



**EXPO  
DENTAL  
MEETING**

RIMINI - ITALY  
**16-17-18  
MAY 2024**



ShaperIT

**AIE**  
ACCADEMIA  
ITALIANA  
ENDODONZIA



# APPROCCI INNOVATIVI PER UNA MODERNA ENDODONZIA



“UTILIZZO DI LE LEGHE TRATTATE  
TERMICAMENTE NELLA  
SAGOMATURA MINI INVASIVA”



**Fabio\_PiccottiDDS**



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**Fabio\_PiccottiDDS**



**DW DENTAL WORLD**  
ITALIAN MANUFACTURER



 **Fabio\_PiccottiDDS**

LA STRUMENTAZIONE NON MODIFICA I PRINCIPI  
BASE DELL' ENDODONZIA



Fabio\_PiccottiDDS

# Endodontonia

E DETERSIONE DI UNO SPAZIO  
ANATOMICO COMPLESSO



Fabio\_PiccottiDDS

# obiettivi del trattamento

## MECCANICI

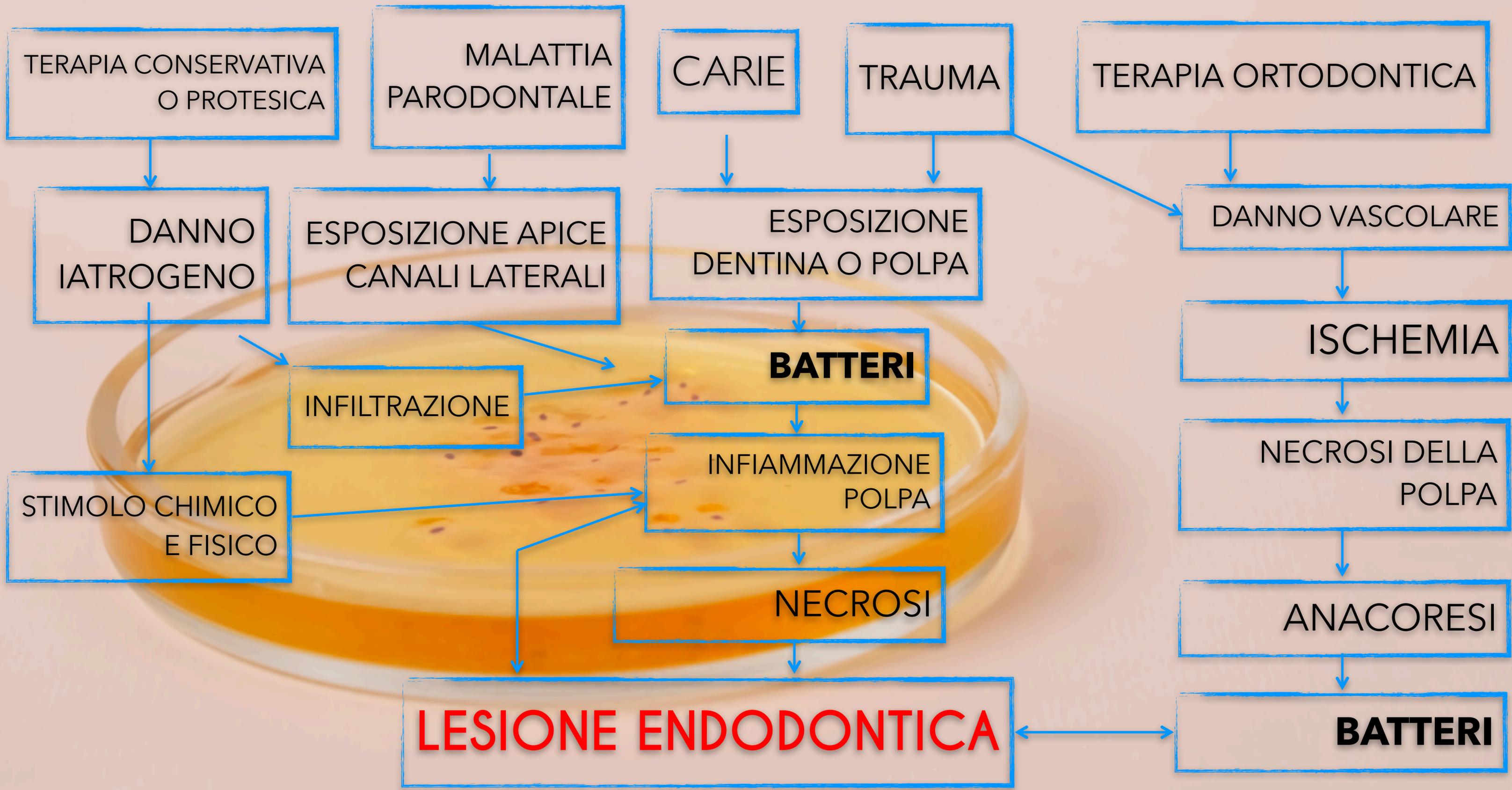
- \* CONICITA CONTINUA DA CORONA AD APICE
- \* PRESERVARE LE CURVATURE DEL CANALE
- \* PRESERVARE IL DIAMETRO APICALE

## BIOLOGICI

- \* RIMUOVERE LA POLPA MALATA
- \* RIDURRE LA CARICA BATTERICA

“BACTERIA ARE  
RESPONSABILE FOR EVERY  
ENDODONTIC LESION”

KAKEHASHI 1965



TERAPIA CONSERVATIVA  
O PROTESICA

MALATTIA  
PARODONTALE

CARIE

TRAUMA

TERAPIA ORTODONTICA

DANNO  
IATROGENO

ESPOSIZIONE APICE  
CANALI LATERALI

ESPOSIZIONE  
DENTINA O POLPA

DANNO VASCOLARE

INFILTRAZIONE

**BATTERI**

ISCHEMIA

STIMOLO CHIMICO  
E FISICO

INFIAMMAZIONE  
POLPA

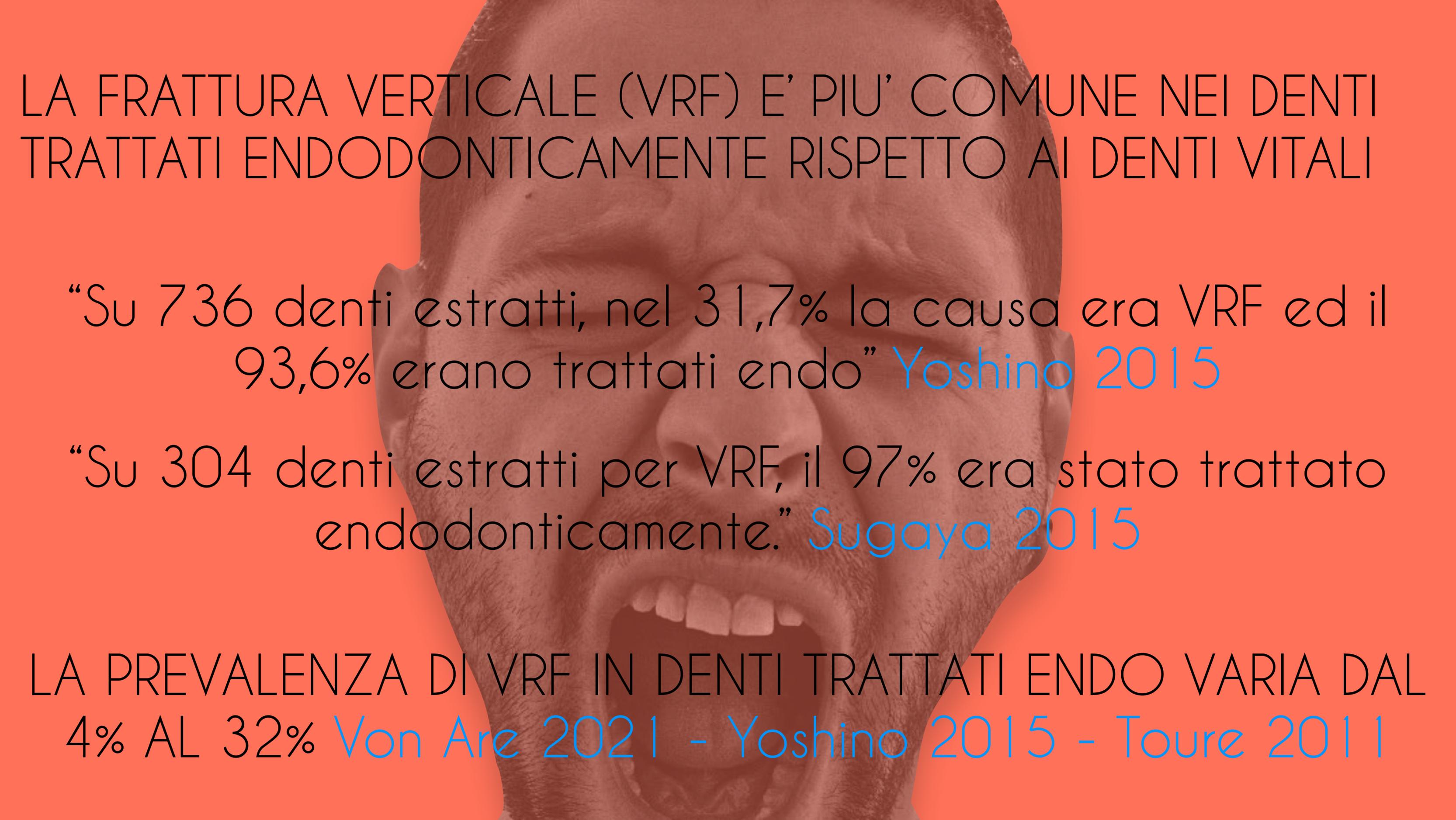
NECROSI DELLA  
POLPA

NECROSI

ANACORESI

**LESIONE ENDODONTICA**

**BATTERI**



LA FRATTURA VERTICALE (VRF) E' PIU' COMUNE NEI DENTI TRATTATI ENDODONTICAMENTE RISPETTO AI DENTI VITALI

“Su 736 denti estratti, nel 31,7% la causa era VRF ed il 93,6% erano trattati endo” [Yoshino 2015](#)

“Su 304 denti estratti per VRF, il 97% era stato trattato endodonticamente.” [Sugaya 2015](#)

LA PREVALENZA DI VRF IN DENTI TRATTATI ENDO VARIA DAL 4% AL 32% [Von Are 2021](#) - [Yoshino 2015](#) - [Toure 2011](#)



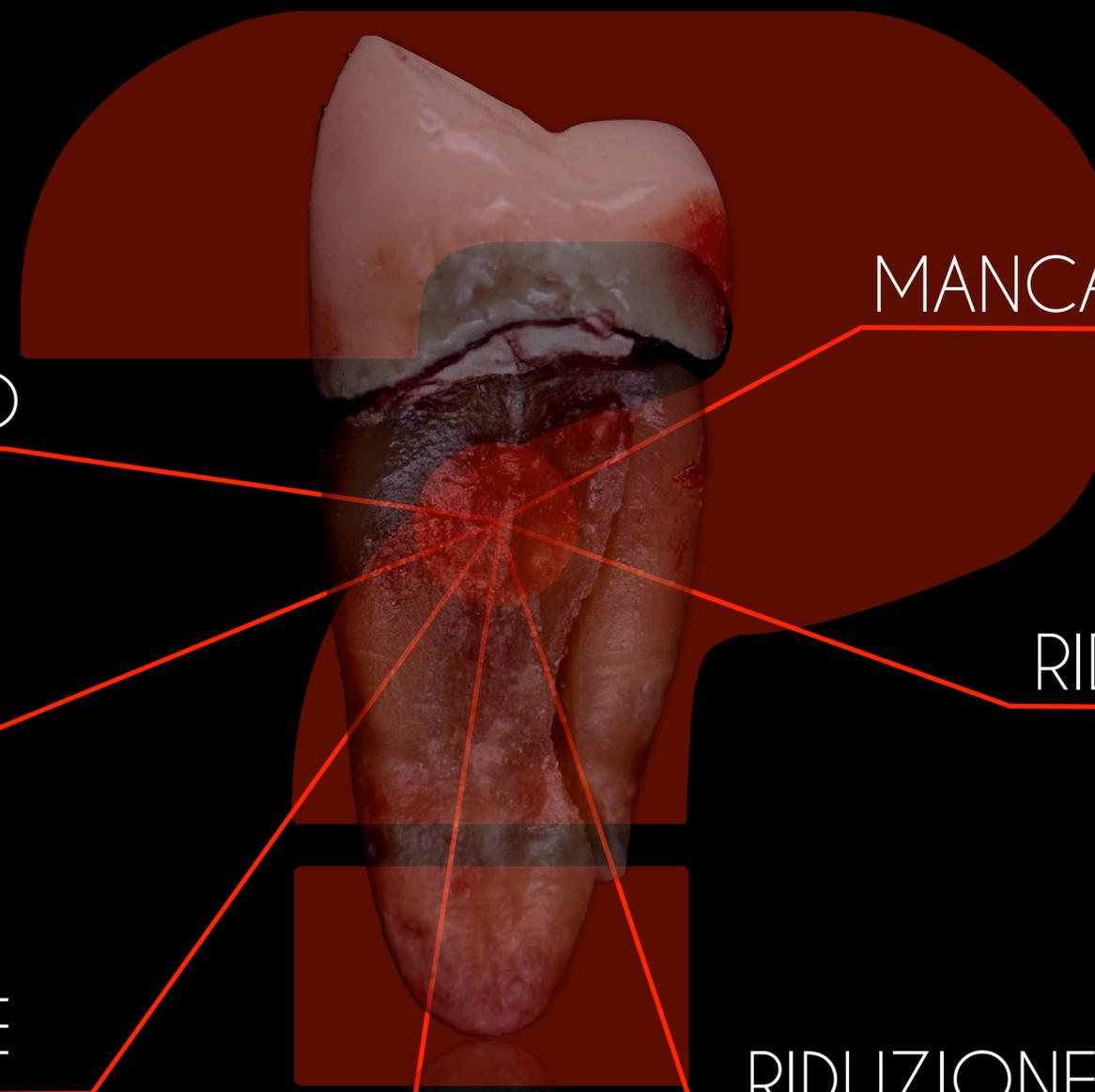
DOPO 20 ANNI, LA VFR È STATA LA  
CAUSA MAGGIORE DI FALLIMENTO

48%

- VRF 48%
- Progressione Parodontite 31%
- Carie 11%
- Frattura Orizzontale 4%
- Fallimento endodontico 3%
- Wash Out cemento 3%

Di Febo 2015

# CAUSE VRF NEI DENTI TRATTATI ENDODONTICAMENTE:



MANCATA COPERTURA CUSPIDALE

TRATTAMENTO ENDODONTICO

RIDOTTA PROPRIOCEZIONE

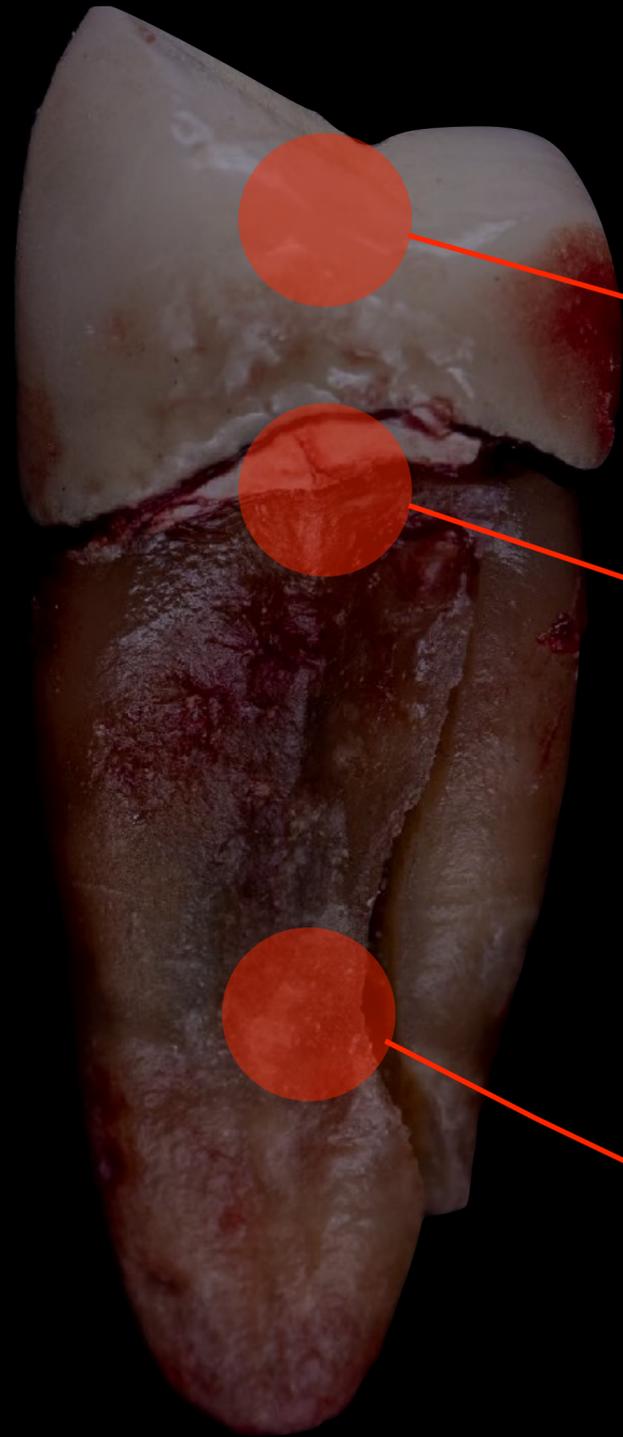
GEOMETRIA DEL CANALE

RIDUZIONE QUOTA ACQUA

PARAFUNZIONI & POSIZIONE

MICROCRACKS

# TRATTAMENTO ENDODONTICO



COPERTURA CUSPIDALE

APERTURA CAMERA

SAGOMATURA CANALI

# COPERTURA CUSPIDALE

97% DEI DENTI TRATTATI CON COPERTURA CUSPIDALE  
SOPRAVVIVE A 8 ANNI

85% DEI DENTI ESTRATTI NON AVEVA COPERTURA  
CUSPIDALE

Lazaraski 2004

I DENTI CHE GODONO DI UNA COPERTURA CUSPIDALE  
OLTRE I 4 MESI DAL TRATTAMENTO ENDODONTICO  
HANNO UN RISCHIO DI ESSERE ESTRATTI QUASI 3 VOLTE  
SUPERIORE AI DENTI CHE SONO RESTAURATI PRIMA DEI  
4 MESI

Pratt 2016





# APERTURA CAMERA

LA MAGGIOR PARTE DEGLI STUDI DIMOSTRANO CHE VARIAZIONI NELLA DIMENSIONE DELL'ACCESSO ALLA CAMERA PULPARE NON DETERMINANO DIFFERENZE STATISTICHE NELLA RESISTENZA AL CARICO DEL DENTE

Plotino 2017 - Rover 2017 - Sabeti 2018 - Augusto 2020 - Barbosa 2020 - Lima 2021



REVIEW

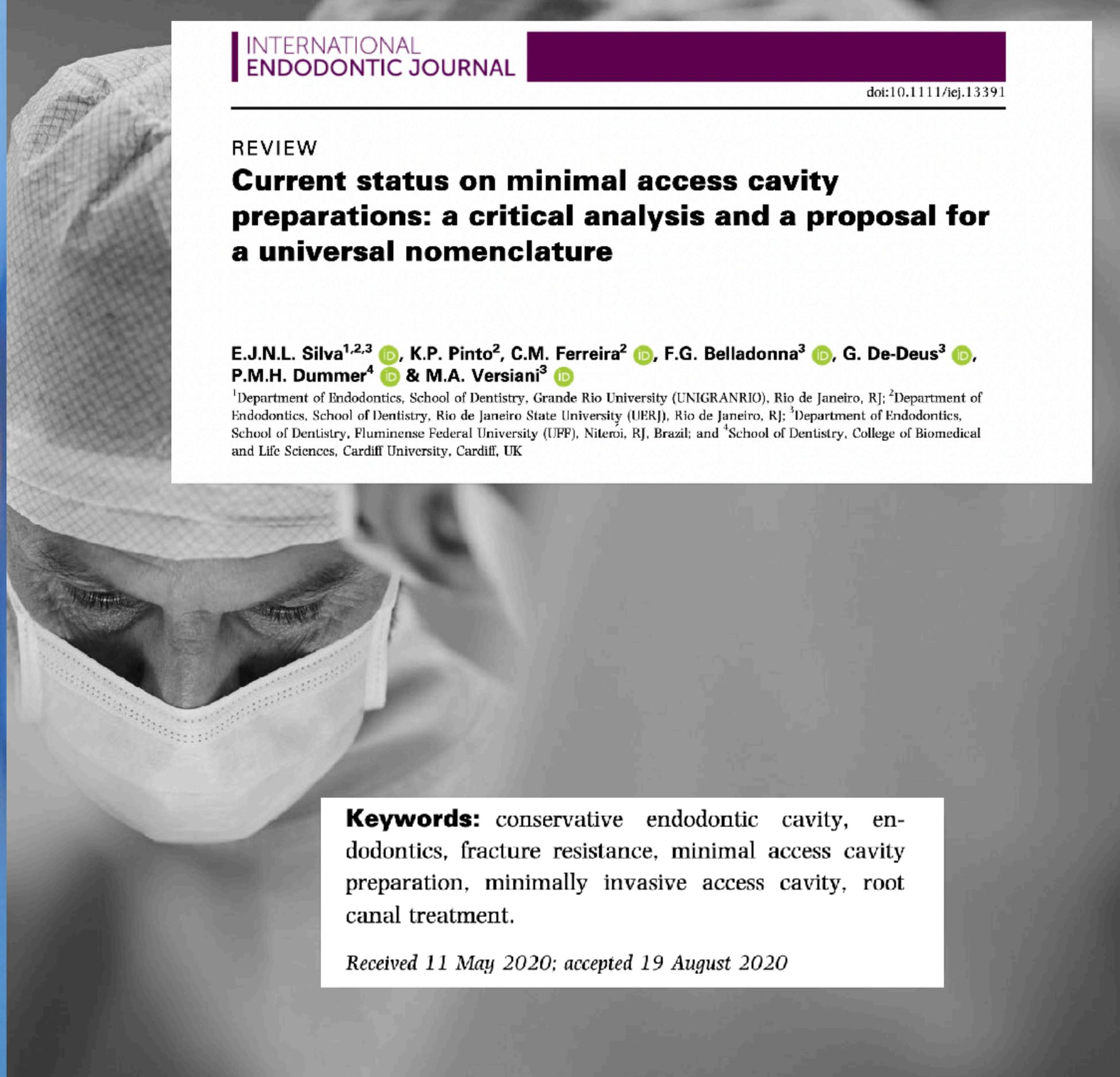
**Current status on minimal access cavity preparations: a critical analysis and a proposal for a universal nomenclature**

E.J.N.L. Silva<sup>1,2,3</sup> , K.P. Pinto<sup>2</sup>, C.M. Ferreira<sup>2</sup> , F.G. Belladonna<sup>3</sup> , G. De-Deus<sup>3</sup> , P.M.H. Dummer<sup>4</sup>  & M.A. Versiani<sup>3</sup> 

<sup>1</sup>Department of Endodontics, School of Dentistry, Grande Rio University (UNIGRANRIO), Rio de Janeiro, RJ; <sup>2</sup>Department of Endodontics, School of Dentistry, Rio de Janeiro State University (UERJ), Rio de Janeiro, RJ; <sup>3</sup>Department of Endodontics, School of Dentistry, Fluminense Federal University (UFF), Niteroi, RJ, Brazil; and <sup>4</sup>School of Dentistry, College of Biomedical and Life Sciences, Cardiff University, Cardiff, UK

**Keywords:** conservative endodontic cavity, endodontics, fracture resistance, minimal access cavity preparation, minimally invasive access cavity, root canal treatment.

*Received 11 May 2020; accepted 19 August 2020*

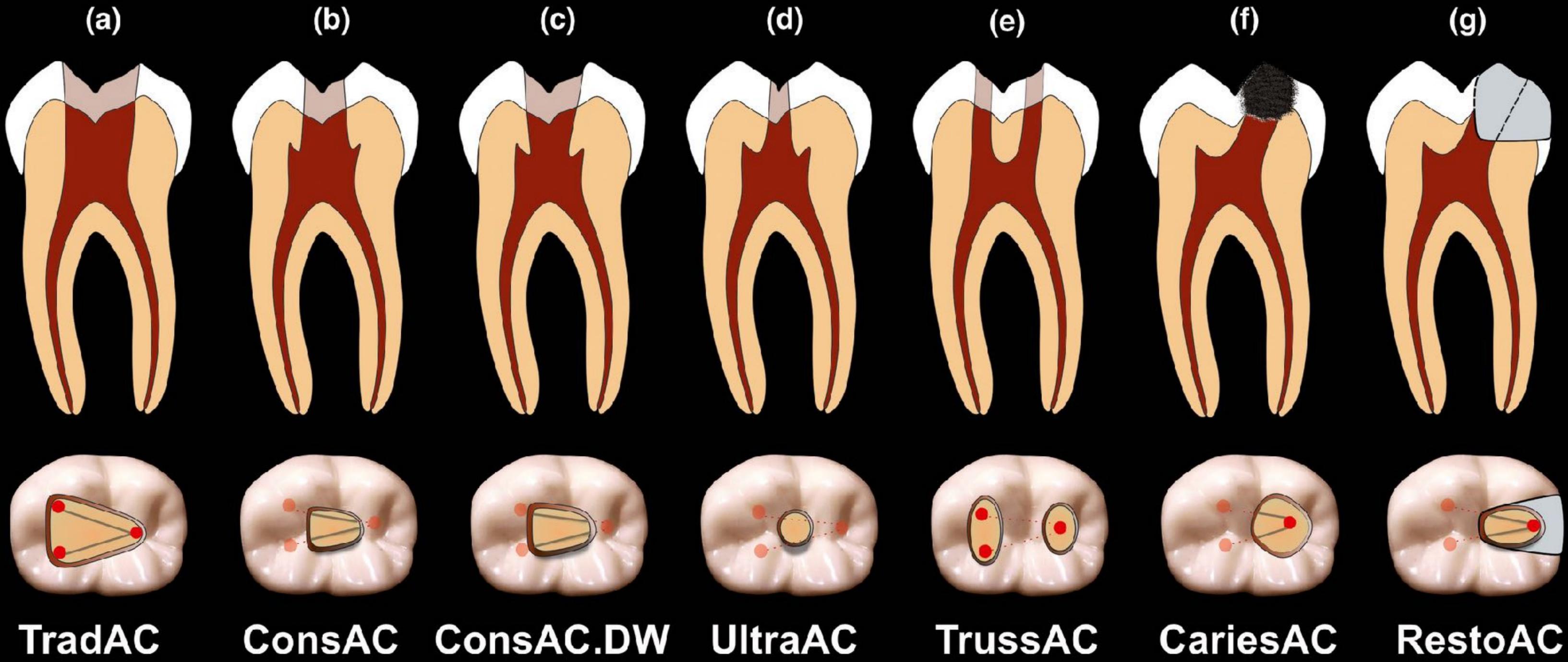


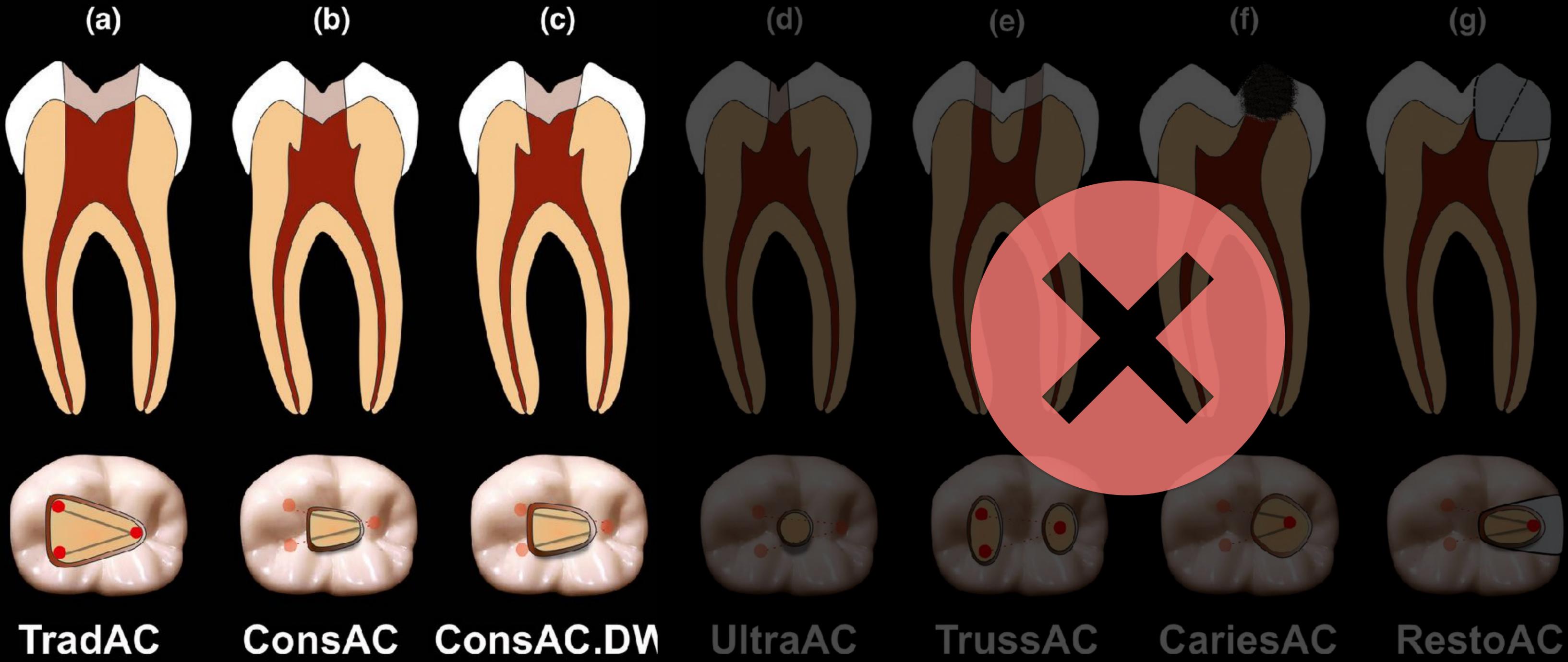
## REVIEW

**Current status on minimal access cavity preparations: a critical analysis and a proposal for a universal nomenclature**E.J.N.L. Silva<sup>1,2,3</sup> , K.P. Pinto<sup>2</sup>, C.M. Ferreira<sup>2</sup> , F.G. Belladonna<sup>3</sup> , G. De-Deus<sup>3</sup> , P.M.H. Dummer<sup>4</sup>  & M.A. Versiani<sup>3</sup> <sup>1</sup>Department of Endodontics, School of Dentistry, Grande Rio University (UNIGRANRIO), Rio de Janeiro, RJ; <sup>2</sup>Department of Endodontics, School of Dentistry, Rio de Janeiro State University (UERJ), Rio de Janeiro, RJ; <sup>3</sup>Department of Endodontics, School of Dentistry, Fluminense Federal University (UFF), Niterói, RJ, Brazil; and <sup>4</sup>School of Dentistry, College of Biomedical and Life Sciences, Cardiff University, Cardiff, UK

Endodontics, was also performed. The initial search retrieved 1831 publications. The titles and abstracts of these papers were reviewed, and the full text of 94 studies was assessed. Finally, a total of 28 studies were identified as evaluating the influence of minimally invasive access cavity designs on the fracture resistance of teeth

*et al.* 2020). Even though several articles have been published on this topic and there is substantial interest in such techniques on social media, **there is a lack of scientific evidence** to support the introduction of these new designs of access cavities into routine clinical practice and/or training of undergraduate and postgraduate students. Therefore, this study aimed to (a)





**TradAC**

**ConsAC**

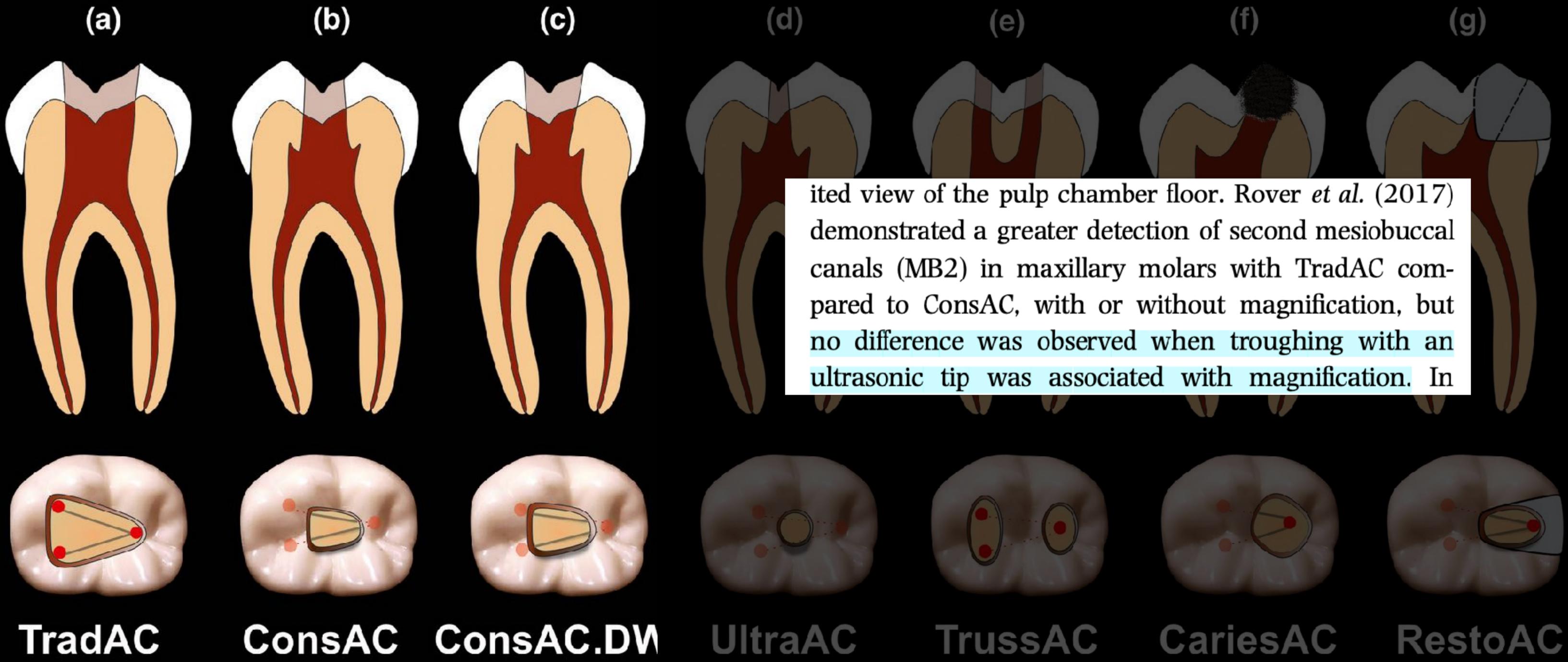
**ConsAC.DW**

**UltraAC**

**TrussAC**

**CariesAC**

**RestoAC**



ited view of the pulp chamber floor. Rover *et al.* (2017) demonstrated a greater detection of second mesiobuccal canals (MB2) in maxillary molars with TradAC compared to ConsAC, with or without magnification, but no difference was observed when troughing with an ultrasonic tip was associated with magnification. In

**TradAC**

**ConsAC**

**ConsAC.DW**

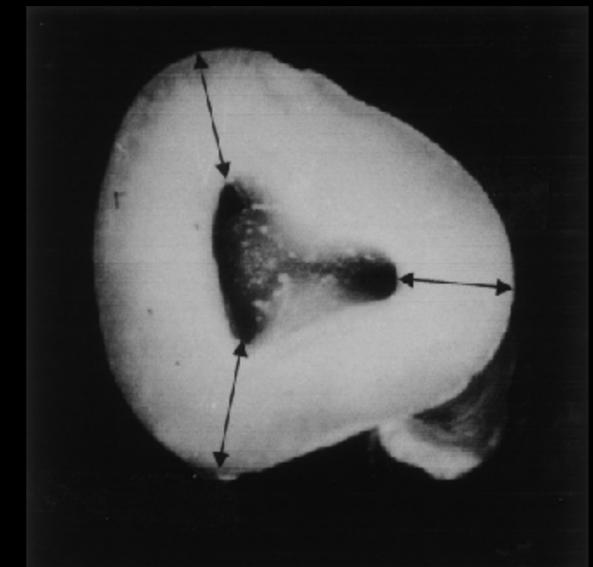
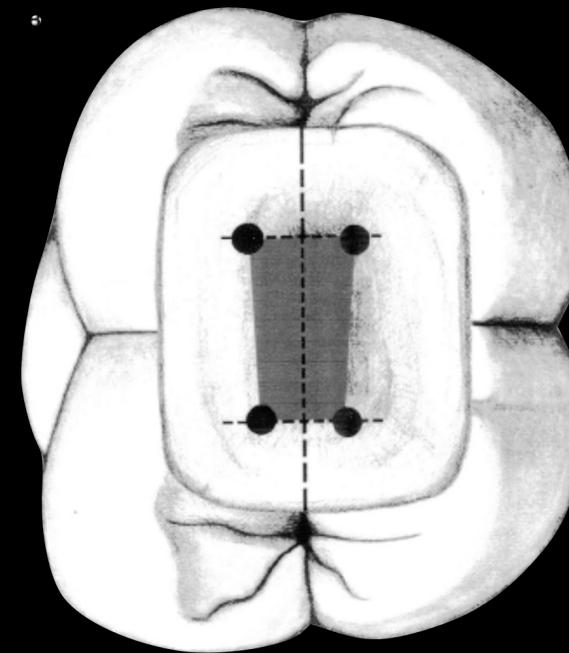
**UltraAC**

**TrussAC**

**CariesAC**

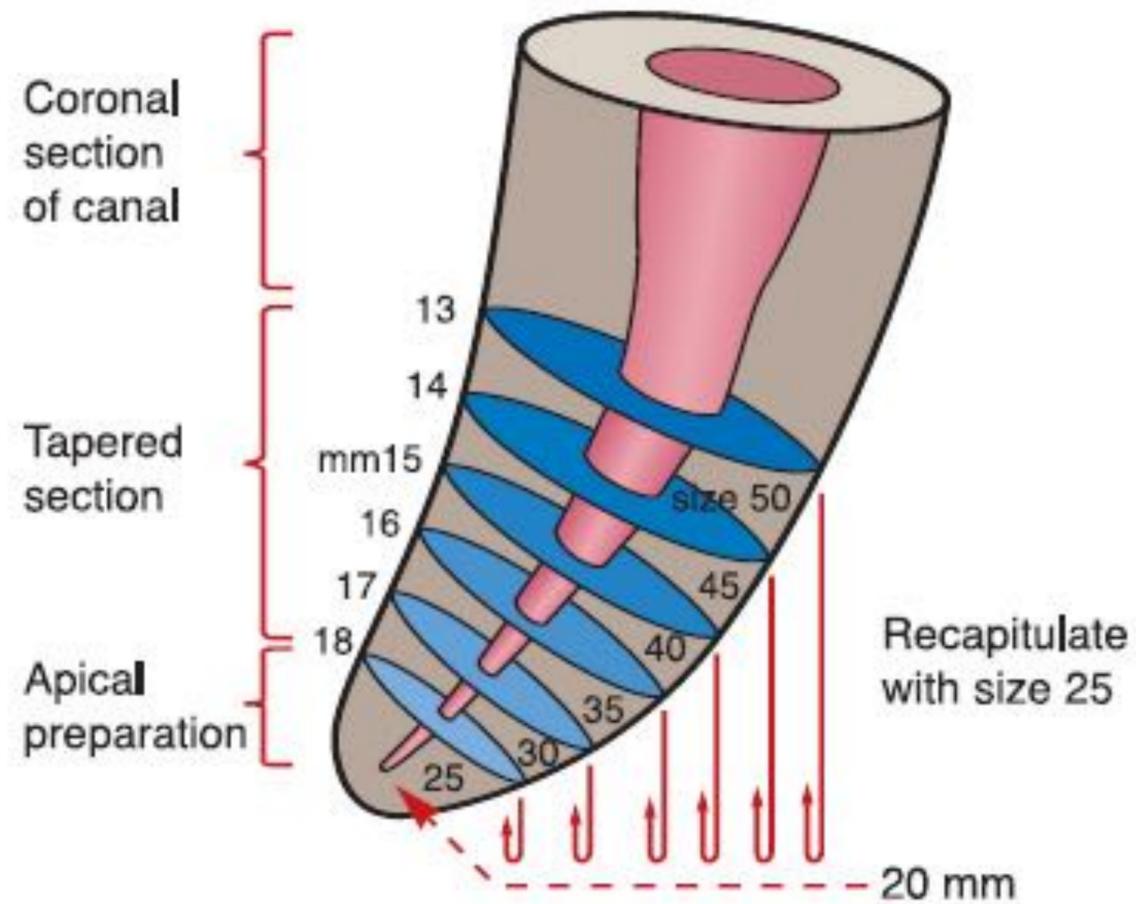
**RestoAC**

# LE INDICAZIONI AD UN CORRETTO ACCESSO NON SONO CAMBIATE MOLTO IN 20 ANNI



Krasner 2003

# SAGOMATURA DEI CANALI



LA SAGOMATURA NECESSITA UNA GEOMETRIA CON UNA CONICITA' PROGRESSIVA IN CUI L'APICE RISULTA ESSERE IL PUNTO PIÙ STRETTO DEL SISTEMA

Schilder 1974

IL NOSTRO OBIETTIVO È DETERGERE  
E SIGILLARE LO SPAZIO  
ENDODONTICO.

LE TECNICHE E STRATEGIE POSSO  
ESSERE DIFFERENTI MA CON LO  
STESSO OBIETTIVO.

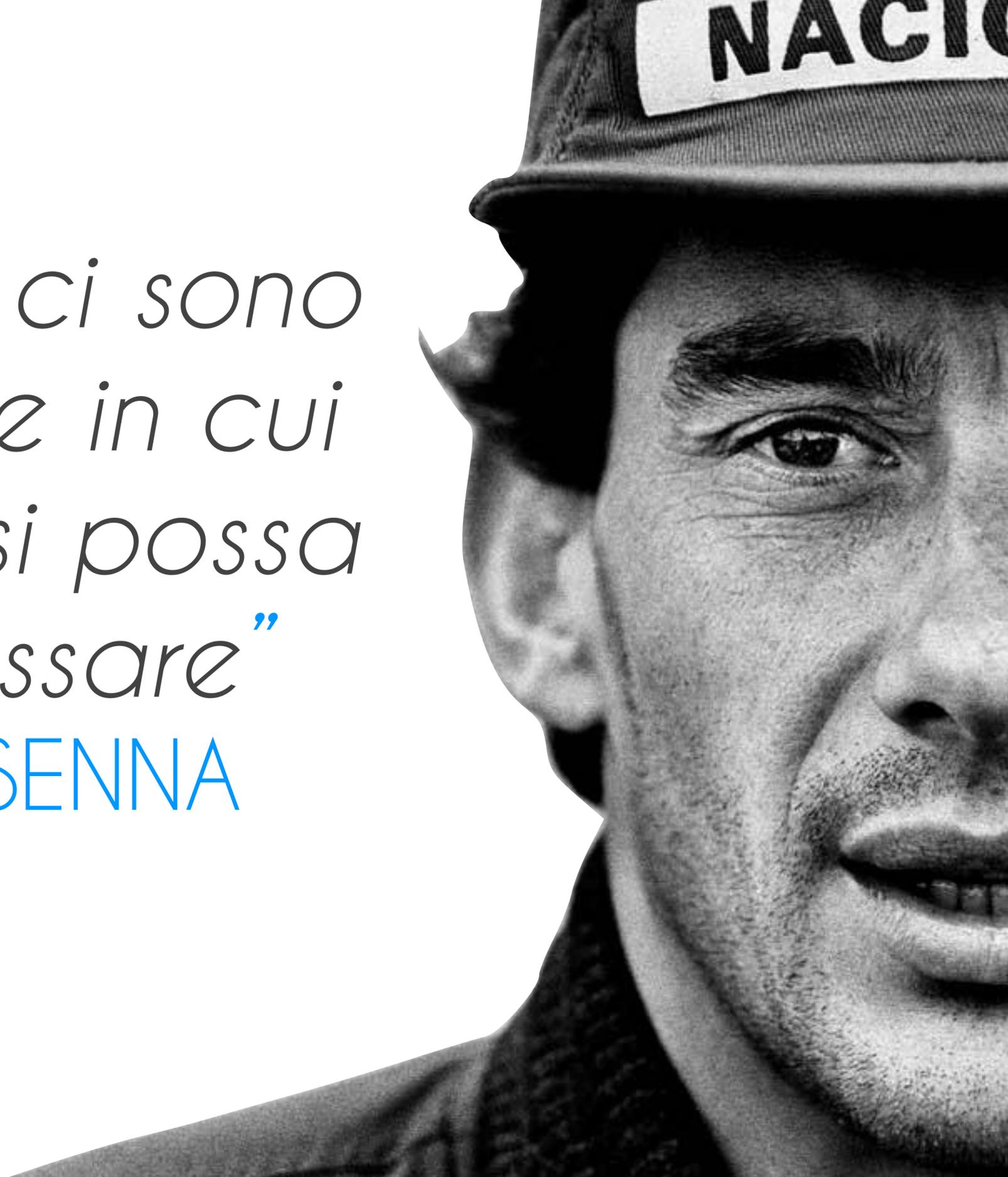
# i tempi cambiano...

*“I denti che presentano canali con curvatura maggiore di 45 gradi, non possono essere trattati con successo senza dover ricorrere alla chirurgia”*

GROSSMAN  
1967



*“Non ci sono  
curve in cui  
non si possa  
passare”*  
A. SENNA



# TECNOLOGIA



- CBCT
- NITI TRATTATI TERMICAMENTE
- INGRANDIMENTO
- PROTOCOLLI DI ISOLAMENTO
- RIVELATORE APICALE ELETTRONICO
- CEMENTI BIO CERAMICI
- PROTOCOLLI DI IRRIGAZIONE ATTIVA
- PUNTE SONICHE ED ULTRASONICHE

STRUMENTAZIONE

STRUMENTI ESPANSIVI

TRATTAMENTI TERMICI

DETERSIONE

PROTOCOLLI DI

DETERSIONE ATTIVA

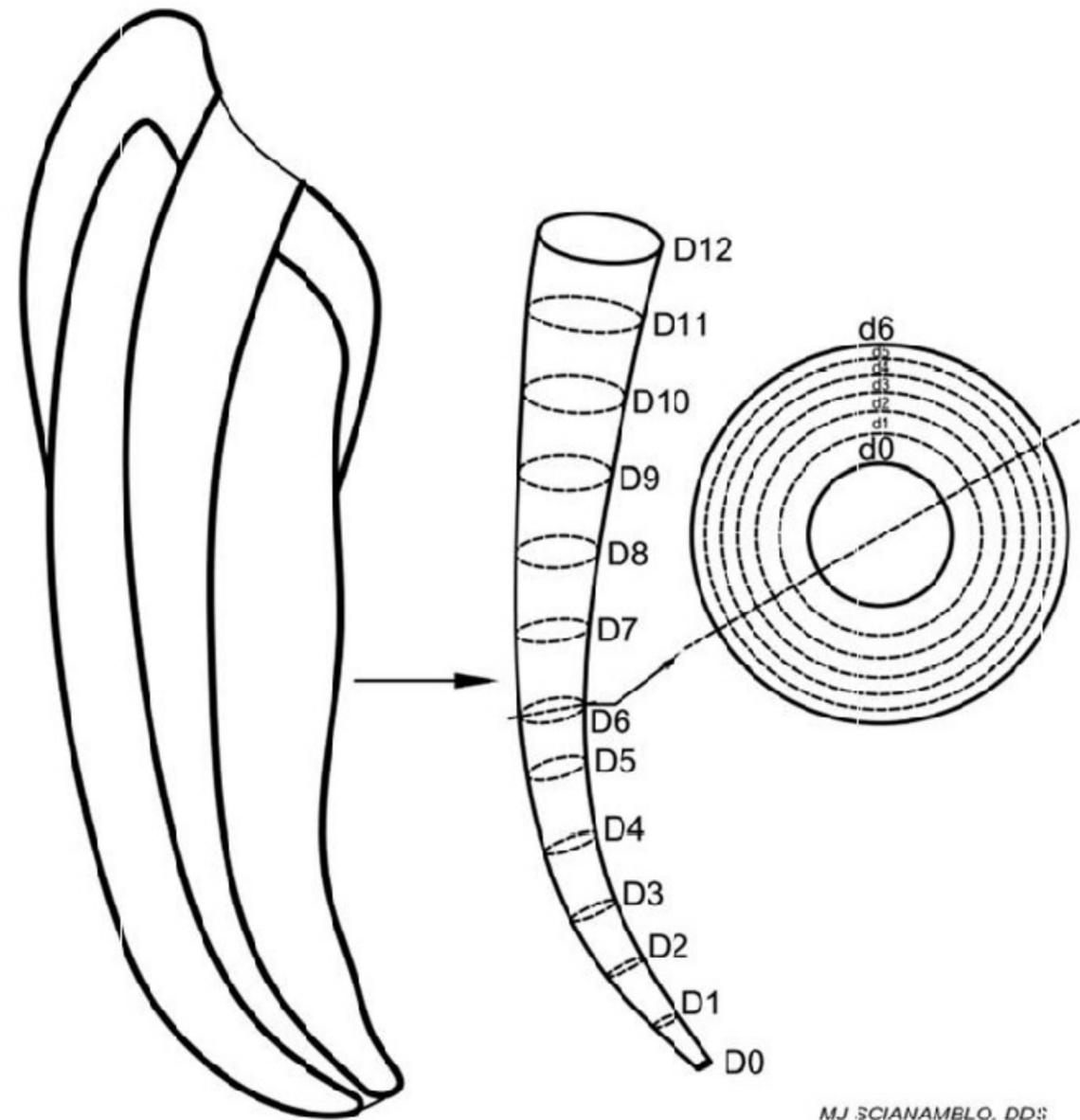
OTTURAZIONE

CEMENTI

BIOCERAMICI



# OBIETTIVI MECCANICI



MJ SCIANAMBLO, DD'S

- \* CONICITA CONTINUA DA CORONA AD APICE
- \* PRESERVARE LE CURVATURE DEL CANALE
- \* PRESERVARE IL DIAMETRO APICALE

SHILDER 1974

# FILE MANUALI



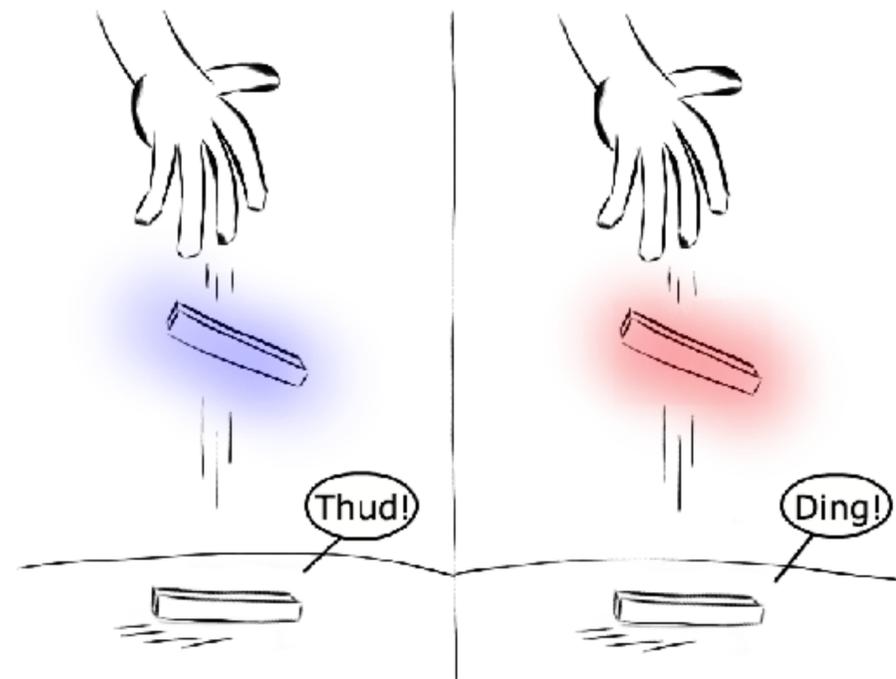
# FILE ROTANTI





# Nitinol

IN UNA RICERCA PER LEGHE POTENZIALMENTE UTILI PER CARATTERISTICHE FISICHE, TRA 60 LEGHE NE SELEZIONA 12. TRA QUESTI IL NITINOL



Nickel Titanium Naval Ordnance Laboratory

WILLIAM J BUEHLER -1963- US NAVY POLARIS PROJECT

LEGA NI-TI

55-45

COMPOSTO BINARIO  
INTERMETALLICO ED EQUIATOMICO



# 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 Herold Gerstein, BS, DDS

Root canal files in size #15 and triangular cross-sections were fabricated from 0.320-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 precurve 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 use in the instrumentation of curved canals, and evaluations of mechanical properties and in vitro cutting efficiency are in progress for size #35 instruments.

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, is 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 Nitinol directly on the wire 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

It is well known by clinicians that inadvertent procedural errors can occasionally arise during the instrumentation of curved canals. These misfortunes include ledge or step 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 of instruments available 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

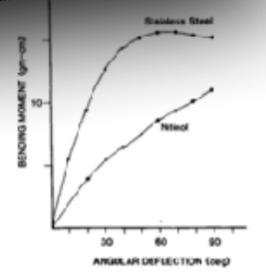


Fig. 5. Cantilever bending test results for the size #15 Nitinol and stainless steel files. The data points in this figure and in Figs. 6 and 7 correspond to average moment values for groups of five instruments at the indicated bend or twist angles.

the reading of bending or torsional moments less than 0.05 inch-oz (3.50 gm-cm). Consequently, the passive position (zero moment value) and the corresponding location for zero angular deflection cannot be determined directly in an experiment. For convenience, all of the graphical plots have been drawn to intersect the origin. This extrapolation appears to be more satisfactory for the bending plots (Fig. 5) and clockwise torsion plots (Fig. 6) than for the counterclockwise torsion plots (Fig. 7).

# 1988

WALIA ET AL. JOE

MC SPADDEN, JOHNSON E SENIA AIUTANO  
 NELLA DIFFUSIONE DEL NITI

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

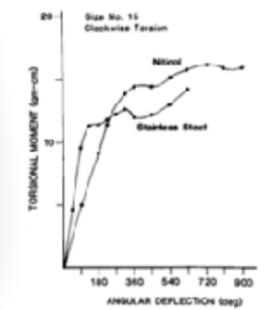


Fig. 6. Clockwise torsion test results for the size #15 Nitinol and stainless steel files.

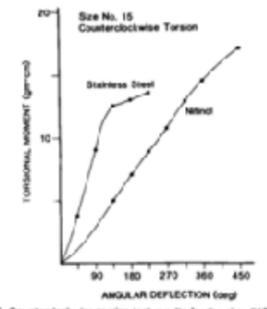
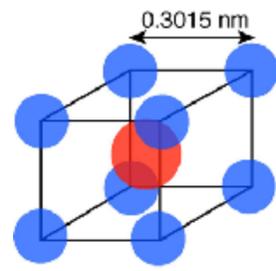
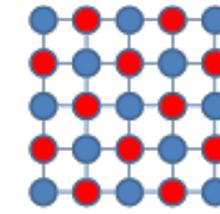


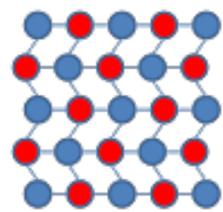
Fig. 7. Counterclockwise torsion test results for the size #15 Nitinol and stainless steel files. The two initial data points for the Nitinol files could not be determined with the torque meter, and the two plots have been drawn to intersect the origin. Both of these considerations are less pronounced in Figs. 5 and 6.



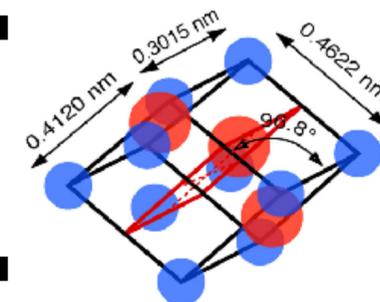
# AUSTENITE



LA LEGA PUO AVERE DUE CONFORMAZIONI ATOMICHE :  
L'**AUSTENITE** E LA FORMA PIU "RIGIDA E STABILE "A  
RETICOLO CUBICO. LA **MARTENSITE** E LA FORMA MENO  
STABILE E PIU PLASTICA A RETICOLO ESAGONALE  
COMPATTO.

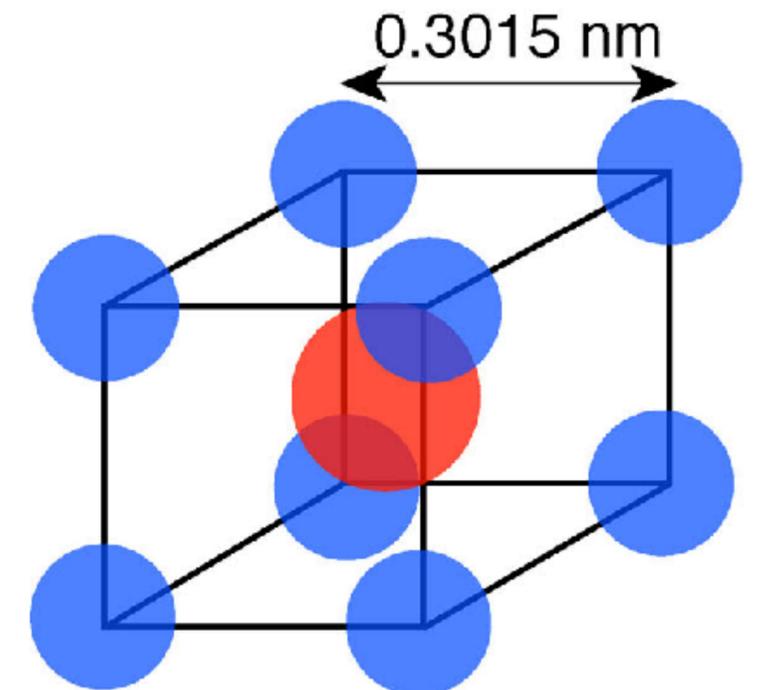


# MARTENSITE



# AUSTENITE

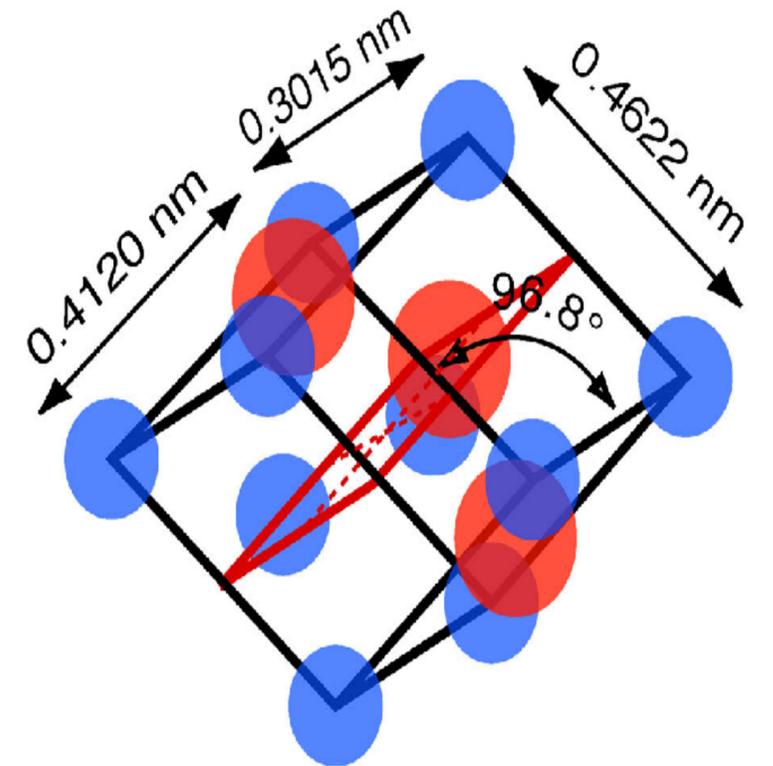
- ☑ RITORNO ELASTICO
- ☑ “RIGIDITA”
- ☑ SUPERELASTICITA



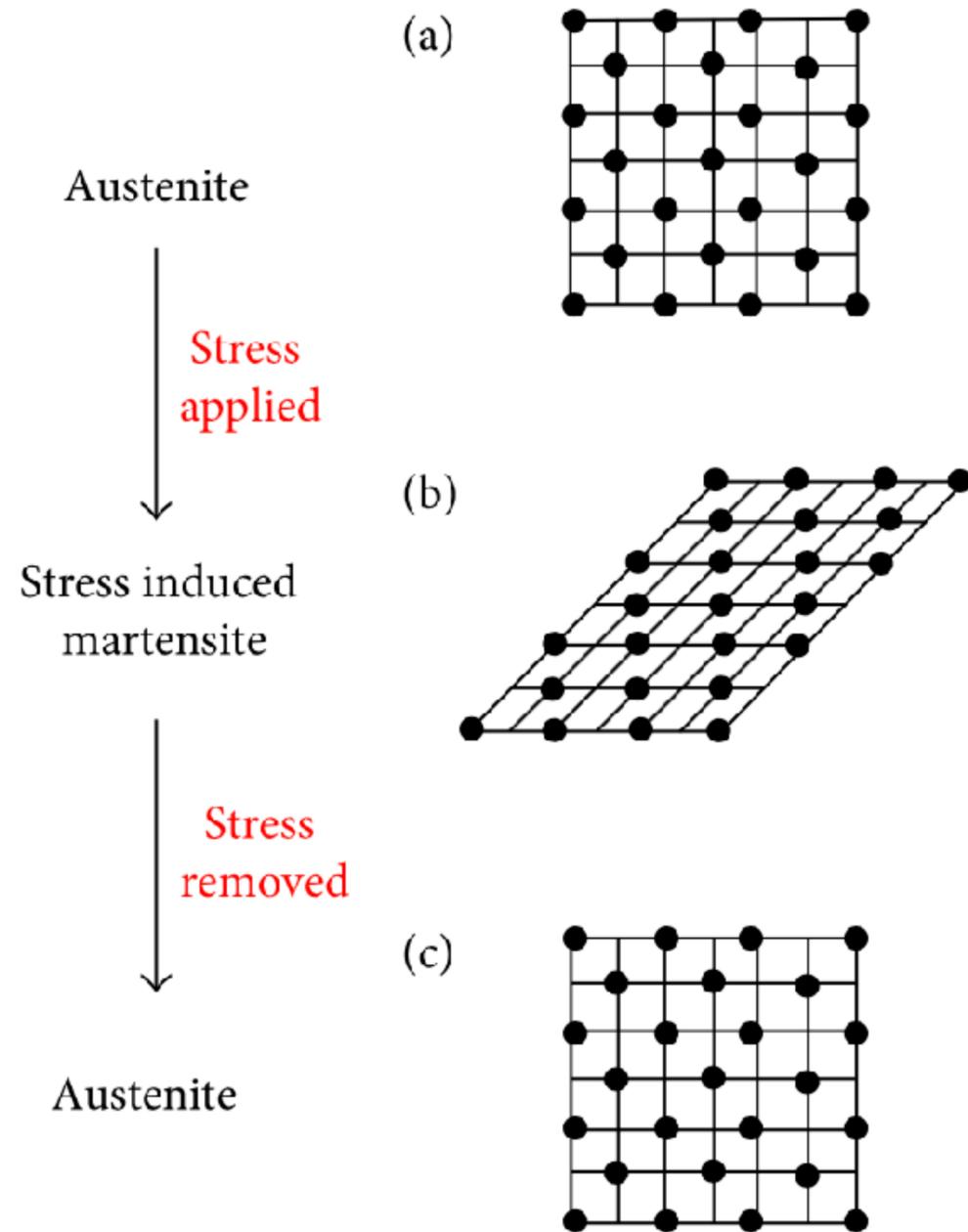
# MARTENSITE

☑ MEMORIA DI FORMA

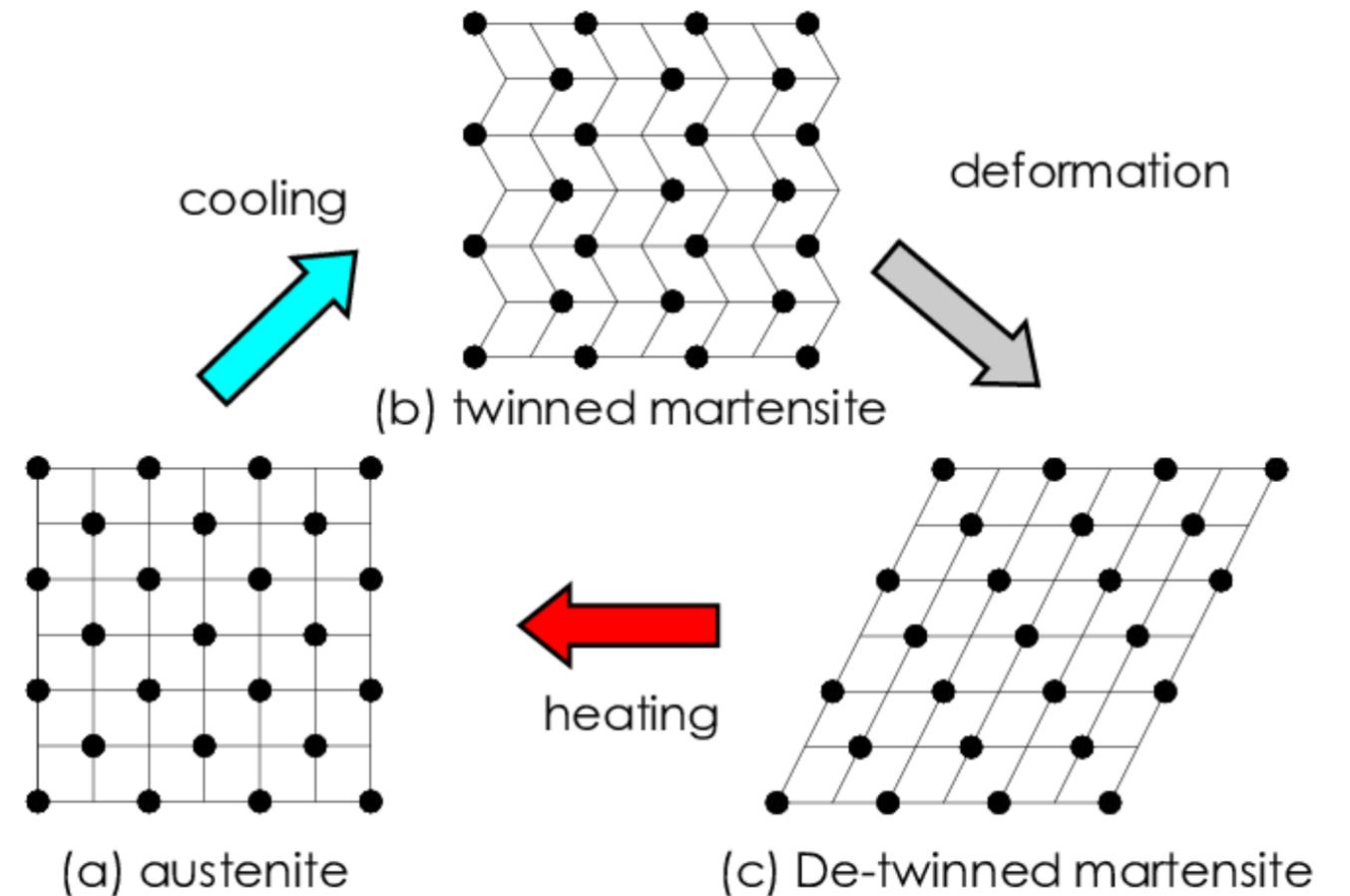
☑ “DUTTILITA”



# TRANSIZIONE AUSTENITE- MARTENSITE INDOTTA DA STRESS

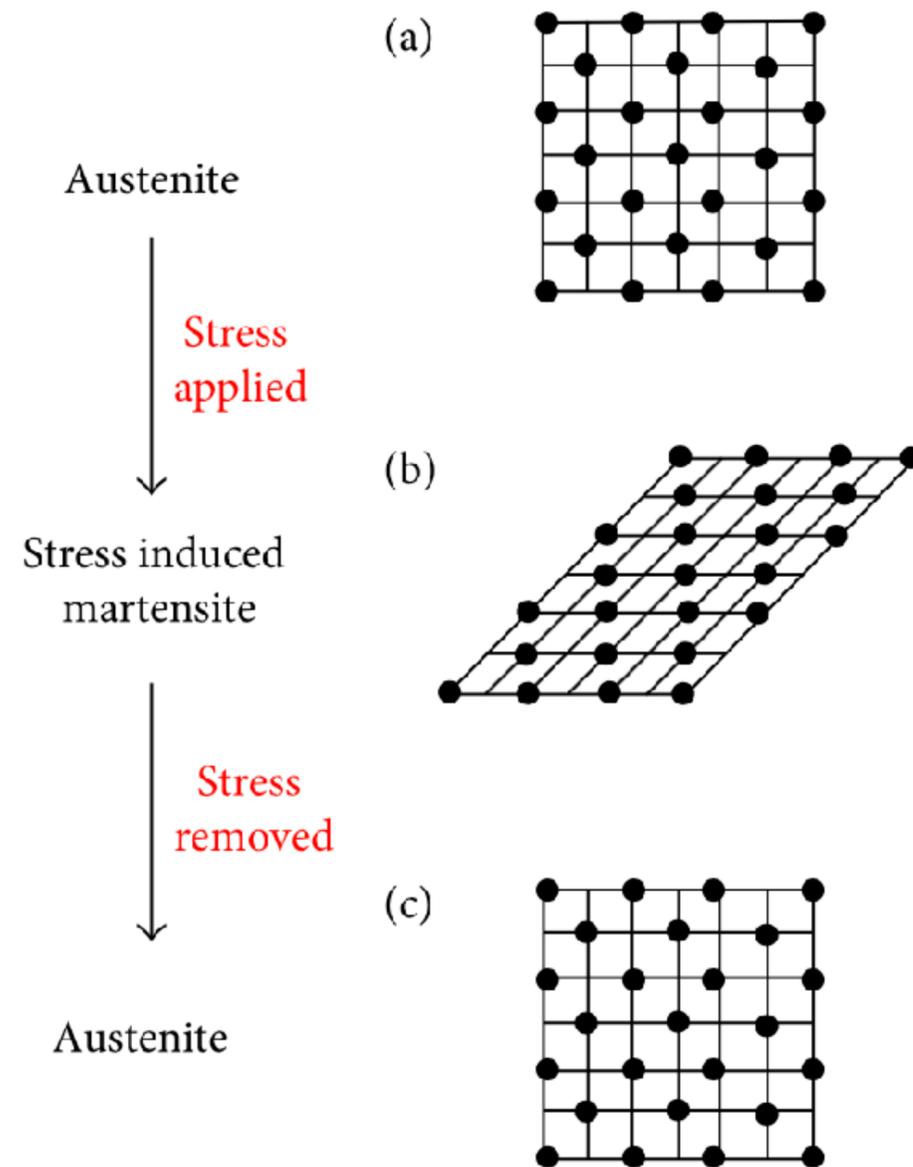


# TRANSIZIONE AUSTENITE- MARTENSITE INDOTTA DALLA TEMPERATURA (TIM)



# SUPERELASTICITÀ' O PSEUDOELASTICITA'

## TRANSIZIONE AUSTENITE-MARTENSITE INDOTTA DA STRESS (SIM)



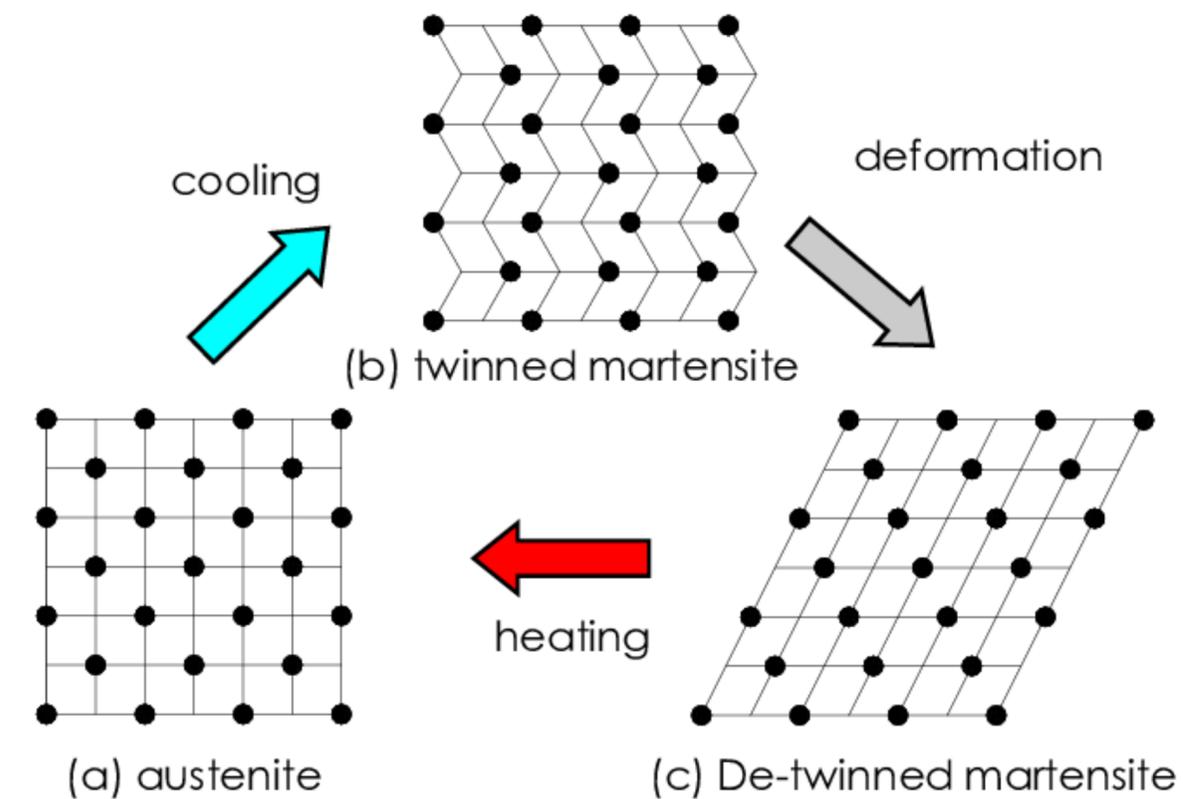
- LA TEMPERATURA ALLA QUALE AVVIENE LA TRANSIZIONE È MAGGIORE DELLA  $A_f$  (LEGA COMPLETAMENTE IN FASE AUTENTICA)
- IL CARICO DETERMINA UNA TRANSIZIONE DA AUSTENITE A MARTENSITE INDOTTA DA STRESS (SIM)
- LA LEGA PUÒ SUBIRE **AMPIE DEFORMAZIONI REVERSIBILI** IN CAMPO ELASTICO, SOTTO **CARICO COSTANTE**, PER UN CAMBIAMENTO DELLA STRUTTURA CRISTALLINA ( 8%)
- ALLA RIMOZIONE DELLO STRESS LA MARTENSITE, INSTABILE AD UNA TEMPERATURA AMBIENTALE SUPERIORE AD  $A_f$ , RITORNA ALLA FASE AUTENTICA RILASCIANDO ENERGIA CON **UN MOVIMENTO RAPIDISSIMO**

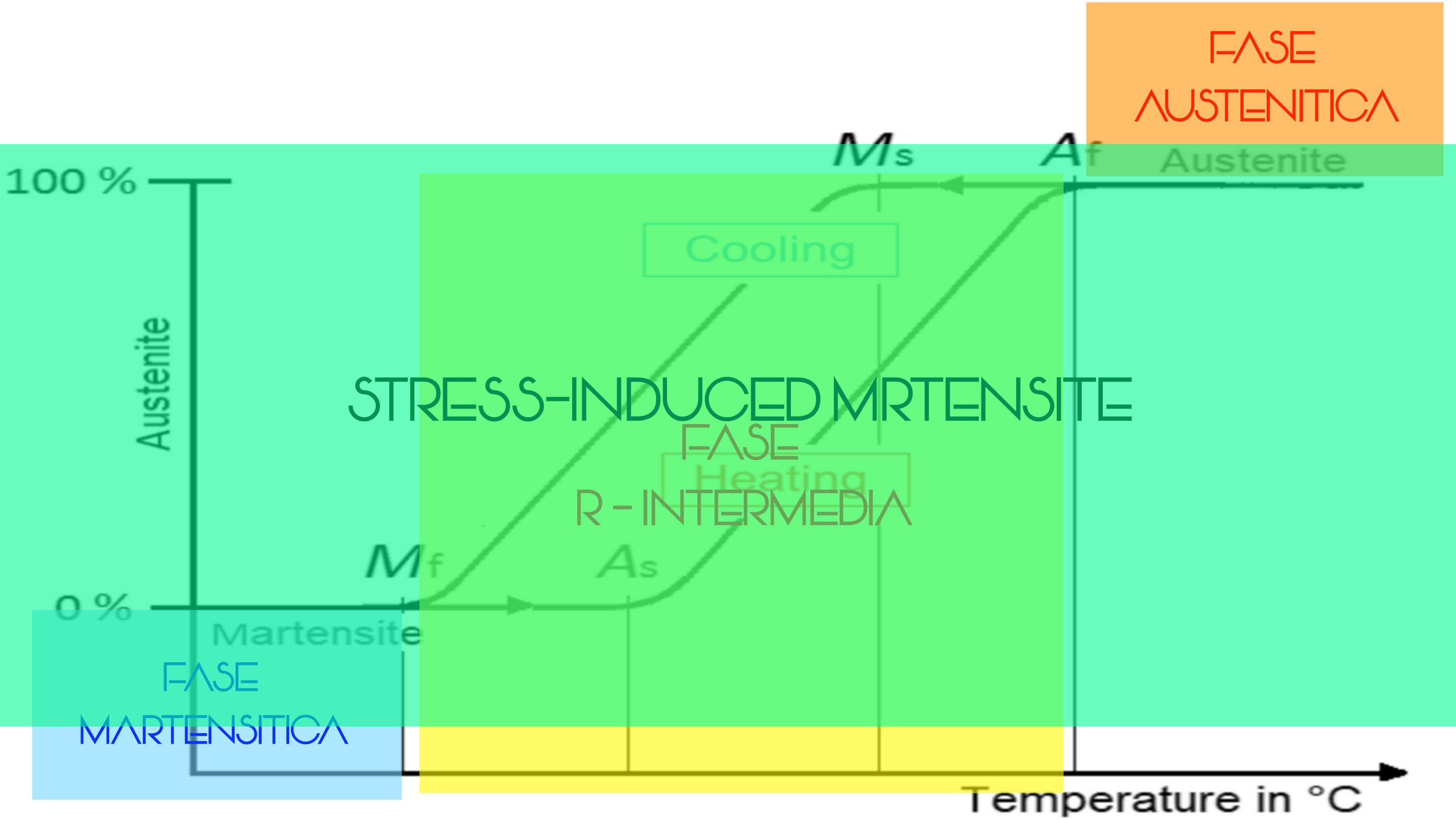
# TRANSIZIONE AUSTENITE- MARTENSITE

## INDOTTA DALLA TEMPERATURA (TIM)

# MEMORIA DI FORMA

- QUANDO LA LEGA NI-TI VENE PORTATA A BASSA TEMPERATURA, ASSUME UNA CONFIGURAZIONE DI TIPO MARTENSITICO
- 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
- LA TEMPERATURA ALLA QUALE LA LEGA RICORDA LA SUA FORMA PRIMITIVA PUÒ ESSERE MODIFICATA ATTRAVERSO APPROPRIATI TRATTAMENTI TERMICI





FASE  
AUSTENITICA

STRESS-INDUCED MARTENSITE  
FASE  
R-INTERMEDIA

FASE  
MARTENSITICA

Temperature in °C

# Resistenza alla fatica ciclica



INVERSAMENTE PROPORZIONALE AL QUADRATO  
DELLA SEZIONE TRASVERSA DEL FILE



# NELLA GESTIONE DELL'ANATOMIA, UNA DELLE MAGGIORI DIFFICOLTÀ DEI FILES INNITI È IL RITORNO ELASTICO

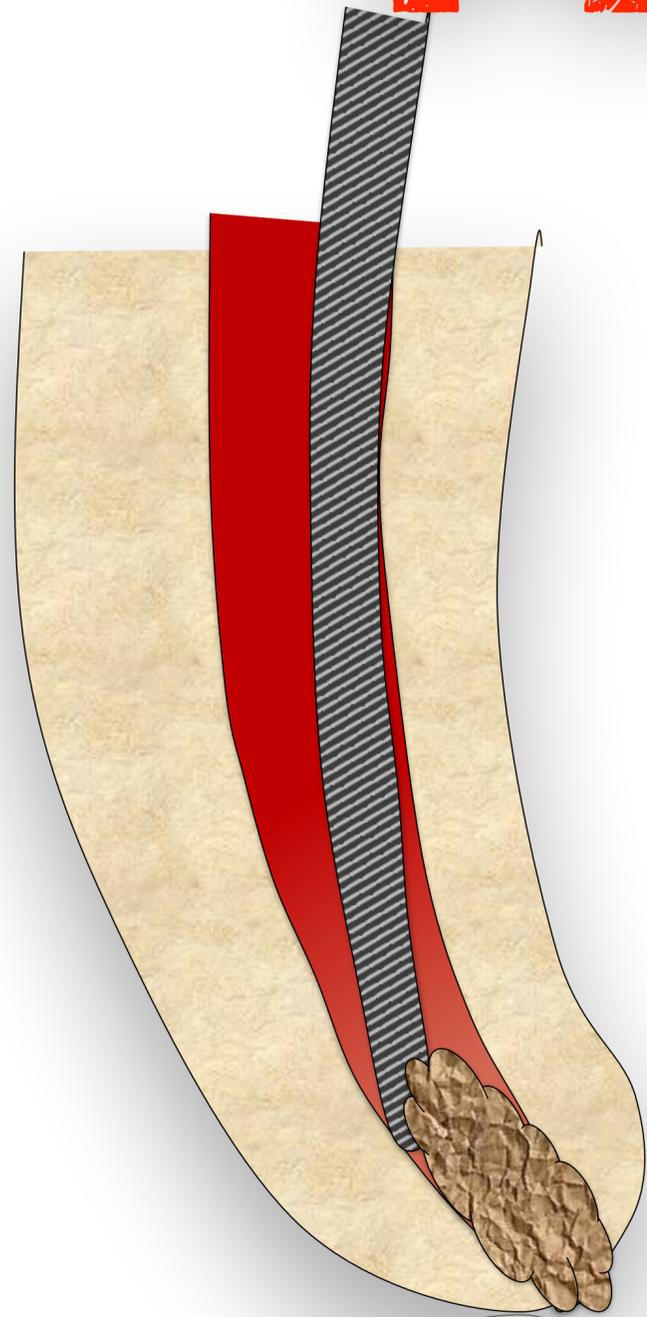


“ROOT CANALS, AS HAS BEEN STATED, HAVE NATURAL CURVES. (...) FILES PLACED IN SUCH CANALS WILL BE DEFLECTED, THEREFORE, FROM THEIR LONG AXES WITH RESULTANT **INEQUALITY OF CUTTING EFFECTIVENESS** (...)

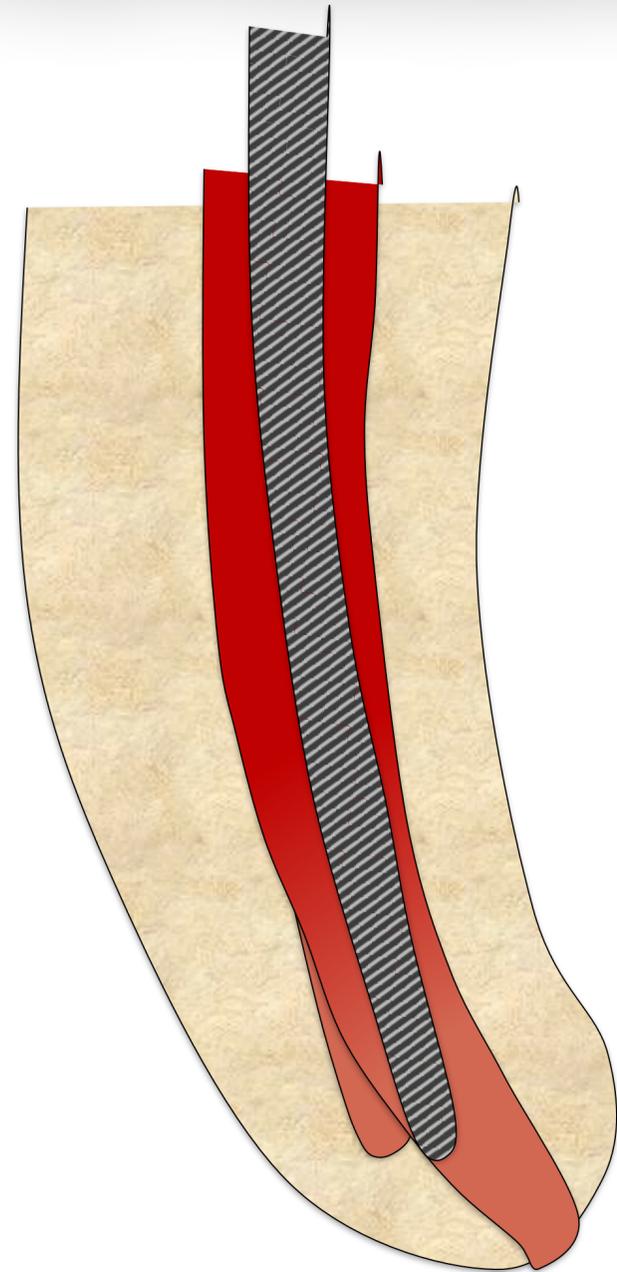
THIS DEFLECTION (...), AND THE ELASTIC MEMORY OF THE DEFLECTED METAL, PRODUCES GREATER CUTTING EFFICIENCY IN THE DIRECTION **OPPOSITE** TO THE CURVATURE OF THE INSTRUMENT”

SCHILDER, H. “CLEANING AND SHAPING THE ROOT CANAL” - DENT CLIN NORTH AM. 1974 APR; 18 (2): 269-96

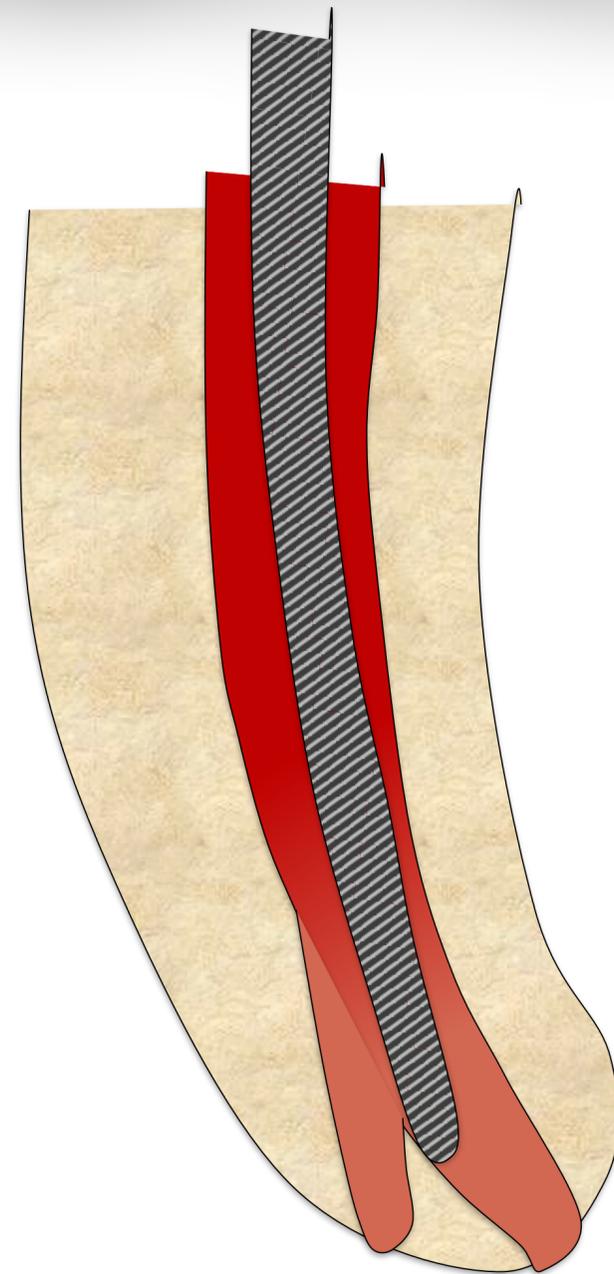
# PROBLEMATICHE



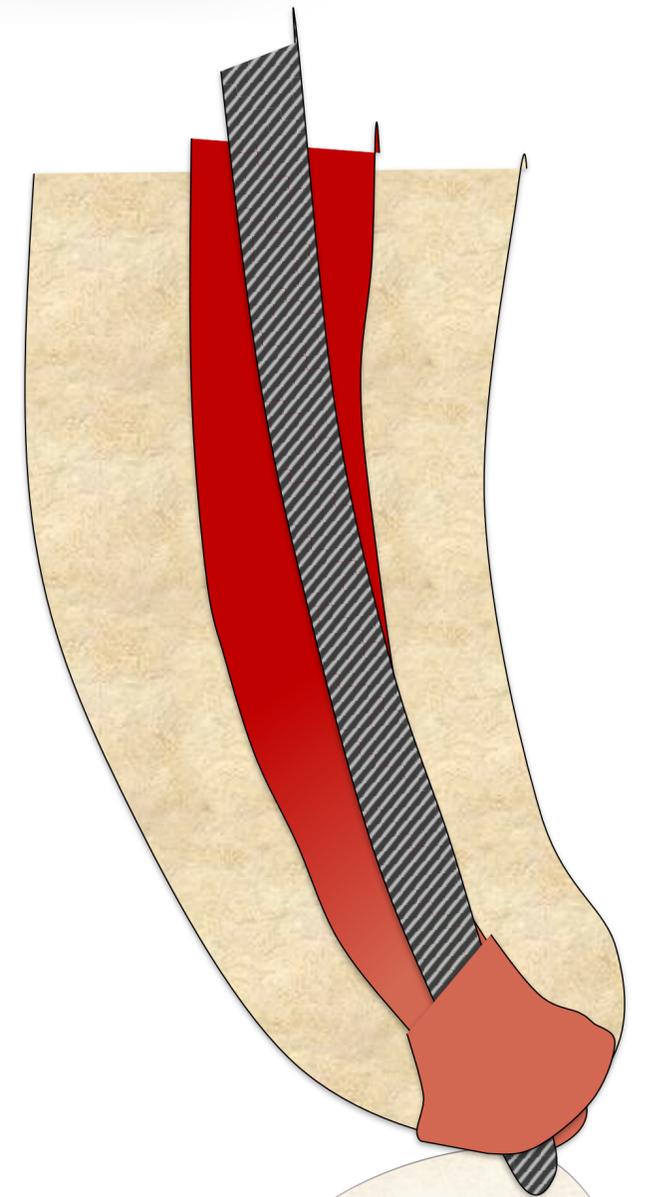
TAPPO



GRADINO



PERFORAZIONE



TRASPORTO

# HEAT TREATMENT T°

± 55°

Cm-Wire

Gold Wire

Blue Wire

R-phase

M-Wire

SE Ni-Ti

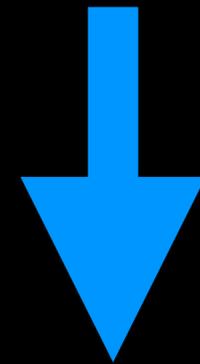
± 0°

Martensitic Phase ( Low T°, Soft)

Austenitic Phase (High T°, Stiff)

SPOSTANDO LA TEMPERATURA  
DI TRANSIZIONE, POSSO  
MODIFICARE LA FASE IN CUI LO  
STRUMENTO SARA' A  
TEMPERATURA AMBIENTE

TEMPERATURA AMBIENTE



Martensite

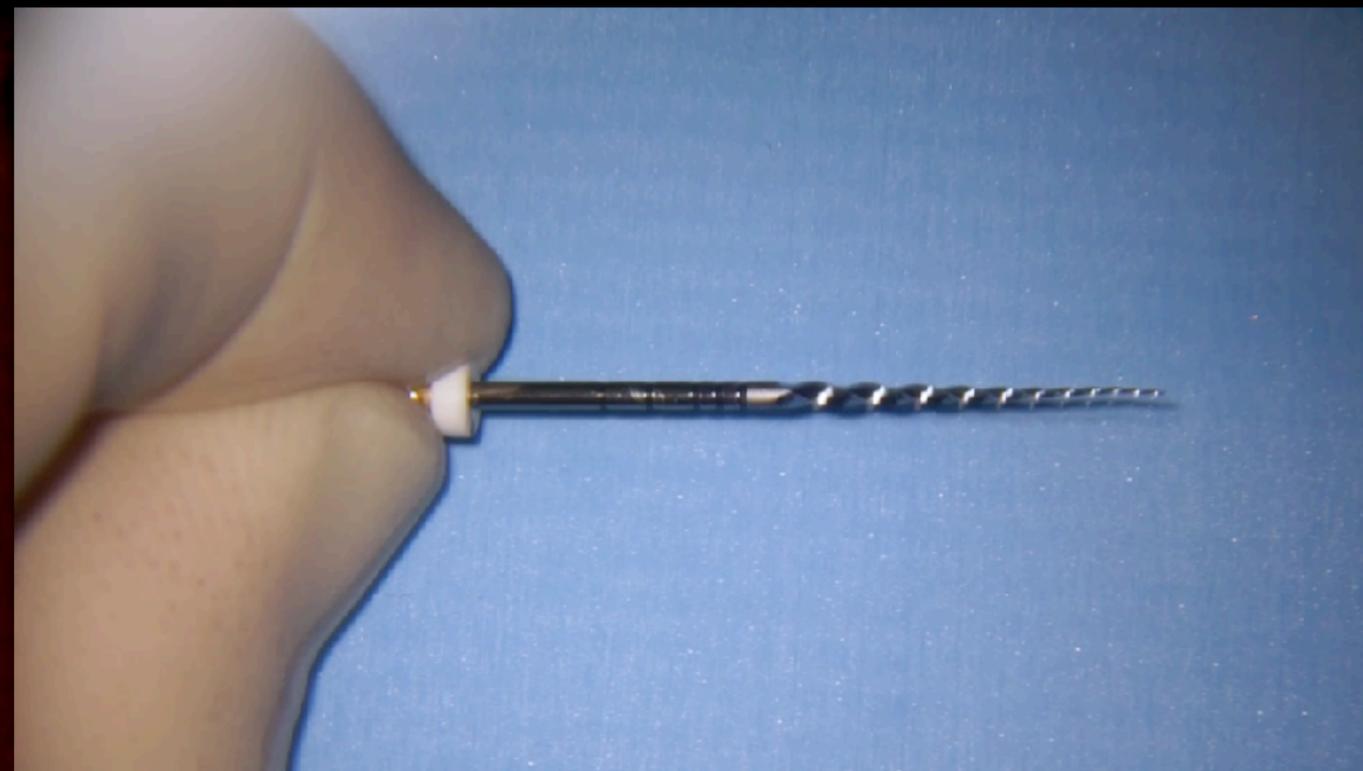


T



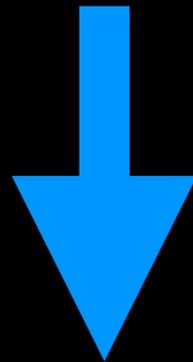
Austenite

temperatura di transizione



STRUMENTO NI TI STANDARD = 0°C

TEMPERATURA AMBIENTE



Martensite



T



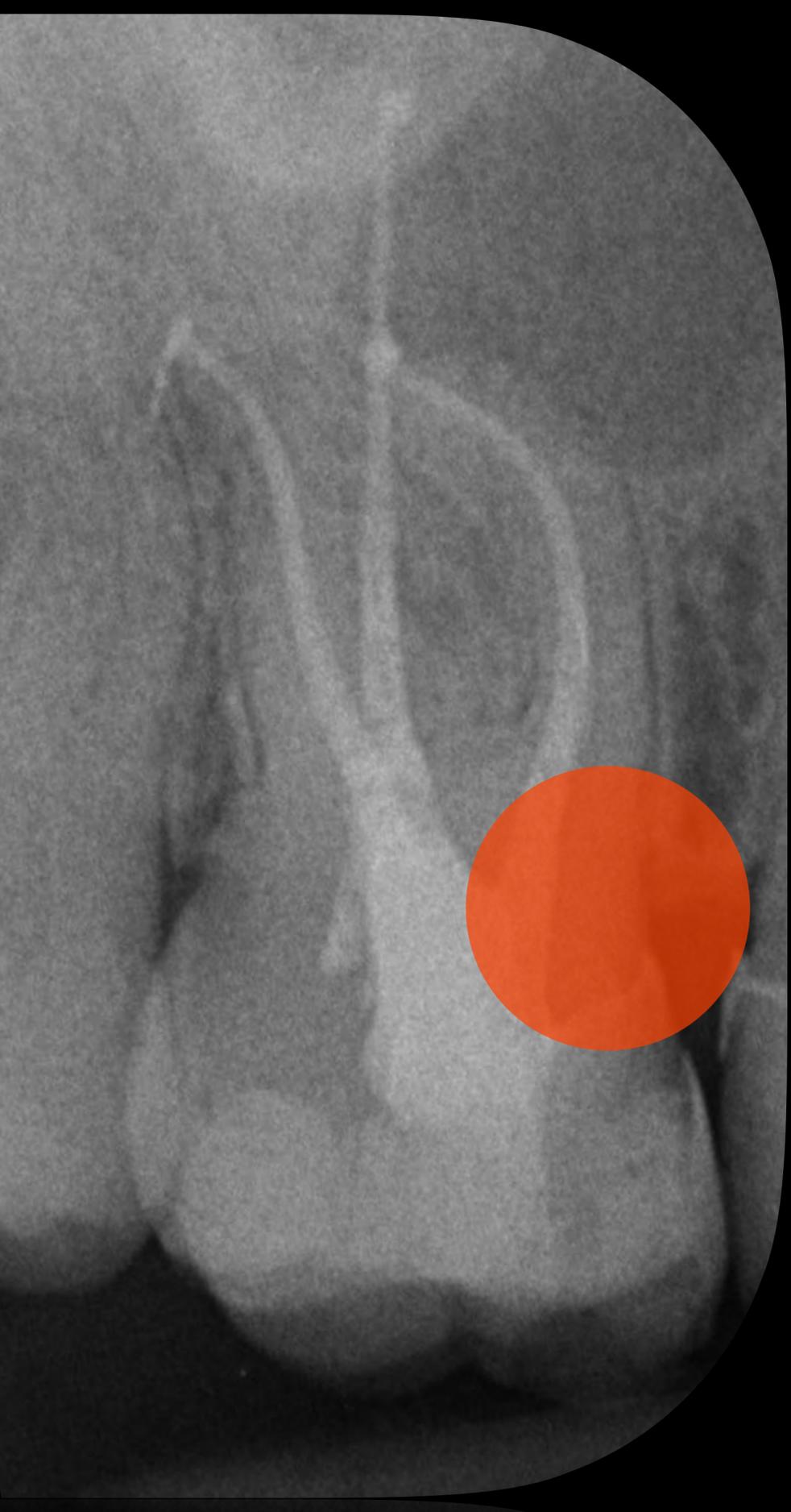
Austenite

temperatura di transizione



STABILMENTE IN FASE MARTENSITICA ALLA  
TEMPERATURA DELL'AMBIENTE

STRUMENTO NI TRATTATO TERMICAMENTE



LA PRESERVAZIONE DELLA DENTINA PERICERVICALE DURANTE UN TRATTAMENTO ENDODONTICO RIDUCE IL RISCHIO DI CFR RIDUCENDO LA TRASMISSIONE DEL CARICO OCCLUSALE ALLE RADICI

Clark e Khademi 2010 - Boveda e Kishen 2015 - Plotino 2017

## 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 endodontically treated tooth. Prognosis most often is hopeless and differential diagnosis from other pathoses may be difficult. Nevertheless, proper diagnosis is critical to distinguish a fracture complication from clinical periodontal and endodontic diseases. This review emphasizes the importance of the correct diagnosis and describes the more typical clinical and radiographic features of this disorder, and summarizes the multifactorial etiology.

TAMSE 2006

“Predisposing factors include **loss of healthy tooth substance**, ... which increases the risk for cracks in the body of dentin that can later propagate to fracture “

“...cutting dentin to **straight lines at curvatures weakens the root structure** ...  
In the infected root canals especially, **a balance between the need to remove infected dentin and maintaining sufficient root thickness** to withstand the forces of mastication should therefore be sought. “

“Special attention to securing **sufficient remaining dentin** should be given to the teeth and roots most susceptible to fracture, i.e., **the maxillary and mandibular premolars and the mesial roots of the mandibular molars**”

APPROCCIO CONSERVATIVO ALLA SACOMATURA

PRESERVARE LA MASSIMA QUANTITÀ DI TESSUTO  
DENTALE DURANTE LA TERAPIA ENDODONTICA

ED “EVITARE” LA  
FRATTURA DEGLI  
STRUMENTI ROTANTI

SAFETY

FLESSIBILITÀ E RESISTENZA

# 2011

# YA SHEN et AL

**TABLE 1.** The Number of Revolutions to Fracture ( $N_f$ ), the Maximum Surface Strain Amplitude ( $\epsilon_a$ ), and the Dimple Area/Total Cross-section Area on the Fractured Instrument (%) for Each Brand at the Curvature of  $35^\circ$  and  $45^\circ$  in Dry Condition

Size 25/.04	$45^\circ$			$35^\circ$		
	$N_f$	$\epsilon_a$	Dimple area (%)	$N_f$	$\epsilon_a$	Dimple area (%)
ProFile	486 ± 163	8.3 ± 1.2	71 ± 6	640 ± 180	6.2 ± 0.4	67 ± 8
TYP	376 ± 124	8.4 ± 0.5	75 ± 1	645 ± 231	6.0 ± 0.9	72 ± 5
TYP CM	1340 ± 160	4.2 ± 1.1	43 ± 17	2422 ± 1806	3.9 ± 0.7	28 ± 6
NEY Y	329 ± 92	6.4 ± 0.3	79 ± 3	1213 ± 430	3.6 ± 0.6	71 ± 4
NEY Y CM	2629 ± 125	3.4 ± 0.7	43 ± 9	3491 ± 1,782	2.2 ± 0.9	39 ± 6

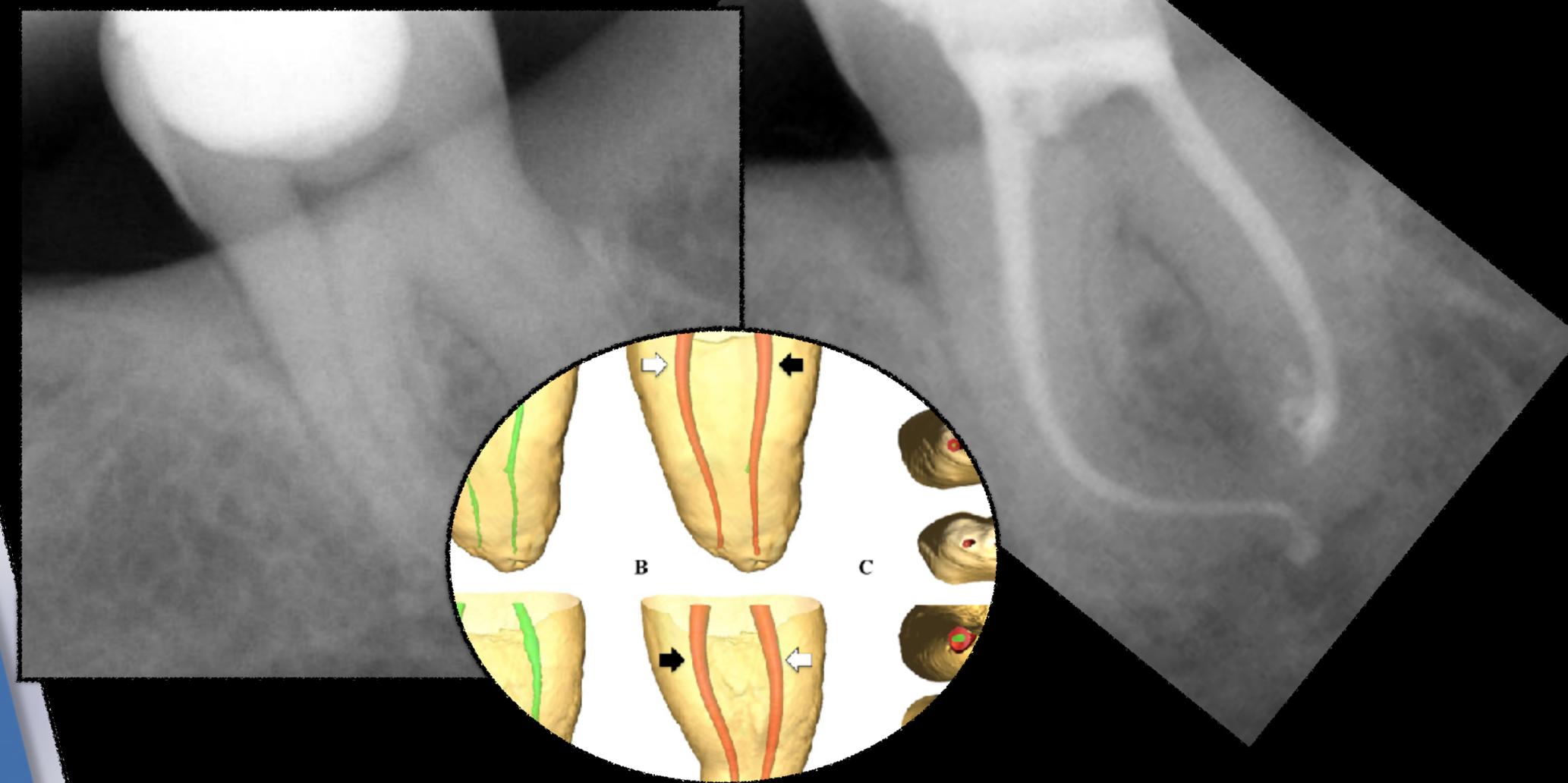
INSTRUMENTS MADE FROM HT WIRE HAD A SIGNIFICANTLY HIGHER NUMBER OF REVOLUTIONS TO FRACTURE THAN THE CONVENTIONAL NI-TI WIRE FILES

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 Oral Investigations  
ISSN 1432-6981  
Clin Oral Invest  
DOI 10.1007/s00784-016-1732-4



..The use of Ni-Ti files made by he-treated alloy could improve the qualities of root canal shaping rather than conventional Ni-Ti instruments

# 2013

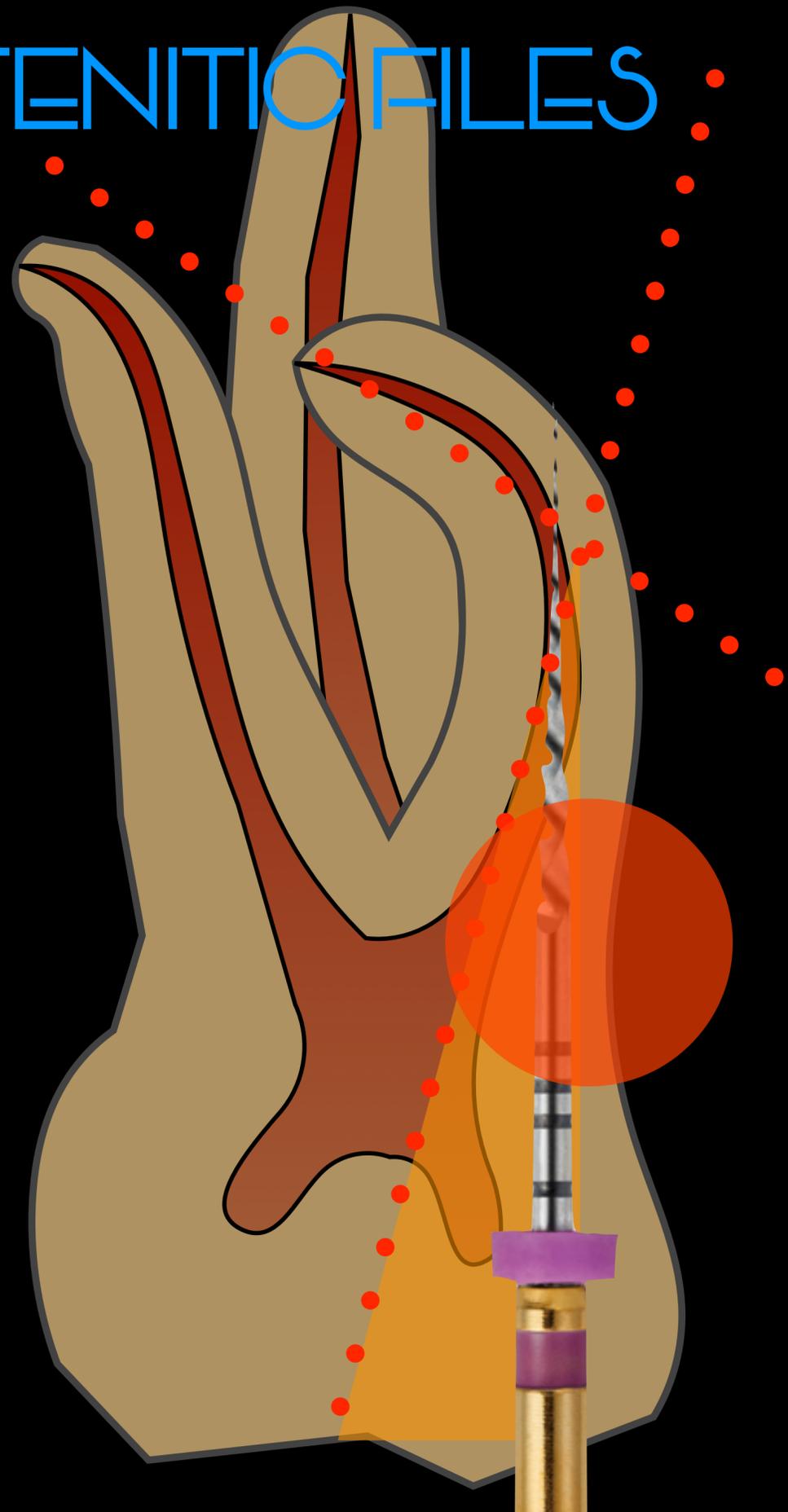
into a single process. The newly developed thermomechanical treatment of NiTi files gives them better flexural fatigue resistance than files of similar design and size made from conventional NiTi alloy. The unique material properties make them particularly suited for endodontic treatment. Although the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

YA SHEN et AL

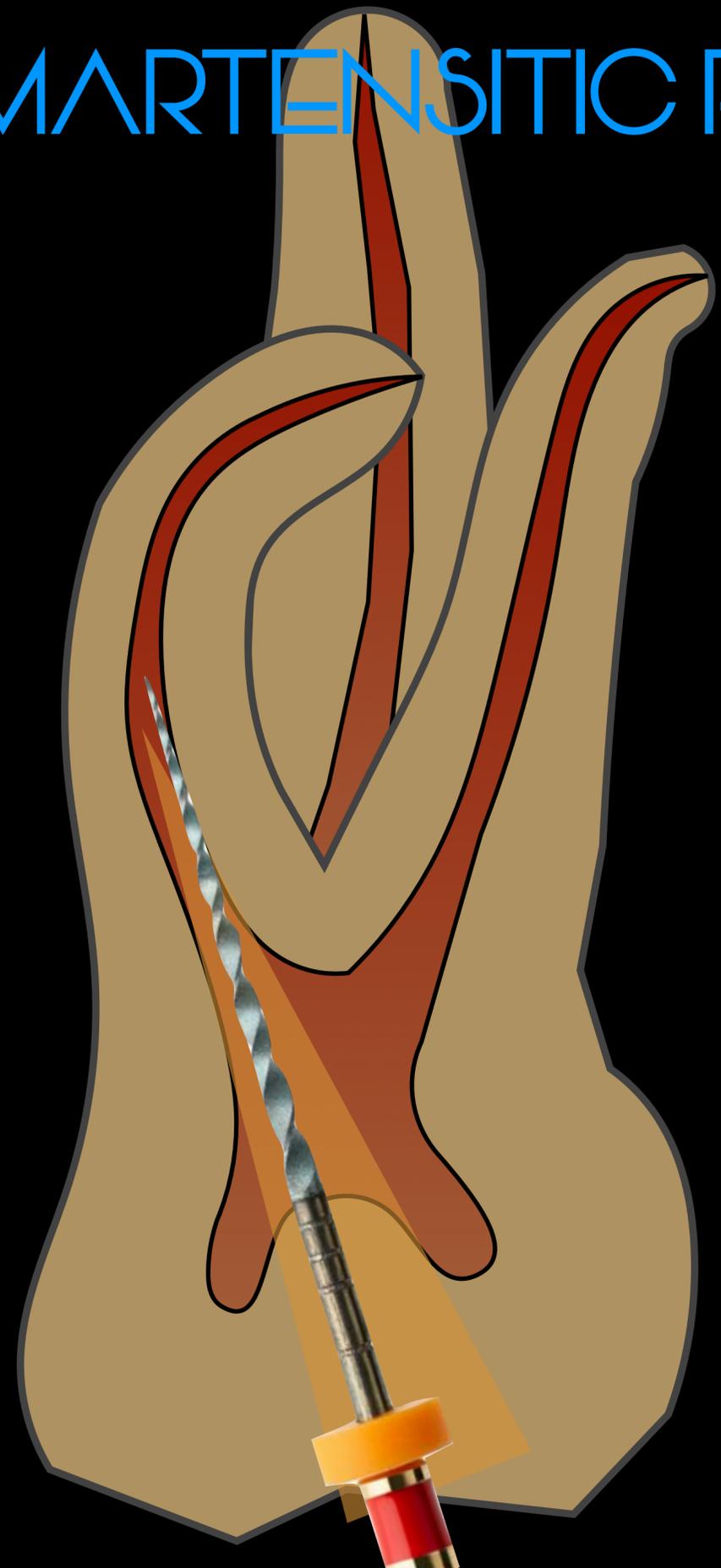
La *Maggioranza* dei nuovi file  
introdotti nel mercato sono  
Trattati termicamente

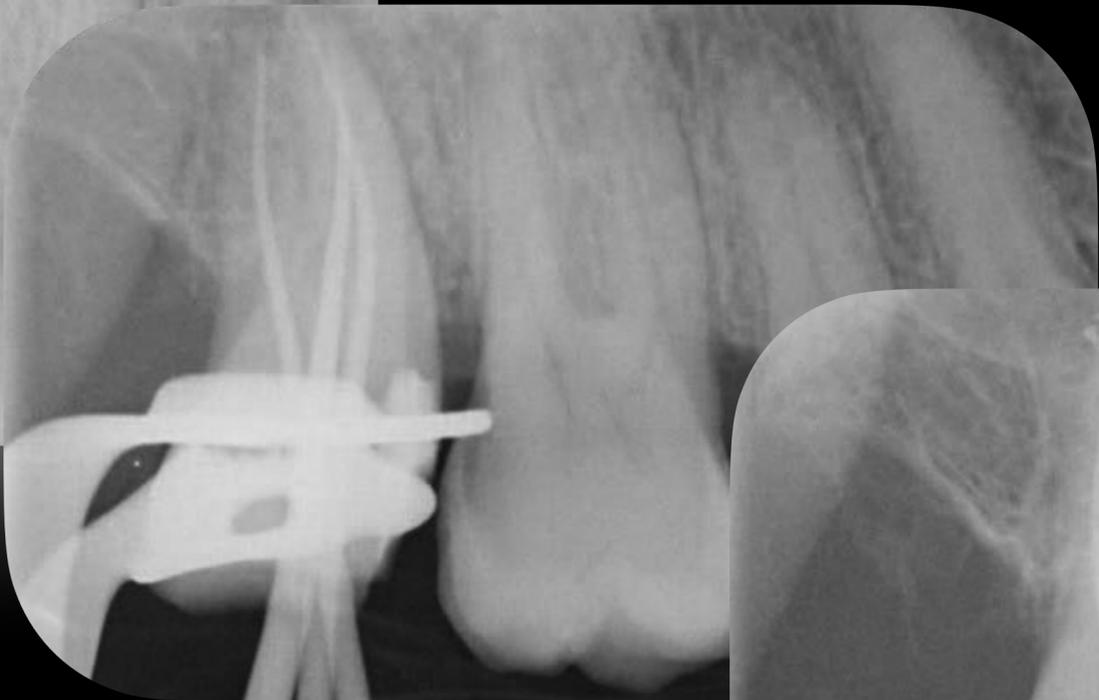


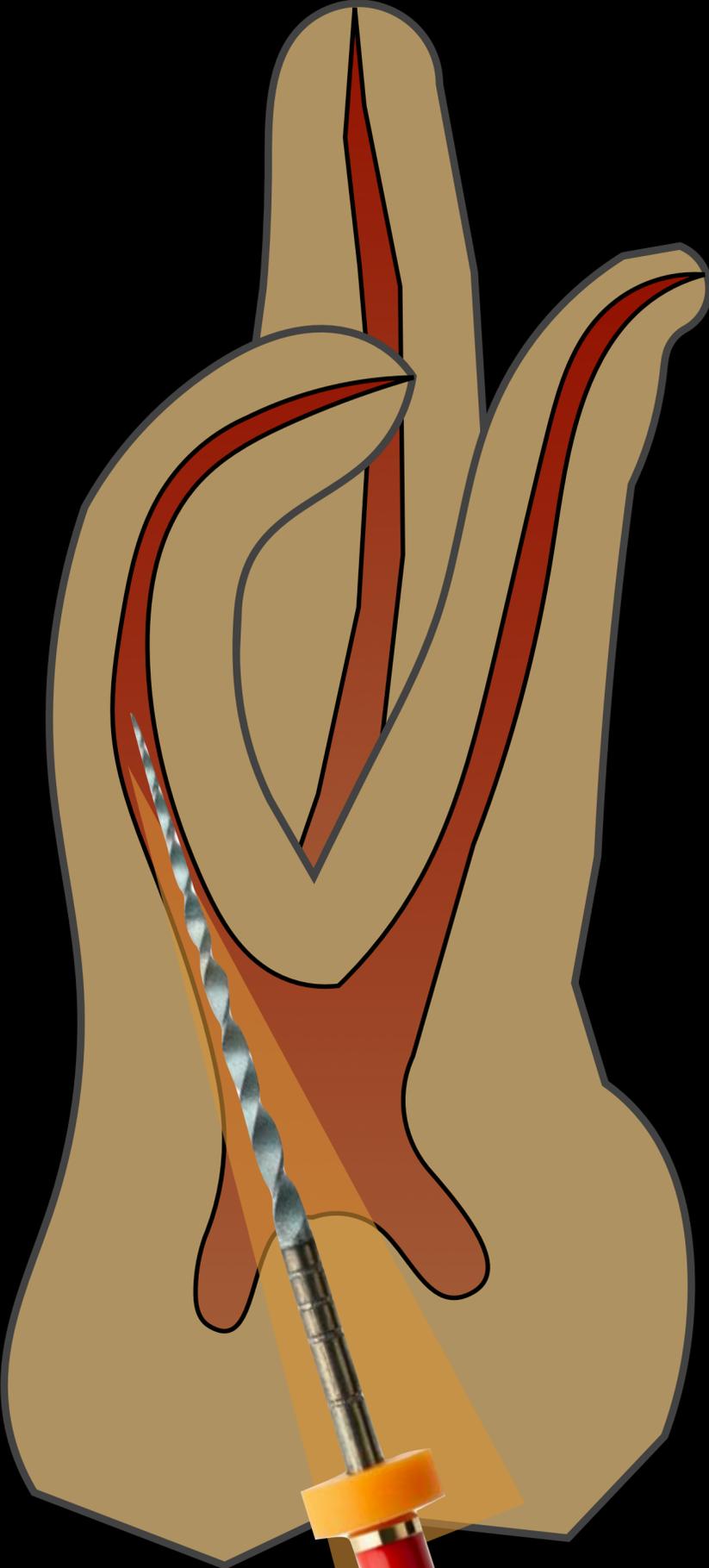
# AUSTENITIC FILES



# MARTENSITIC FILES







LA SAGOMATURA ESEGUITA CON STRUMENTI  
MARTENSITICI CONSENTE UNA RIDUZIONE DELLA  
CONCITA'

Peters 2015

LA SAGOMATURA CONVENZIONALE CON  
STRUMENTI AUSTENITICI PORTA AD UN SACRIFICIO  
MAGGIORE DI DENTINA PERICERVICALE RISPETTO A  
AD UNA SAGOMATURA CON STRUMENTI CON  
MEMORIA DI FORMA

Schen 2013 - Zupanc 2018

# Aumento del diametro apicale



40.4



60.4

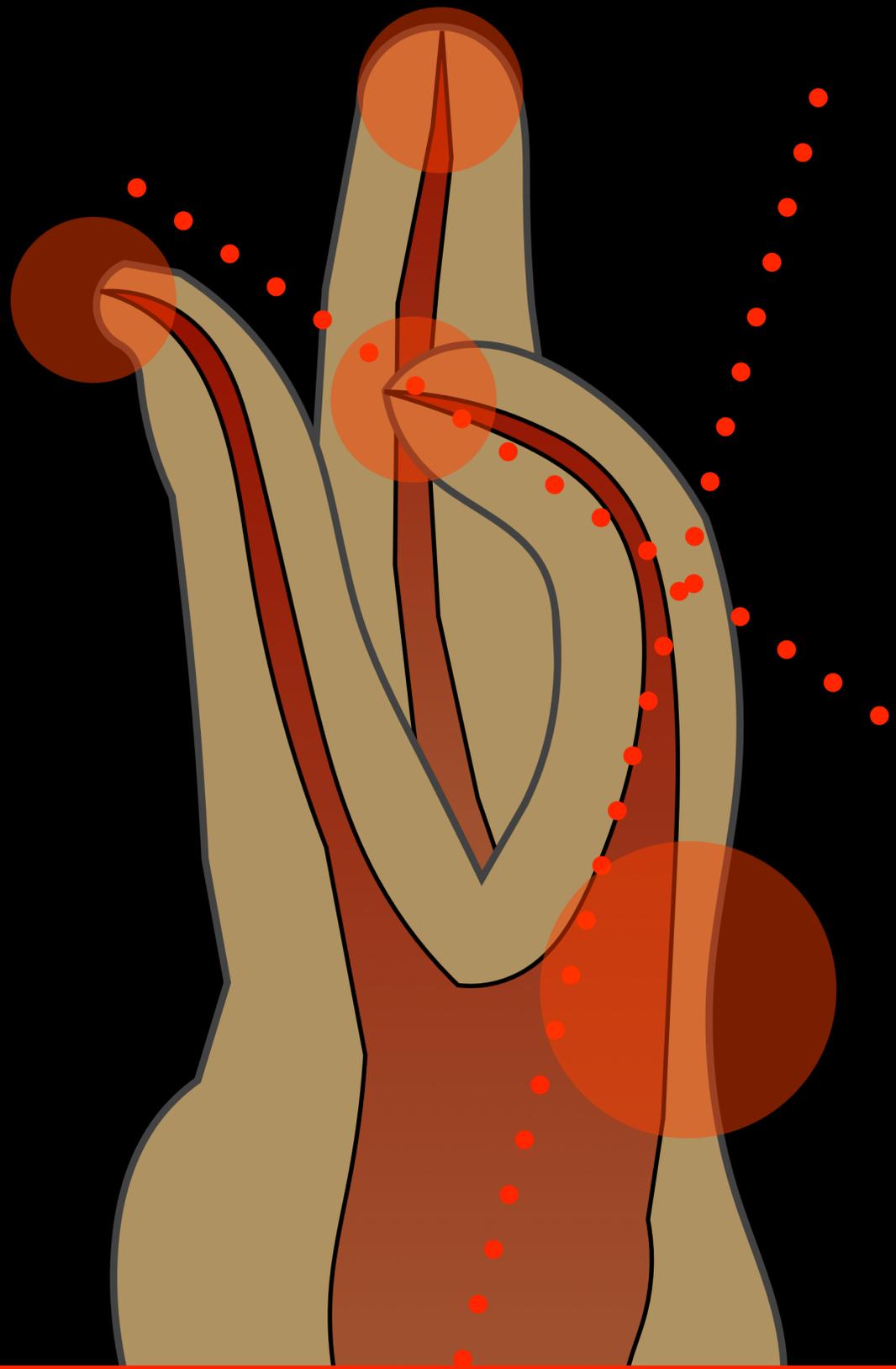


30.4

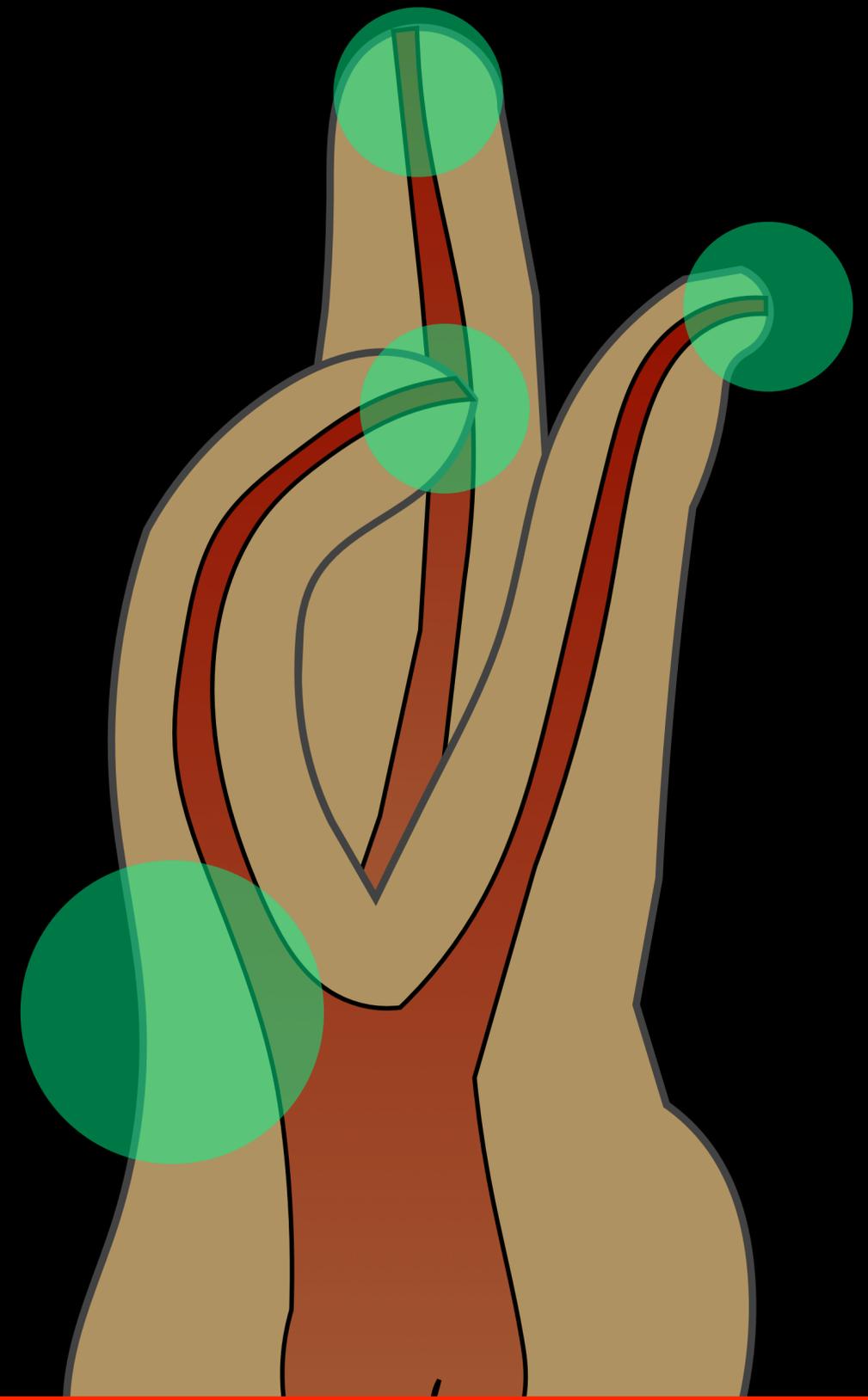


35.4

# Diminuzione della conicità



FILE AUSTENITICI



FILE MARTENSITICI

# PRO FLEX NHA

NANO RIVESTITO ATTIVAZIONE TERMICA

ESTREMA  
FLESSIBILITÀ

MAGGIORE  
RESISTENZA

TECNOLOGIA  
CONTROL MEMORY

RIVESTIMENTO  
NANO-COATED



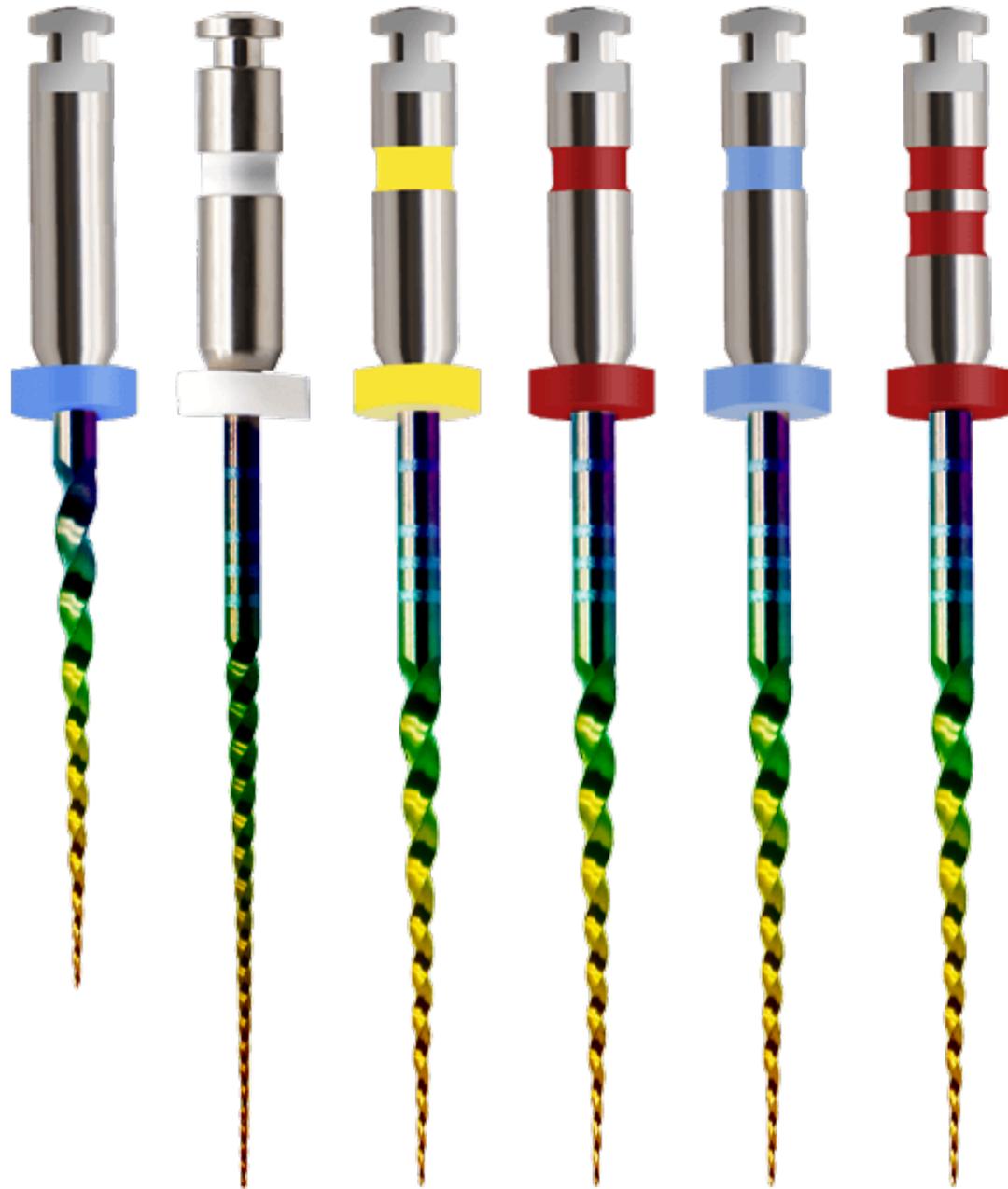
**NEW  
ENTRY!!!**

**NEW  
ENTRY!!!**

**NEW  
ENTRY!!!**

# PRO FLEX NHA

NANO RIVESTITO ATTIVAZIONE TERMICA



## CONTROL MEMORY

La tecnologia *Control Memory* degli strumenti canalari garantisce stabilità e precisione durante la pulizia del canale radicolare anche quando non viene applicata forza sullo strumento.



## NI-TI RAINBOW

Il nuovo materiale *Ni-Ti Rainbow* garantisce resistenza e flessibilità durante il trattamento endodontico, offrendo una maggiore durata e resistenza nella pulizia dei canali radicolari grazie alle sue proprietà avanzate.



## ROTAZIONE CONTINUA

Gli strumentini canalari *Pro Flex NHA* sono *compatibili con i motori endodontici a rotazione continua*, garantendo una maggiore velocità di lavoro, una maggiore capacità di rimuovere i detriti durante la sagomatura e una maggior linearità del taglio.

PRO FLEX NHA								
	Ø	%	N/cm	RPM	21 mm	25 mm	31 mm	
R	20	10	2,5	350	17 mm REF: 144900550			
○ 016	15	2-6	2,5	300	144900551	144900561	144900571	
● D1	20	4	2,5	250-300	144900552	144900562	144900572	
● D2	25	4	2,5	250-300	144900553	144900563	144900573	
● D3	30	4	2,5	250-300	144900554	144900564	144900574	
● D4	25	6	2,5	250-300	144900555	144900565	144900575	
016-D4	--	--	2,5	--	144900556	144900566	144900576	

Legenda / Legend  
 - Ø Diametro / Diameter  
 - % Conicità / Taper  
 - N/cm Torque  
 - RPM Velocità / Speed

\* La velocità e il torque sono indicativi e possono variare a seconda del dispositivo utilizzato e delle preferenze dell'operatore  
 Speed and torque are approximated and can change in relation to the device and to the operator choices

**PRO FLEX NHA**  
NANO RIVESTITO ATTIVAZIONE TERMICA



**20/10**



**15/2-6**



**20/4**



**25/4**



**30/4**



**DR. GIANLUCA FUMEI**



**DR. GIANLUCA FUMEI**

# TAKE HOME MESSAGES:

I TRATTAMENTI TERMICI AUMENTANO LA RESISTENZA

RIDUCONO IL RITORNO ELASTICO

AIUTANO NEL MANTENIMENTO DELL'ANATOMIA

RIDUCONO RISCHI DI STRIPPING E TRASPORTO

DANNO IL LORO MEGLIO ALL'AUMENTARE DEL DIAMETRO

CONSENTONO DI AUMENTARE IL DIAMETRO E RIDURRE LA CONICITA'

# LA SCELTA DELLE TECNICHE DI SAGOMATURA

LE MODERNE TECNICHE DI SAGOMATURA CI CONSENTONO DI MASSIMIZZARE LA DETERSIONE E LA SAGOMATURA DELLA ZONA APICALE, PRESERVANDO DENTINA PERICERVICALE NEL PIENO RISPETTO DELL'ANATOMIA DEL DENTE TRATTATO



# I CEMENTI BIO CERAMICI IN ENDODONZIA

CEMENTO APICAL PLUG

BIOCOMPATIBILI

ENDODONTICO

BIOATTIVI

ENDODONZIA CHIRURGICA

RIPARAZIONE PERFORAZIONI

TERAPIA DELLA POLPA VITALE

# LE BIO CERAMICHE IN ENDODONZIA

1995

0899-2399/95/2107-0349\$03.00/0  
JOURNAL OF ENDODONTICS  
Copyright © 1995 by The American Association of Endodontists

Printed in U.S.A.  
Vol. 21, No. 7, July 1995

## SCIENTIFIC ARTICLES

### Physical and Chemical Properties of a New Root-End Filling Material

Mahmoud Torabinejad, DMD, MSD, PhD, C. U. Hong, DDS, MS, F. McDonald, BDS, PhD, and T. R. Pitt Ford, BDS, PhD

This study determined the chemical composition, pH, and radiopacity of mineral trioxide aggregate (MTA), and also compared the setting time, compressive strength, and solubility of this material with those of amalgam, Super-EBA, and Intermediate Restorative Material (IRM). X-ray energy dispersive spectrometer in conjunction with the scanning electron microscope were used to determine the composition of MTA, and the pH value of MTA was assessed with a pH meter using a temperature-compensated electrode. The radiopacity of MTA was determined according to the method described by the International Organization for Standardization. The setting time and compressive strength of these materials were determined according to methods recommended by the British Standards Institution. The degree of solubility of the materials was assessed according to modified American Dental Association specifications. The results showed that the main molecules present in MTA are calcium and phosphorous ions. In addition, MTA has a pH of 10.2 initially, which rises to 12.5 three hours after mixing. MTA is more radiopaque than Super-EBA and IRM. Amalgam had the shortest setting time (4 min) and MTA the longest (2 h 45 min). At 24 h MTA had the lowest compressive strength (40 MPa) among the materials, but it increased after 21 days to 67 MPa. Finally, except for IRM, none of the materials tested showed any solubility under the conditions of this study.

When nonsurgical root canal therapy fails or cannot be performed, surgical root canal therapy is conducted. The procedure usually consists of root-end exposure and resection, as well as preparation

of a class I cavity and placement of a root-end filling material. A number of substances have been suggested and used as root-end filling materials (1).

Recently, an experimental substance, mineral trioxide aggregate (MTA), has been suggested as a potential root-end filling material. In a series of in vitro studies, Torabinejad et al. (2-5) evaluated the sealing ability of MTA, compared with commonly used root-end filling materials. Statistical analysis of their data showed that MTA had significantly less dye (2, 3) and bacterial (4) leakage than amalgam, Super-EBA or Intermediate Restorative Material (IRM). In addition, when marginal adaptation of MTA root-end fillings was compared with those of amalgam, Super-EBA, and IRM under scanning electron microscope, they reported no noticeable gap between MTA and its surrounding dentinal walls (5).

Because these studies show that MTA leaks less and has better adaptation to the root-end cavity walls than commonly used root-end filling materials, its other characteristics—such as chemical composition, physical properties, antibacterial effects, cytotoxicity, and biocompatibility—should also be investigated.

The purpose of this study was first to determine the chemical composition, pH of the setting cement, and radiopacity of MTA, and second to compare the setting time, compressive strength, and solubility of this material with those of three commonly used root end filling materials, amalgam, Super-EBA, and IRM.

#### MATERIALS AND METHODS

##### Chemical Composition

To study the chemical composition of MTA, we used the KVEX Delta 4460 X-ray Energy dispersive spectrometer, modified with Micro EDS software (BEMAX UK Ltd.), in conjunction with a Hitachi S520 scanning electron microscope. MTA was mixed with sterilized distilled water and allowed to set in a 37°C incubator with 5% carbon dioxide and moisture. The material was set on a glass cover slip that had been previously sterilized using alcohol and flaming. Five set specimens with different proportions of water and powder were examined. For quantitative X-ray analysis, the specimens were carbon-coated to a thickness of 100 nm and again mounted in the S520 using the quantum DVEX system. Acceler-

IL COMPOSTO OTTENUTO PER IDRATAZIONE HA LA CARATTERISTICA DI NON SUBIRE CONTRAZIONE VOLUMETRICA, GARANTENDO QUINDI OTTIMA STABILITÀ MARGINALE E DI OTTENERE PH ALCALINO PROSSIMO AD UN VALORE 11 CHE GLI ATTRIBUISCE ANCHE PROPRIETÀ ANTIBATTERICHE

# LE BIO CERAMICHE IN ENDODONZIA

## REAZIONE DI IDRATAZIONE



L'IDRATAZIONE FA INDURIRE IL MATERIALE RENDENDOLO PARTICOLARMENTE STABILE E RILASCIANDO IDROSSIDO DI CALCIO ALZANDO IL PH (AZIONE ANTIBATTERICA) E STIMOLANDO ATTIVITA' RIPARATIVA DEI TESSUTI

# LE BIO CERAMICHE IN ENDODONZIA

## REAZIONE DI PRECIPITAZIONE



L'IDROSSIDO DI CALCIO INSIEME AI FOSFATI PRESENTE NEI TESSUTI DANNO ORIGINE ALL'IDROSSIAPATITE E ALTRA ACQUA CHE POTENZIA DI NUOVO IL CICLO

# LE BIO CERAMICHE IN ENDODONZIA

BIOMATERIALE + ACQUA



IDROSSIDO DI CALCIO + FOSFATI



IDROSSIAPATITE + ACQUA



# LE BIO CERAMICHE IN ENDODONZIA

TOSSICITÀ PER I METALLI PESANTI (CROMO, ARSENICO)

DISCOLOREAZIONE DENTALE (OSSIDO DI BISMUTO + IPO)

TEMPO INDURIMENTO(3-4H)

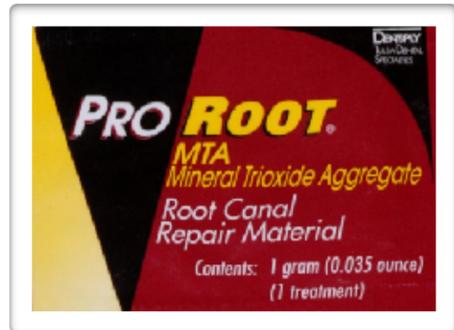
DIFFICILE MISCELAZIONE

DIMENSIONE PARTICELLE

WASH-OUT

RESISTENZA MECCANICA

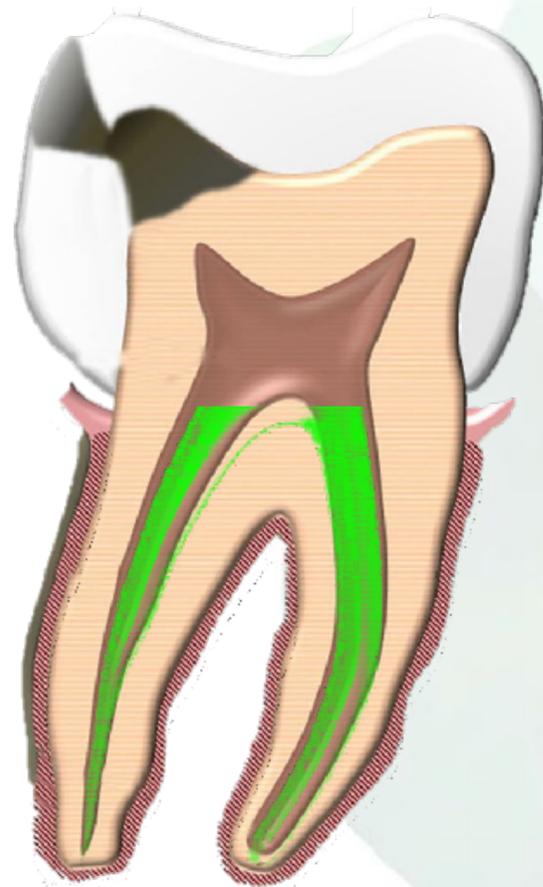
CONSISTENZA SABBIOSA



(GRANDI: POCHE PARTICELLE INTEGRAGISCONO CON ACQUA RISPETTO NUOVI MATERIALI)



INDICAZIONI  
CLINICHE  
ALL UTILIZZO DEI  
BIOCERAMICI



# CEMENTO CANALARE



INDICAZIONI  
CLINICHE  
ALL UTILIZZO DEI  
BIOCERAMICI



# CEMENTO CANALARE

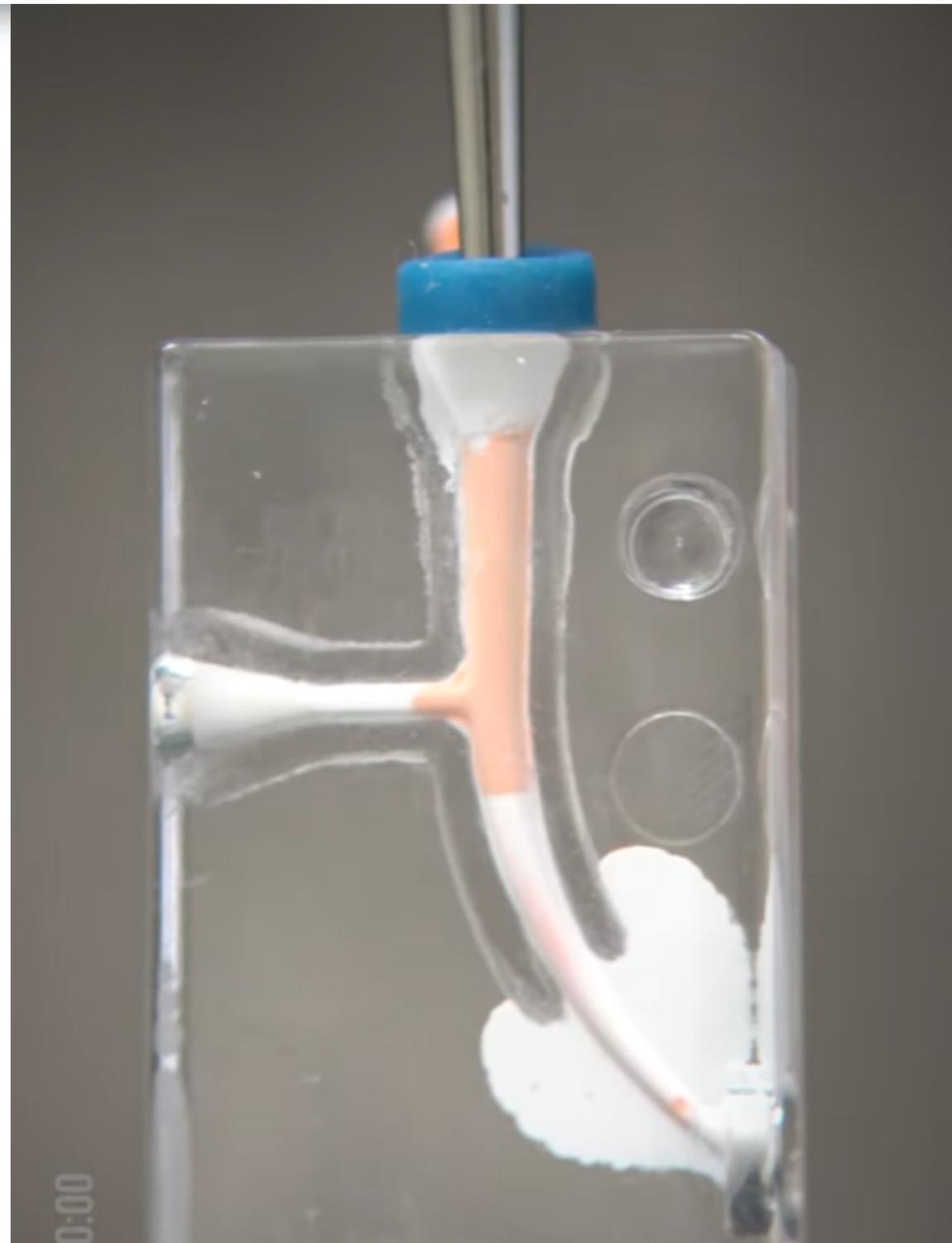


# CEMENTO CANALARE



1. INSERISCI IL CEMENTO NELLA PORZIONE CORONALE DEL CANALE
2. PORTA IL CEMENTO A LUNGHEZZA DI LAVORO CON UN FILE PER ELIMINARE IL VAPOR LOCK
3. SPORCA UN CONO DI GUTTAPERCA CON IL BC SEALER
4. INSERISCI IL CONO DI GUTTAPERCA A LUNGHEZZA DI LAVORO
5. TAGLIA LA PORZIONE CORONALE DEL CONO DI GUTTAPERCA





# CEMENTO CANALARE



1. PRENDI LA MISURA DEL PORTATORE DI CALORE – CIRCA 5 MM DALL'IMBOCCO
2. INSERISCI IL CEMENTO NELLA PORZIONE CORONALE DEL CANALE
3. PORTA IL CEMENTO A LUNGHEZZA DI LAVORO CON UN FILE PER ELIMINARE IL VAPOR LOCK
4. SPORCA UN CONO DI GUTTAPERCA CON IL BC SEALER
5. INSERISCI IL CONO DI GUTTAPERCA A LUNGHEZZA DI LAVORO
6. TAGLIA LA PORZIONE MEDIA DEL CONO CON IL PORTATORE DI CALORE PRECEDENTEMENTE MISURATO
7. COMPATTARE LA GUTTAPERCA RISCALDATA ED ESEGUIRE IL BACK-FILLING

INDICAZIONI  
CLINICHE  
ALL UTILIZZO DEI  
BIOCERAMICI



# CEMENTO CANALARE



## Take Home Message



- LE TECNICHE SONO ANCORA IN DIVENIRE, SI MODIFICANO AL CAMBIAMENTO DELLE PROPRIETÀ DEI BC SEALER SUL MERCATO
- IL CAMBIAMENTO PIÙ IMPORTANTE È CONCETTUALE, È IL CEMENTO AD ESSERE IL PROTAGONISTA DEL SIGILLO ENDODONTICO

## Hydraulic Condensation

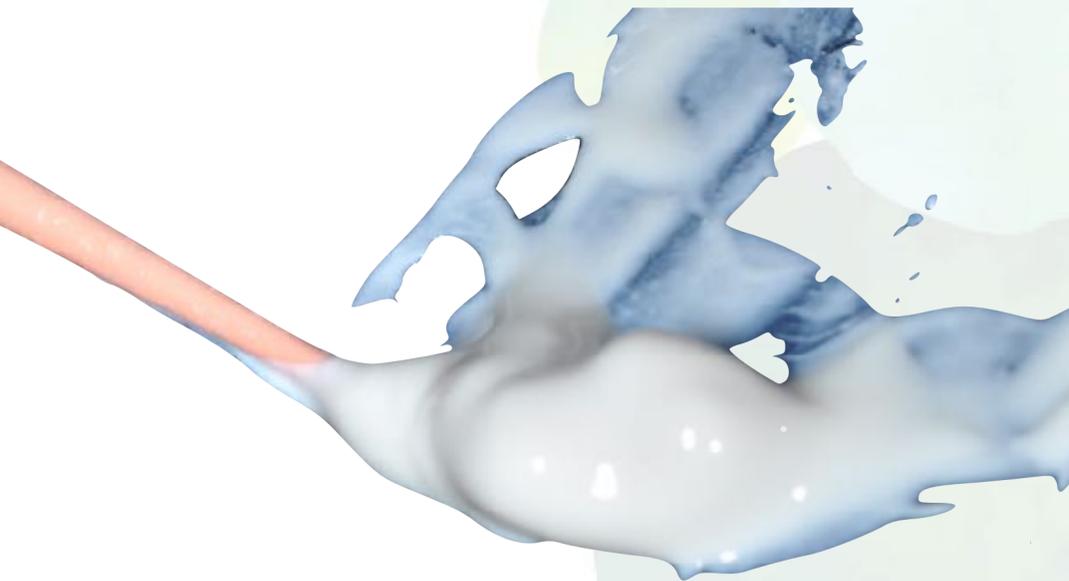
### Clinical Steps

- Portare il cono di gutta alla LDL o accorciato di 1/2 mm per mantenere a contatto il bioceramico con il tessuto periapicale\*

\*N.B. 1/2 mm di sealer bioceramico in apice non preclude assolutamente la possibilità di ritrattare l'elemento

- Portare il cemento nel canale utilizzando una delle seguenti tecniche:

- Utilizzare un lentulo
- Portare il cemento mediante una siringa
- Sporcare il cono di guttaperca nel cemento bioceramico



A



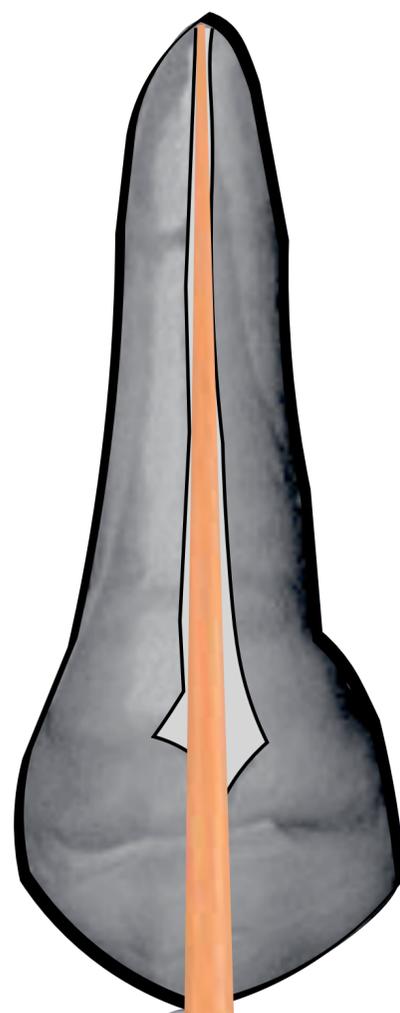
B



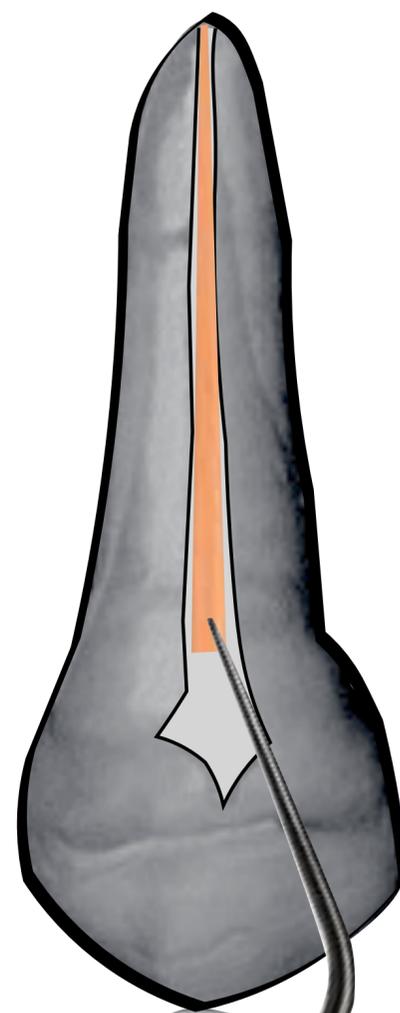
C



D



E



# MANTENIMENTO VITALITA'



# MANTENIMENTO VITALIA'



MAI IN CADERE  
SENZA PRIMA  
AVER SONDATO



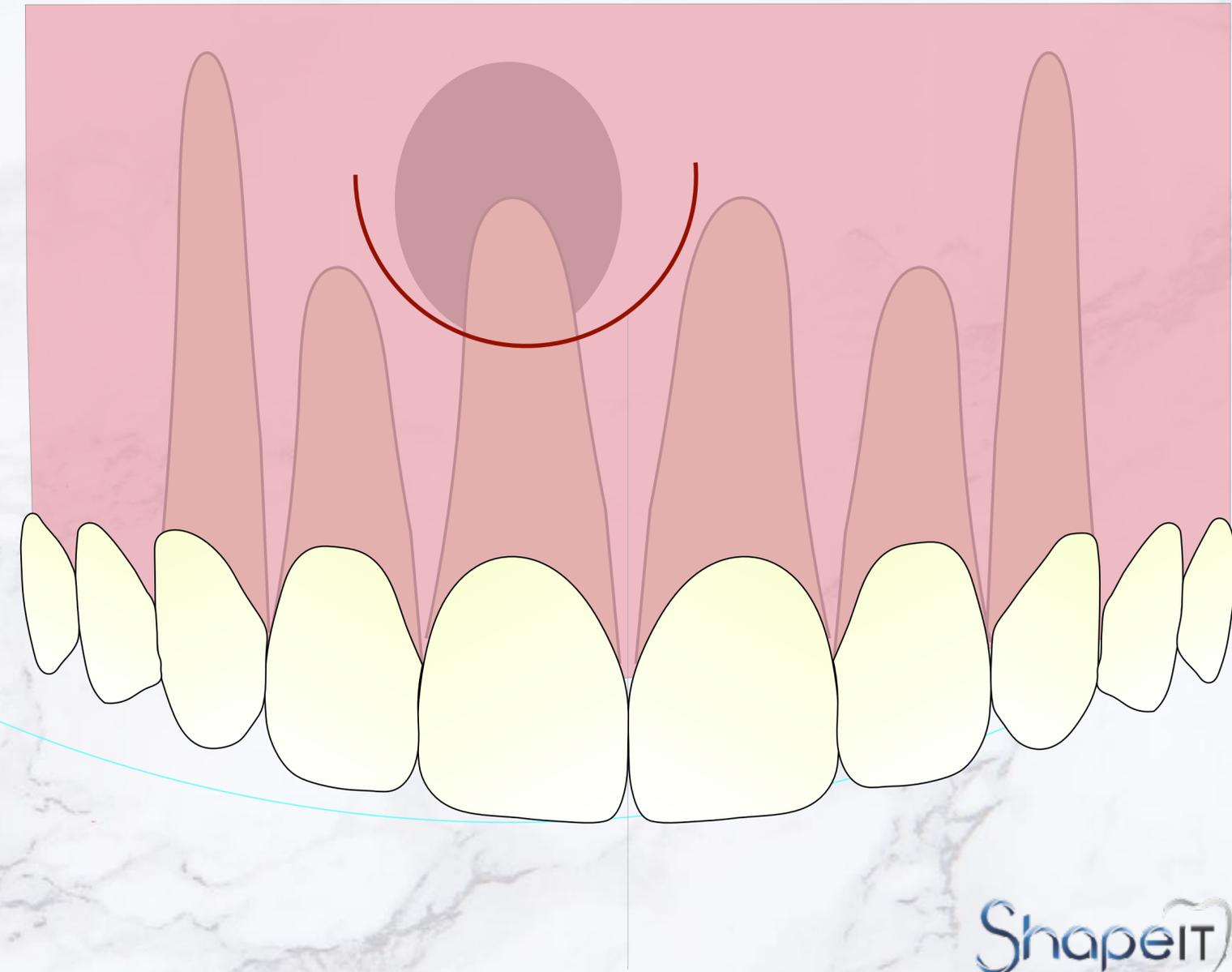
**NON SI INCIDE  
ALL'INTERNO  
DI UN SOLCO**

# L'INCISIONE E' PERPENDICOLARE AL PIANO OSSEO

# LEMBO SEMILUNARE

ENDODONZIA  
CHIRURGICA

CADUTO IN DISUSO,  
NON CONSENTE  
ISOLAMENTO NE' LA  
CORRETTA EMOSTASI.  
DIFFICILE  
RIPOSIZIONAMENTO  
UNICO VANTAGGIO  
NON COINVOLGE  
PARODONTO

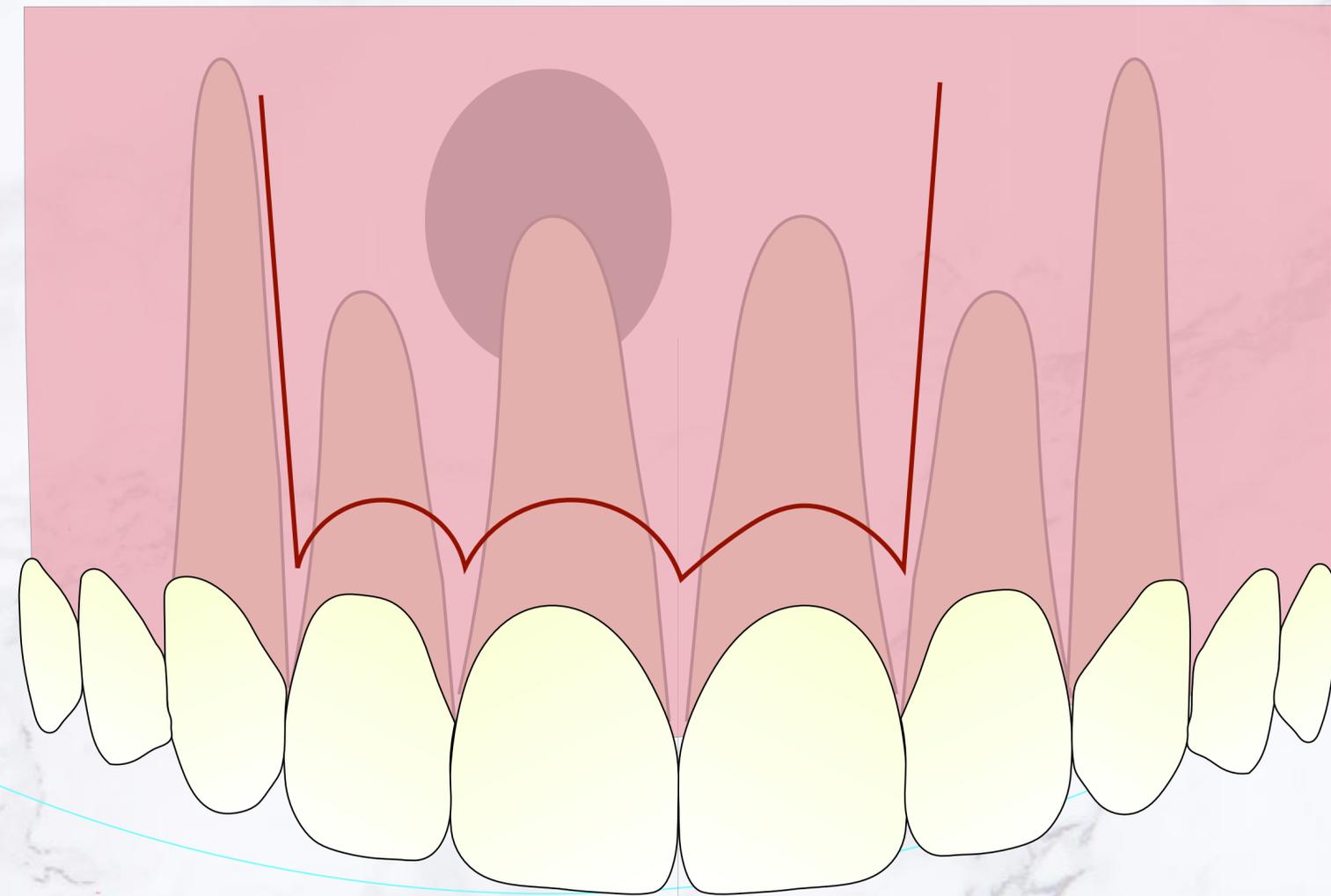


ShapeIT®

# LEMBO DI OCHSENBEIN LUEBKE

ENDODONZIA  
CHIRURGICA

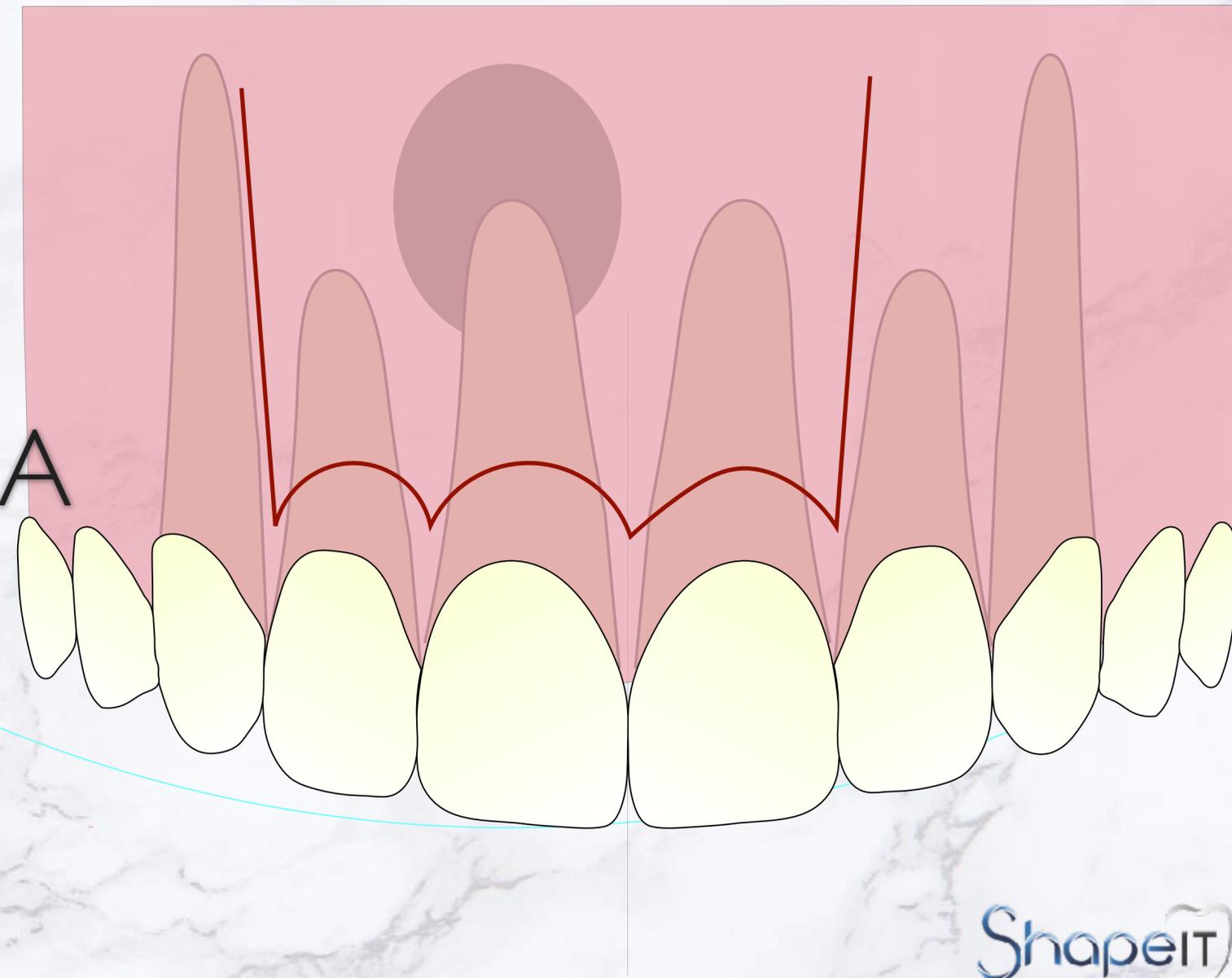
IL LEMBO PIU' COMUNE:  
PARAMARGINALE CHE  
SEGUE LA FESTONATURA E  
DUE INCISIONI DI RILASCIO  
QUASIVERTICALI



# LEMBO DI OCHSENBEIN LUEBKE

ENDODONZIA  
CHIRURGICA

SUFFICIENTE GENGIVA  
ADERENTE  
RADICE ABBASTANZA LUNGA  
SALUTE PARODONTALE  
GARANTISCE STABILITA'  
DELL'ATTACCO

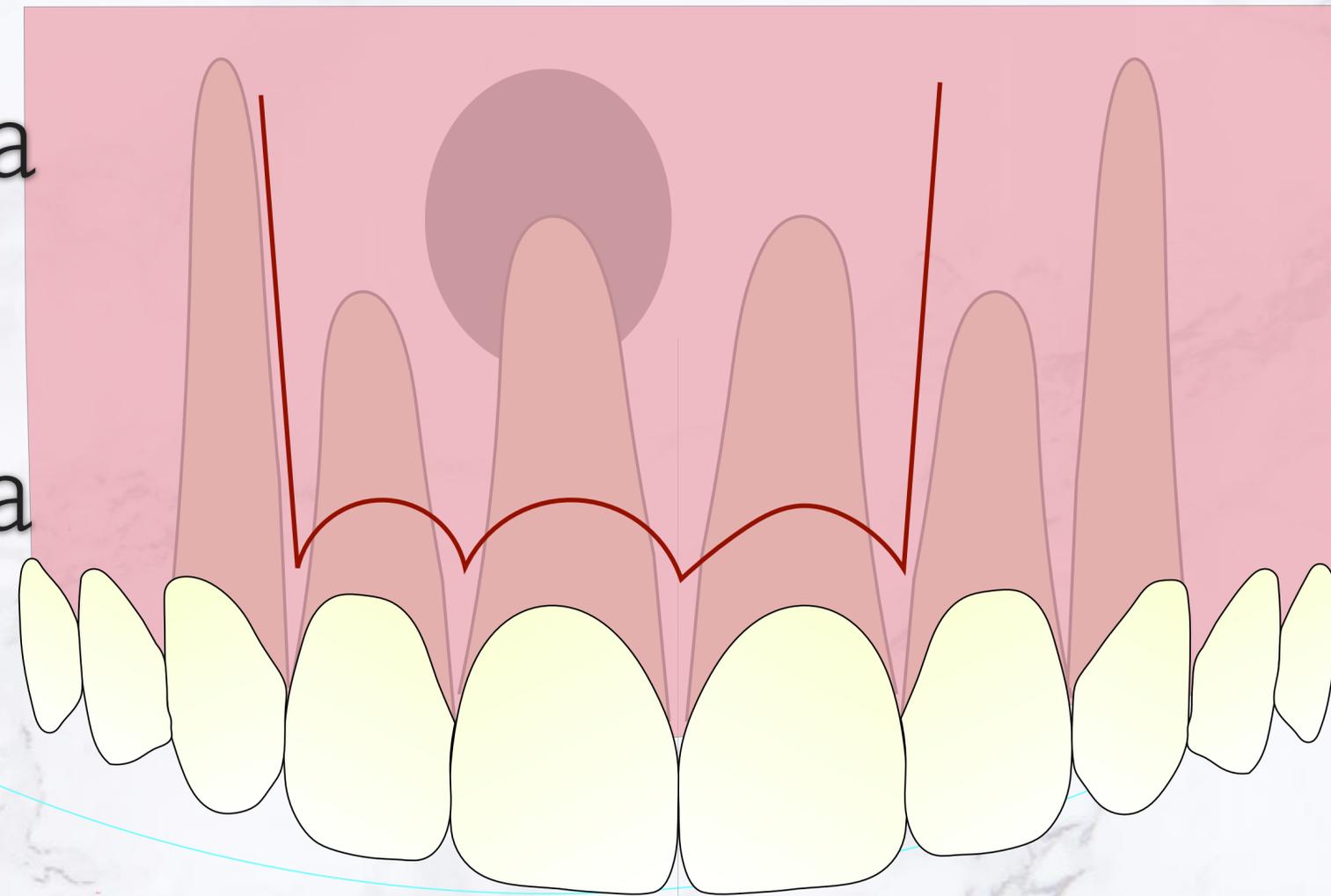


ShapeIT<sup>®</sup>

# LEMBO DI OCHSENBEIN LUEBKE

ENDODONZIA  
CHIRURGICA

Solitamente si incide incisale alla  
linea alba così da nascondere  
l'eventuale cicatrice e favorire la  
fase di sutura in cheratinizzata



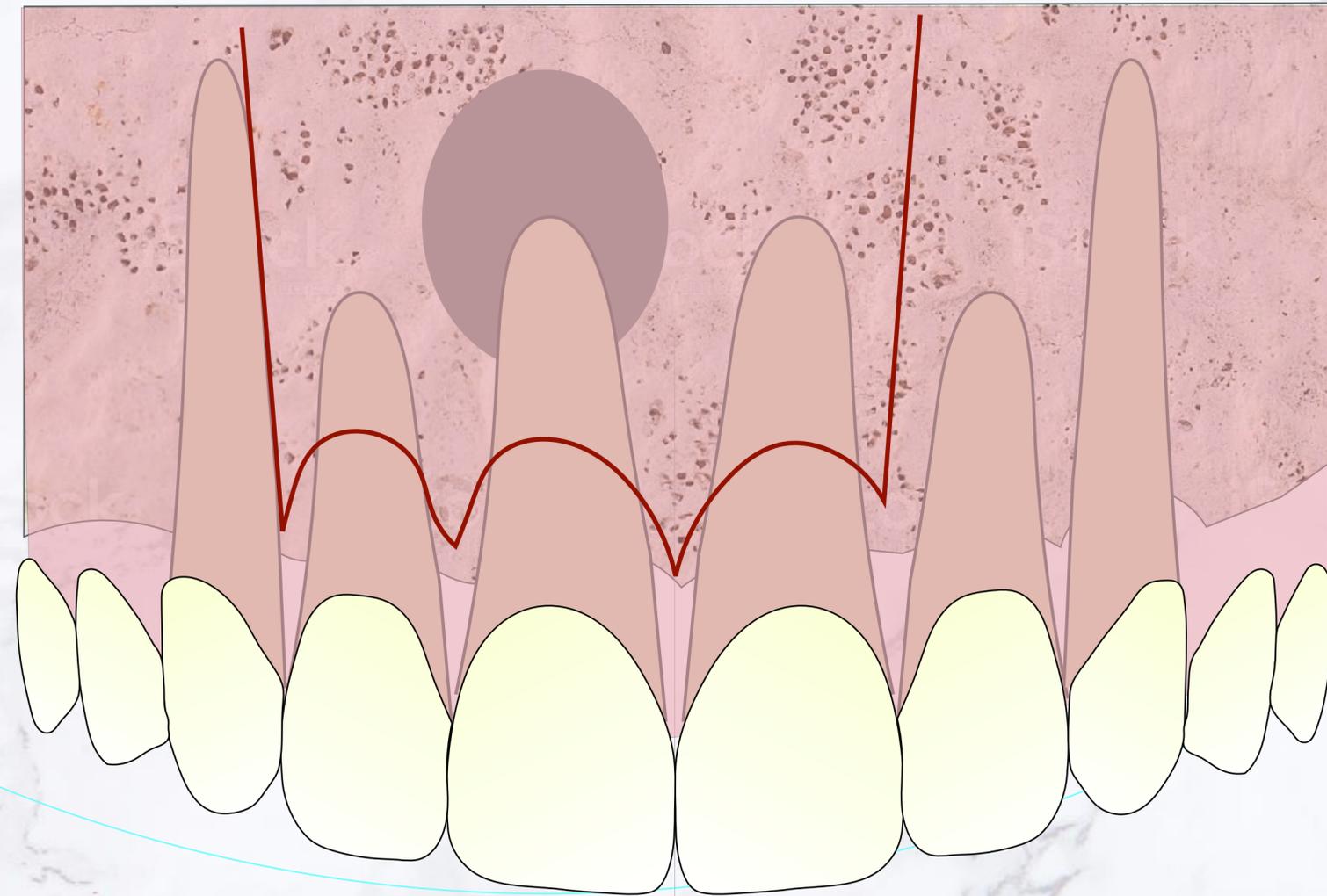
# LEMBO DI OCHSENBEIN LUEBKE

ENDODONZIA  
CHIRURGICA

In caso di:

- Insufficiente gengiva cheratinizzata
- Difetti parodontali / sondaggi
- Radice corta

Spostiamo l'incisione  
intrasulculare andando all'interno  
del solco, dividendo le papille.



ShapeIT<sup>®</sup>

# PARAMARGINALE vs INTRASULCULARE

ENDODONZIA  
CHIRURGICA

- **CORONE ZONA ESTETICA**

- **TANTA CHERATINIZZATA**

- **RADICI LUNGHE**

- **BIOTIPO SOTTILE**

- **NO RECESSIONE**

- **MINOR VISIBILITA'**

- **MINOR SPAZIO**

- **RISCHIO CICATRICE**

- **SOSPETTO DI FRATTURA**

- **RADICI CORTE**

- **CANALI LATERALI**

- **SORRISO GENGIVALE**

- **SONDAGGI PERIO**

# GRAZIE

Shapell<sup>®</sup>



DR. GIACOMO SUARDI



DR. FABIO PICCOTTI



DR. ANDREA BALOCCO



DR. MARCO BUCCI



DR. GIANLUCA FUMEI