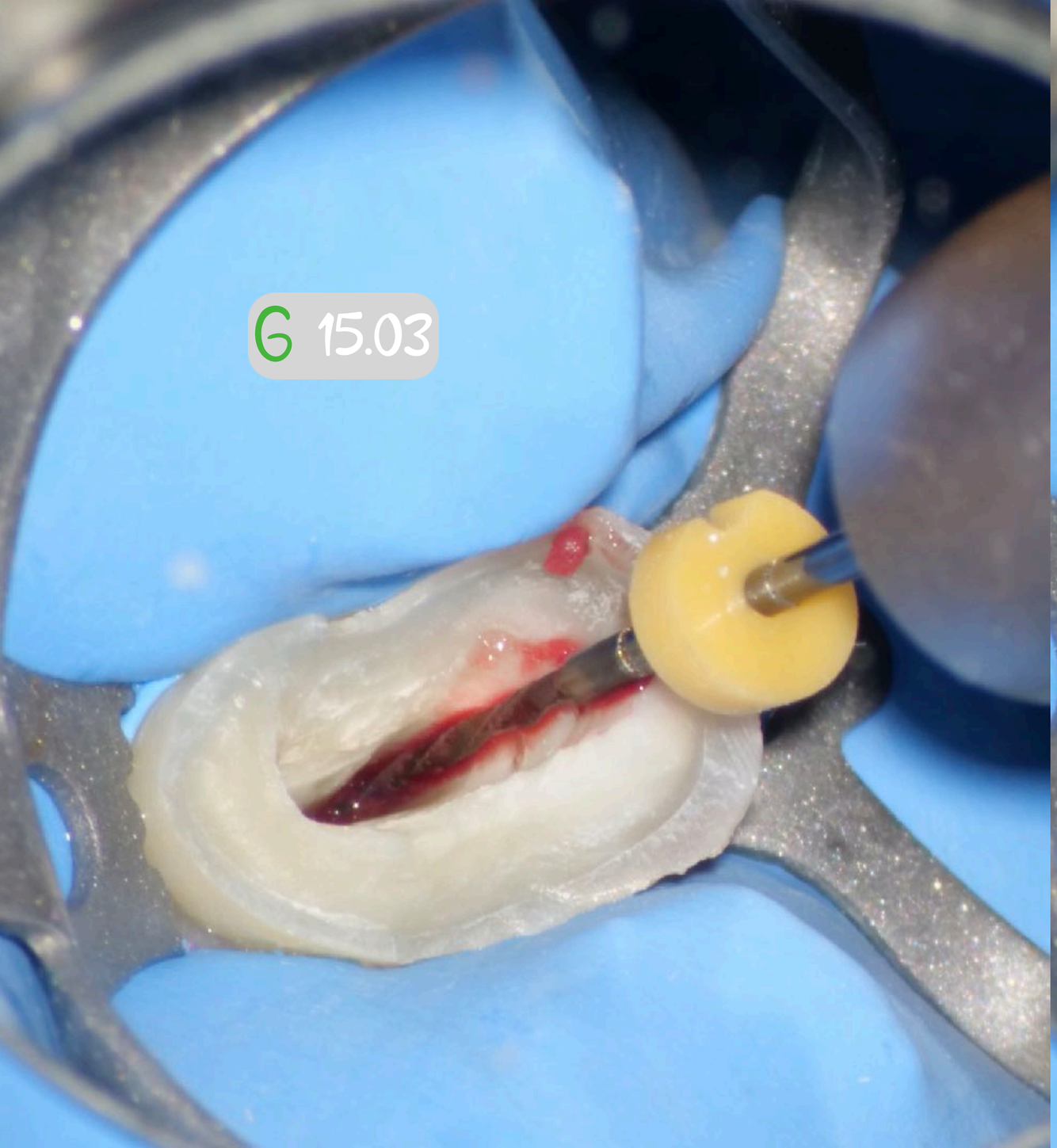
Nickel-titanium (NiTi) rotary instruments may exhibit a higher risk of intraoperative fracture within the root canal[1]. Fracture may occur due to torsional failure or cyclic fatigue[2,3]. Cyclic fatigue appears to be the more prevalent cause
crack propagation o
canal[2,3].

Several factors
treatment, and metal
instrument fracture is
shaped curvatures[4,1
anatomic access co
endodontics, the rec
NiTi instruments[1,2].

Heat treatment
characteristics of trad



.05). **Conclusions:** An inclined insertion into the canals decreased cyclic fatigue resistance of thermal-treated instruments with a .04 taper at all radii of curvature tested. The synergistic effect of a small radius of curvature and access angulation of heat-treated instruments decreases their fatigue resistance. *(J Endod 2020;46:431–436.)*


G 15.03

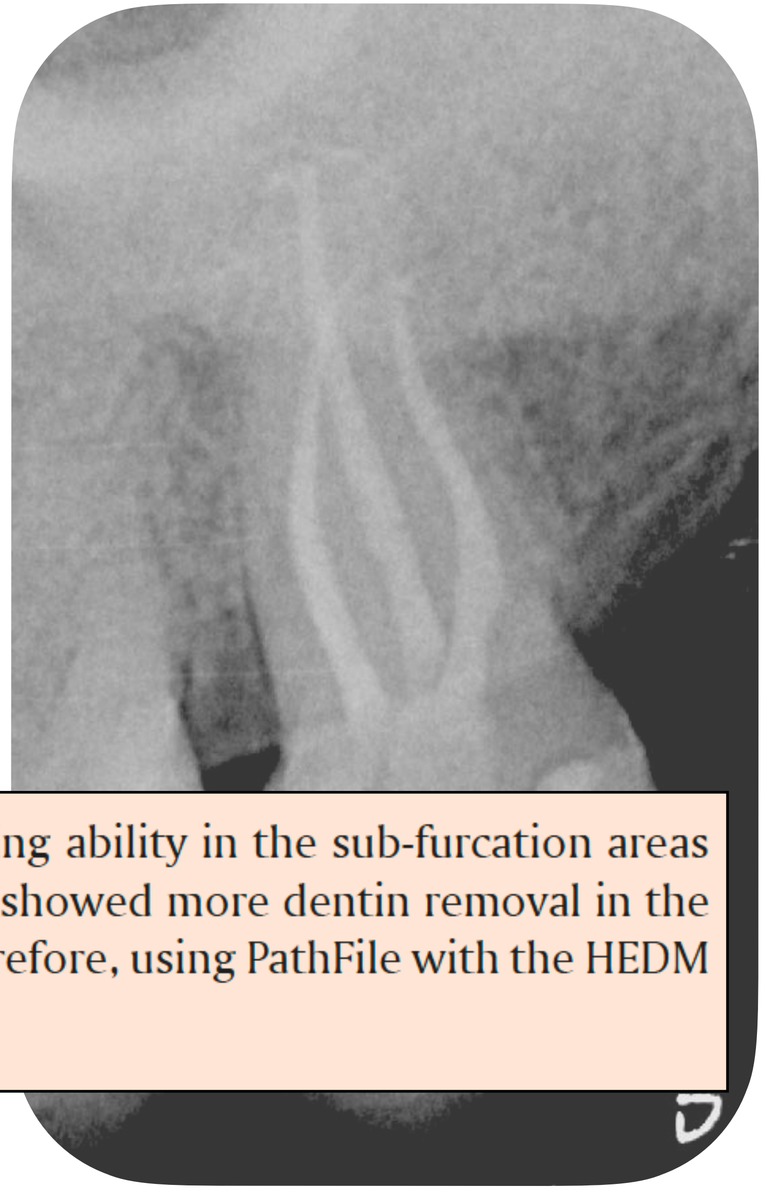

S 18.045

Original Article

Shaping ability of HyFlex EDM and ProTaper Gold files with or without using glide path files: An *in vitro* study

Maryam Gharechahi, Harir Ahmadi[1], Maryam Forghanirad, Melika Hoseinzadeh[2], Anahita Nouri[3]

Departments of Endodontics and [3]Prosthodontics, School of Dentistry, Mashhad University of Medical Science, [2]Dentist, Research Assistant, Dental Research Center, Mashhad Dental School, Mashhad University of Medical Sciences, [1]Dentist, Mashhad, Iran



Abstract

Introduction: The necessity of using a glide path before the canal preparation is inconclusive. Therefore, this study aimed to assess the shaping ability of two rotary systems in the maxillary first molars' first mesiobuccal canal (MB1), with or without employing the glide path files.

Materials and Methods: The MB1 canals of 100 extracted molars were randomly prepared using either HyFlex EDM (HEDM) or ProTaper Gold (PTG) systems (n = 50 each). Half of the samples in each group were prepared using ProGlider (PG) or HyFlex EDM Glide (HEG). The cone-beam computed tomography scanning was conducted before and after the instrumentation. The canal transportation, centering ability,

Conclusions: The HEDM system outperformed PTG regarding centering ability in the sub-furcation areas and canal transportation 2 mm below the furcation. However, HEDM showed more dentin removal in the middle region than PTG, which was resolved when HEG was used. Therefore, using PathFile with the HEDM system might be suggested.

and canal transportation 2 mm below the furcation. However, HEDM showed more dentin removal in the middle region than PTG, which was resolved when HEG was used. Therefore, using PathFile with the HEDM system might be suggested.

Keywords: Canal transportation, centering ability, glide path, NiTi file, root canal preparation

Science behind the developments:

Preparation to size 30 offers minimum requirement for irrigation and obturation

F 30.04

Determination of the Minimum Instrumentation Size for Penetration of Irrigants to the Apical Third of Root Canal Systems

Abbasali Khademi, DDS, MS, Mohammad Yazdizadeh, DDS, MS, and Mahboobe Feizianfard, DDS, MS

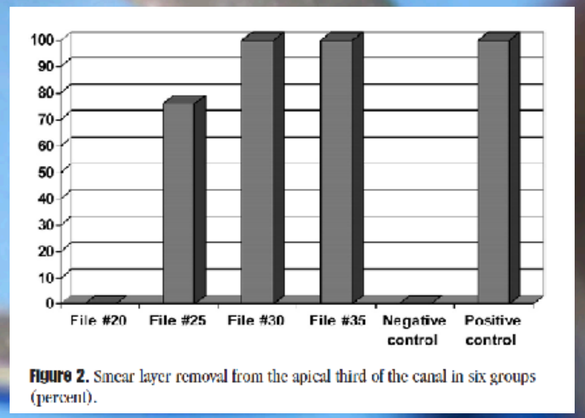


Figure 2. Smear layer removal from the apical third of the canal in six groups (percent).

PERCHÈ I FINISHER SONO IMPORTANTI??

DETERSIONE MECCANICA

2025

OGSF

Nuovi colori e nuova lunghezza 31mm

2025

EDM

Nuovi colori e nuova lunghezza 31mm

Vantaggi Clinici

1) Cavità d'accesso conservative

2) Preservazione Dentina

3) Sicurezza nelle curvature

4) Diametri apicali grandi

4) Otturazione Canalare facilitata

MOTORI ENDODONTICI

CanalPro X-Move

CanalPro X-Move

Contrangolo:
- Trasmissione 6:1
- Rotazione di 360 gradi

Torque range: 0.4 Ncm - 5.0 Ncm（4 mNm – 50 mNm）

Speed range: 100 rpm – 2500 rpm

Regolazione degli angoli di reciprocazione: intervalli di 10°

Angoli possibili: 20° - 400°

Contrangolo di dimensioni ridotte:

Diametro di 8 mm ed altezza di 9.7 mm

CanalPro X-Move

- Wireless
- Rotazione Continua
- Movimento Reciprocante con preimpostazione de angoli di rotazione del OneReci
- Localizzatore Apicale Integrato
- Contrangolo Isolato
- Files Coltene preimpostati, per un facile utilizzo

- Rilevatore d'apice integrato & Rotazione Continua + Movimento Reciprocante:

  TUTTO IN UN DISPOSITIVO

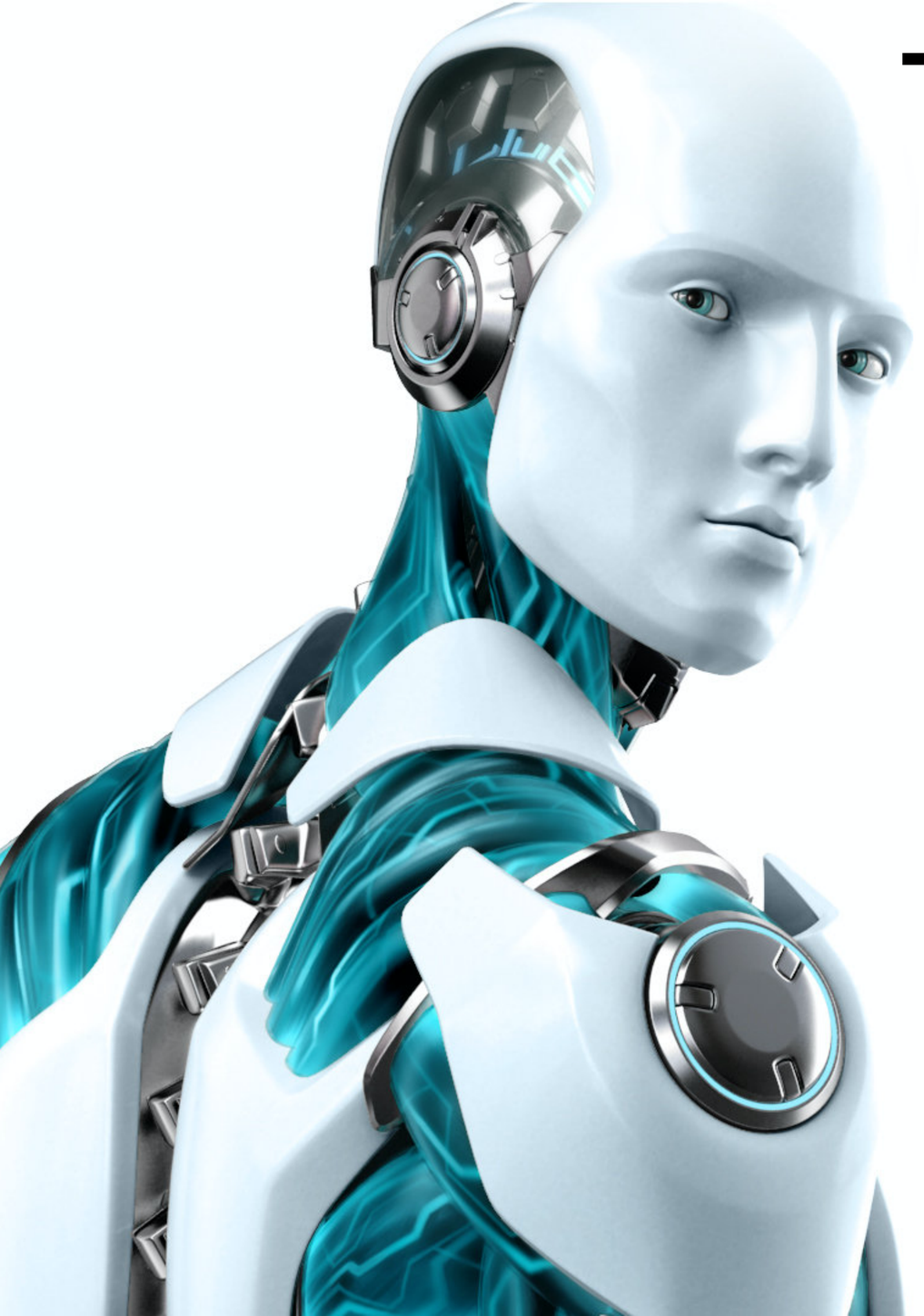
- Contrangolo isolato con dimensioni ridotte per:
  FACILITA' DI UTILIZZO, FACILE ACCESSO E MIGLIORE VISIBILITA'

- Files Coltene preimpostati:

  RISPARMIO DI TEMPO E FACILITA' DI UTILIZZO

ONE MORE THING

The future is Now



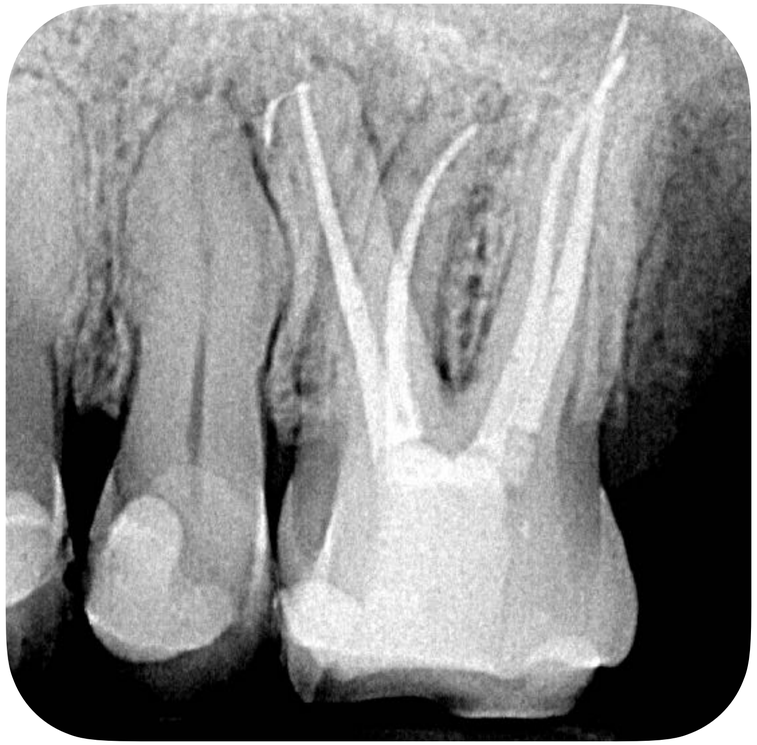
CanalPro™ Jeni

Caratteristiche Tecniche

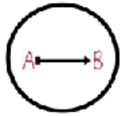
- ☑ Motore da tavolo cordless
- ☑ Monitor touch screen 7“ a colori
- ☑ Scheda SD contenente il software
- ☑ Contrangolo con rilevatore d’apice integrato
- ☑ Pedale Bluetooth

REGOLE

1. Leggera e costante pressione in senso apicale
2. Uscire quando si sente il Beep



4 programmi : HyFlex EDM, HyFlex CM, MM OneCurve, MM 2Shape



APPLICANDO UNA LEGGERA PRESSIONE CONTINUA SUL MANIPOLO, IL MOTORE RILEVA AUTOMATICAMENTE L'INTENSITA ATTUALE DELLO STRESS DEL FILE, L'ANATOMIA DEL CANALE RADICOLARE E LA PRESSIONE APPLICATA E REGOLA DI CONSEGUENZA IL MOVIMENTO DEL FILE.

LA RISPOSTA DEL MOTORE E DIVERSA PER OGNI STRUMENTO E CIASCUN CANALE RADICOLARE. NON E NECESSARIO IL MOVIMENTO DI PECKING NE DI BRUSHING.

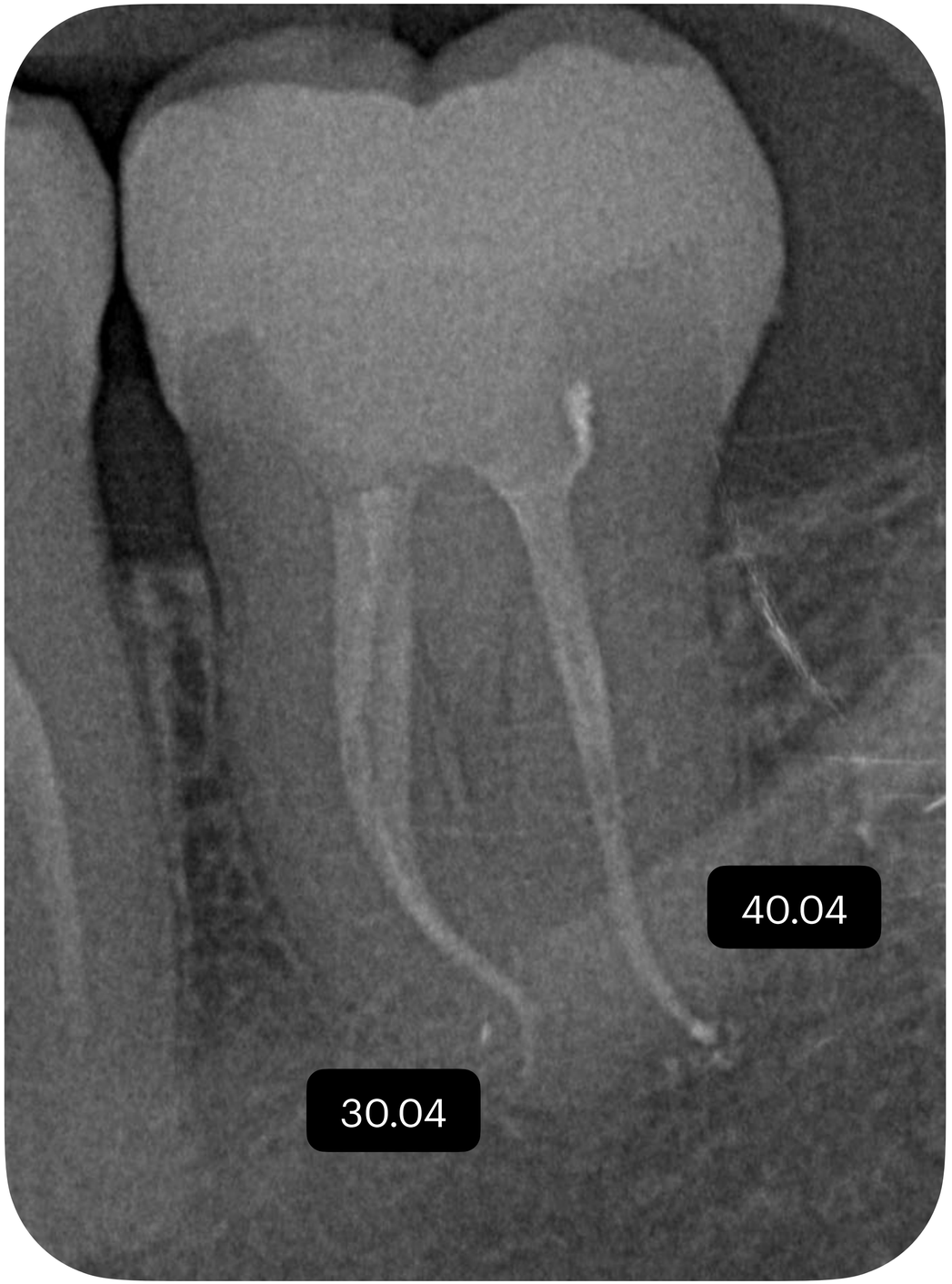
Notifica di Irrigazione automatica (beep lungo)

IL MOTORE EMETTE AUTOMATICAMENTE UN SEGNALE ACUSTICO PER INDICARE IL MOMENTO IN CUI E NECESSARIO ESTRARRE IL FILE DAL CANALE ED IRRIGARE .

Notifica di cambio file automatica (più beep brevi)

IL MOTORE INDICA CHE IL FILE DEVE ESSERE CAMBIATO DOPO UN CERTO NUMERO DI UTILIZZI (PER EVITARE LA ROTTURA)


30.04
40.04


40.04
30.04

KEY POINT

KNOW THE DIFFERENT FEATURES OF ROTARY SYSTEMS

CUSTOMIZE ENDO TREATMENT PLAN

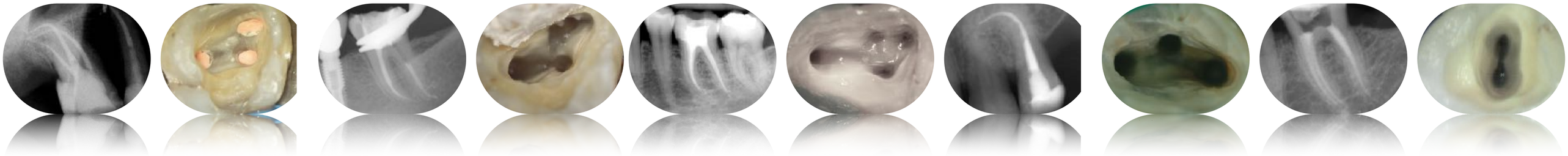
FOCUS ON BIOLOGICAL OBJECTIVES

GFUMEI@TISCALI.IT

DRGFUMEIENDODONTICS

WWW.SHAPE-IT-ENDO.SOCIALACADEMY.COM

The end



Dr Gianluca Fumei


Grazie
Gianluca

Scarica un estratto della presentazione!!!


HANDS
ON!

I STEP

LUNGHEZZA DI LAVORO

II STEP

Opener EDM 18.11
Preflaring

400 rpm
T 2,5 Ncm

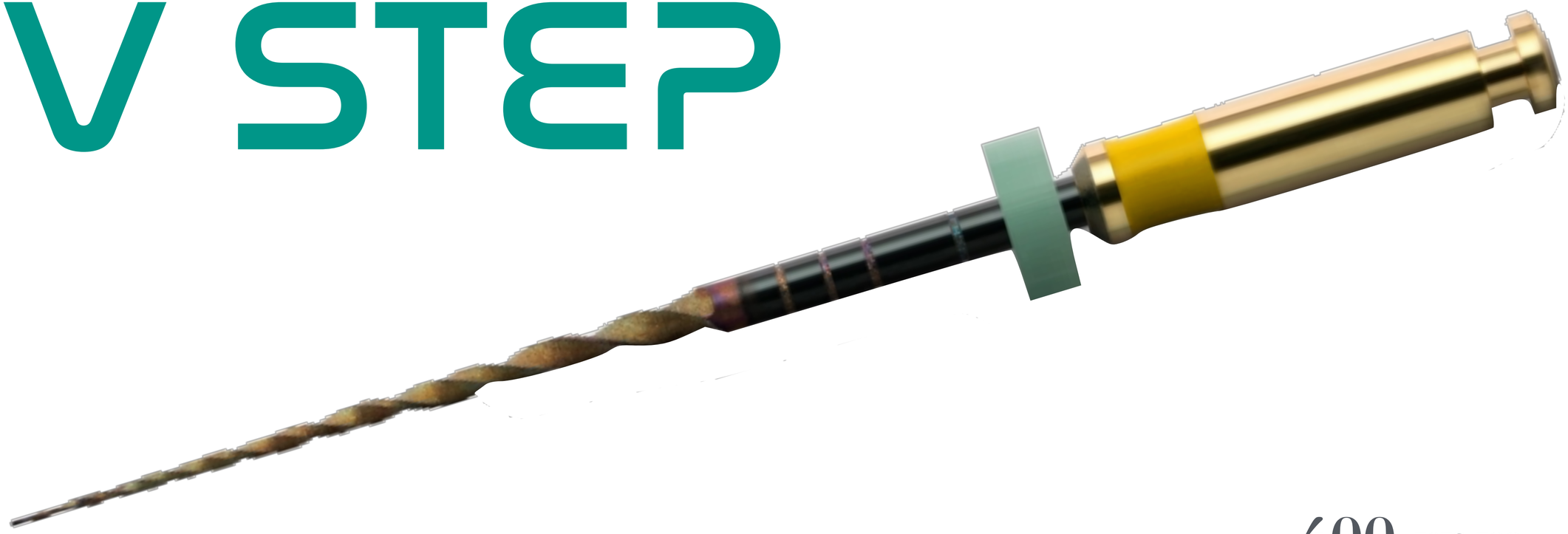
III STEP

EDM GLYDER 15.3
Glide path

300 rpm

T 1,8 Ncm

IV STEP



400 rpm
T 2,5 Ncm

EDM SHAPER 18.045
Sagomatura

V STEP

400 rpm
T 2,5 Ncm

EDM FINISHER 30.4
Rifinitura apicale