

CORSO DI ENDODONZIA MININVASIVA con strumenti martensitici **ORODEKA PLEX V**



LA STRUMENTAZIONE NON MODIFICA I PRINCIPI
BASE DELL' ENDODONZIA



FABIO_PICCOTIDDS

Endodonzia



E DETERSIONE DI UNO SPAZIO

ANATOMICO COMPLESSO

obiettivi del trattamento

MECCANICI

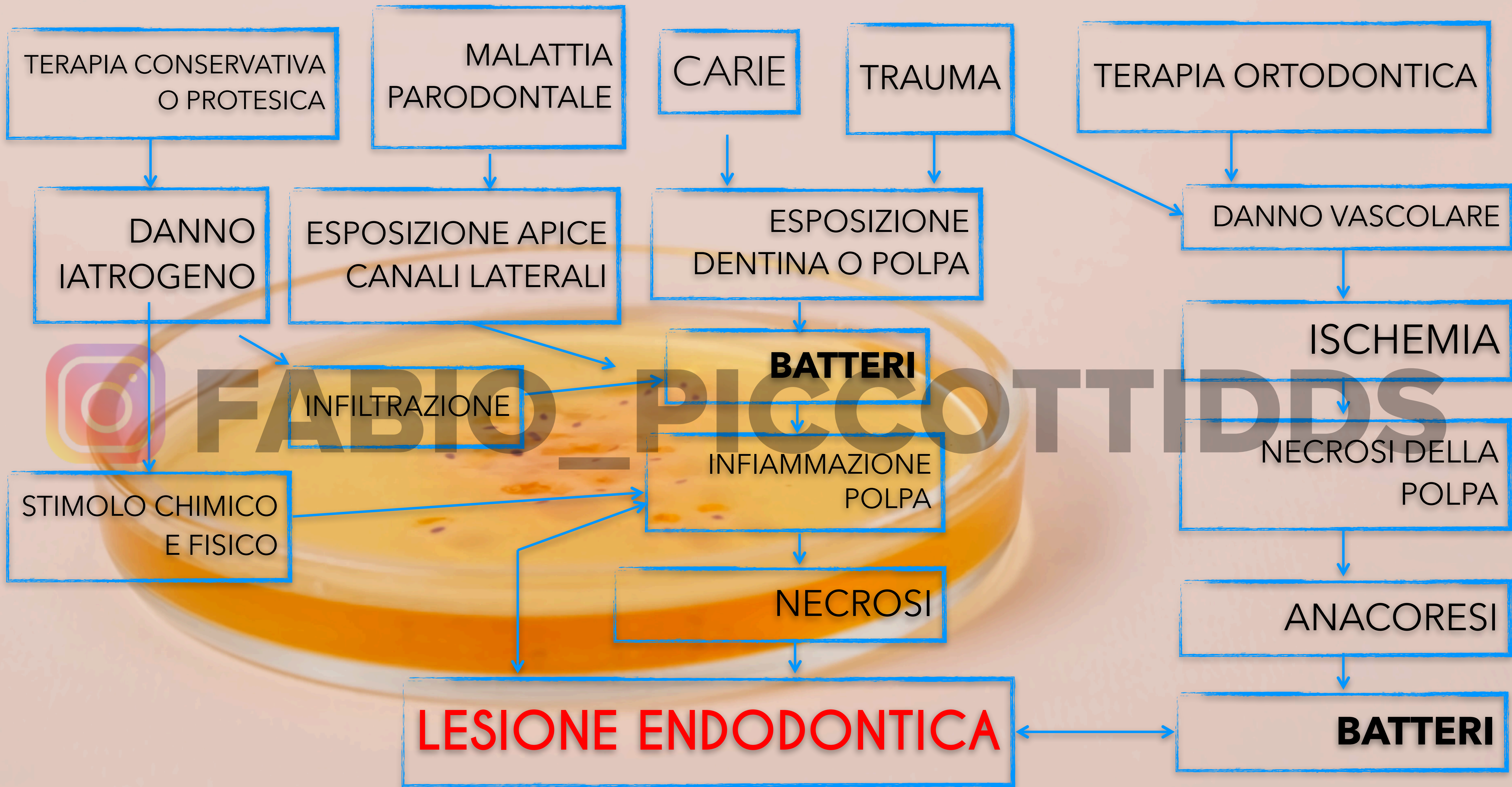
- * CONICITA CONTINUA DA CORONA AD APICE
- * PRESERVARE LE CURVATURE DEL CANALE
- * PRESERVARE IL DIAMETRO APICALE

BIOLOGICI

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

“BACTERIA ARE
RESPONSIBLE FOR EVERY
ENDODONTIC LESION”

KAKEHASHI 1965



PERIAPICAL STATUS OF ENDODONTICALLY TREATED TEETH IN RELATION TO THE
TECHNICAL QUALITY OF THE ROOT FILLING AND THE CORONAL RESTORATION.

TORPE M. INT END J (1995) 28, 12-18



FABIO PICCOTTI DDS

	GOOD RESTO	POOR RESTO
GOOD ENDO	90%	44%
POOR ENDO	68%	18%

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](#)



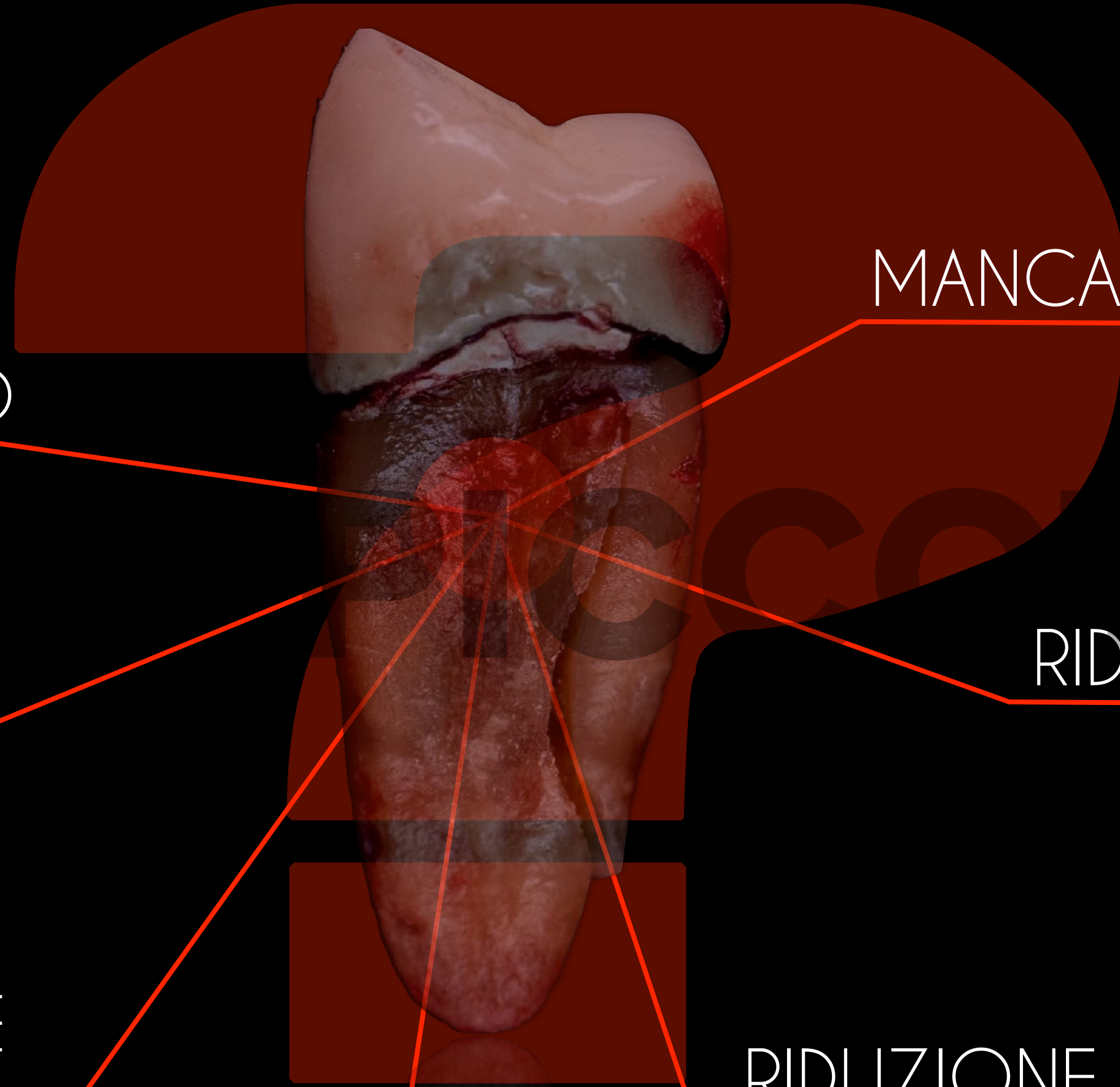
DOPO 20 ANNI, LA VFR È STATA LA
CAUSA MAGGIORE DI FALLIMENTO

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

RIDOTTA PROPRIOCEZIONE

RIDUZIONE QUOTA ACQUA

MICROCRACKS

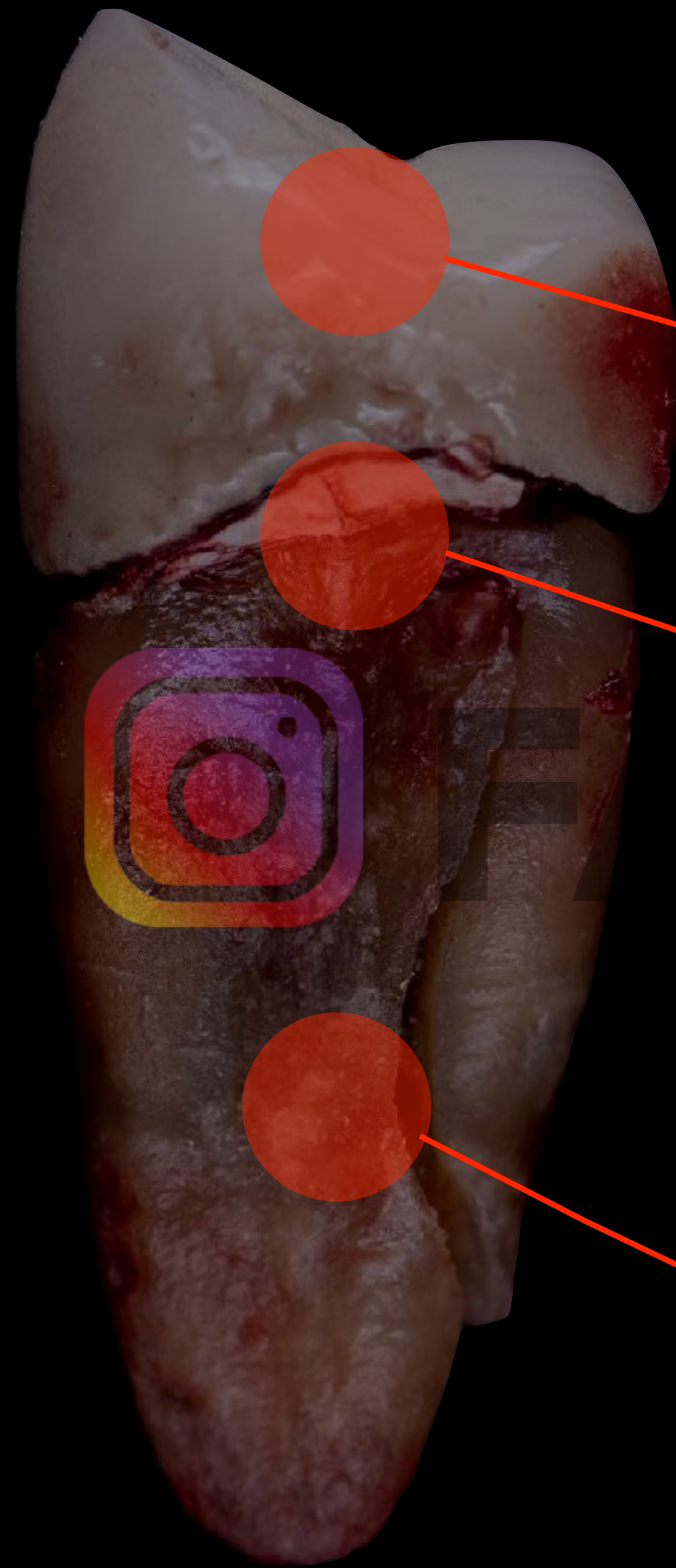
PARAFUNZIONI & POSIZIONE

GEOMETRIA DEL CANALE

TRATTAMENTO ENDODONTICO



TRATTAMENTO ENDODONTICO



COPERTURA CUSPIDALE

APERTURA CAMERA

SAGOMATURA CANALI

COPERTURA CUSPIDALE

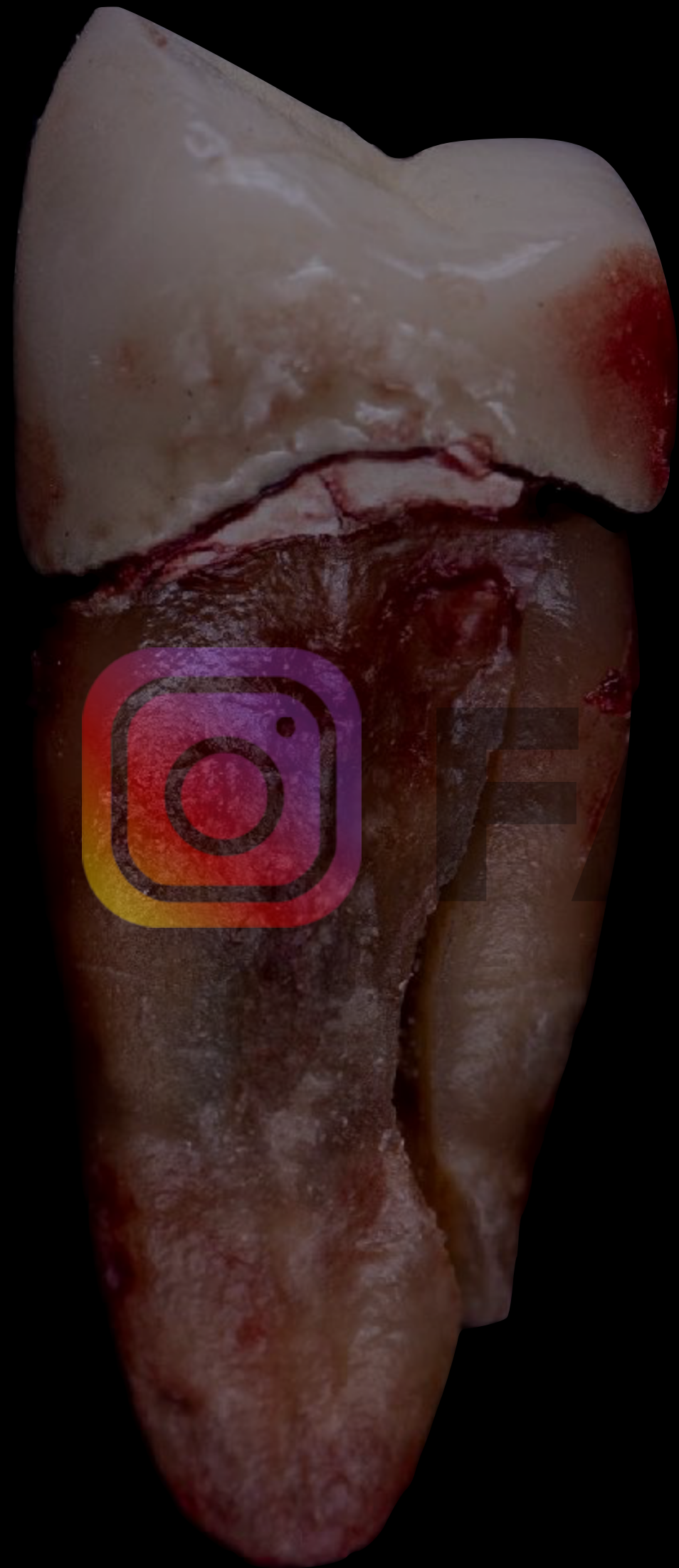
97% DEI DENTI TRATTATI CON COPERTURA CUSPIDALE
SOPRAVVIVE A 8 ANNI

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

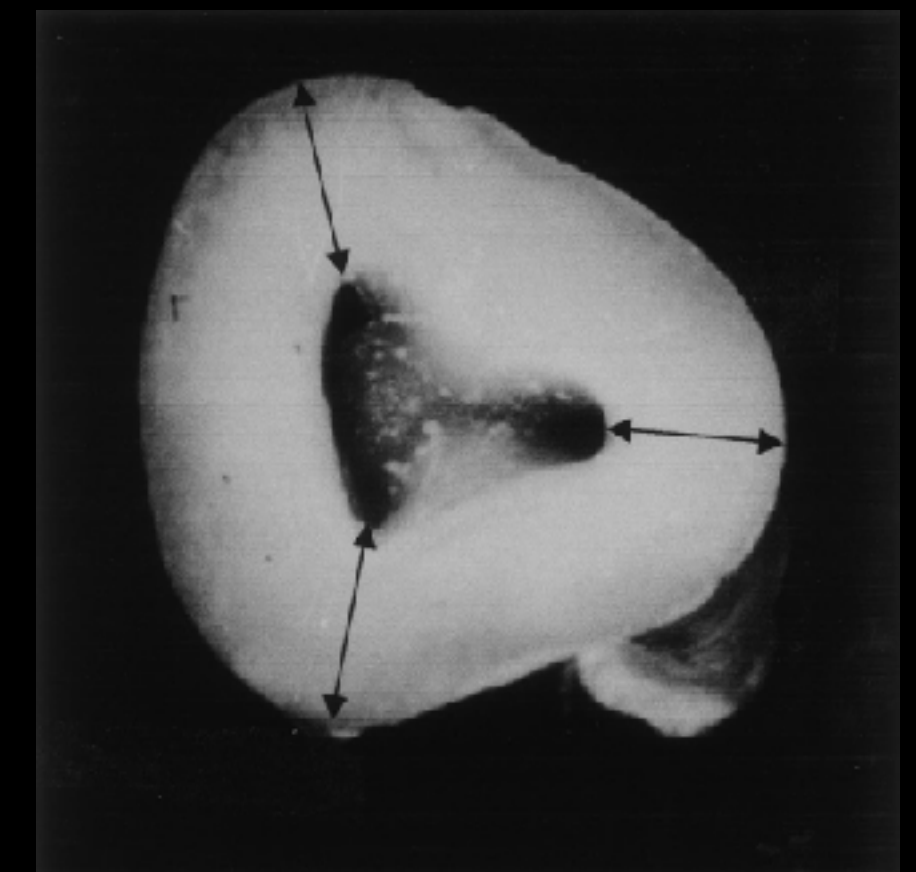
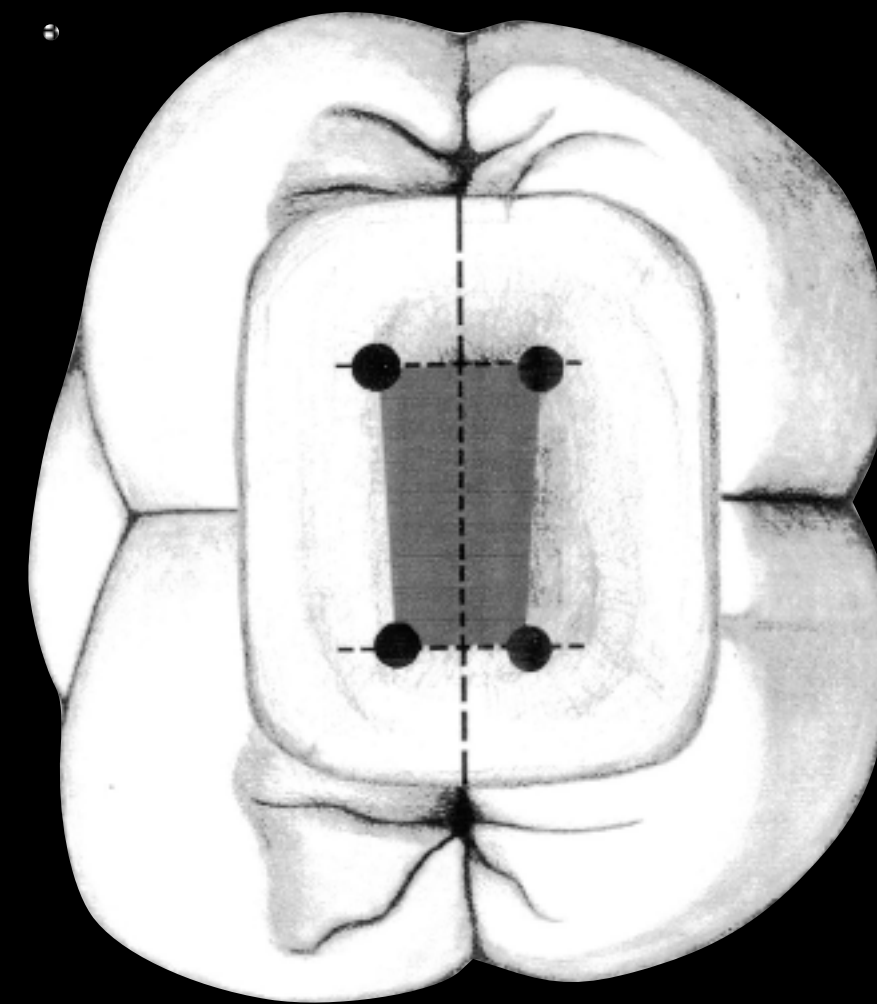
LA MAGGIOR PARTE DEGLI STUDI DIMOSTRANO CHE
VARIAZIONI NELLA DIMENSIONE DELL'ACCESSO ALLA



CAMERA PULPARE NON DETERMINANO DIFFERENZE
STATISTICHE NELLA RESISTENZA AL CARICO DEL DENTE

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

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



Krasner 2003

LA CORRETTA APERTURA E' UN PROCESSO DINAMICO



FABIO_PICCOTTIDDS



**APRO DI PIU'
VEDO DI PIU'
RIDUCO ANGOLO D'INGRESSO**

PRESERVO DENTINA

Anatomy of the Pulp-Chamber Floor

Paul Krasner, DDS, and Henry J. Rankow, DDS

Locating the number and position of orifices on pulp-chamber floors can be difficult. This is especially true when the tooth being treated is heavily restored, malposed, or calcified. After evaluating 500 pulp chambers of extracted teeth, new laws for finding pulp chambers and root-canal orifices are proposed. The use of these laws can aid in the determination of the pulp-chamber position and the exact location and number of root canals in any individual tooth.

Endodontic therapy is essentially a surgical procedure, a micro-neurologic surgical procedure. Because the fundamental foundation on which all surgical procedures are performed is an intimate knowledge of anatomy, any attempt to perform endodontic therapy must be preceded with a thorough understanding of the anatomy of both the pulp chamber and the root-canal system. Attempting to treat the root-canal system without detailed anatomic description would be the equivalent of a physician looking for an appendix without ever having read *Gray's Anatomy*.

Literature describing pulp-chamber anatomy in the past has been very general and offered little specificity for determining orifice number and location. Discussions, in print and in the classroom, typically present generalizations about the average number of canals in different teeth. However, the average number of canals in a tooth is of no value when dealing with an individual tooth. Likewise, the description of the location of canal orifices has often been presented in a nonsystematic manner. Essentially, most advice has been to make an access in an appropriate position in the clinical crown and look for the orifices in the hope that they are seen. If they are not easily seen, there is little guidance for safely locating them without the danger of excessive tooth destruction or even perforation. As any experienced operator knows, looking for root-canal orifices in teeth that are heavily restored, cariously broken down, or gouged by previous accessing is very difficult. In these cases, normal anatomy is often severely distorted and the advice given in articles and textbooks is of little value.

We felt, after accessing thousands of teeth in our practices, that there are consistent, identifiable, anatomic configurations of the pulp chamber and the pulp-chamber floor. This study was undertaken to observe the anatomy of the pulp chamber and the pulp-chamber floor and to see if specific, consistent landmarks or configurations exist and are quantifiable. If these landmarks exist, then the task of locating orifices can be made more systematic and,

therefore, with greater certainty. This could aid in a rational approach to root-canal therapy.

MATERIALS AND METHODS

A total of 500 extracted, permanent, human teeth were used. The teeth were equally distributed between maxillary and mandibular anteriors, premolars, and molars. The teeth had a wide variety of crown conditions: virgin crowns, small restorations, large restorations, metal and porcelain crowns, and caries. A total of 400 teeth had their crowns cut off horizontally at the level of the CEJ so that the outline of the pulp chamber relative to the external surface of the tooth could be observed. Fifty teeth were sectioned in a buccolingual direction through the crown and the roots. Fifty teeth were sectioned in a mesiodistal direction through the crown and the roots. Each cut section was irrigated with water, dried, and examined. Two observers examined each specimen independently and recorded all observed anatomical relationships. These relationships included orifice location, size, color, and shape. These observations were then correlated and any consistent patterns were listed. Lines were drawn on horizontal sections to observe the relationships more easily.

RESULTS

Two categories of anatomic patterns were observed: relationships of the pulp chamber to the clinical crown and relationships of orifices on the pulp-chamber floor.

Relationships of the Pulp Chamber to the Clinical Crown

The following observations were noted:

1. The pulp chamber was always in the center of the tooth at the level of the CEJ (Figs. 1-3).
2. The walls of the pulp chamber were always concentric to the external surface of the crown at the level of the CEJ (Fig. 2).
3. The distance from the external surface of the clinical crown to the wall of the pulp chamber was the same throughout the circumference of the tooth at the level of the CEJ (Fig. 3).

These observations were consistent enough that several anatomic laws could be formulated:

- Law of centrality: the floor of the pulp chamber is always located in the center of the tooth at the level of the CEJ (Figs. 1-3).
Law of concentricity: the walls of the pulp chamber are always



FIG 1. Cut specimen of a mandibular molar showing the centrality of the pulp chamber.

concentric to the external surface of the tooth at the level of the CEJ (Figs. 1-3).

Law of the CEJ: the CEJ is the most consistent, repeatable landmark for locating the position of the pulp chamber.

Relationships on the Pulp-chamber Floor

The following observations were noted relative to all teeth:

1. The floor of pulp chamber is always a darker color than the surrounding dentinal walls (Fig. 4A).
2. This color difference creates a distinct junction where the walls and the floor of the pulp chamber meet (Figs. 4B and 5).
3. The orifices of the root canals are always located at the junction of the walls and floor (Figs. 5 and 6).
4. The orifices of the root canals are located at the angles in the floor wall junction [Fig. 6 (A and B)].
5. The orifices lay at the terminus of developmental root fusion lines, if present [Fig. 7 (A-C)].
6. The developmental root fusion lines are darker than the floor color (Fig. 7A).
7. Reparative dentin or calcifications are lighter than the pulp-chamber floor and often obscure it and the orifices (Fig. 8).

The following observations were noted relative to all teeth except maxillary molars:

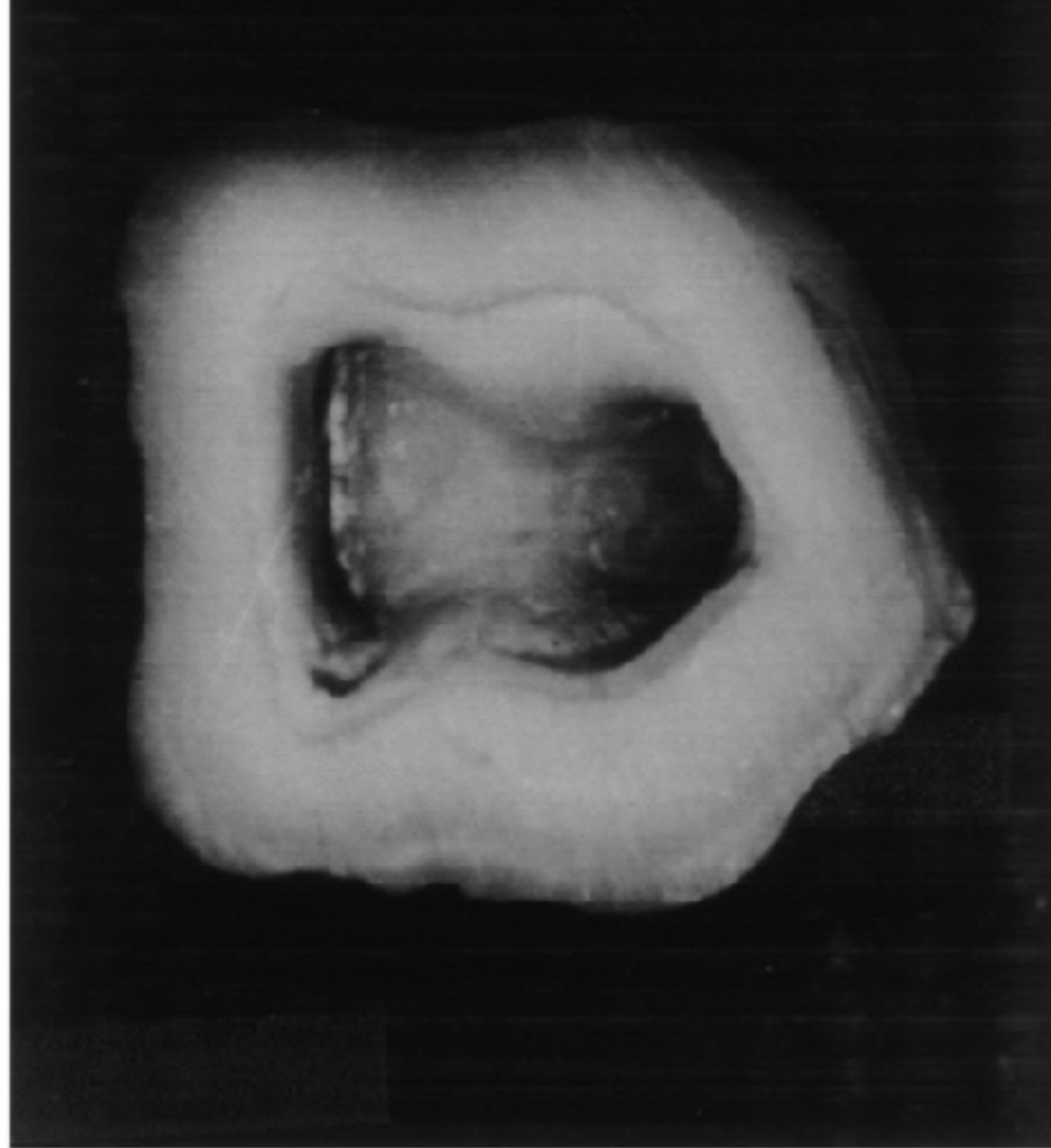


FIG 2. Cut specimen of a mandibular molar showing the concentricity of the pulp-chamber walls to the external tooth surface at the CEJ.

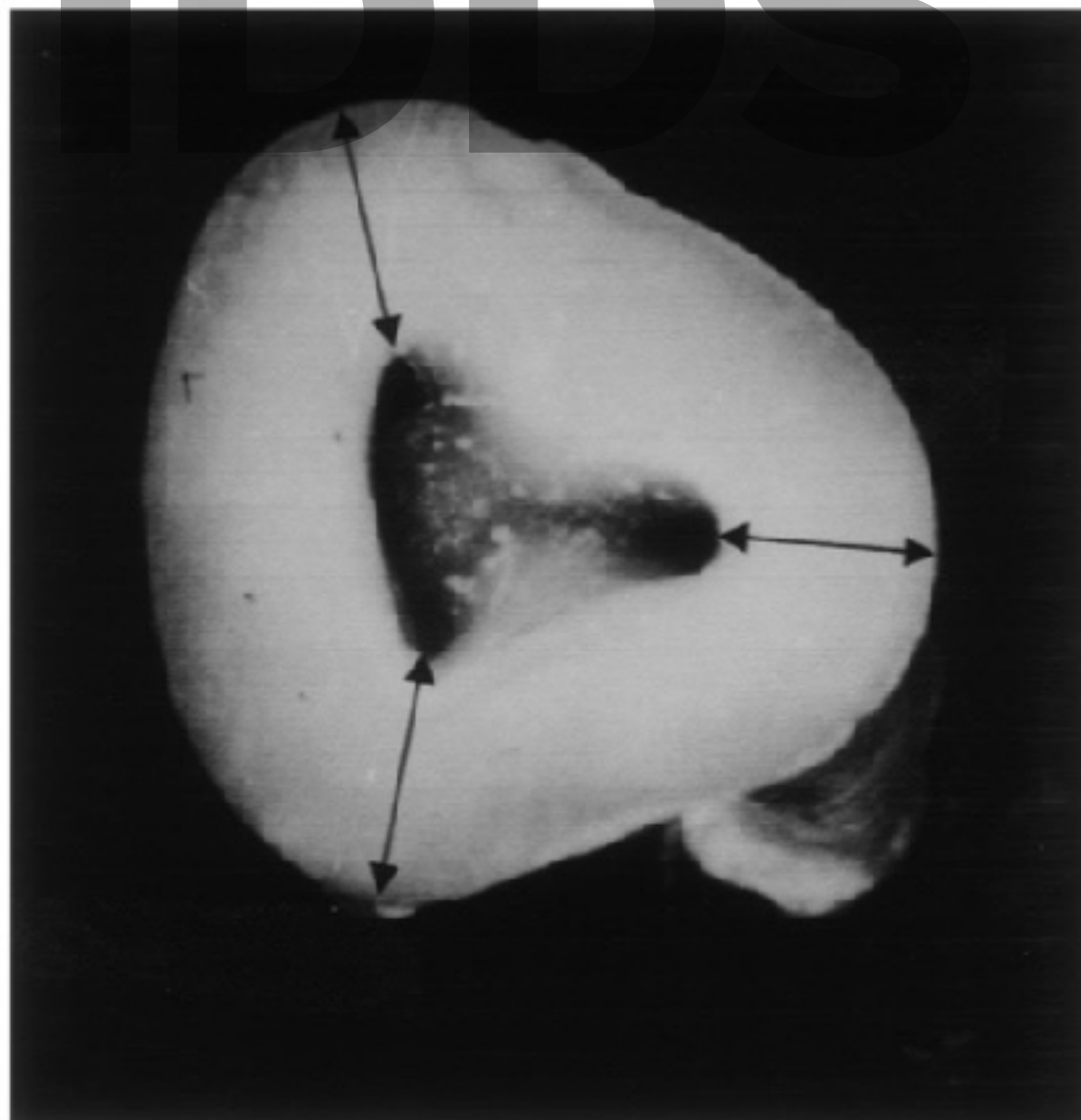


FIG 3. Cut specimen of a mandibular molar showing the equality of the distance of the pulp chamber walls from the external root surface (arrows).

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FIG 1. Cut specimen of a mandibular molar showing the centrality of the pulp chamber.



FIG 2. Cut specimen of a mandibular molar showing the concentricity of the pulp-chamber walls to the external tooth surface at the CEJ.

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The following observations were noted relative to all teeth except maxillary molars:



FIG 3. Cut specimen of a mandibular molar showing the equality of the distance of the pulp chamber walls from the external root surface (arrows).

LEGGI DELLA CAMERA PULPARE:

-
-
-

CENTRALITA'
CONCENTRICITA'
EQUIDISTANZA

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The following observations were noted relative to all teeth except maxillary molars:



FIG 3. Cut specimen of a mandibular molar showing the equality of the distance of the pulp chamber walls from the external root surface (arrows).

LEGGI DEGLI ORIFIZI CANALARI:

PRIMA LEGGE DI SIMMETRIA

SECONDA LEGGE DI SIMMETRIA

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PRIMA LEGGE: **E**QUIDISTANZA



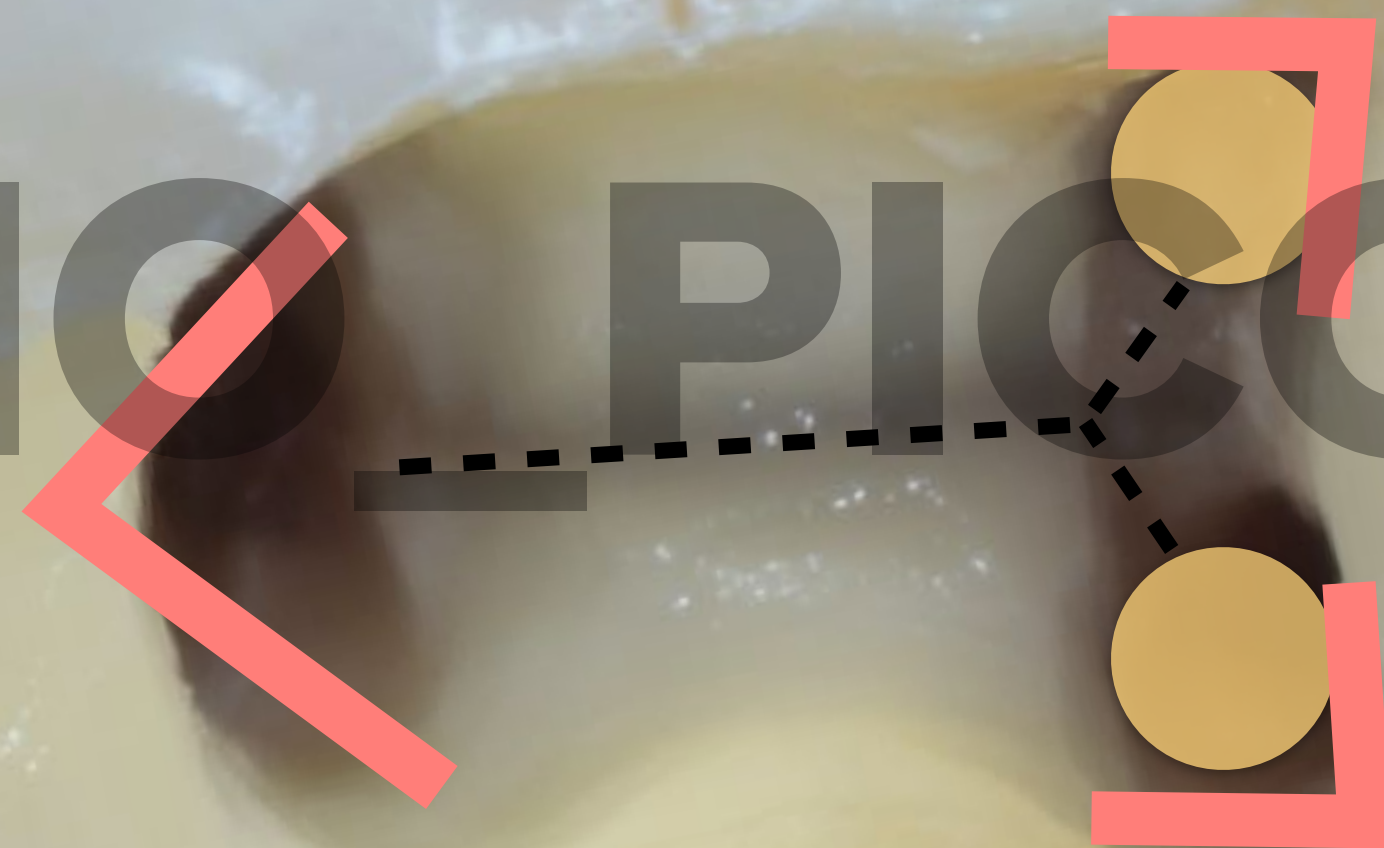
FABIO_PICCOLTIDDS

SECONDA LEGGE: **P**ERPENDICOLARITA'

I CANALI SONO NEL PUNTO DI INCROCIO TRA LE PARETI E
UNITI DALLE LINEE DI FUSIONI DEL PAVIMENTO



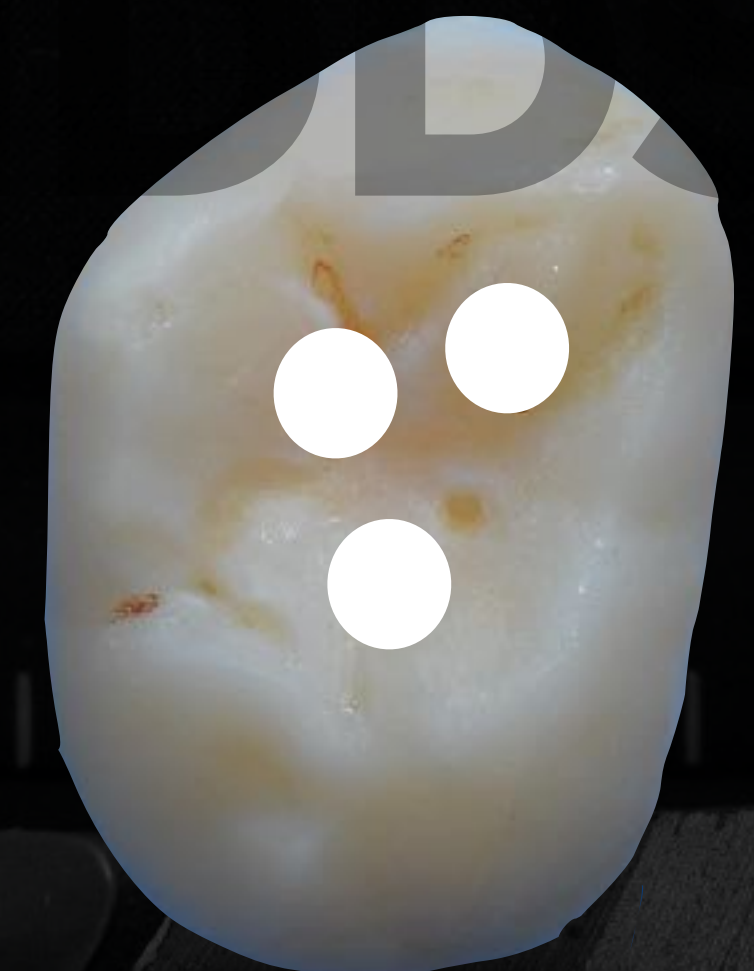
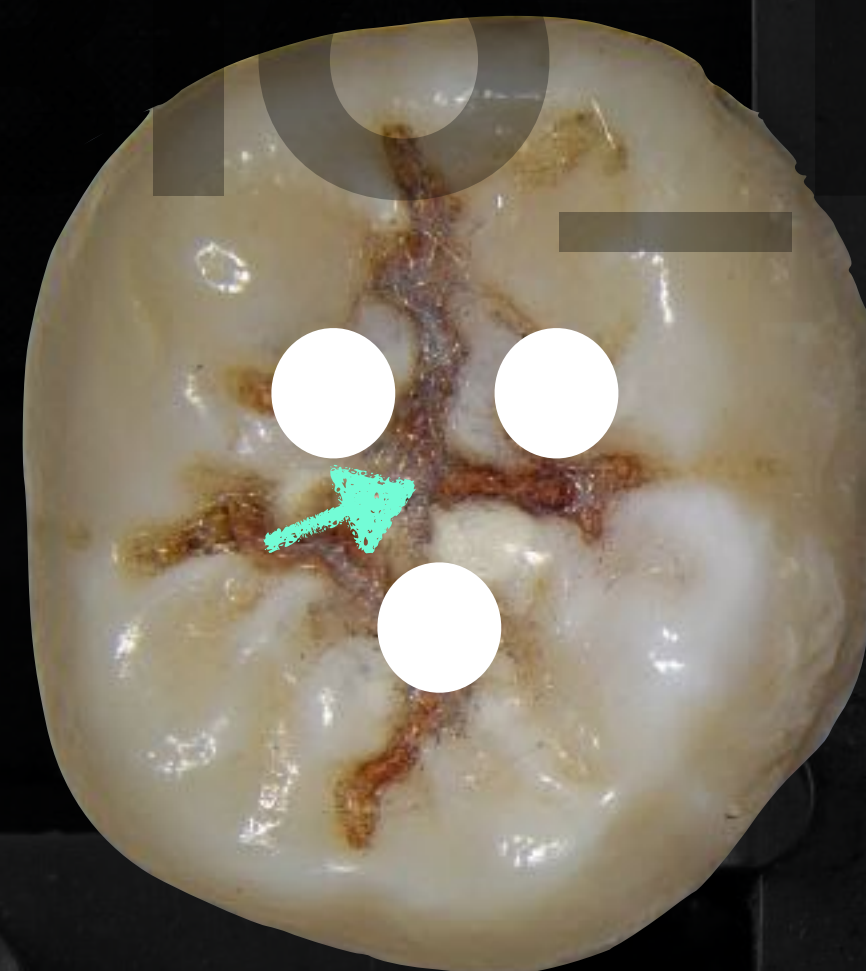
FABIO PICCOTTIDDS



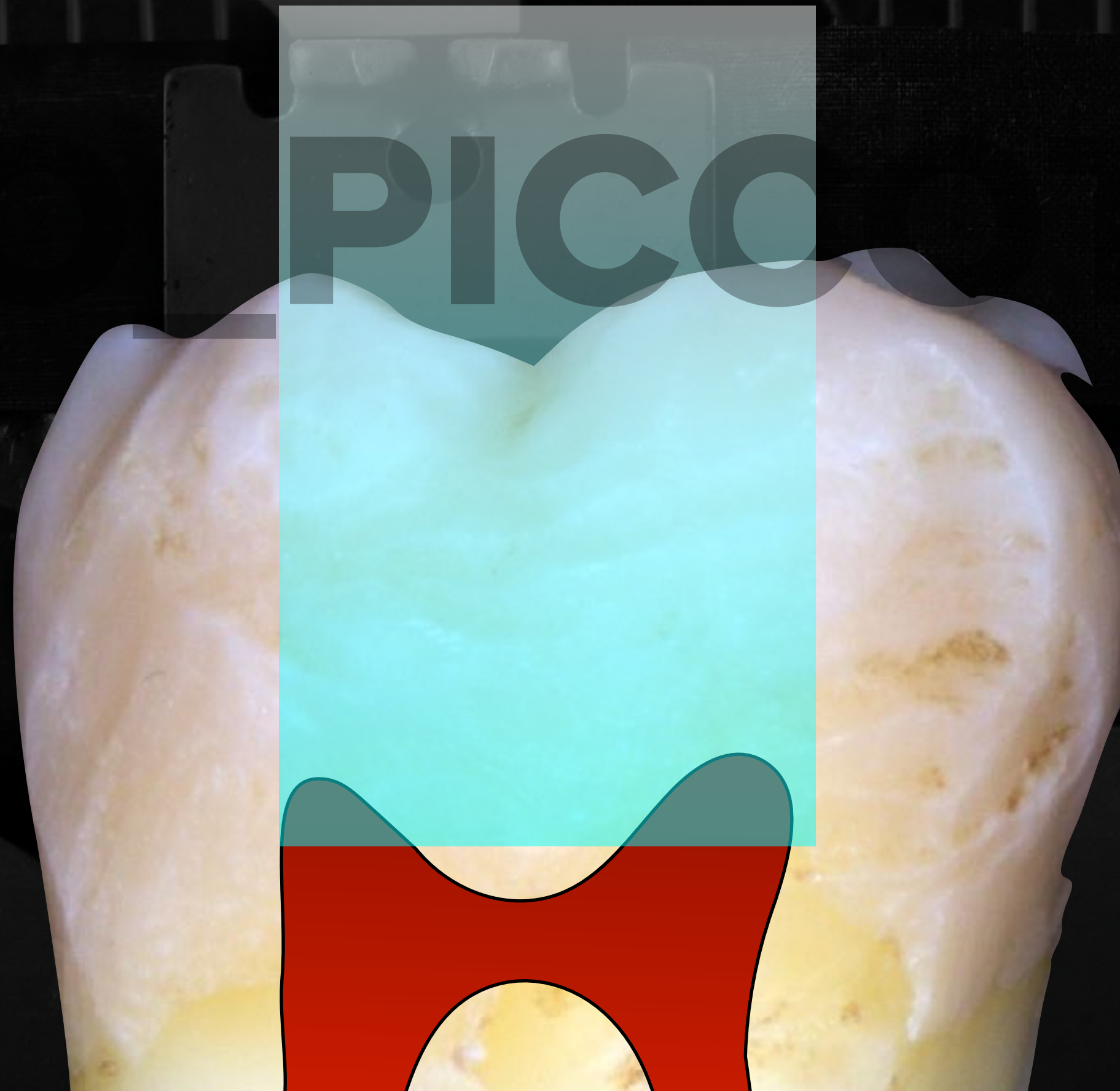
PAVIMENTO – FORCAZIONE: CIRCA 3MM

TETTO – CUSPIDE: CIRCA 6,5 MM

ALTEZZA CAMERA PULPARE: 1– 2,5MM



NELLA DISCESA IN APERTURA STIAMO CENTRALI A
LIVELLO DELLA G.A.C. E SCEGLIAMO LA
CORRISPONDENZA CON I CORNETTI E NON CON LA
FORCA



THINK ABOUT..

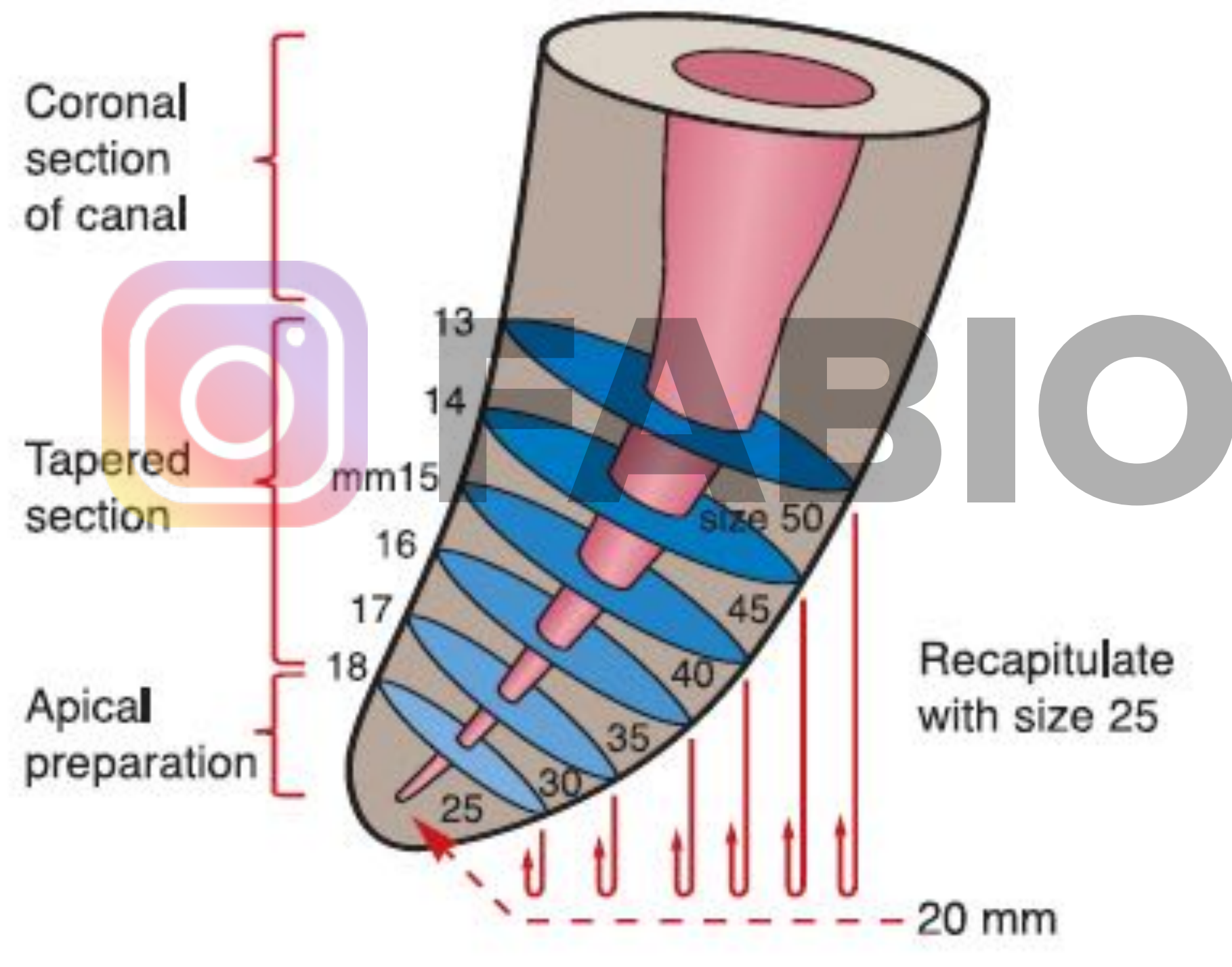
ERRORI IN APERTURA O
STRUMENTI RIGIDI A GRANDI
CONICITA' POSSONO
AUMENTARE I RISCHI



FABIO_PICCOLI



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.

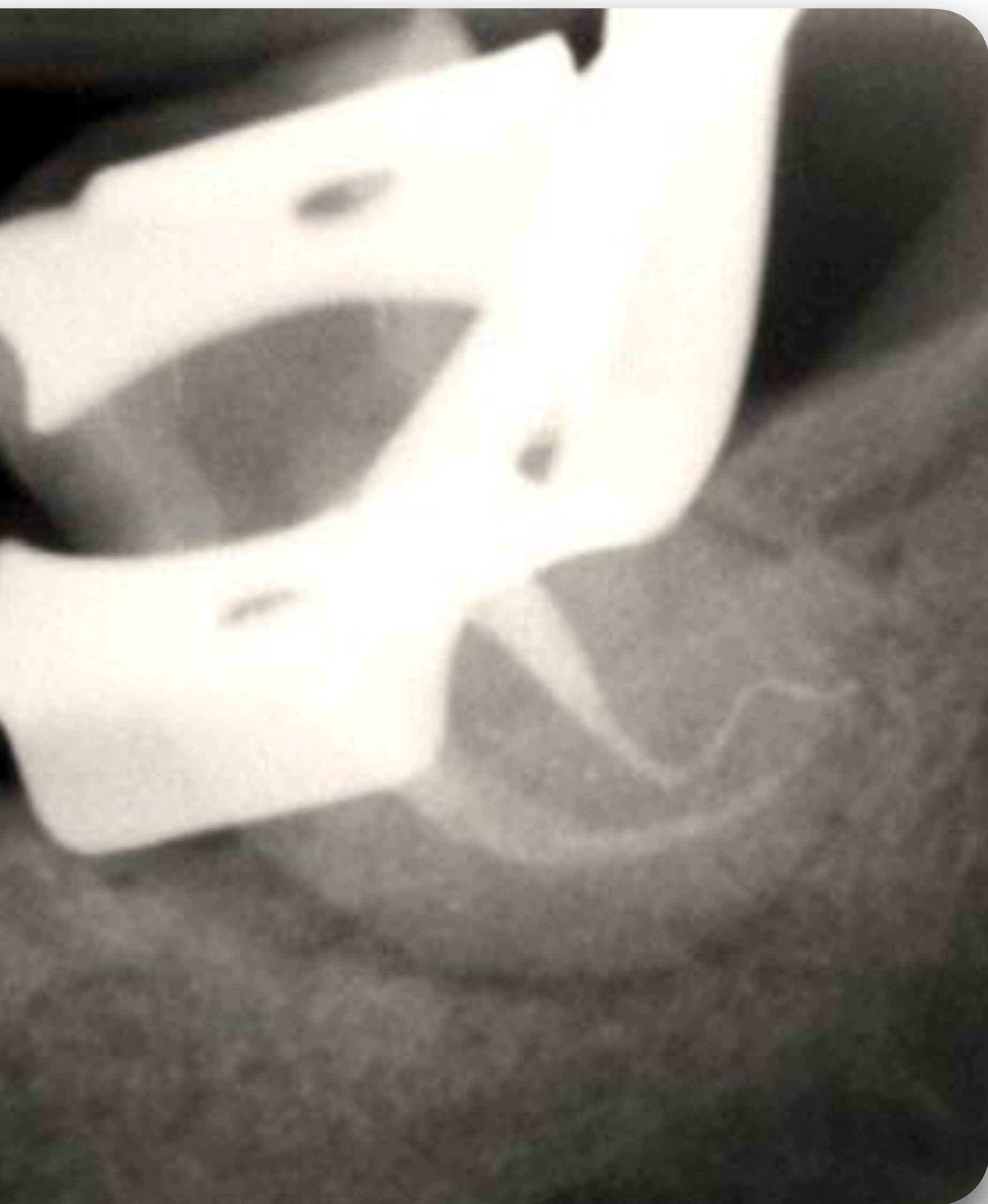


FABIO_PICCOTTIDDS
LE TECNICHE E STRATEGIE POSSO
ESSERE **DIFFERENTI** MA CON LO
STESSO OBIETTIVO.

i tempi cambiano...

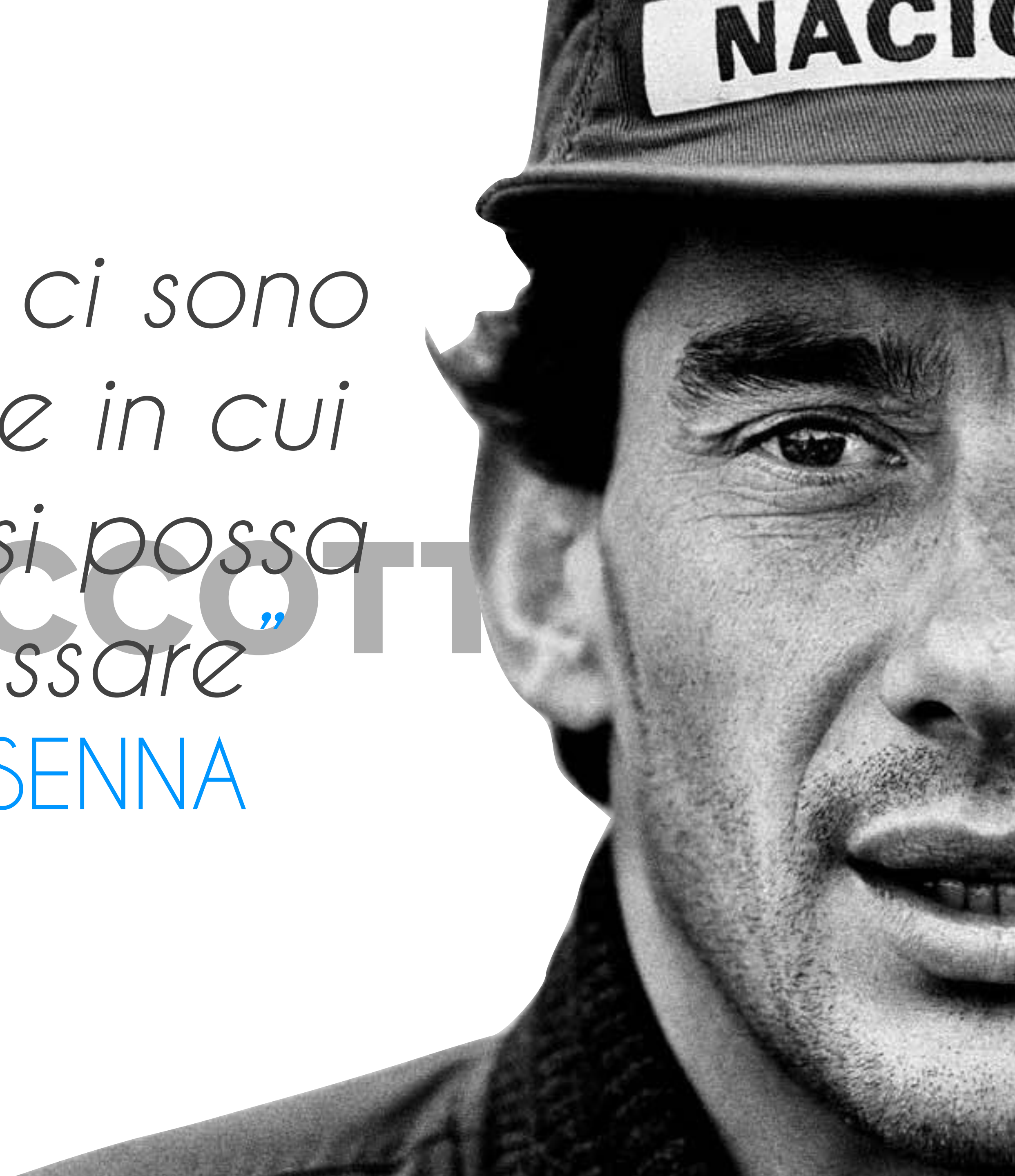
 *“I denti che presentano canali con curvatura maggiore di 45 gradi, non possono essere trattati con successo senza dover ricorrere alla chirurgia”*

GROSSMAN
1967



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

PICCO



TECNOLOGIA

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

MANNING S. 2000 - JOHN V. 2007

STRUMENTAZIONE

STRUMENTI ESPANSIVI

TRATTAMENTI TERMICI



FABIO_PIOCC

DETERSIONE

PROTOCOLLI DI
DETERSIONE ATTIVA

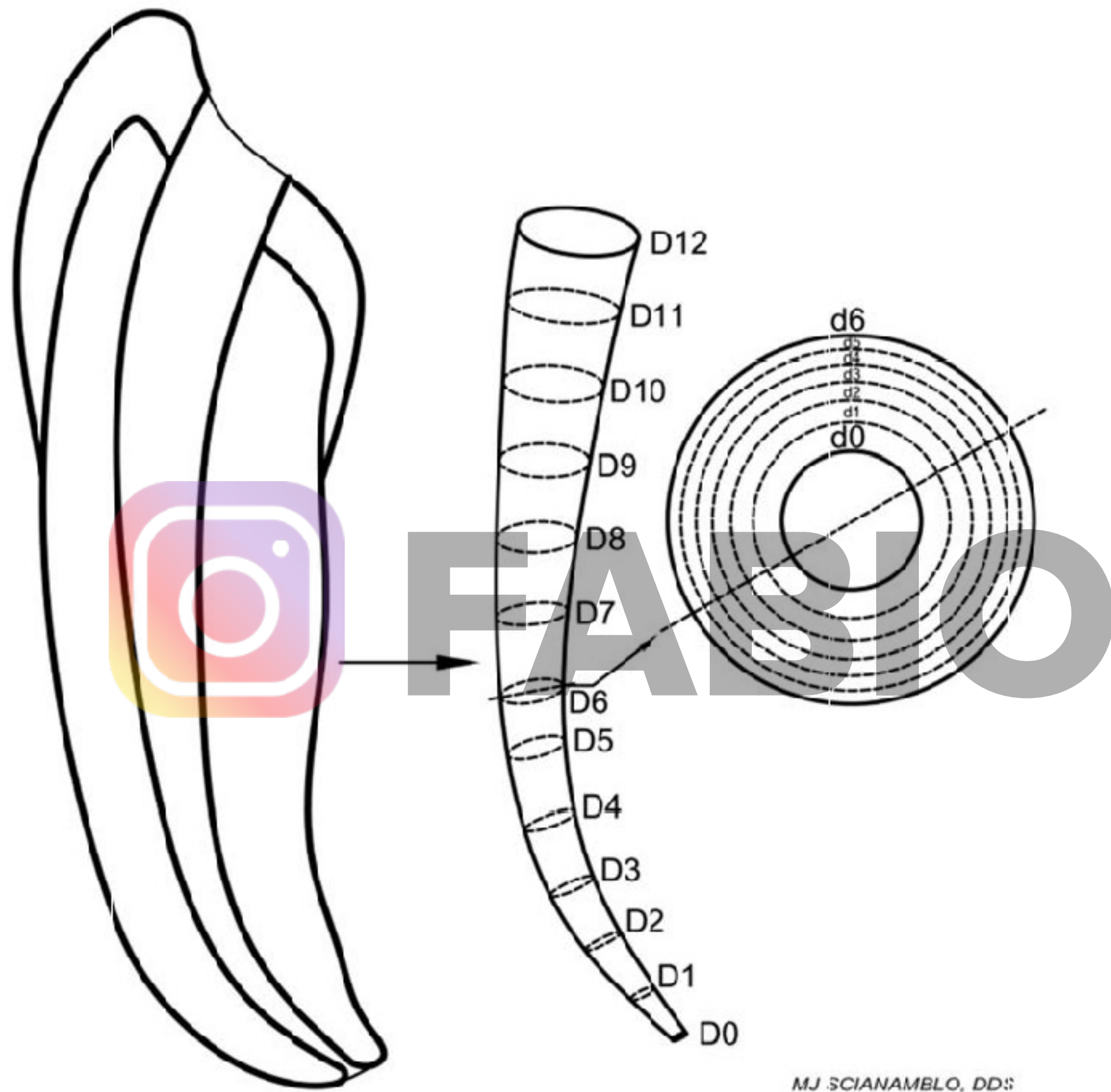
OTTURAZIONE

CEMENTI

BIOCERAMICI



OBIETTIVI MECCANICI



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

SHILDER 1974

FILE MANUALI



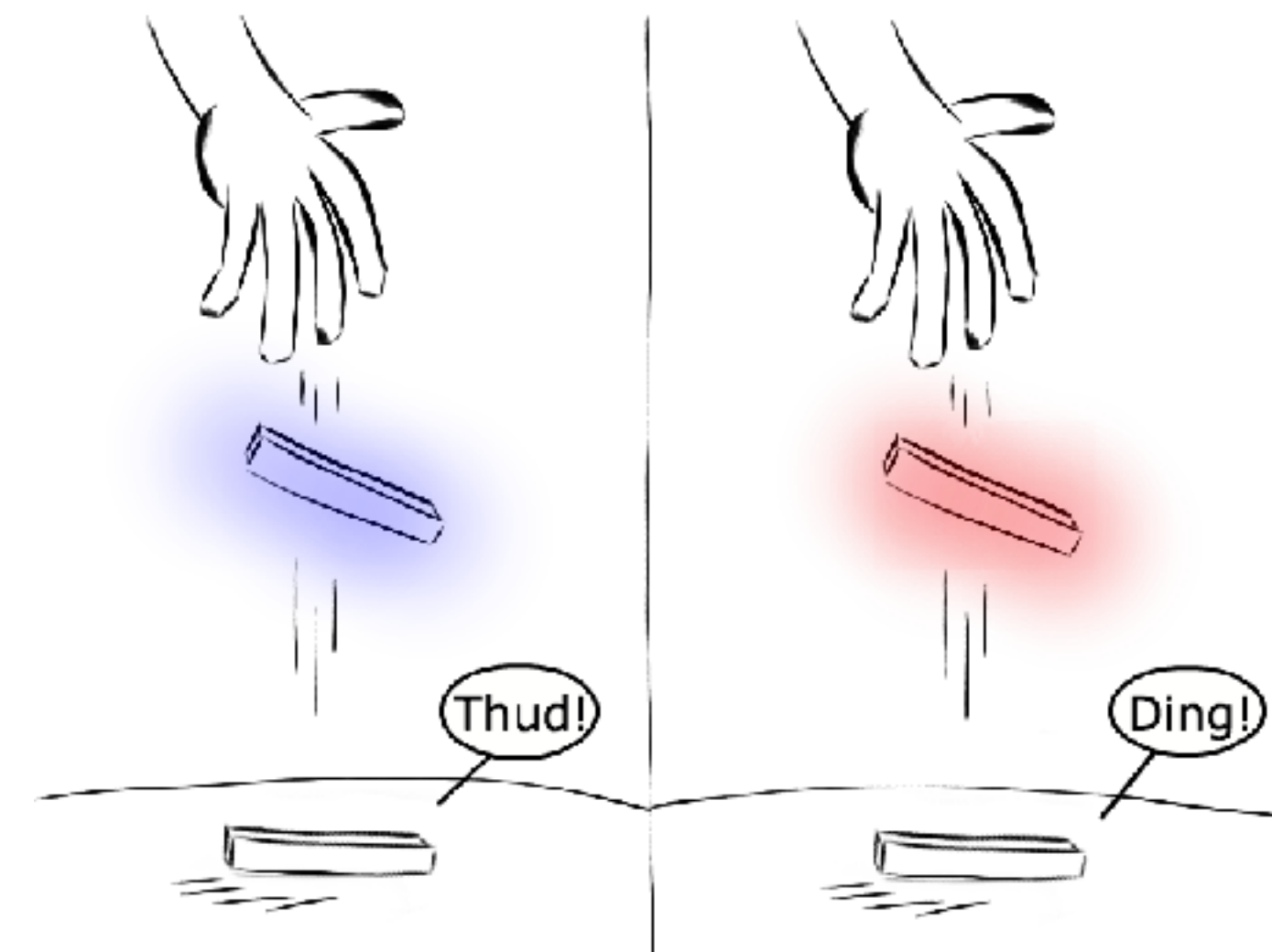
FILE ROTANTI





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

1988

WALIA ET AL. JOE

MC SPADDEN, JOHNSON E SENIA AIUTANO
NELLA DIFFUSIONE DEL NITI

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

Harmeet Walia, BDS, MSc, 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 0.020-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 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 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 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). Weise (4) has suggested that clinicians might remove the tips of instruments at chairside to make intermediate sizes (1-3). Weise (4) has suggested that clinicians might remove the tips of instruments at chairside to make intermediate sizes (1-3).

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, all of these 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, the 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 conventional (10) Nitinol 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 the American Dental Association specification no. 28 (11). All specimens were subjected to bending or twisting at a point 3

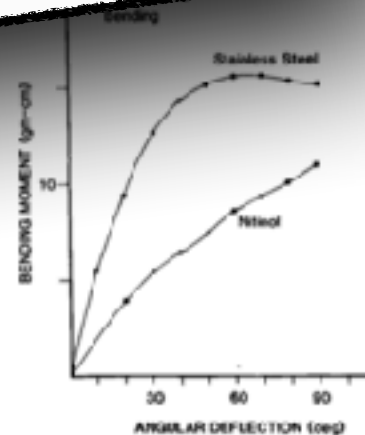


Fig. 5. Cantilever bending test results for the size #15 Nitinol and stainless steel files. The data points in this figure and in Figs. 6 and 7 correspond to average moment values for groups of five instruments at the indicated bend or twist angles.

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).

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

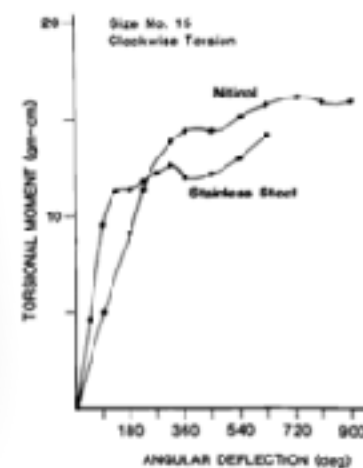


Fig. 6. Clockwise torsion test results for the size #15 Nitinol and stainless steel files.

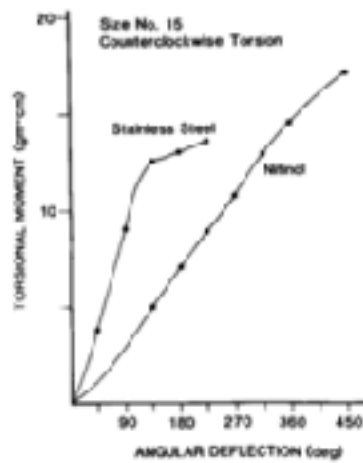
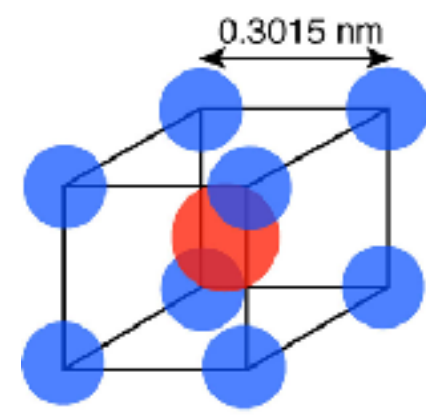


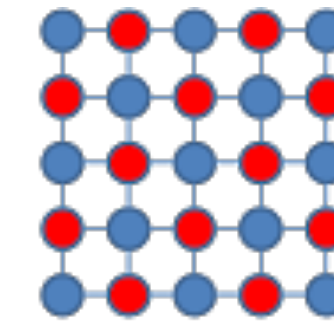
Fig. 7. Counterclockwise torsion test results for the size #15 Nitinol and stainless steel files. The two initial data points for the Nitinol files could not be determined with the torque meter, and the two plots have been drawn to intersect the origin. Both of these considerations are less pronounced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

FILE ROTANTI IN FINITI

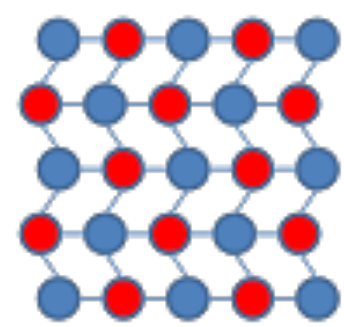
- *PRESERVARE L'ANATOMIA
- *RIMANERE CENTRATO NEL CANALE
- *EFFICIENZA DI TAGLIO
- *NUMERO RIDOTTO DI PASSAGGI /
SEQUENZA BREVE
- *RESISTENTE



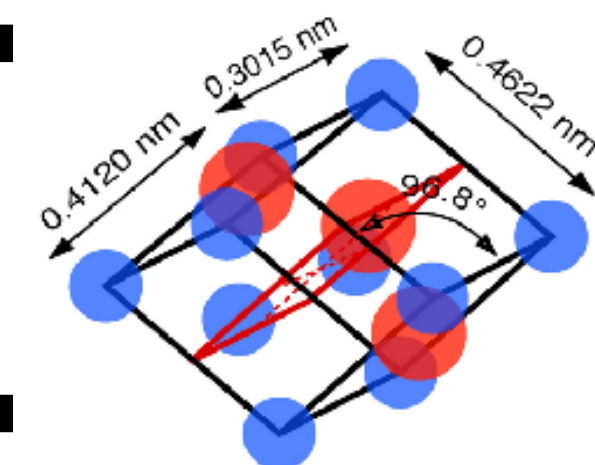
AUSTENITE



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.

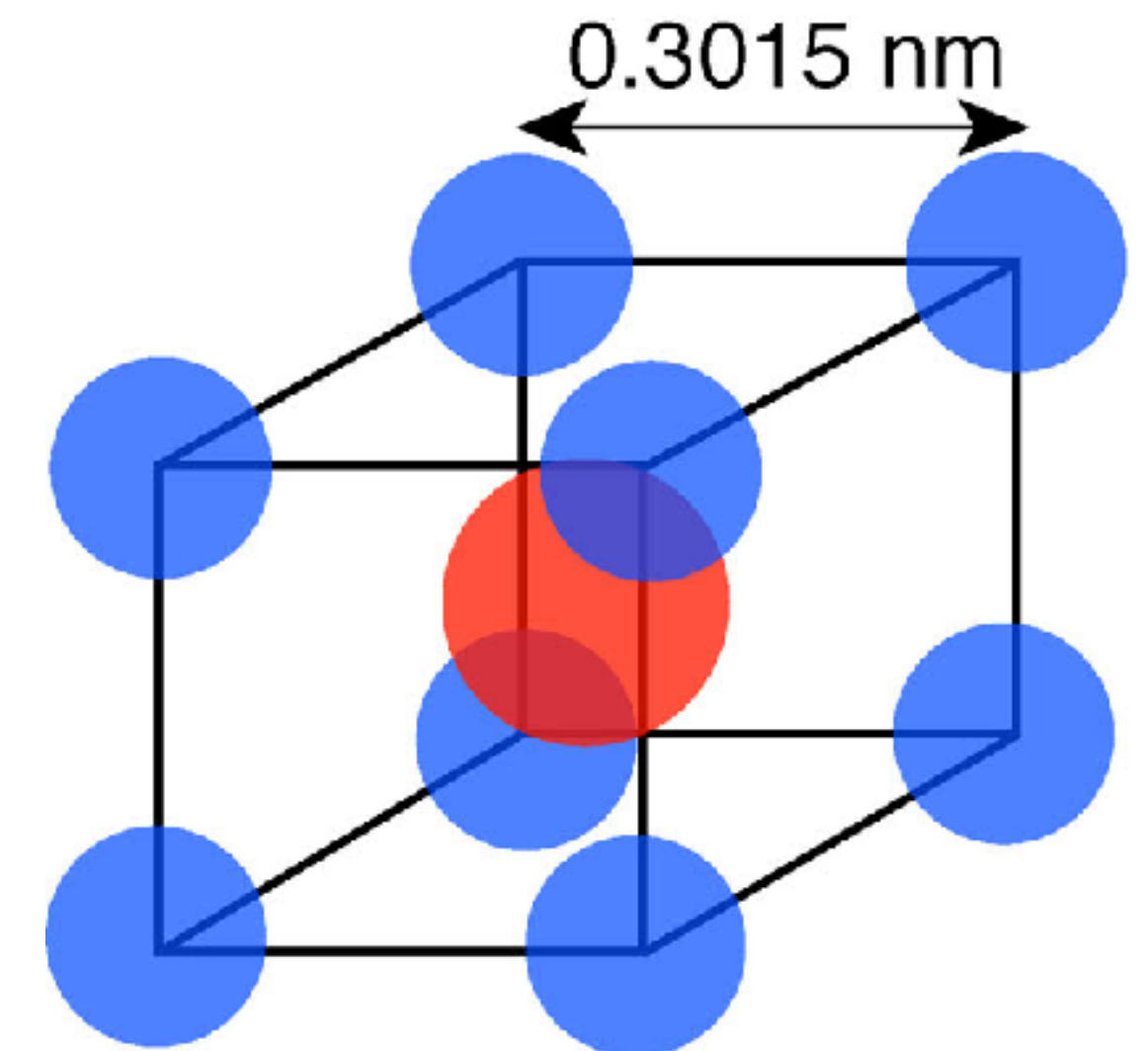


MARTENSITE



AUSTENITE

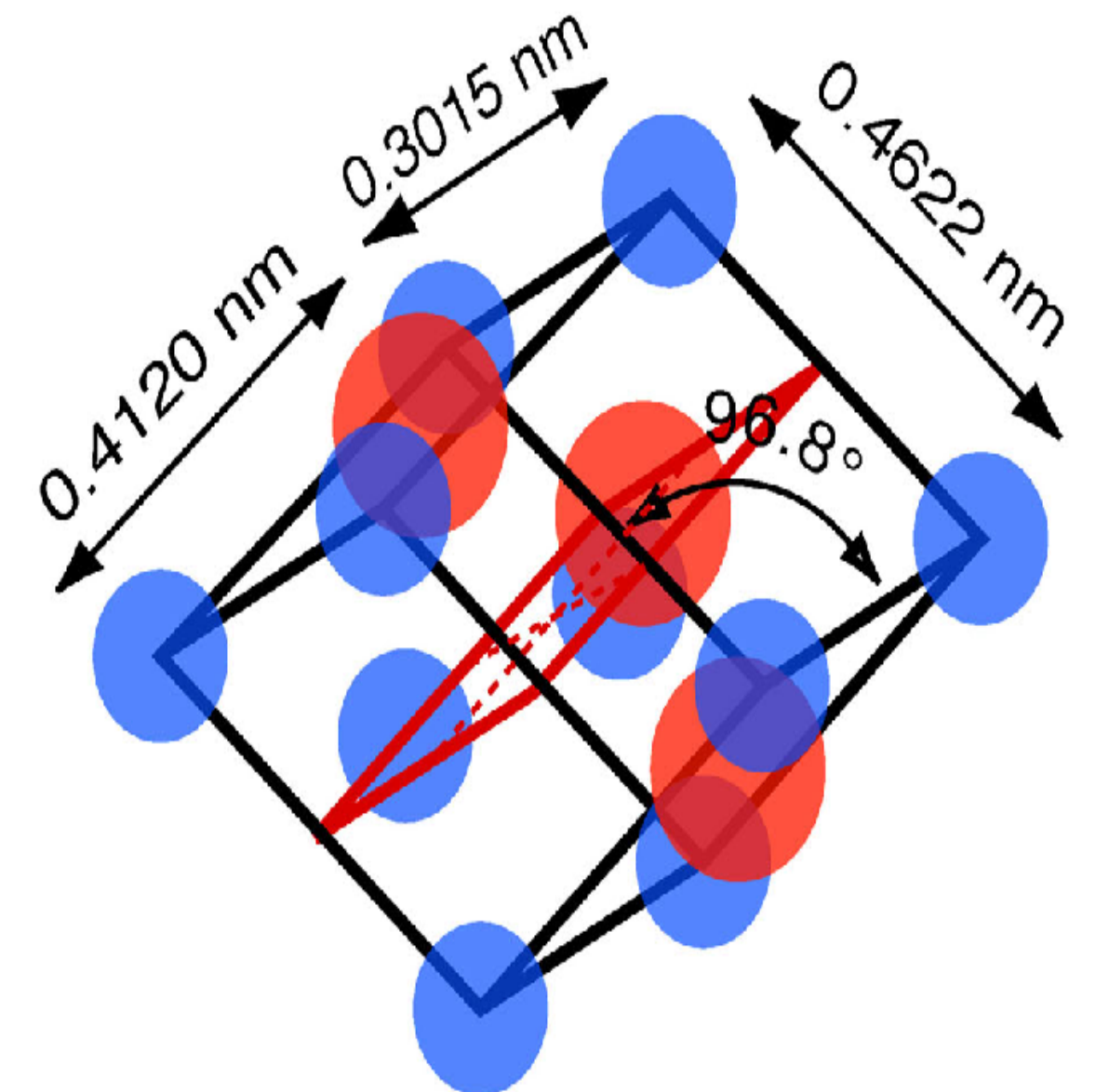
- ☑ RITORNO ELASTICO
- ☑ “RIGIDITA”
- ☑ SUPERELASTICITA



MARTENSITE

☑ MEMORIA DI FORMA

☑ “DUTTILITA”



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

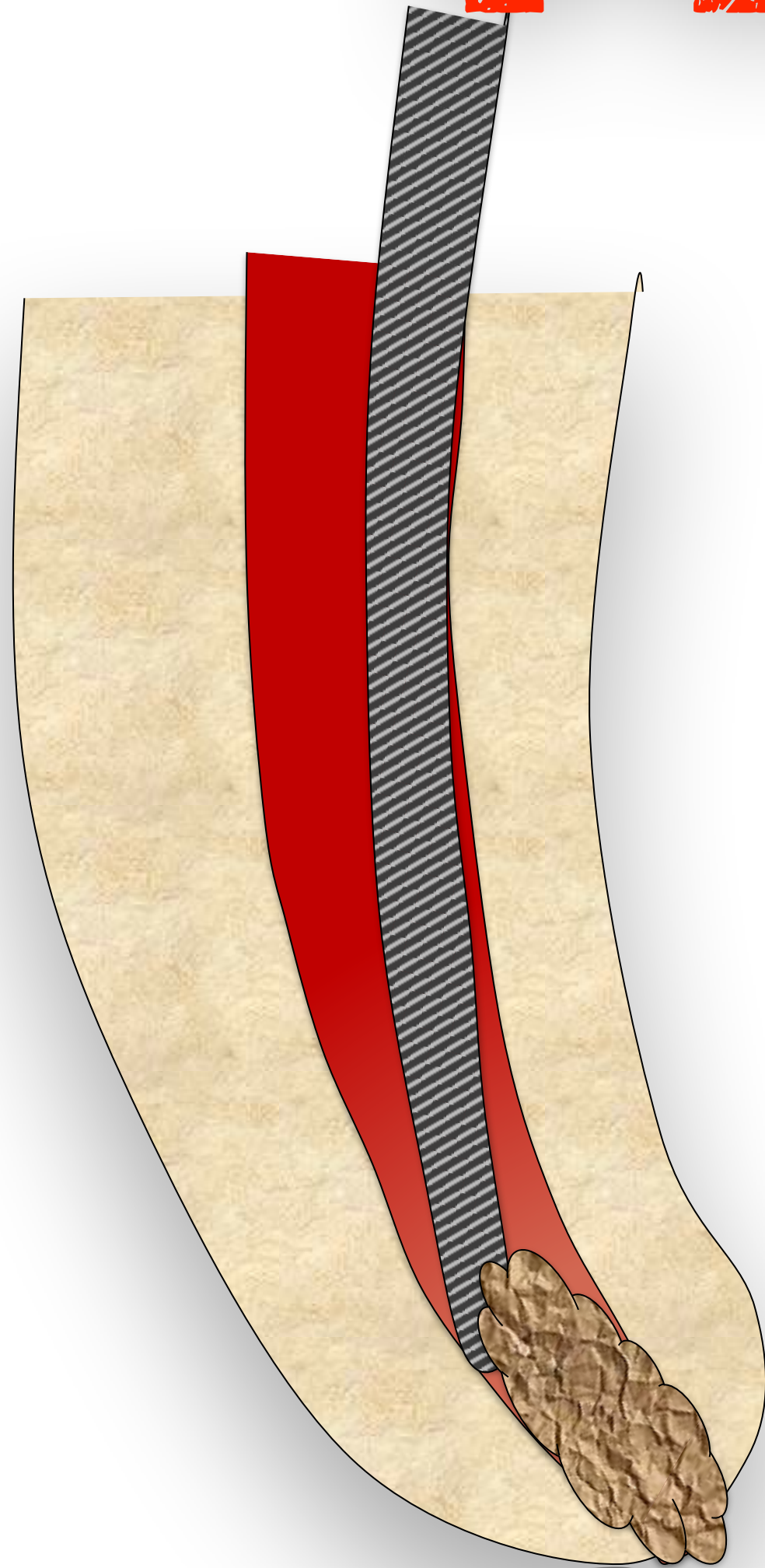


“ROOT CANALS, AS HAS BEEN STATED, HAVE NATURAL CURVES. (...) FILES PLACED IN SUCH CANALS WILL BE DEFLECTED, THEREFORE, FROM THEIR LONG AXES WITH RESULTANT **INEQUALITY OF CUTTING EFFECTIVENESS** (...)

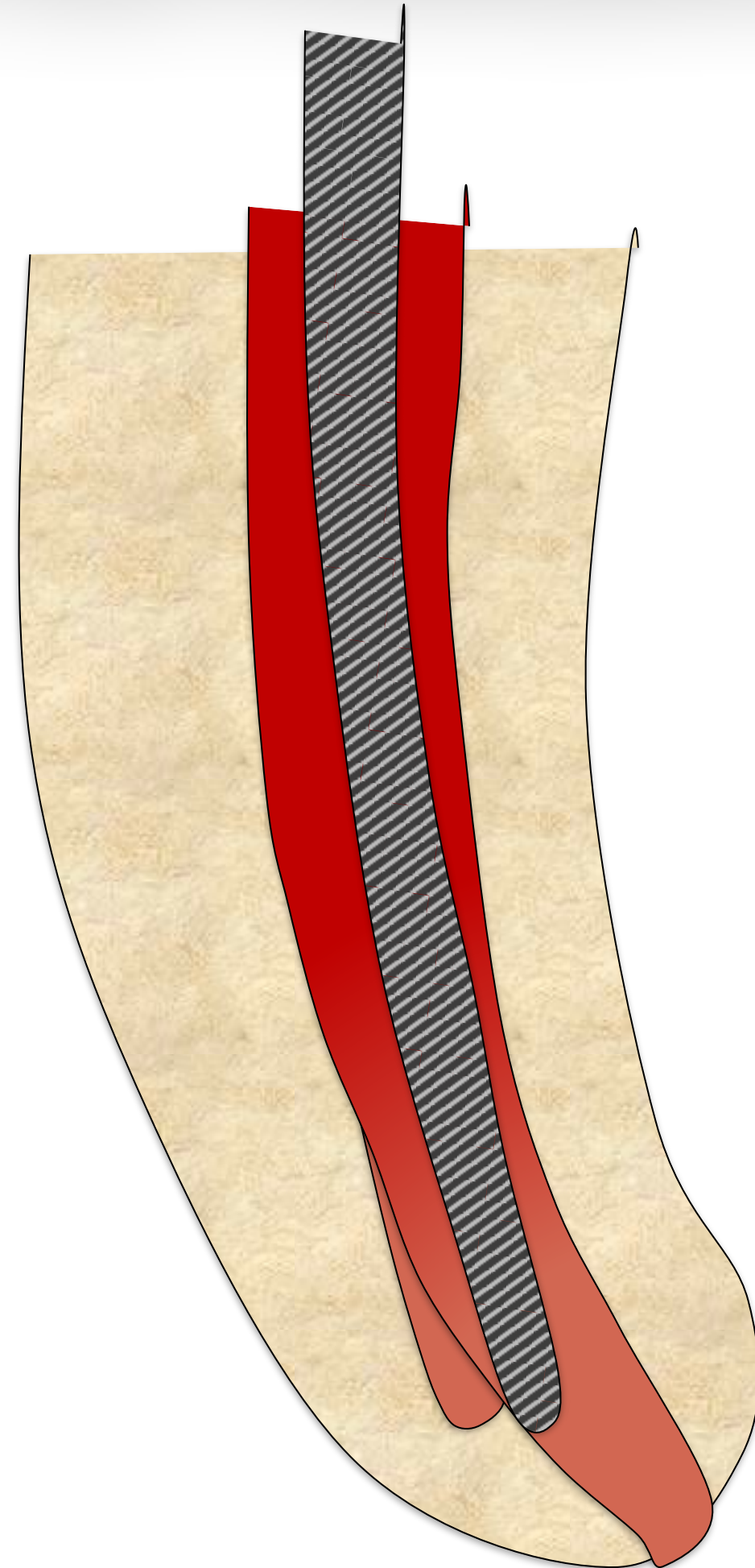
THIS DEFLECTION (...), AND THE ELASTIC MEMORY OF THE DEFLECTED METAL, PRODUCES GREATER CUTTING EFFICIENCY IN THE DIRECTION **OPPOSITE** TO THE CURVATURE OF THE INSTRUMENT”

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

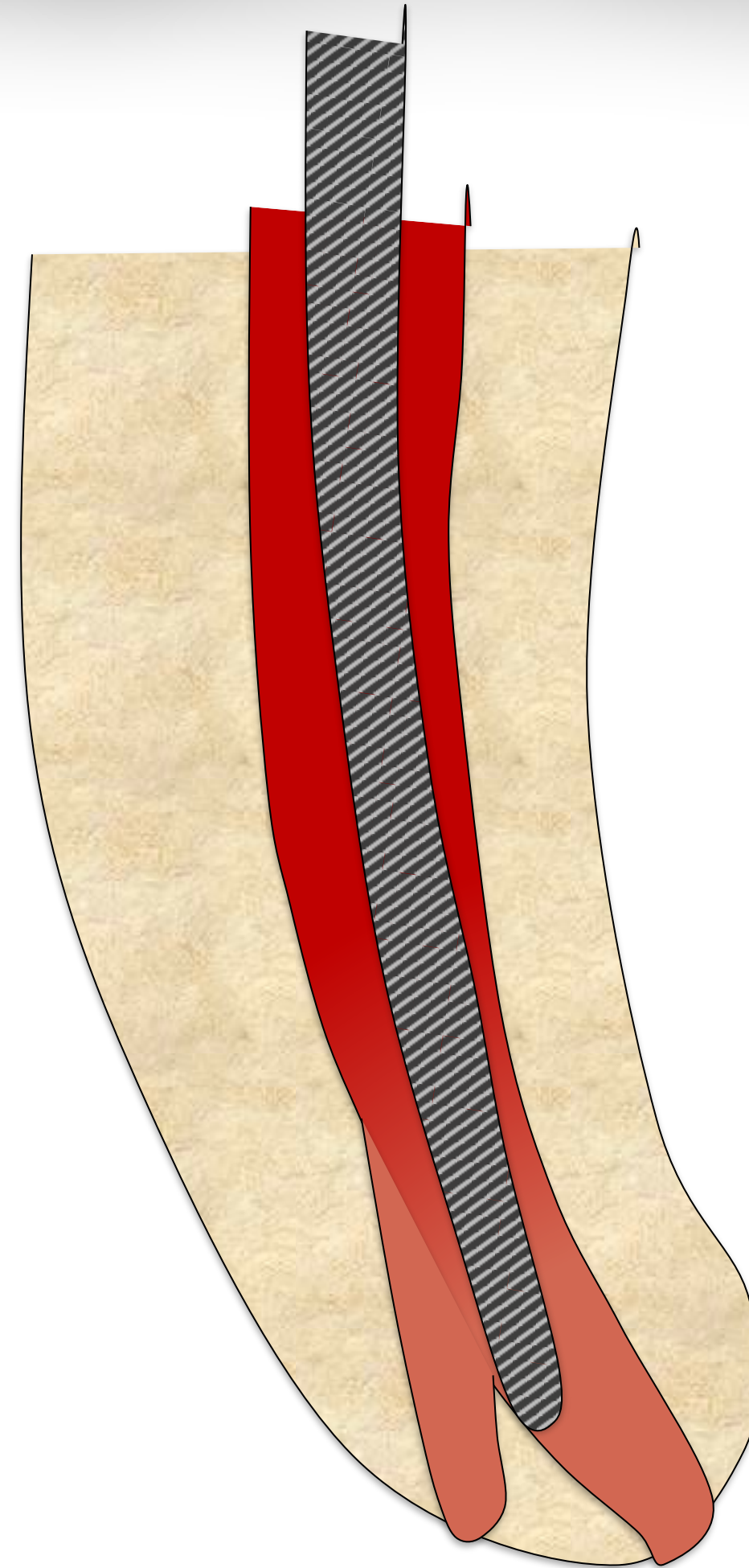
PROBLEMATICHE



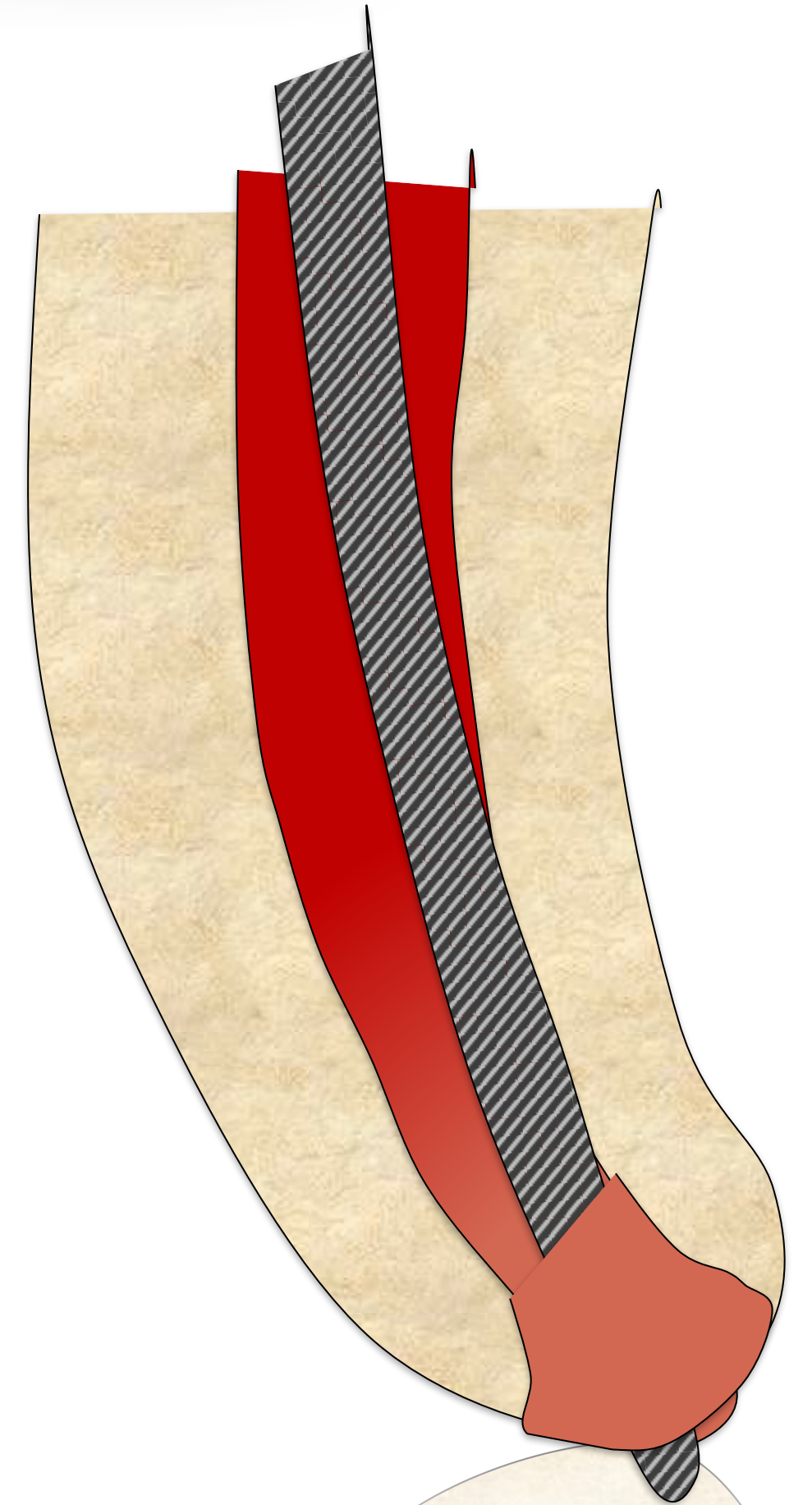
TAPPO



GRADINO



PERFORAZIONE



TRASPORTO

EVITARE FRATTURE E MIGLIORARE LA SACCOMATURA

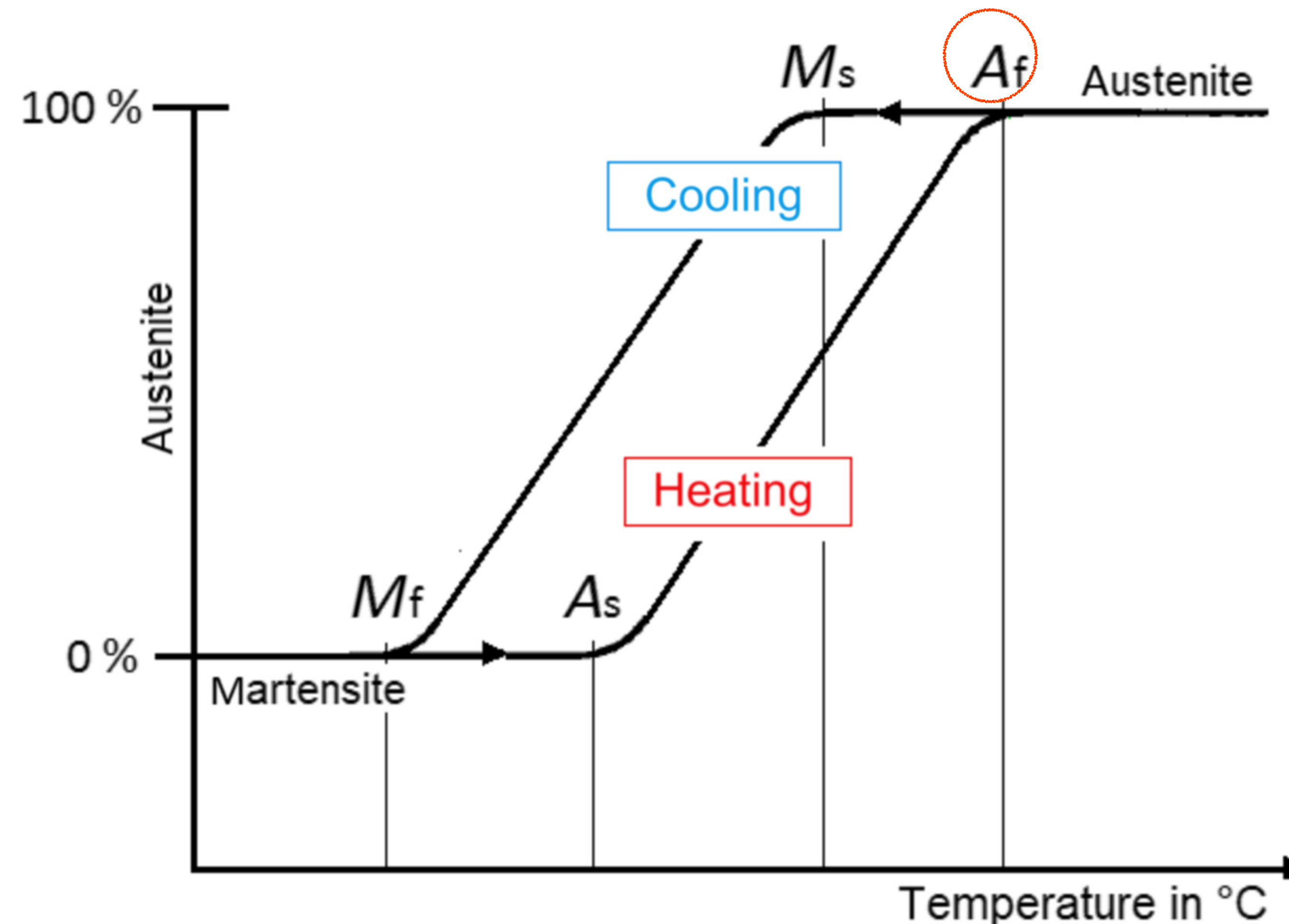
DESIGN • ROTAZIONE
LEGA



2011

ENTRANO NEL MERCATO I FILES LE
LECHE TRATTATE TERMICAMENTE

COLTENE ATTRAVERSO UN TRATTAMENTO TERMICO DELLA LEGA HA MODIFICATO LA TEMPERATURA DI TRANSIZIONE



QUINDI ORA POSSO
SCEGLIERE LE
PERCENTUALI DI A E
M A T° AMBIENTE



HEAT TREATMENT T°

± 55°

Cm-Wire

Gold Wire

Blue Wire

R-phase

M-Wire

SE Ni-Ti

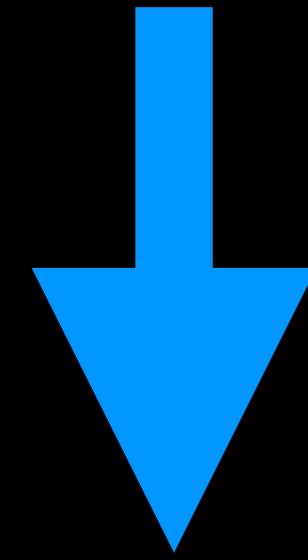
± 0°

Martensitic Phase (Low T°, Soft)

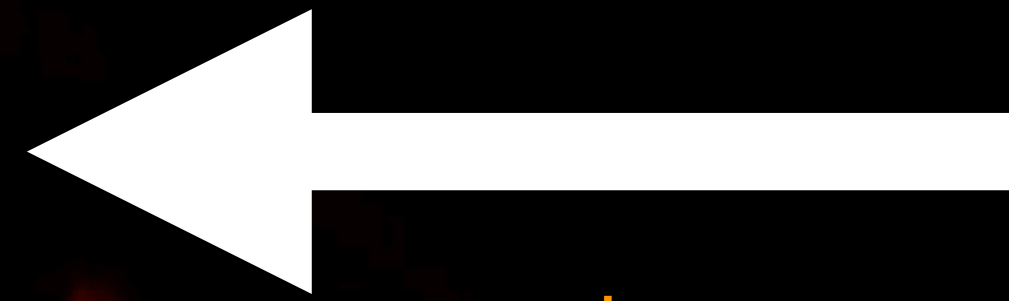
Austenitic Phase (High T°, Stiff)

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

TEMPERATURA AMBIENTE



Martensite

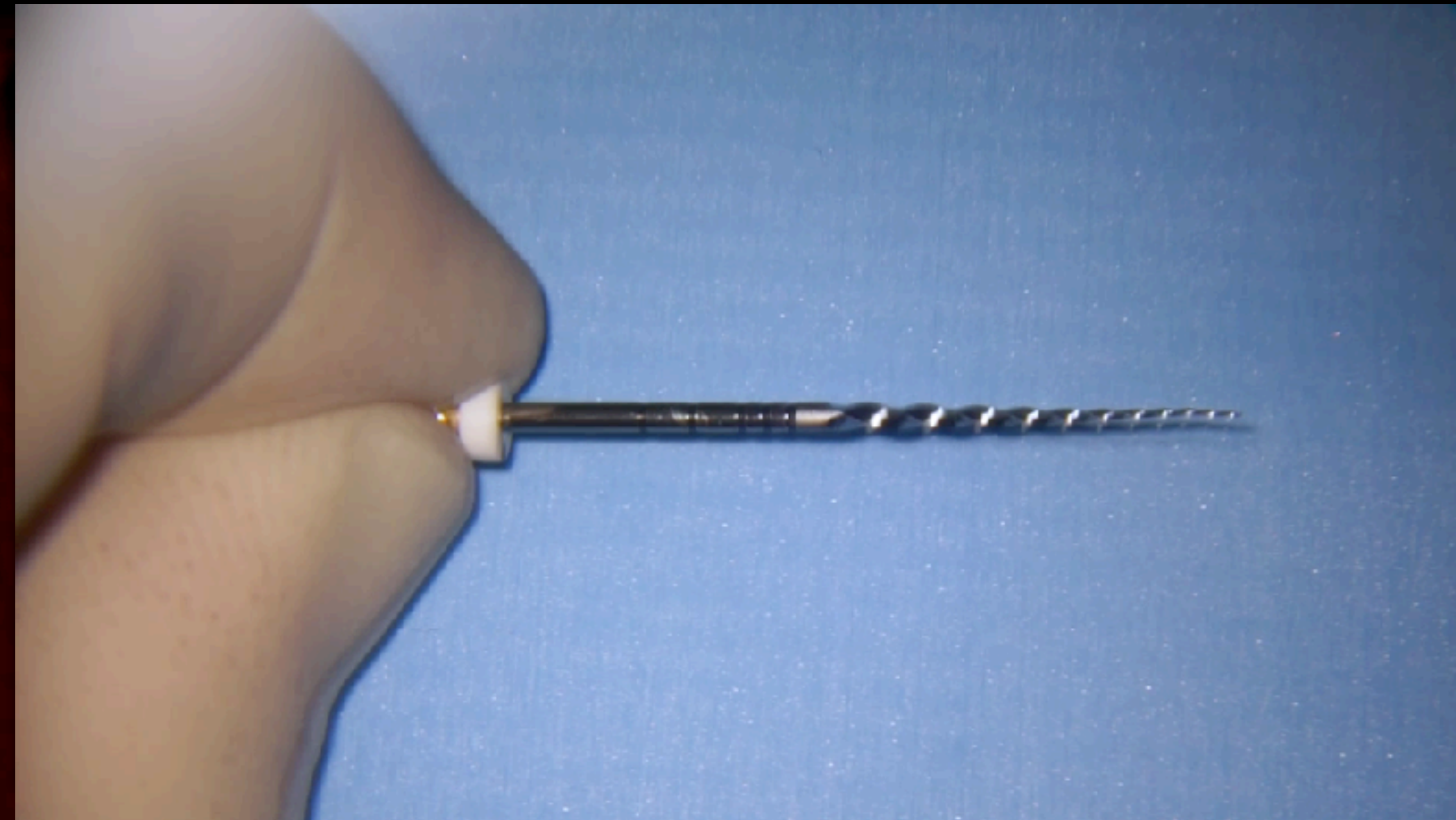


T

temperatura di transizione

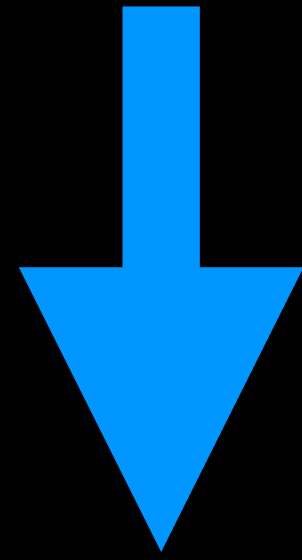


Austenite

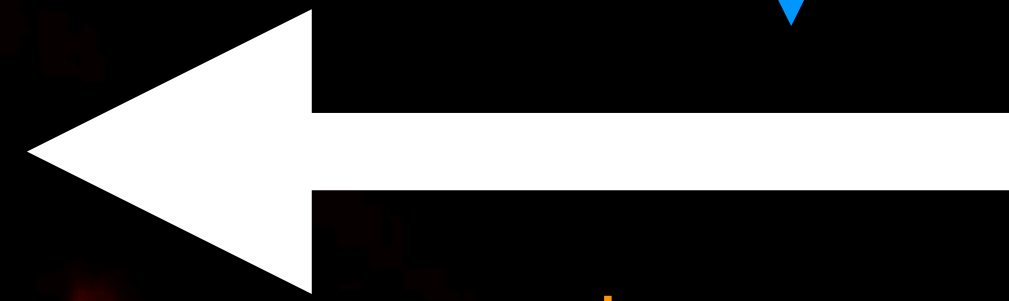


STRUMENTO NI TI STANDARD = 0°C

TEMPERATURA AMBIENTE



Martensite



T



Austenite

temperatura di transizione



STABILMENTE IN FASE MARTENSITICA ALLA
TEMPERATURA DELL'AMBIENTE

STRUMENTO NI TRATTATO TERMICAMENTE

AUSTENITICO

ROOM
TEMPERATURE

MARTENSITICO

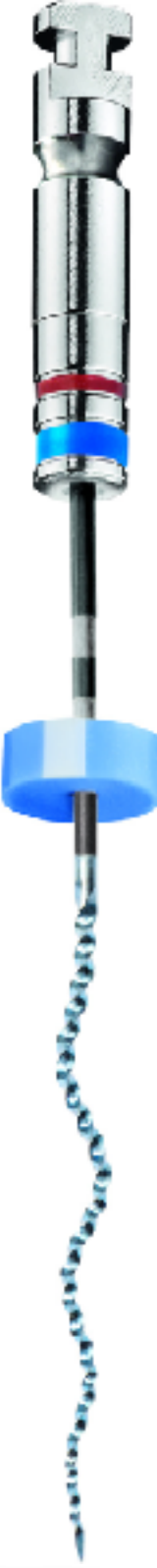
M-wire



R-phase



Max-wire



Gold Blue



*CM
wire*



*CM
EDM*



INCREASING MARTENSITE = INCREASING FLEXIBILITY

Reciproc

Twisted File

XP endo
shaper

ProTaper
Gold

Vortex
Blue

HyFlex CMHyFlex EDM

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, 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 QUANTITA DI TESSUTO
DENTALE DURANTE LA TERAPIA ENDODONTICA

ED “EVITARE” LA
FRATTURA DEGLI
STRUMENTI ROTANTI

SAFETY

FLESSIBILITA' E RESISTENZA

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



KIT INTRO:

Sono disponibili 2 composizioni diverse

ORODEKA S.p.A.
Via Pian Dell'isola, 64
Rignano Sull'Arno (50067)
FIRENZE ITALIA
Tel. +39.055 83 36 643
www.orodeka.com



CONICITA' 04:

15/08
15/03
20/04
25/04



CONICITA' 06:

15/08
15/03
20/05
25/06

FINISHER:

Sono disponibili diverse conicità e diversi diametri apicali:



30/04
30/06
35/04
40/04
50/04
60/04

PARAMETRI D'UTILIZZO:

TIPO	OPENER	GLIDER	SHAPER	FINISHER
CONICITA'	08	03	04 - 05 - 06	04 - 06
DIAMETRO	15	15	20-25	30-35-40-50-60
LUNGHEZZA	19 mm	21 mm - 25 mm - 28 mm - 31 mm		
TORQUE	2.5 N/cm	1.5 N/cm	2.5 N/cm	2.5 N/cm
VELOCITA'	500 rpm	300 rpm	500 rpm	500 rpm





Opener 15/0.8

DIAMETRO IN PUNTA: 15

CONICITA': 0.8

LUNGHEZZA: 19mm

TORQUE: 2.5 N-cm

VELOCITA': 500 rpm



OPENER PIÙ PICCOLO IN PUNTA E PIÙ MORBIDO SUL MERCATO



Glider 15/0.3

DIAMETRO IN PUNTA: 15

CONICITA': 0.8

LUNGHEZZA: 21/25/28/31mm

TORQUE: 1.5N-cm

VELOCITA': 300rpm





Shaper 20-25/0.4

DIAMETRO IN PUNTA: 20/25

CONICITA': 0.4

LUNGHEZZA: 21/25/28/31 mm

TORQUE: 2.5 N-cm

VELOCITA': 300/500 rpm

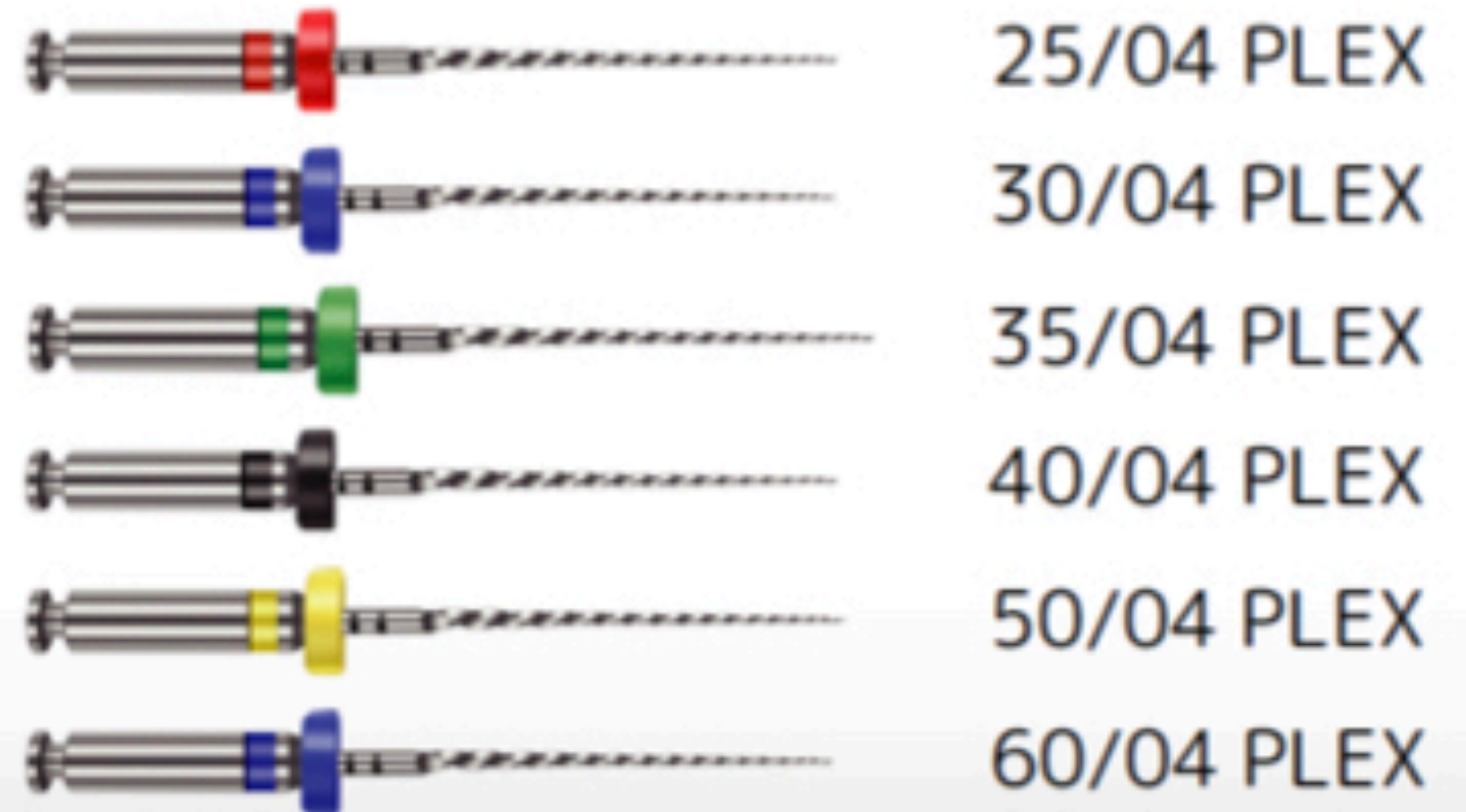


25-30/06



EXTRA

21mm / 25mm / 28mm / 31mm



FINISHER

.PLEX V - 04

Difficult Canals

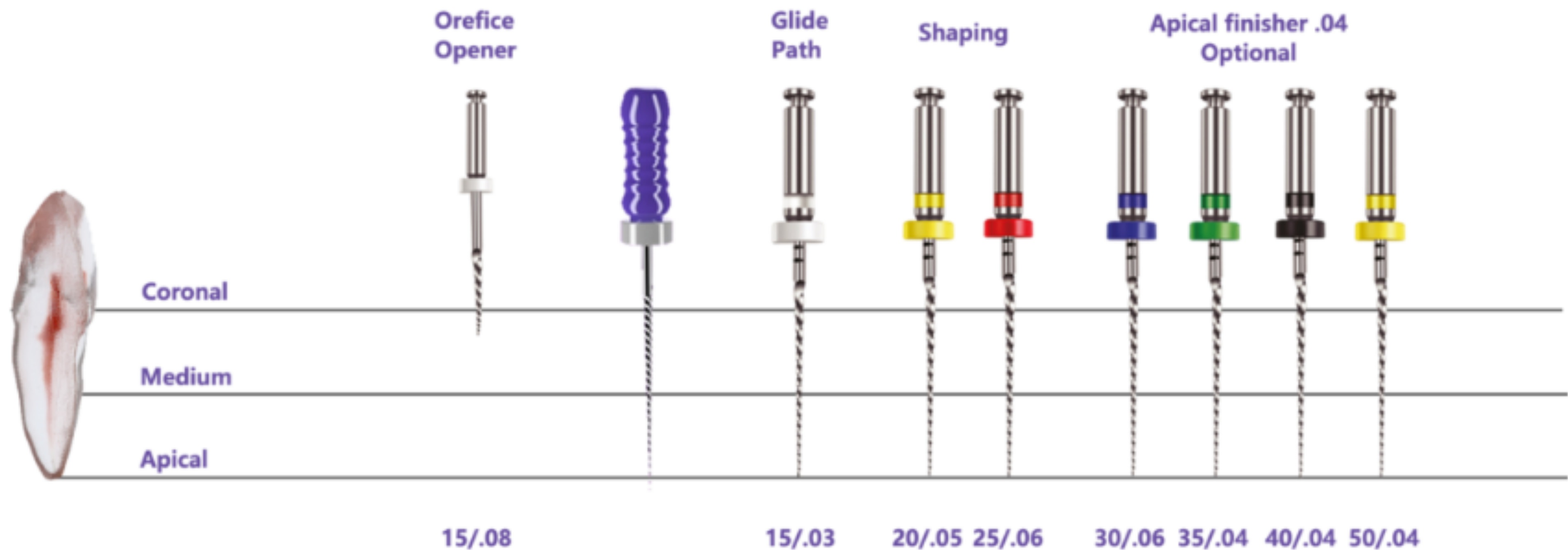
Mode	Open	Path Files	Finishing	
TAPER	08	03	04	04
DIAMETER	15	15	20	25
LENGHT	19mm	21 mm - 25 mm - 28 mm - 31 mm		
TORQUE	2.5 N.Cm	1.5 N.Cm	2.5 N.Cm	2.5 N.Cm
SPEED	500 RPM	300 RPM	500 RPM	500 RPM

.PLEX V - 06

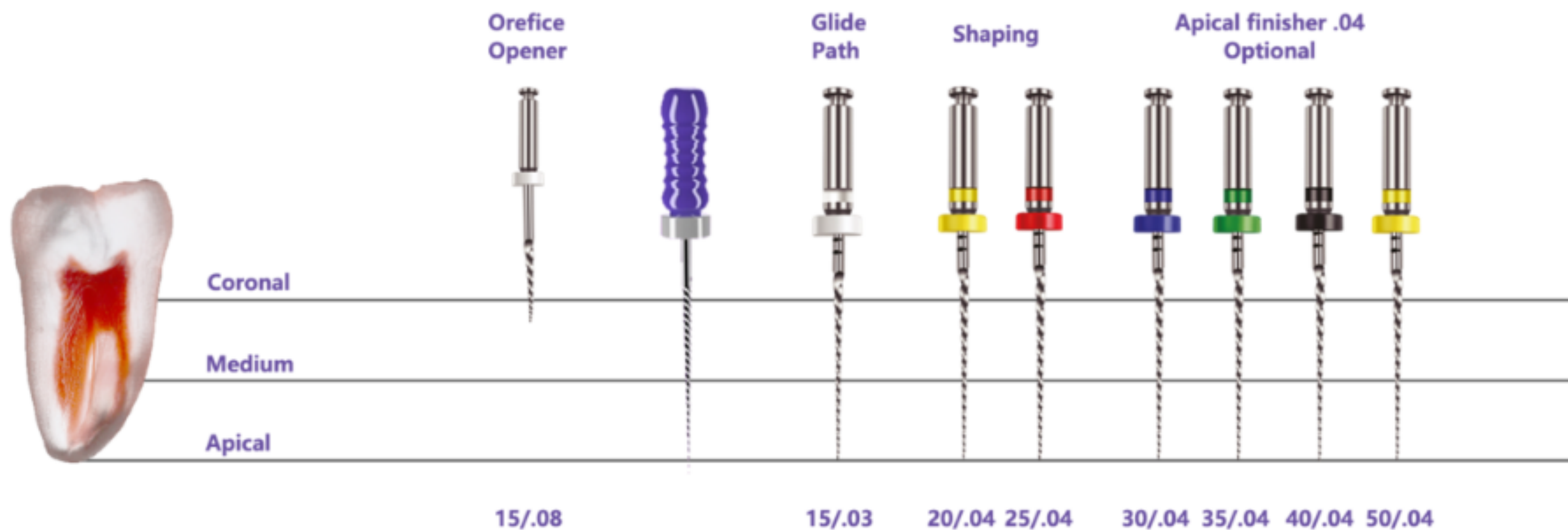
Easy Canals

Mode	Open	Path Files	Finishing	
TAPER	08	03	04	04
DIAMETER	15	15	20	25
LENGHT	19mm	21 mm - 25 mm - 28 mm - 31 mm		
TORQUE	2.5 N.Cm	1.5 N.Cm	2.5 N.Cm	2.5 N.Cm
SPEED	500 RPM	300 RPM	500 RPM	500 RPM

MODE	OPEN	PATH FILES	FINISHING	
TAPER	08	03	05	06
DIAMETRO	15	15	20	25
LUNGHEZZA	19mm	21mm - 25mm - 28mm - 31mm		
TORQUE	2,5 N.Cm	1,5 N.Cm	2,5 N.Cm	2,5 N.Cm
VELOCITÀ	500 RPM	300 RPM	500 RPM	500 RPM



MODE	OPEN	PATH FILES	FINISHING	
TAPER	08	03	04	04
DIAMETRO	15	15	20	25
LUNGHEZZA	19mm	21mm - 25mm - 28mm - 31mm		
TORQUE	2,5 N.Cm	1,5 N.Cm	2,5 N.Cm	2,5 N.Cm
VELOCITÀ	500 RPM	300 RPM	500 RPM	500 RPM



A person wearing a white button-down shirt has a yellow measuring tape draped around their neck. They are standing at a wooden workbench, where they are working on a black fabric pattern. Their hands are visible, one holding a piece of the pattern. The background is softly blurred, showing warm, bokeh-style lights. A semi-transparent blue horizontal band is overlaid across the middle of the image, containing the text.

più files significano
POSSIBILITA' DI PERSONALIZZARE LA
NOSTRA SACOMATURA

FILE CON TRATTAMENTO TERMICO

Cyclic Fatigue

Torsional Stress

Rpm

250-300

TORQUE

FORCE 1,5-2,5 N/cm

LOW



DESPIRALIZZAZIONE

EVITA L'IMPEGNO CANALARE DELLO
STRUMENTO

DEFORMAZIONE ELASTICA O PLASTICA?

HTNFTI VISUAL CHECKING

NEW

AFTER USE



FABIO_PICCOATTIDS

HEAT

READY

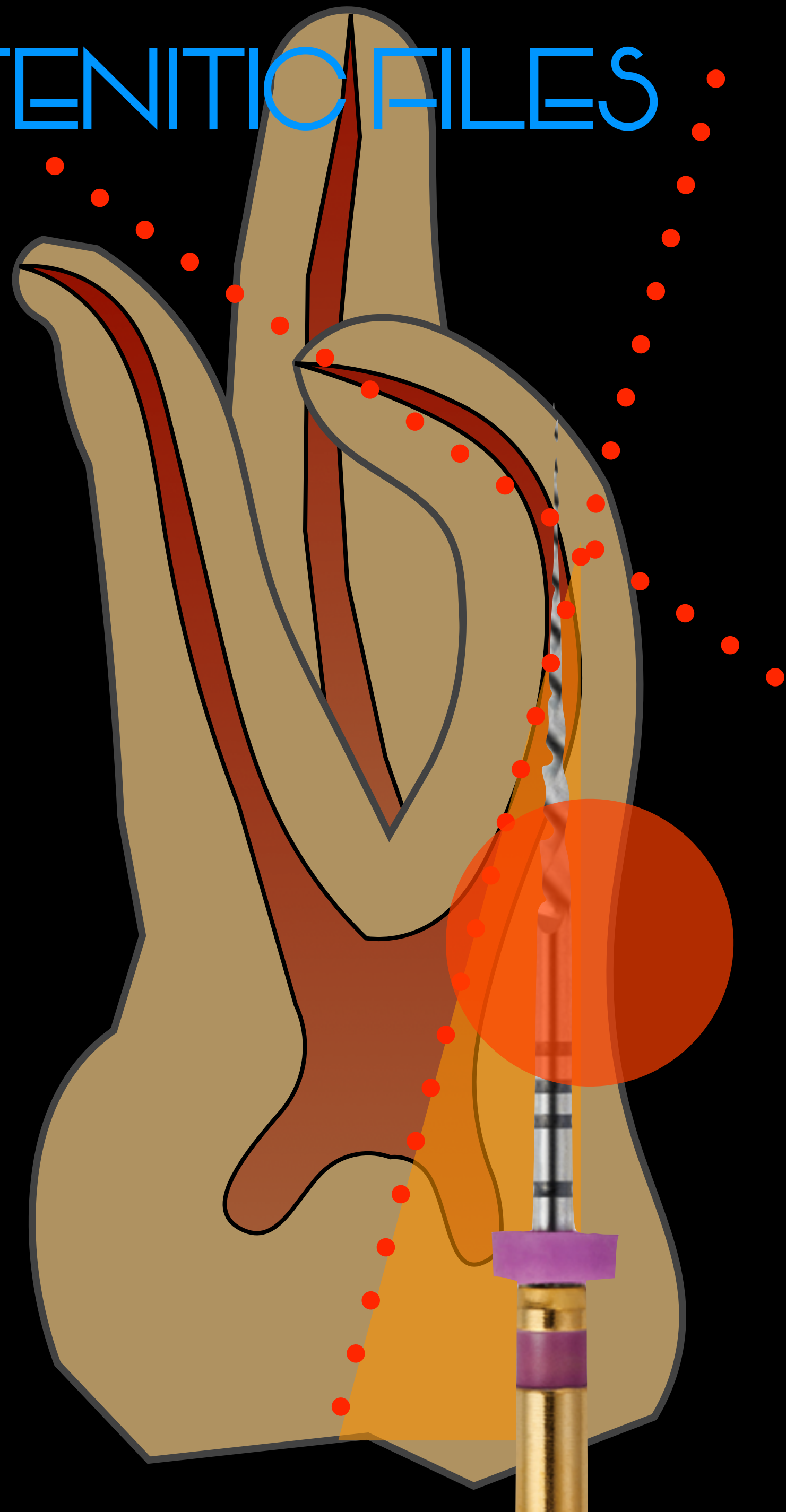


THE “HOT WATER” TRICK TO REGENERATE FILES

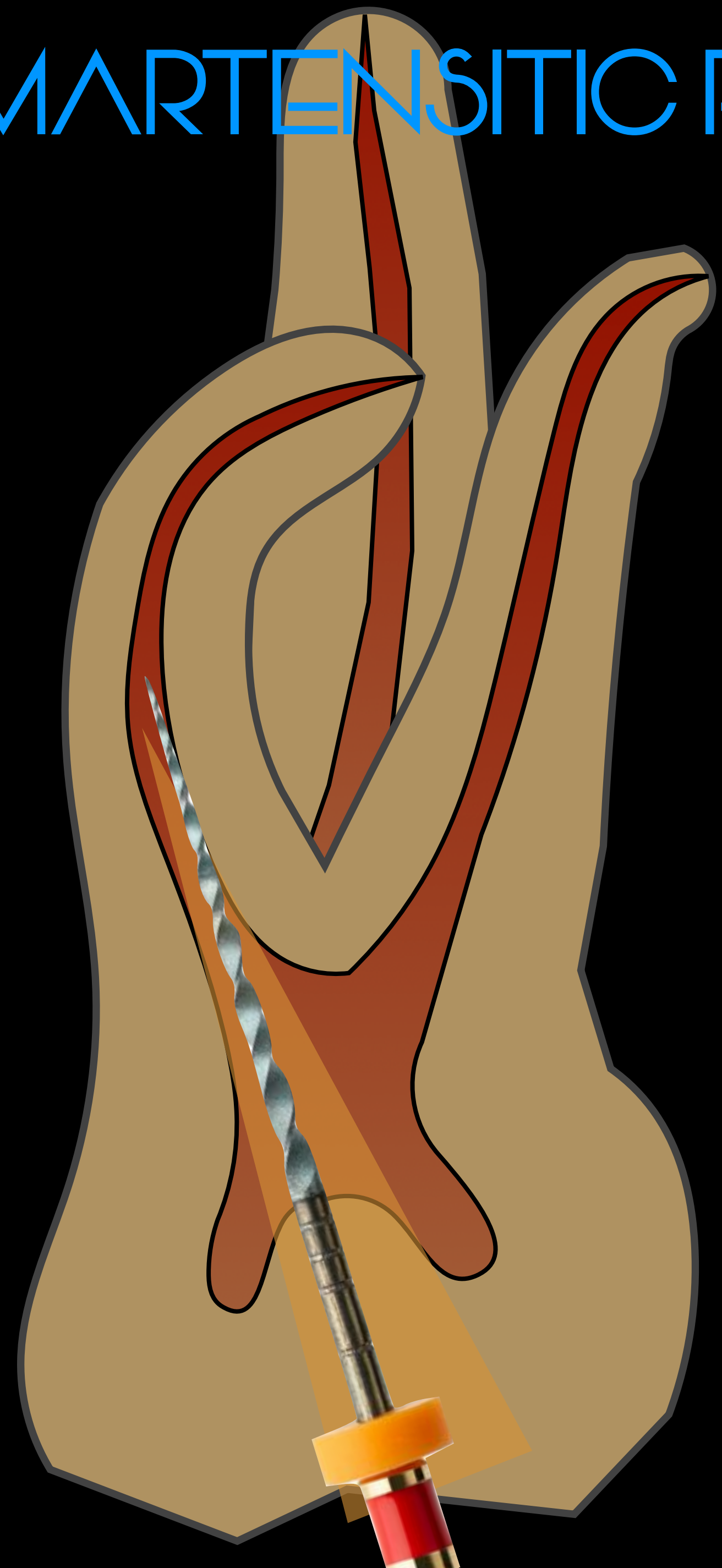


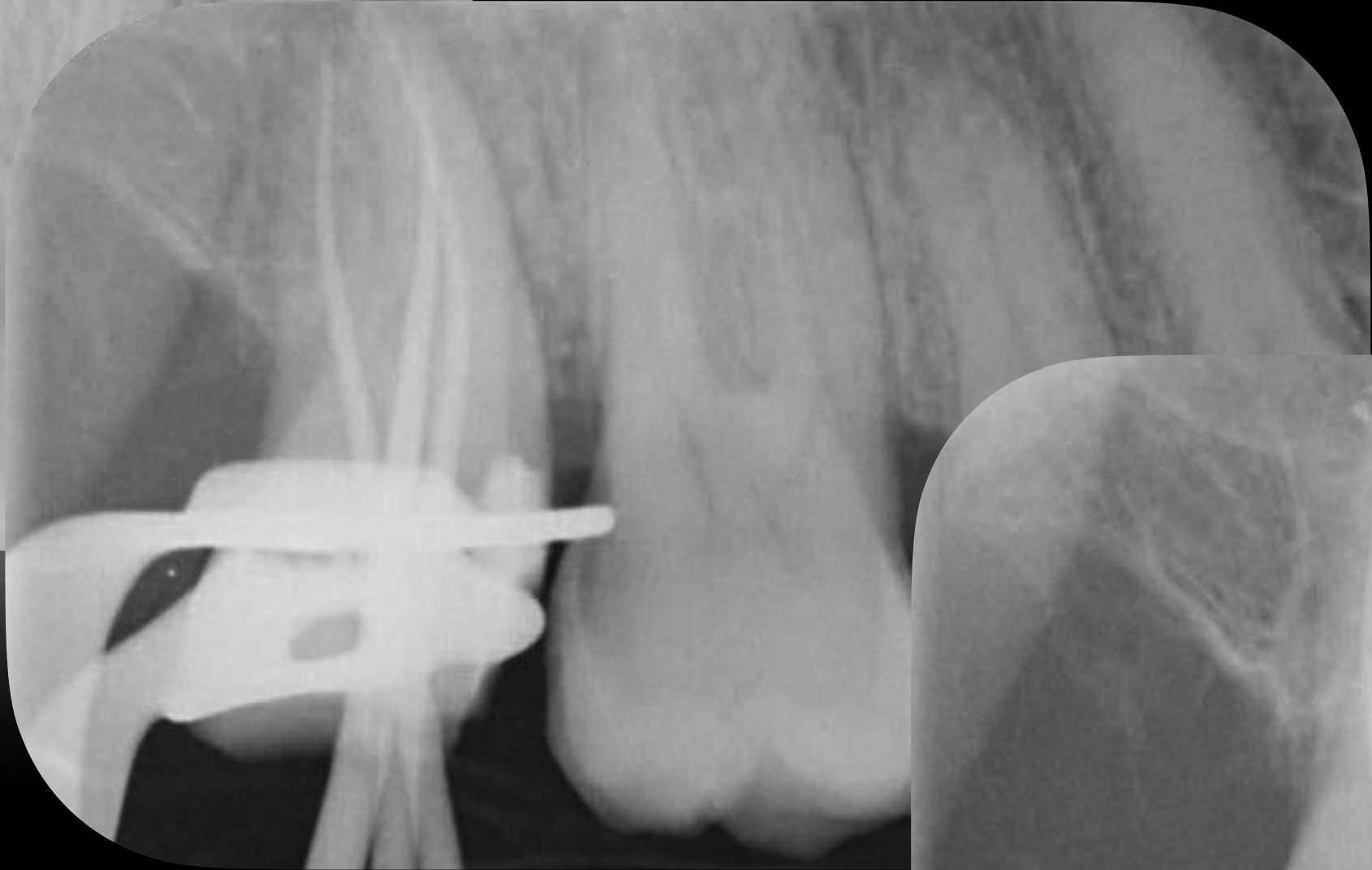
VISUAL CHECKING

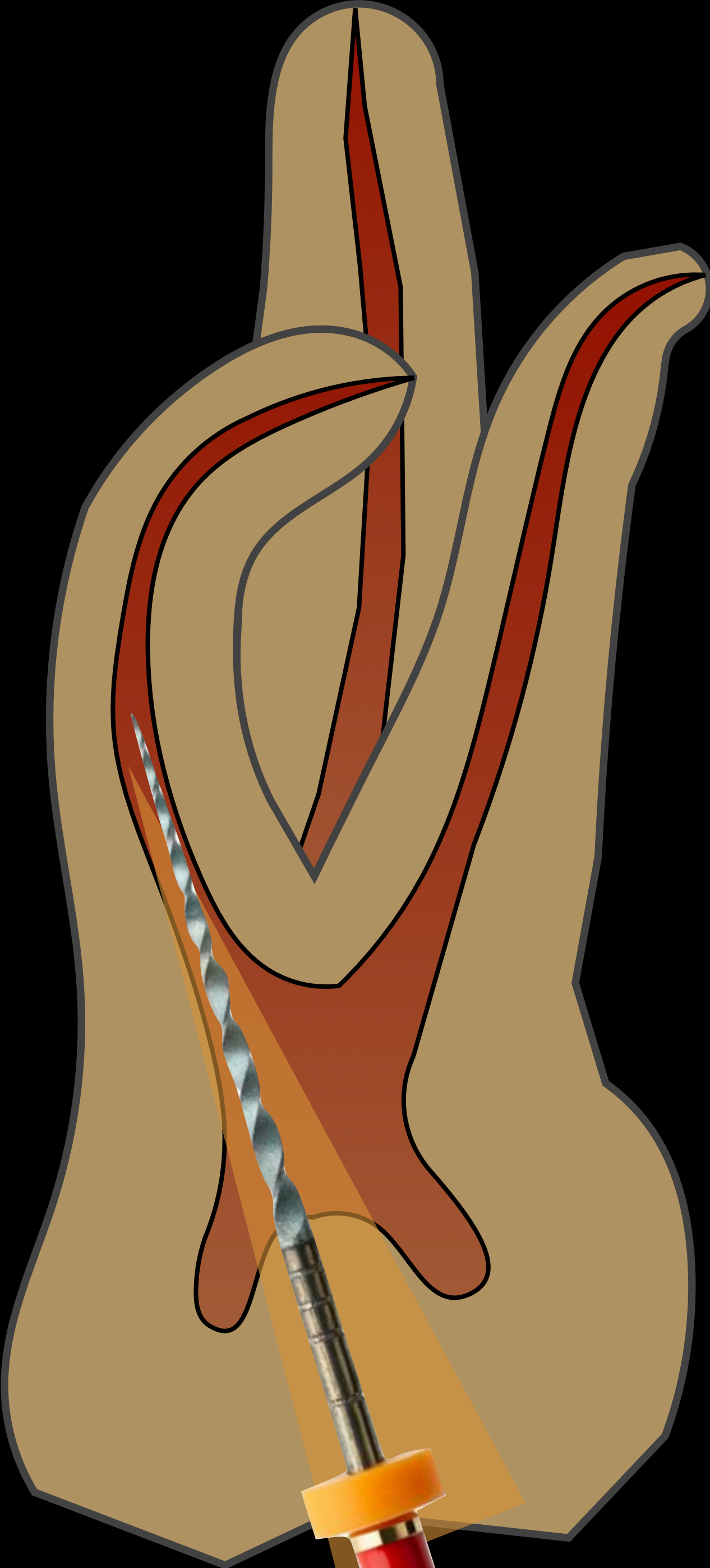
AUSTENITIC FILES :



MARTENSITIC FILES







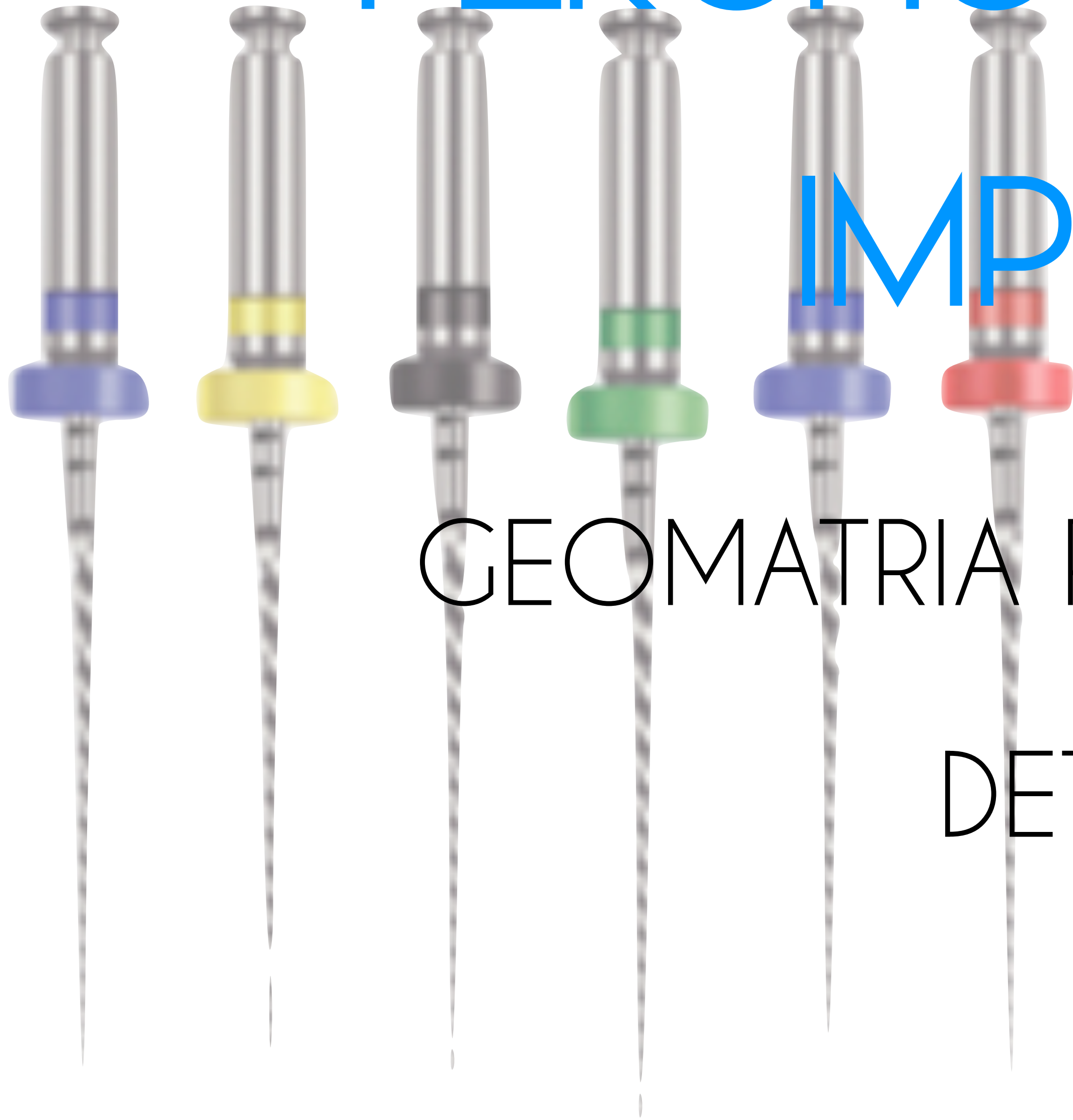
LA SAGOMATURA ESEGUITA CON STRUMENTI
MARTENSITICI CONSENTE UNA RIDUZIONE DELLA
CONCITA'

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

PERCHÈ I FINISHER SONO IMPORTANTI??



GЕОМАТRІА PREPARAZIONE CANALARE

DETERSIONE MECCANICA

MIGLIORAMENTO
PERMEABILITA' APICALE

LA SAGOMATURA DEVE
TERMINARE CON UNA
CONICITA' PROGRESSIVA IN
CUI L'APICE E' IL PUNTO PIU'
STRETTO.

DETERMINAZIONE DIAMETRO APICALE

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

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 Srikanth¹, Amaravadi Gopi Krishna², Siva Srinivas³, E Sujayeendranatha Reddy⁴, Someshwar Battu⁵, Swathi Aravelli¹

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

DETERMINAZIONE DIAMETRO APICALE

Orstavik 1991. The larger the preparation the higher the efficiency in reducing infection

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

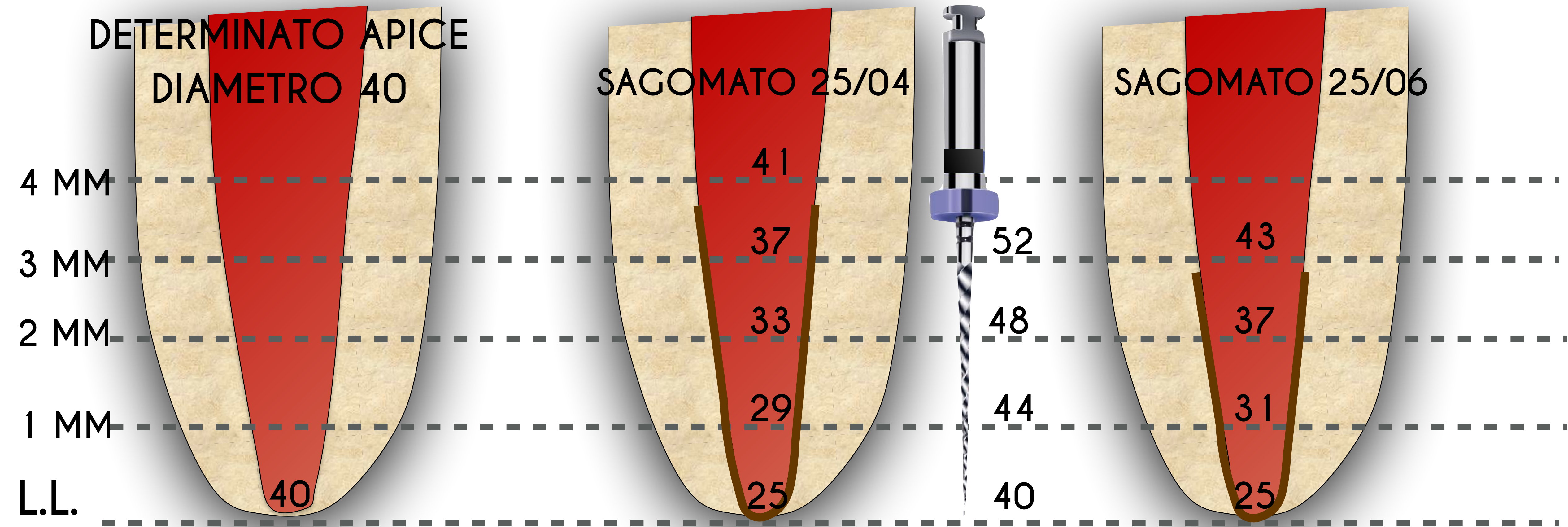
Siqueira 1999. The most dramatic bacterial reduction was obtained after larger apical preparations

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

UNA VOLTA DETERMINATO L'APICE



COME RACCORDARE?

IL MODO PIU' SEMPLICE E' AVERE A
DISPOSIZIONE UN FILI NITI
MARTENSITICO A DIAMETRI GRANDI E
CONICITA' $\varnothing 4$
POSSO ESEGUIRE UNA STEP BACK
MANUALE

REVIEW

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

A. Aminoshariae¹ & J. C. Kulild²¹Department of Endodontics, Case School of Dental Medicine, Cleveland, OH; and ²Dental School, UMKC, Kansas City, MO, USA

Abstract

Aminoshariae A, Kulild JC. Master apical file size – smaller or larger: a systematic review of healing outcomes. *International Endodontic Journal*, 48, 639–647, 2015.

The purpose of this systematic review was to determine in patients undergoing root canal treatment, whether apical enlargement affected the healing outcome. A PICO (population, intervention, comparison and outcome) strategy was developed to identify studies dealing with apical size of canal and healing outcome as measured clinically and radiographically. The MEDLINE, Embase, Cochrane and PubMed databases were searched. Additionally, the bibliography of all relevant articles and textbooks was manually searched. Based on inclusion and exclusion criteria,

two reviewers independently articles. Four articles were included. There were no apical enlargement and cone beam computed tomography systematic review confirmed research in this area is needed. The best evidence suggests that for root canal treatment, apical enlargement and periapical lesions, enlargement would result in an increase in healing outcomes in terms of clinical and radiographic.

Keywords: apical enlargement, master apical file size, healing outcome.

Received 26 June 2014; accepted 10 October 2014

Introduction

The primary objective of root canal treatment is to eliminate microorganisms and pathologic debris from the root canal system (Kakehashi *et al.* 1969) and to prevent its reinfection (Nair 2004). Gutierrez & Garcia (1968) reported that root canal systems are often improperly cleaned and shaped.

Byström & Sundqvist (1981) cultured 15 teeth with necrotic pulps after instrumentation accompanied with saline irrigation. They reported a 100- to 1000-fold reduction in the bacterial counts, yet no teeth

cultured bacteria-free. Chemomechanical preparation devices promote but is not able to (Dalton *et al.* 1998, 2005, Alves *et al.* 2013).

In a quest for the contaminants from authors have suggested that instrumentation may be improved (Ørstavik *et al.* 1995, Shulman *et al.* 1995, Rollison *et al.* 2005). The authors defined the master apical file as the largest file that can be inserted into the apical portion of the canal. This was accepted as the

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

Dean Raugh, 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 Raugh, DDS. E-mail address: baughd@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 system, 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 1951 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, Syangbeg (6) noted that the strong emphasis on reducing the number of instruments and limiting apical preparations to small size 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. Ricci (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. Ricci and Langland (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 Ricci and Langland. However, it is worth noting that the apical constriction may not always be present or easily identifiable (4, 18).

Better microbial removal and more effective irrigation occurs when canals are instrumented to larger apical sizes

30-35

AMINOSHARIE 2015

BAUGH 2005

DIAMETRO DI PREPARAZIONE

ALLARGAMENTO
APICALE



MIGLIORA EFFICACIA
IRRIGANTI



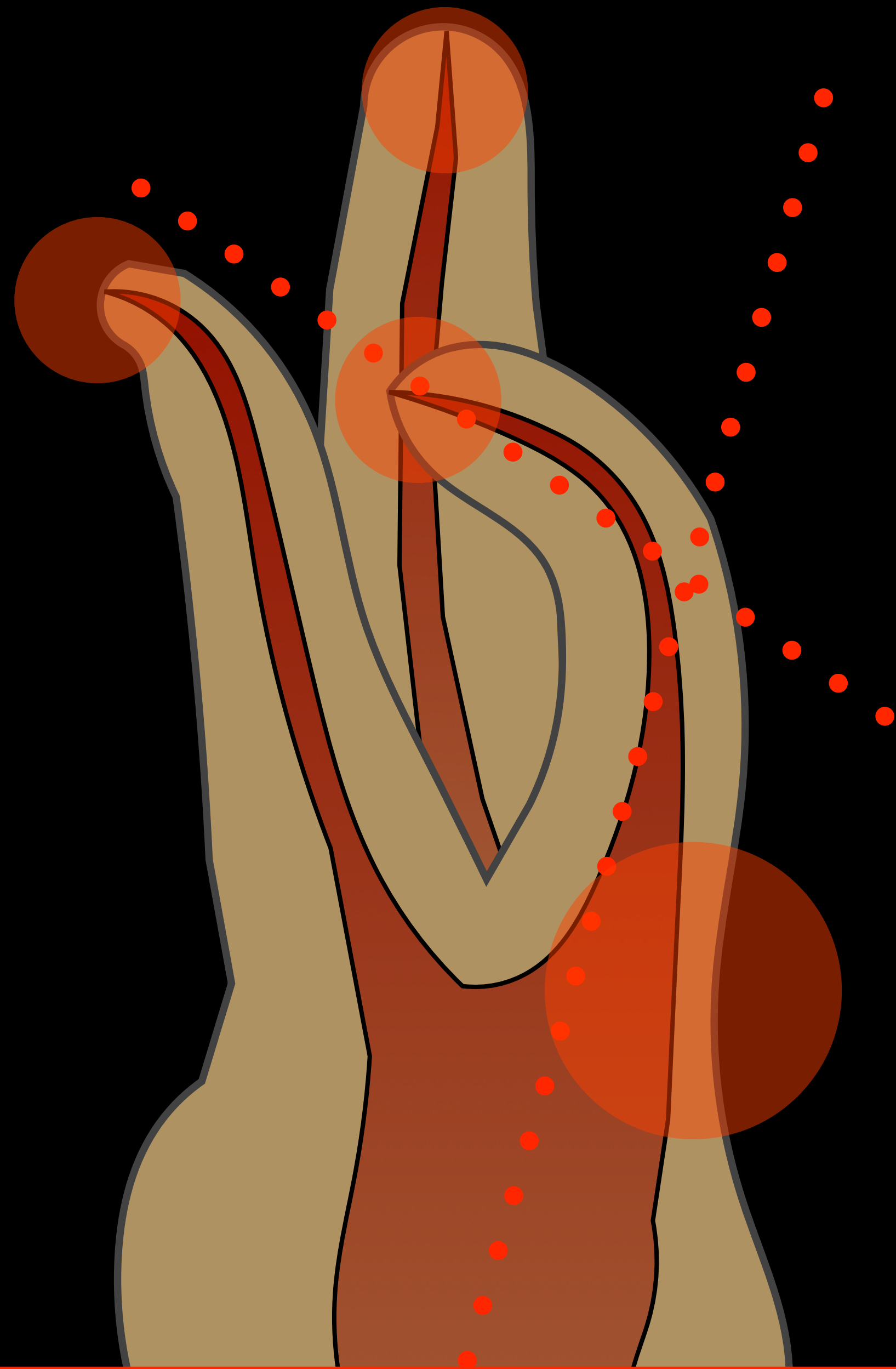
MIGLIORE DISINFEZIONE
MECCANICA



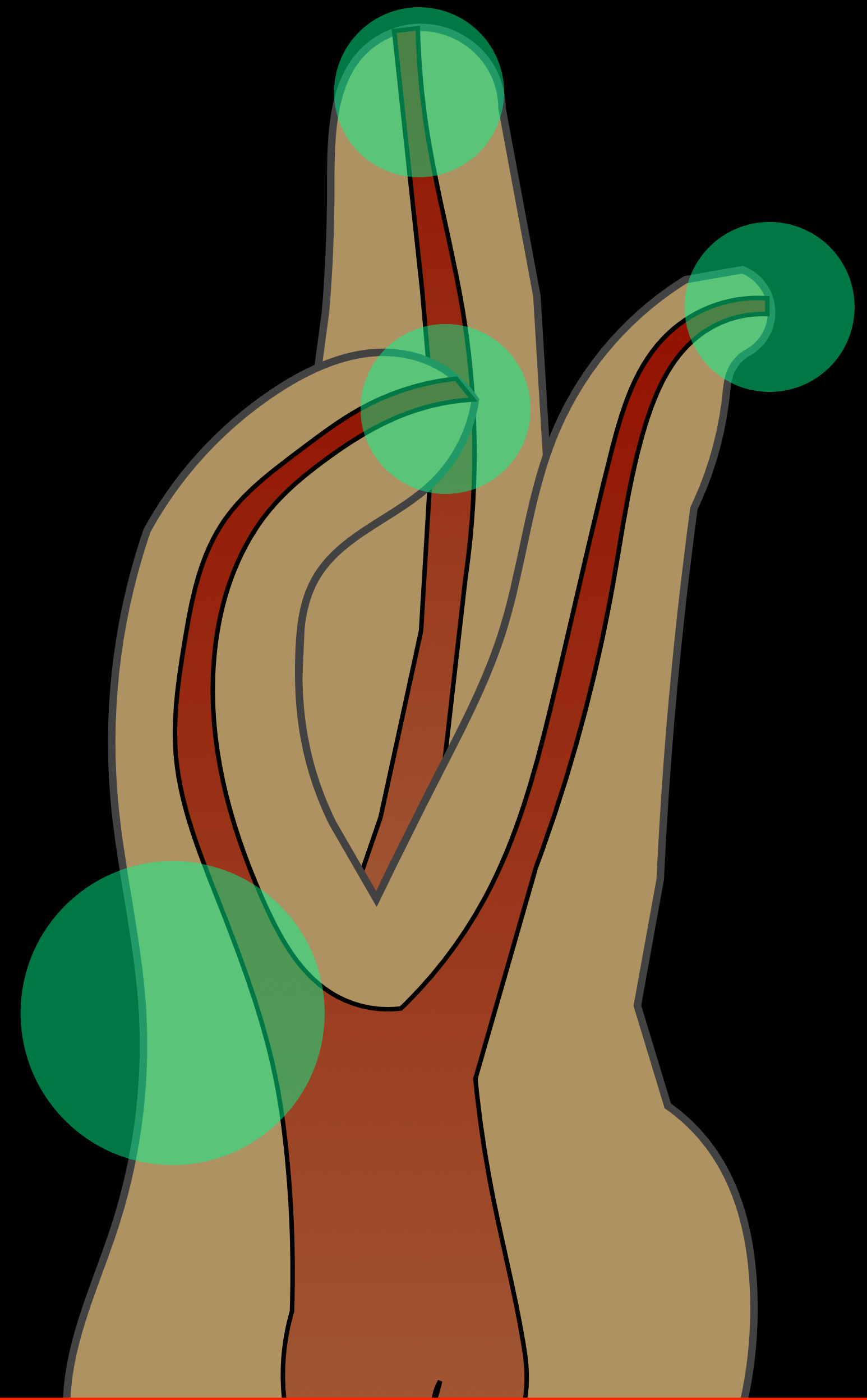


USUALLY, THE MORE SEVERE THE
CANAL CURVATURE,
THE GREATER THE RISK OF
TRANSPORTATION AND
UNEXPECTED FRACTURE
...WHEN LARGER APICAL
PREPARATIONS ARE TARGETED

SHAHER 2009



FILE AUSTENITICI



FILE MARTENSITICI

Aumento del diametro apicale



40.4



60.4



30.4



35.4

Diminuzione della conicità



1. APERTURA
CAMERA PULPARE

2. SONDAGGIO

3. GLIDE PATH

4. SAGOMATURA:

CONICITA' Ø4

CONICITA' Ø6

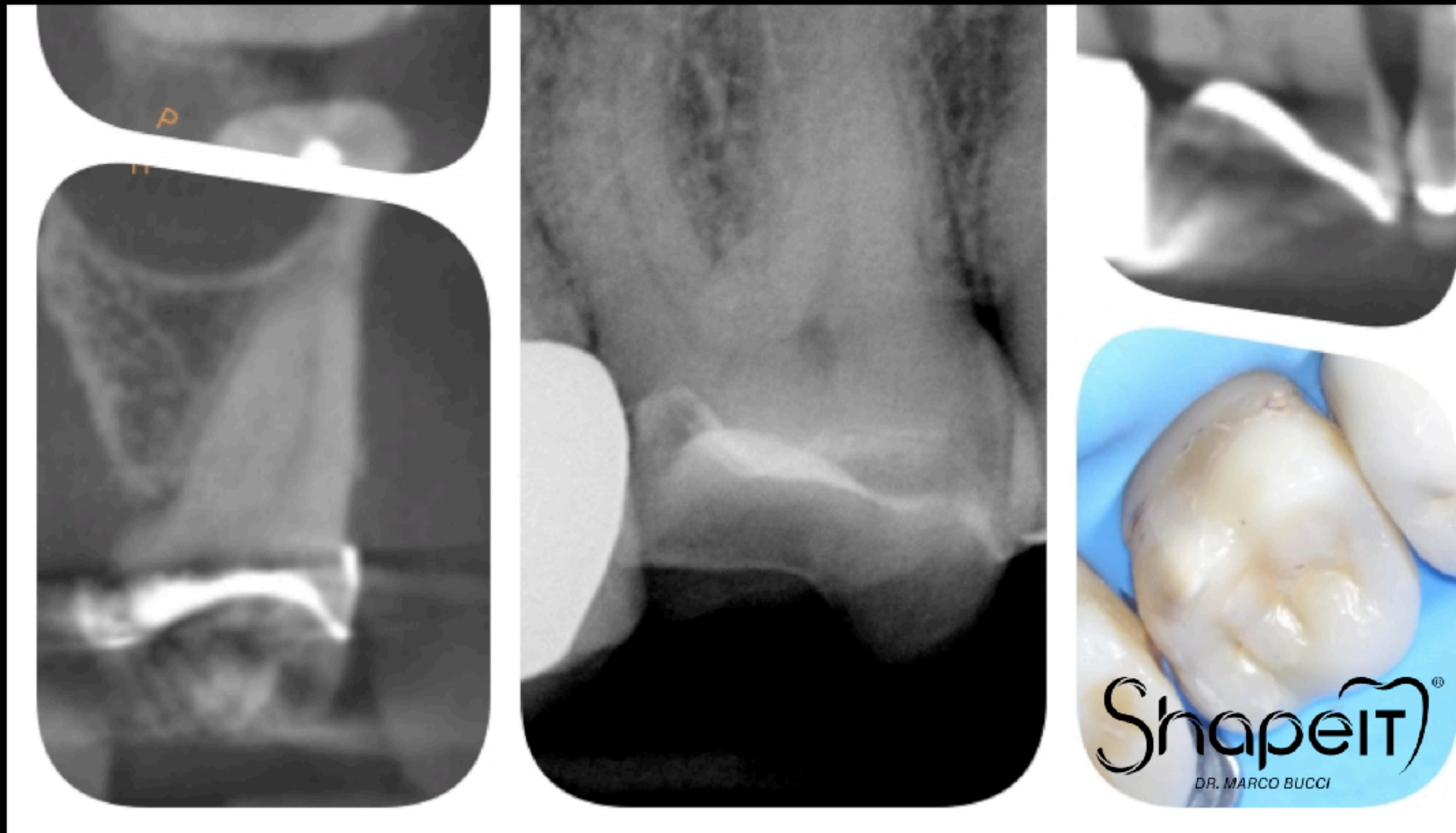
5. RIFINITURA
APICALE



1. APERTURA CAMERA PULPARE

GLI STRUMENTI UTILI SONO:

- FRESA A PALLINA GAMBO LUNGO
- FRESA ENDOZ O SIMILARI
- PUNTE ULTRASONICHE DEDICATE



LA LEGA MARTENSITICA CONSENTE L'UTILIZZO DI FILE PRECURVATI E UNA SAGOMATURA CORRETTA E IN SICUREZZA ANCHE CON APERTURE DI CAMERA PIU' CONSERVATIVE. QUESTA CARATTERISTICA PUO' ESSERE UTILE ANCHE IN CASI DI ACCESSO RIDOTTO CON APERTURA DELLA BOCCA LIMITATA.

2. SONDAGGIO

GLI STRUMENTI UTILI SONO:

- K FILES MANUALI Ø8 E 10



DI FONDAMENTALE IMPORTANZA PER VALUTARE L'ANATOMIA E LA CONSEGUENTE DIFFICOLTÀ' DEL CASO SONO L'ANALISI DELLA RX PREOPERATORIA E IL RISCONTRO DEL SONDAGGIO MANUALE CON FILES DI DIAMETRO SOTTILE (08-10). A DIFFERENTI ANATOMIE, CORRISPONDERANNO APPROCCI CLINICI DI SAGOMATURA DIVERSI.

2. SONDAGGIO



SE LO STRUMENTO NON RAGGIUNGE L'APICE IN MODO PASSIVO MA SI BLOCCA NEL PERCORSO, E' OPPORTUNO NON FORZARE E RIMUOVERE LE INTERFERENZE CORONALI. PUO' ESSERE UTILE IRRIGARE PER RIMUOVERE DETRITI IN SOSPENSIONE E UTILIZZARE CHELANTI IN GEL PER EVITARE LA FORMAZIONE DI TAPPI

3. E 4. GLIDE PATH E SAGOMATURA IN CANALI SEMPLICI

GLI STRUMENTI UTILI
SONO:

- 15/Ø8

- 10/Ø3

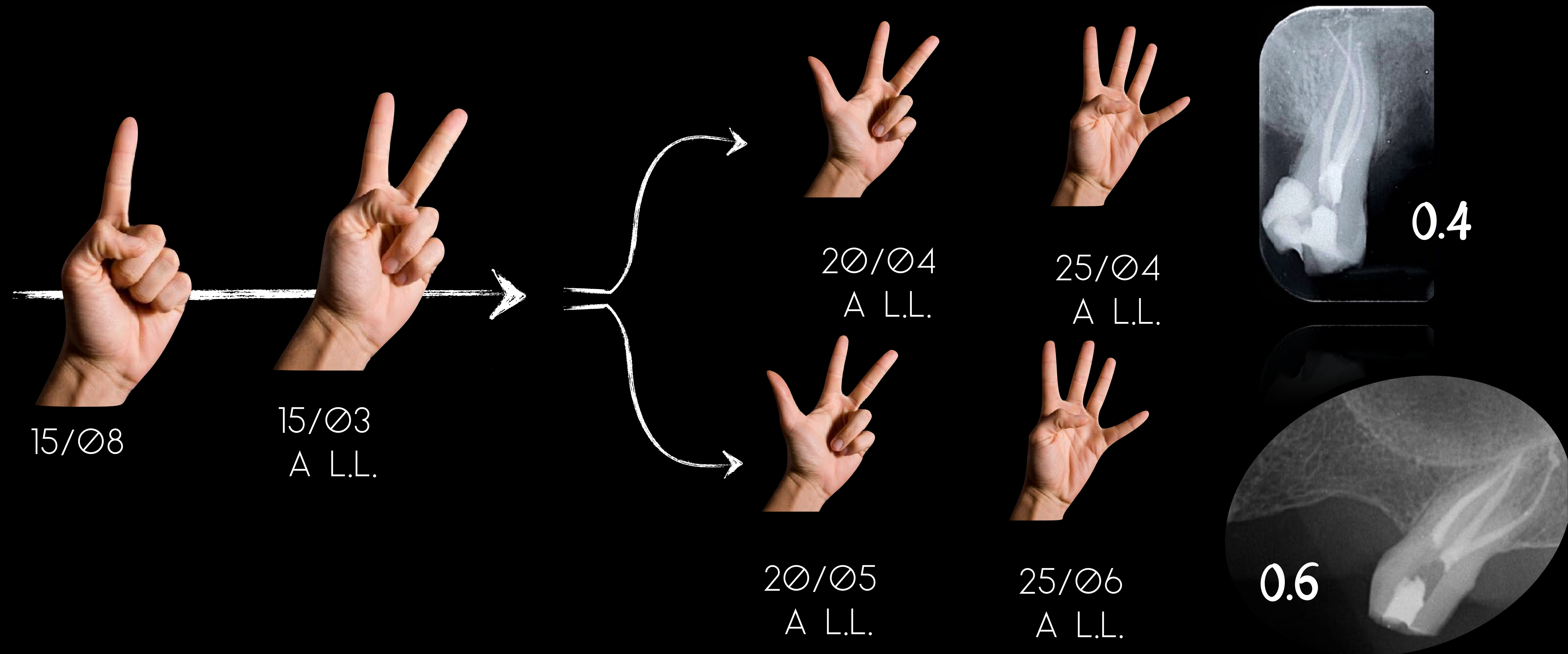
- 20/Ø4

- 25/Ø4



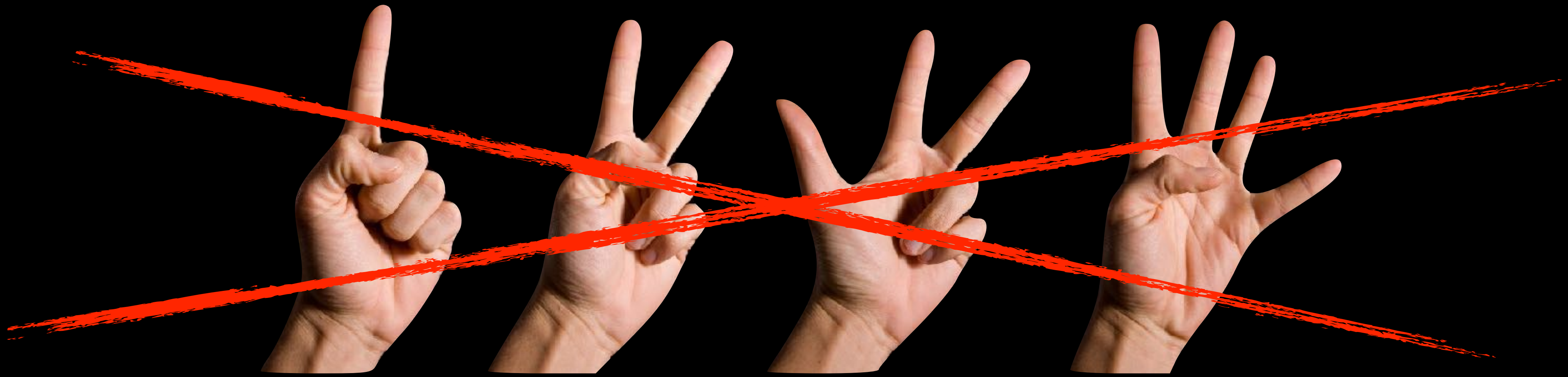
IN CANALI SEMPLICI E' SPESSO SUFFICIENTE PORTARE TUTTI GLI STRUMENTI
IN MODO PROGRESSIVO A LUNGHEZZA DI LAVORO RISPETTANDO LA
SEQUENZA BASE CONSIGLIATA.

3. E 4. GLIDE PATH E SAGOMATURA IN CANALI SEMPLICI CONICITA' 04 O CONICITA' 06

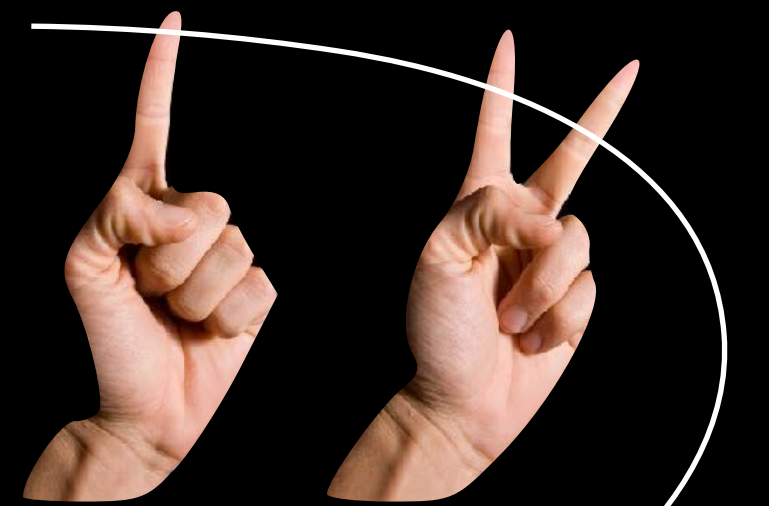


3. E 4. GLIDE PATH E SAGOMATURA IN CANALI COMPLESSI

IN ANATOMIE COMPLESSE, PUO' NON ESSERE POSSIBILE RAGGIUNGERE LA LUNGHEZZA DI LAVORO CON TUTTI GLI STRUMENTI IN MODO PROGRESSIVO RISPETTANDO LA SEQUENZA BASE. IN QUESTI CASI, E' CONSIGLIABILE GIOCARE CON I VARI DIAMETRI E CONICITA' AL FINE DI RIDURRE LE INTERFERENZE CORONALI E FAVORIRE LO SCORRIMENTO DEL FILE PIU' SOTTILE A LUNGHEZZA DI LAVORO

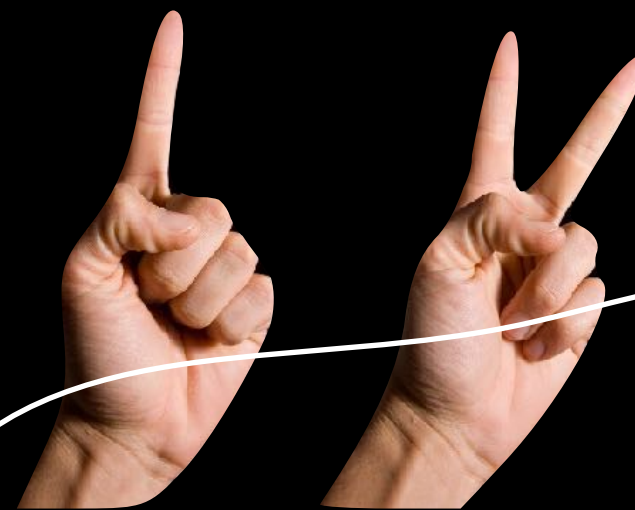


3. E 4. GLIDE PATH E SAGOMATURA IN CANALI COMPLESSI



15/08

15/03 FINCHE'
SCENDE PASSIVO



15/08

15/03 FINCHE'
SCENDE PASSIVO



20/04 FINCHE'
SCENDE PASSIVO



15/08



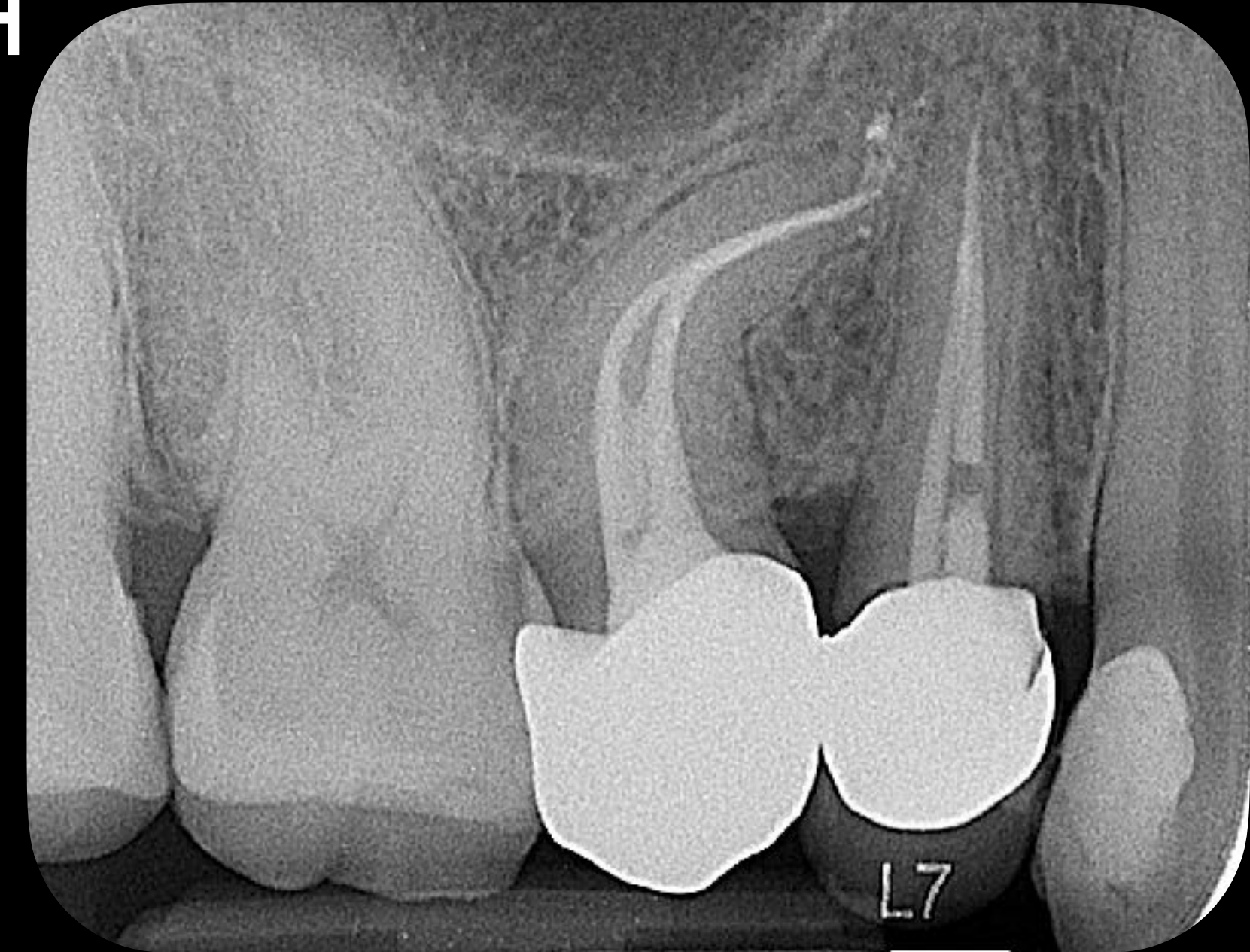
15/03 FINCHE'
SCENDE PASSIVO



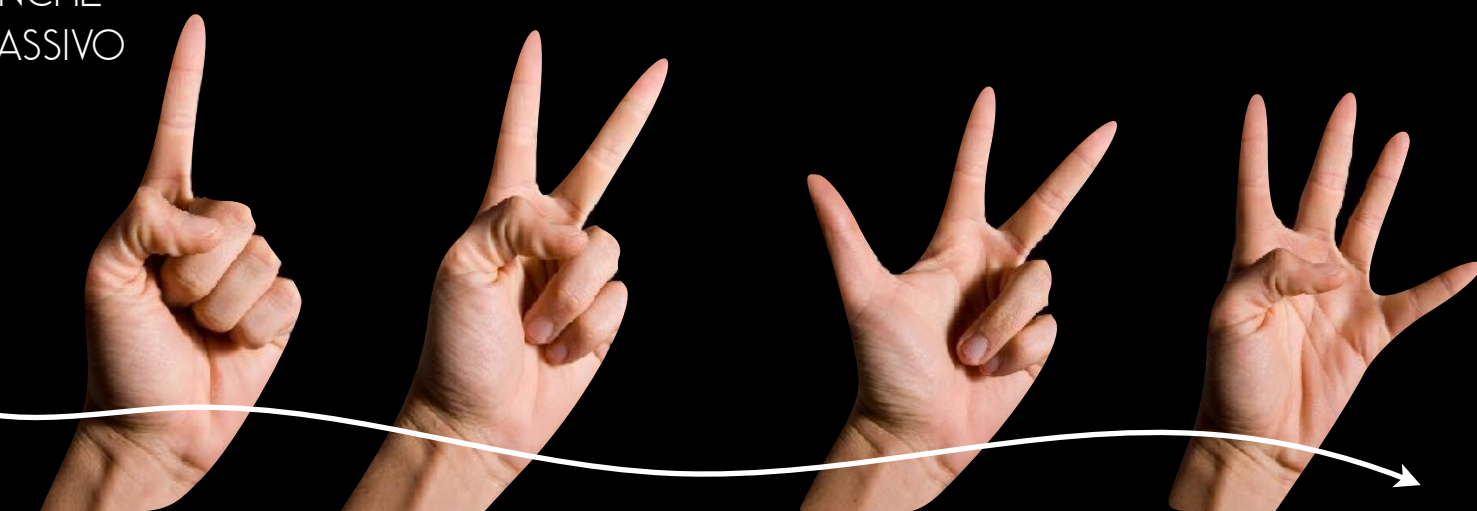
20/04 FINCHE'
SCENDE PASSIVO



25/04 FINCHE'
SCENDE PASSIVO



E' OPPORTUNO SCENDERE CON GLI STRUMENTI SENZA FORZARE ED ESEGUIRE FREQUENTI RICAPITOLAZIONI E FREQUENTI LAVAGGI AL FINE DI RAGGIUNGERE LA LUNGHEZZA DI LAVORO IN SICUREZZA



15/08

15/03 A L. L.

20/04 A L. L.

25/04 A L. L.

5. RIFINITURA APICALE

GLI STRUMENTI UTILI SONO:

- 30/04 E 30/06
- 35/04
- 40/04
- 50/04
- 60/04



UNA VOLTA DETERMINATO IL DIAMETRO APICALE, E' NECESSARIO ADEGUARE LA PREPARAZIONE DEL TERZO APICALE CON UN FINISHER DEL DIAMETRO CORRISPONDENTE. IL TRATTAMENTO TERMICO DELLA LEGA GARANTISCE UN UTILIZZO IN SICUREZZA E NEL PIENO RISPETTO DELL'ANATOMIA ANCHE CON STRUMENTI DI DIAMETRO IMPORTANTE

TIPS & TRICKS

- LO STRUMENTO 15/Ø8 CONSENTE UNA RIDUZIONE DELLO STRESS NELLA SAGOMATURA DI TUTTI GLI STRUMENTI ROTANTI SUCCESSIVI. LO SPECIALE TRATTAMENTO TERMICO LO RENDE MOLTO VERSATILE IN QUANTO PRECURVABILE E FLESSIBILE SEBBENE ABBIA UNA CONICITA' Ø8.
- LO STRUMENTO 15/Ø3 E' IL PIU' SOGGETTO A STRESS MECCANICO E PER QUESTO RICHIEDE UN TURN OVER PIU' FREQUENTE. E' IMPORTANTE NON FORZARE NELLA PROGRESSIONE DEL FILE CHE DEVE ESSERE PASSIVA. IN CASO DI IMPEDIMENTO, RICAPITOLARE CON 15/Ø8 E MODIFICARE LA SEQUENZA CON TECNICA CROWN-DOWN.
- IL TRATTAMENTO TERMICO DELLA LEGA RENDE I FILES MOLTO PIU' FLESSIBILI, PIU' RESISTENTI E GARANTISCE IL RISPETTO DELL'ANATOMIA E LA SICUREZZA. LA MINORE EFFICENZA DI TAGLIO VIENE COMPENSATA DALLA CORRETTA APPLICAZIONE DELLA SEQUENZA OPERATIVA CONSIGLIATA
- L'UTILIZZO IN SICUREZZA DEGLI STRUMENTI ROTANTI PRESUPPONE UN CONTINUO MOVIMENTO NEL CANALE SOPRATTUTTO IN PRESENZA DI CURVE E DI NON FORZARE IN PRESENZA DI IMPEDIMENTI.

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'

15/Ø8

15/Ø3

25/Ø4
20/Ø4

30/Ø4 - 60/Ø4



PIU' CORTO DI L.L.

A LUNGHEZZA DI LAVORO

1

PREFLARING

2

SCOUTING

3

GLIDE PATH

4

SHAPING

5

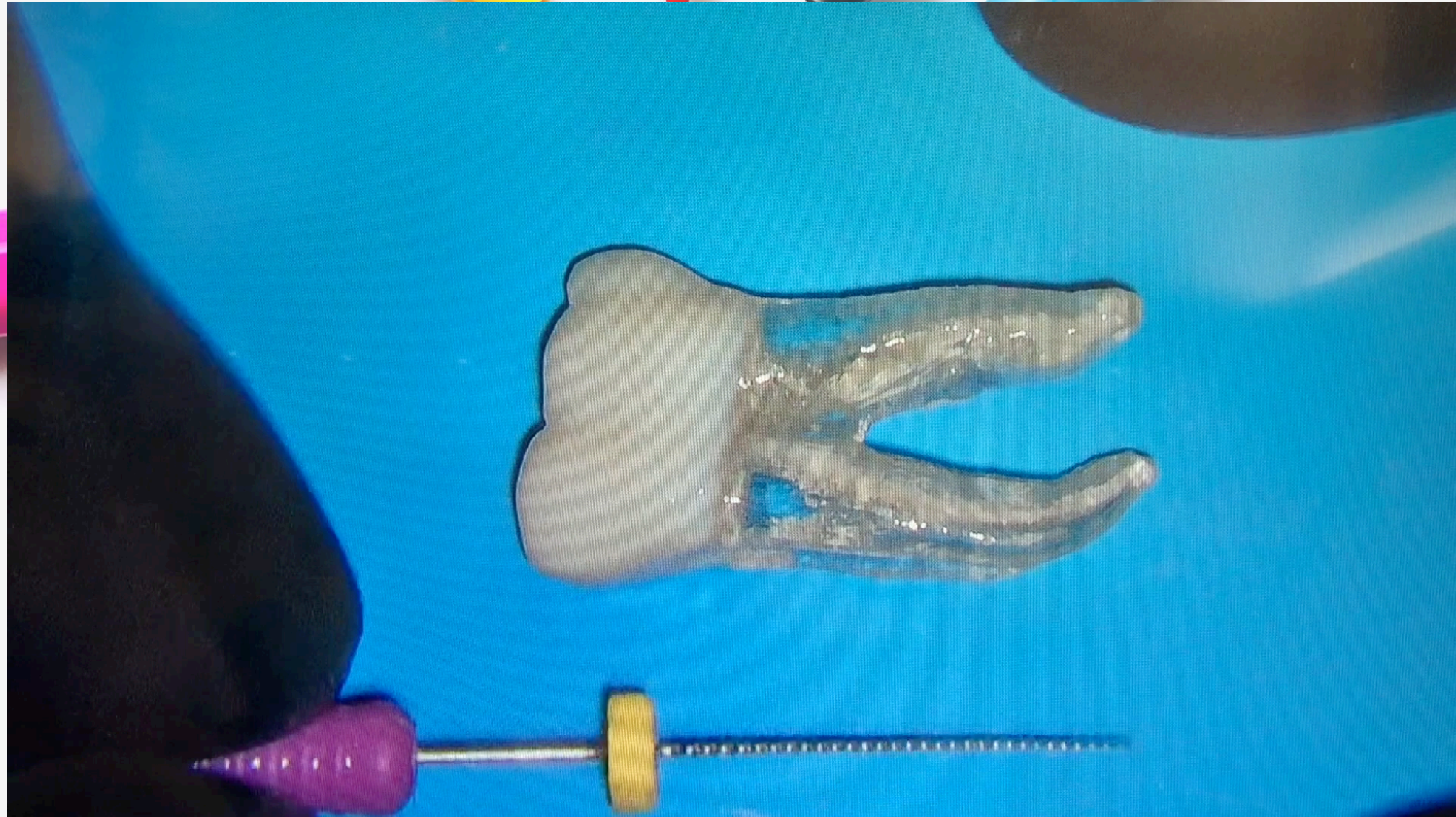
FINISHING

500RPM
25Ncm

300RPM
15Ncm

500RPM
25Ncm

400RPM
25Ncm



SCOPRI LE NOSTRE ATTIVITA':

- Corso Avanzato
Ritrattamenti & Chirurgia
- Corso Base
Endodonzia Microscopica



GRAZIE

ShapeIT[®]



DR. GIACOMO SUARDI



DR. FABIO PICCOTTI



DR. ANDREA BALOCCO



DR. MARCO BUCCI



DR. GIANLUCA FUMEI