

RIMINI 15-16-17 Maggio 2025



# SPEAKER SESSIONS

ShapeIT<sup>®</sup>  
*Shape the Future of Endodontics*

Sagomatura con sistematica  
**PRO FLEX N.H.A.**

Otturazione canalare con i bioceramici  
**FILL ROOT<sup>ST</sup> e WELL ROOT<sup>PT</sup>**



**15 Maggio**  
ore 16:00



**16 Maggio**  
ore 10:00

Prof. FUMEI

*Gianluca*

PROFESSORE A.C. ODONTOIATRIA, CONSERVATIVA ED ENDODONZIA



EXPO DENTAL MEETING



Stand  
**C3/001**





# Obbiettivi del Trattamento

- MECCANICI**
- \* Conicità continua da corona ad apice
  - \* PreServare le curvature del canale
  - \* PreServare il diametro apicale

- BIOLOGICI**
- \* Rimuovere la polpa malata
  - \* Ridurre la carica batterica



## Cleaning and Shaping the Root Canal

Herbert Schilder, D.D.S.\*

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

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

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

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

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

DETERSIONE

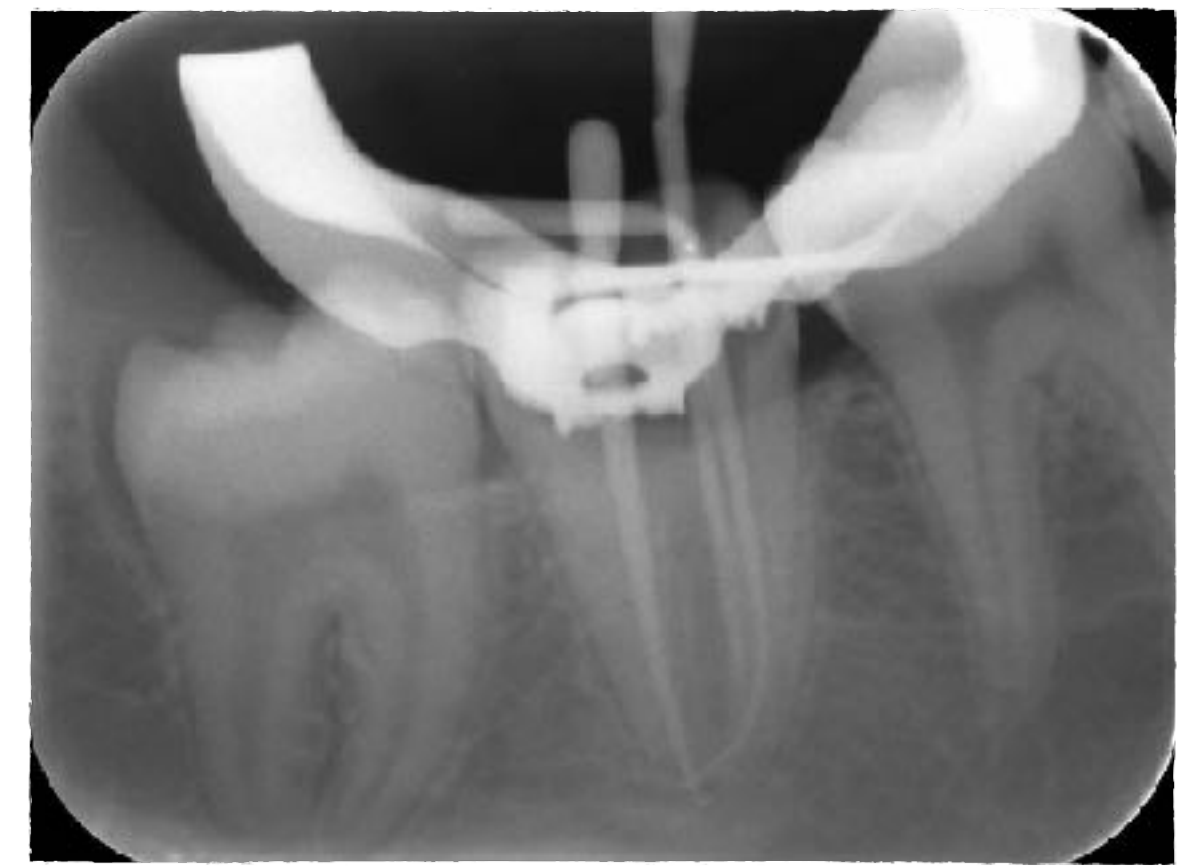
SAGOMATURA

OTTURAZIONE





**Sagomatura**



**Detersione**



**Otturazione**







Minimally

Invasive

Endodontics



# Preservare la dentina

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

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

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

[Pilo R](#), [Shapenco E](#), [Lewinstein I](#).

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

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

[Ikram OH](#), [Patel S](#), [Sauro S](#), [Mannocci F](#).

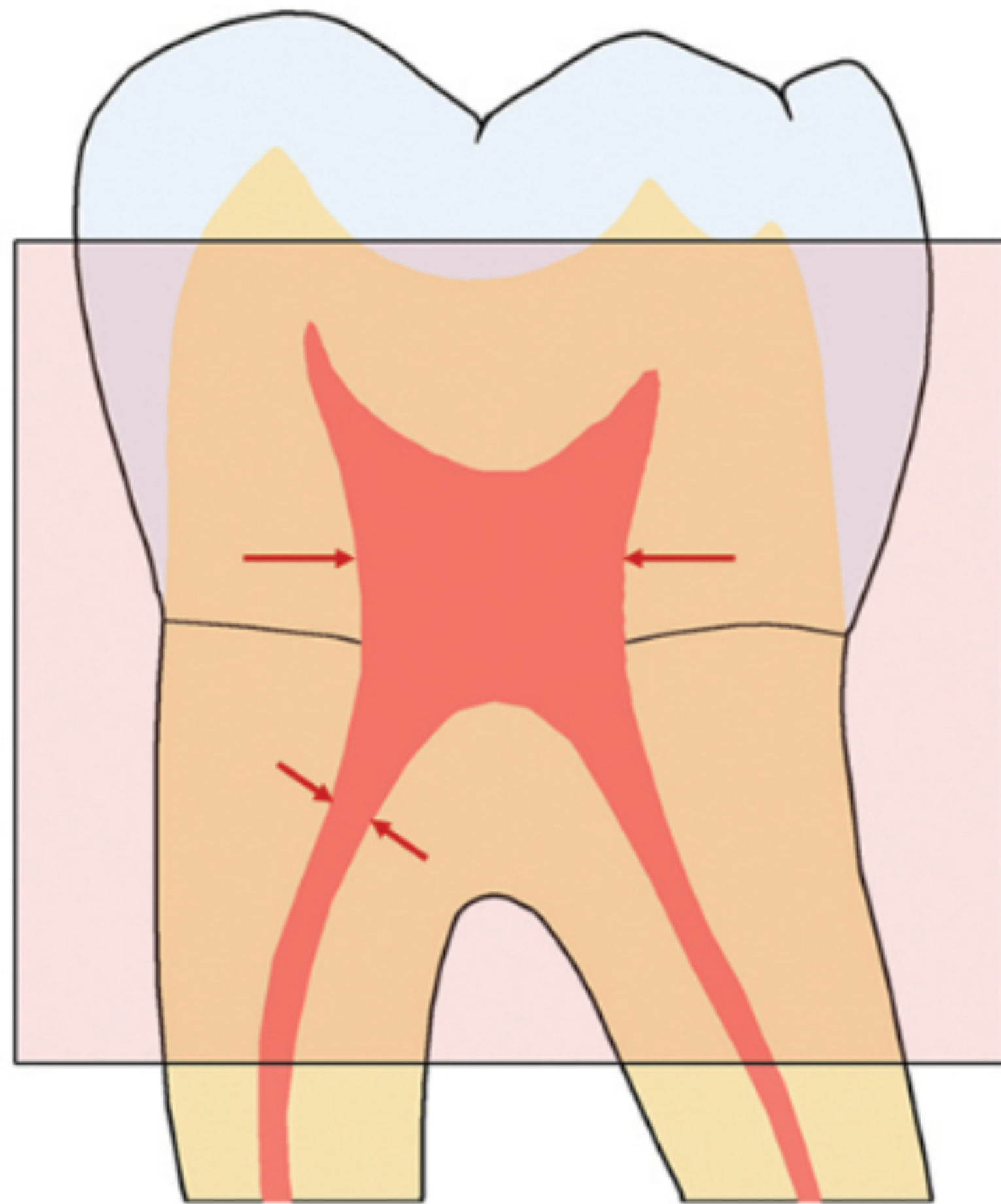
[J Endod](#). 2006 Mar;32(3):202-5.

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

[Katz A](#), [Wasenstein-Kohn S](#), [Tamse A](#), [Zuckerman O](#).

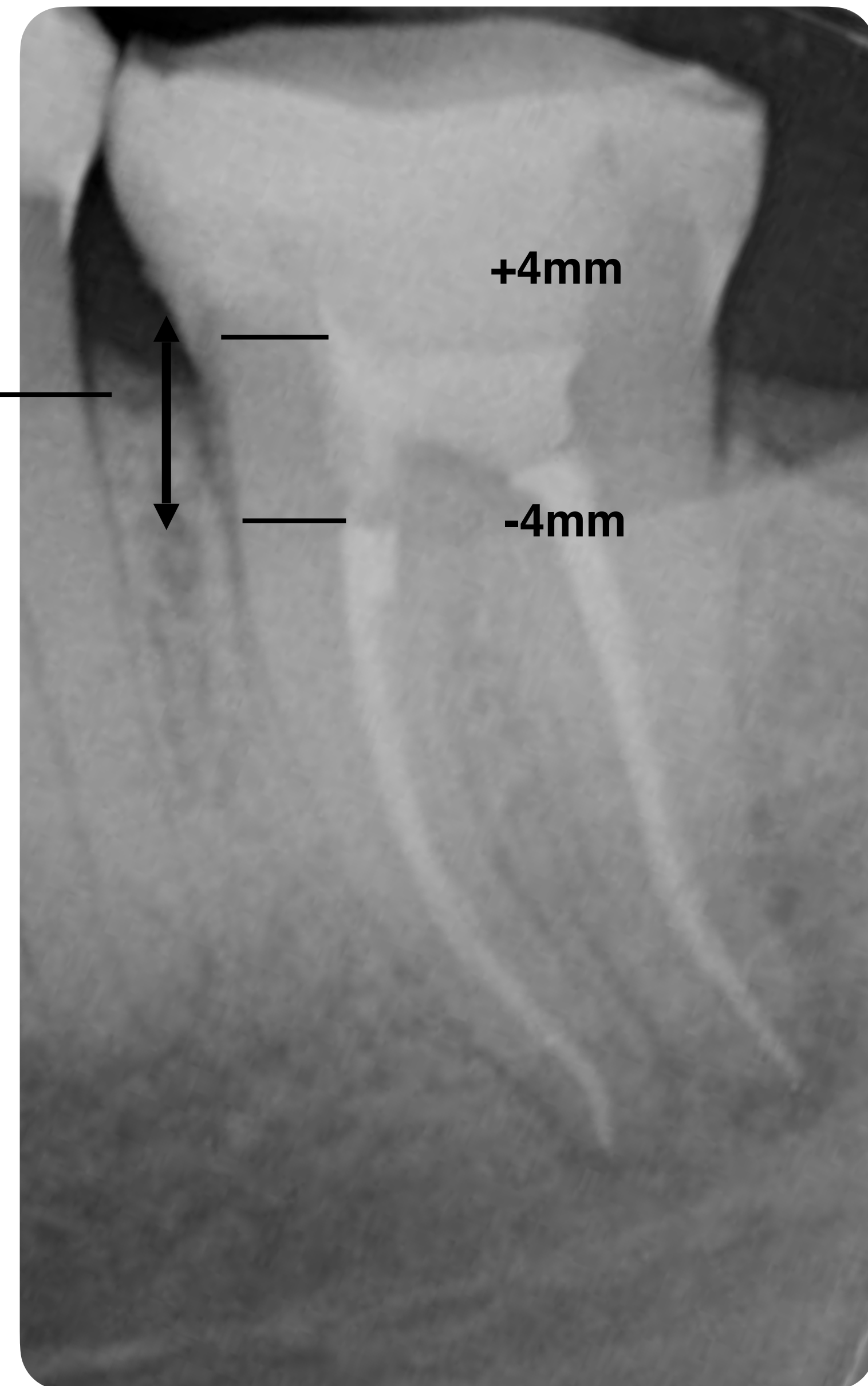


# CONSERVAZIONE DELLA DENTINA PERICERVICALE

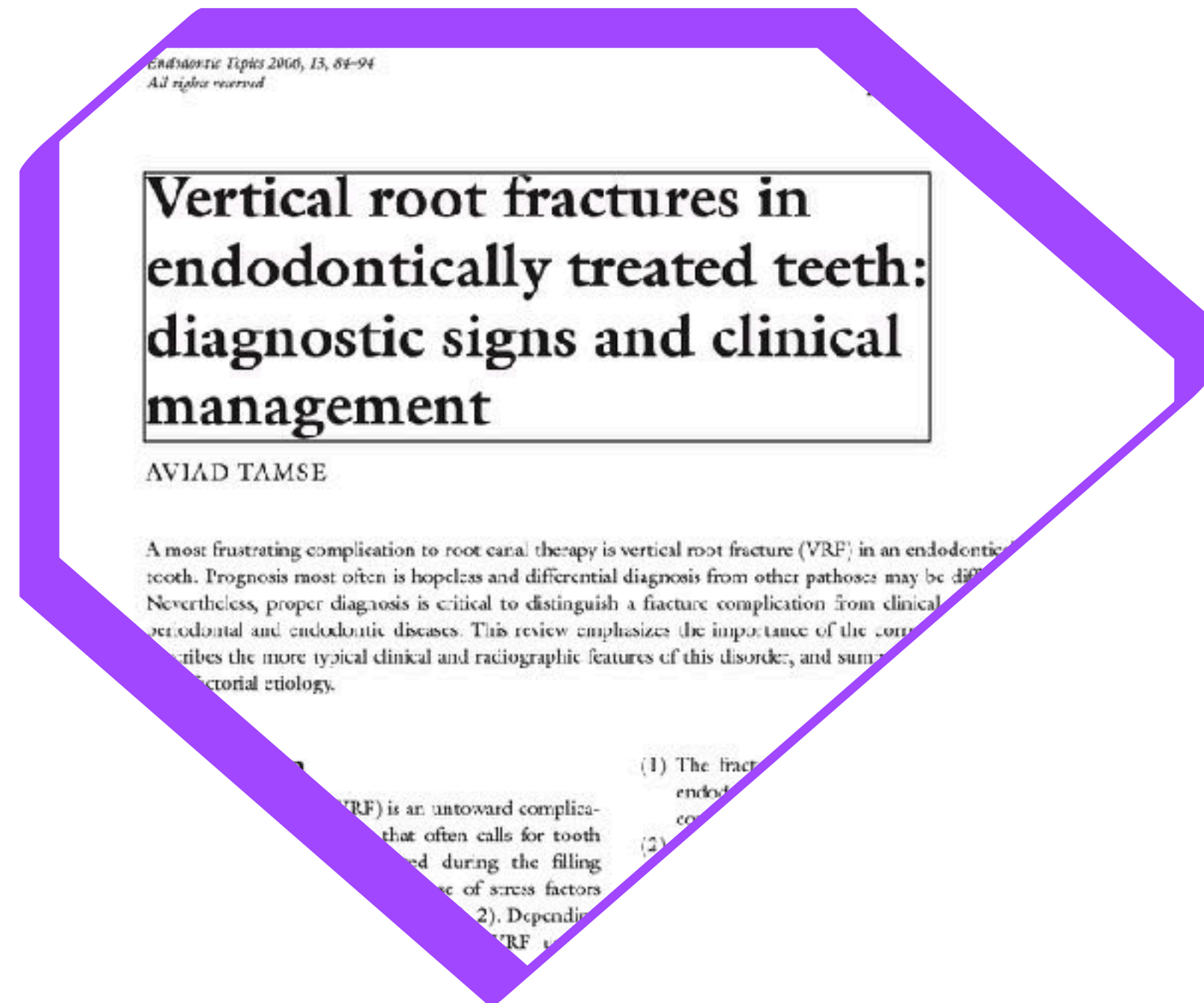


1. LA DENTINA PERICERVICALE È LOCALIZZATA GENERALMENTE A **4MM CORONALMENTE E APICALMENTE** ALLA CRESTA ALVEOLARE
2. LA DENTINA PERICERVICALE È INSOSTITUIBILE

PCD







“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**”

## CONSERVATIVE APPROACH



SAFETY



Preservare la  
**massima** quantità  
di tessuto dentale  
durante la terapia  
endodontica  
“Evitare” la  
**frattura** degli  
strumenti rotanti



Treatment  
Plan

ANATOMY

diagnosis

knowledge

skills

Tips & tricks

Structure  
Preservation

tools

longevity

new technologies

research





EXPECTING THE UNEXPECTED Partnoy 2005





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

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

Schäfer E<sup>1</sup>, Diez C, Hoppe W, Tepel J.

### **+ Author information**

#### **Abstract**

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



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

Schäfer E<sup>1</sup>, Diez C, Hoppe W, Tepel J.

### Author information

## Abstract

Canal curvatures of 700 permanent teeth were measured as a part of the canal. For each type of tooth, the curvature was measured into the canals, and the teeth were radiographed. The radiographs were computerized digital image processing with radii  $< 40$  mm. Thirteen percent of the teeth investigated had curves  $> 35$  degrees. To define the canal curvature mathematically, the curvature was measured as the angle between the long axis of the tooth and the long axis of the canal.

1163 roots examined:  
980 (84%) curved

the curvatures and the length of the curved  
ed. Size 08 silver points were inserted  
nique. All radiographs were analyzed by a  
d 65% showed an angle  $\leq 27$  degrees  
ter than 15 mm, and 9% of all canals that  
eth was 75 degrees with a radius of 2 mm.  
curve should be given.

65% angle  $< 27^\circ$   
30% angle  $27-35^\circ$   
9% angle  $> 35^\circ$





# DAILY PRACTICE



# Strumentazione Endodontica



# FILE MANUALI



# FILE ROTANTI





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

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

Root canal files in size #15 and triangular cross-sections were fabricated from 0.020-inch diameter arch wires of Nitinol, a nickel-titanium orthodontic alloy with a very low modulus of elasticity. A unique manufacturing process was used in which the fluted structure of a K-type file was machined directly on the starting wire blanks. The Nitinol files were found to have two to three times more elastic flexibility in bending and torsion, as well as superior resistance to torsional fracture, compared with size #15 stainless steel files manufactured by the same process. The fracture surfaces were observed with the scanning electron microscope and exhibited a largely flat clockwise 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 zip formation, perforation of the canal, and separation or fracture of the instrument (1). As a consequence, the root canal morphology is adversely altered, a violation of the basic principle that endodontic preparation is to retain the original shape of the canal. Clinicians have adopted various methods to circumvent problems with the preparation of curved canals, such as precurving instruments and using a telescopic filing technique (1-3). Weine (4) has suggested that clinicians might remove the tips of instruments at chairside to make intermediate sizes for use in the preparation of curved canals.

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

greater flexibility and can conform much better to the morphology of curved canals.

While manufacturers have recently marketed a number of new instruments based upon different cross-sectional shapes, design concepts, and fabrication procedures, in a quest for improved cutting efficiency (7) and flexibility (8), all of these brands have been fabricated from stainless steel. In this article we report the first use of an entirely new metallurgical system, 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 ground and tapered blank. For this initial feasibility study, experimental Nitinol root canal files were fabricated in size #15 and triangular cross-sections, for comparison to size #15 stainless steel files with the same cross-sectional shape and manufactured by the same process, which served as the controls.

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

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

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

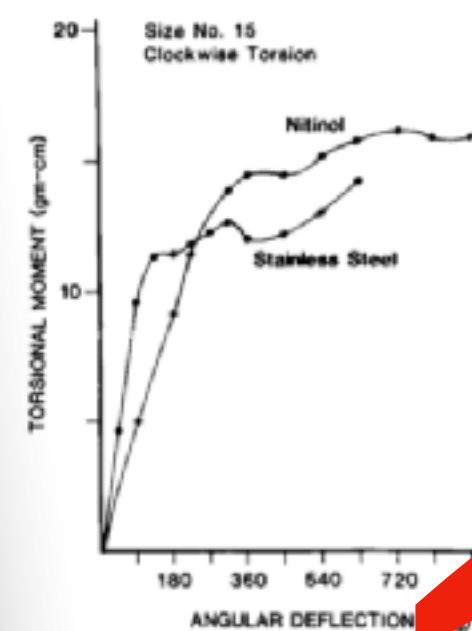


Fig. 6. Clockwise torsion test results for the size #15 Nitinol and stainless steel files.

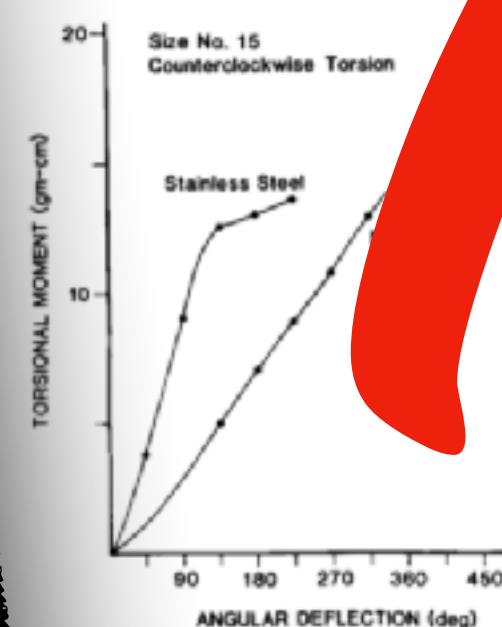


Fig. 7. Counterclockwise torsion test results for the size #15 Nitinol and stainless steel files. The two initial data points for the Nitinol files were determined with the torque meter, and the two plots were drawn to intersect the origin. Both of these considerations are pronounced in Figs. 5 and 6.

WALIA et AL JOE



# Nitinol

**Ni**ckel **Ti**tanium **N**aval **O**rdnance **L**aboratory

William J Buehler -1963- US Navy Polaris Project



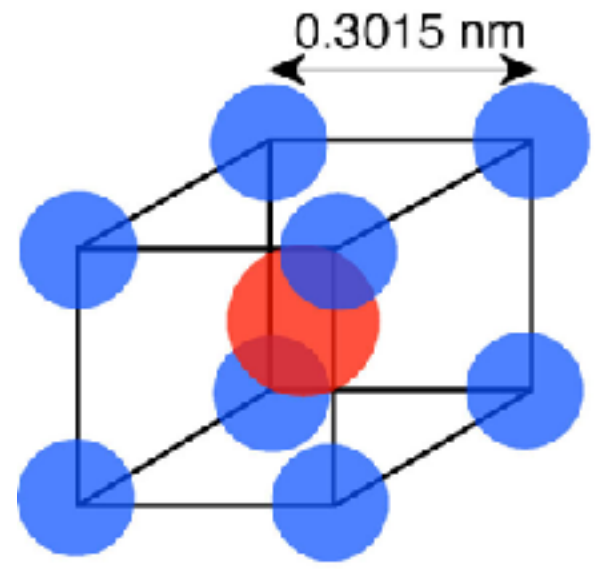
# LEGA NI-TI

- Composto binario intermetallico ed equiatomico

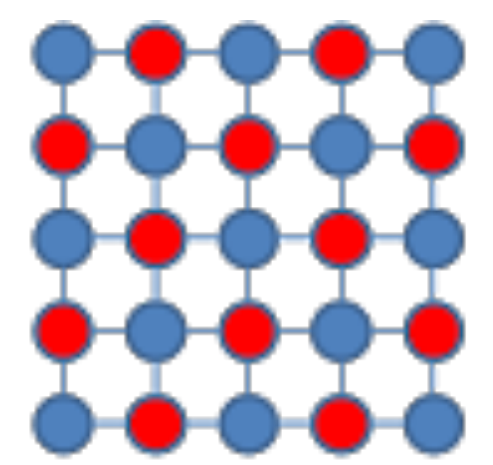
# 55-45



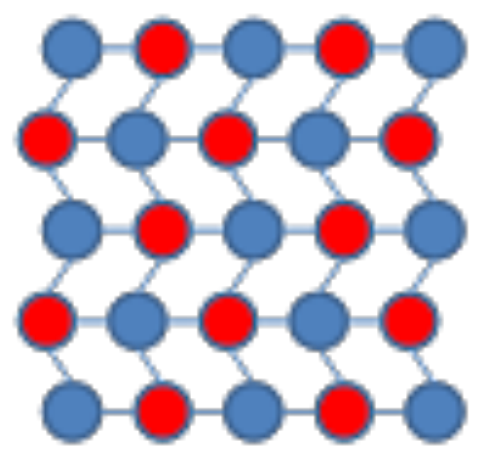




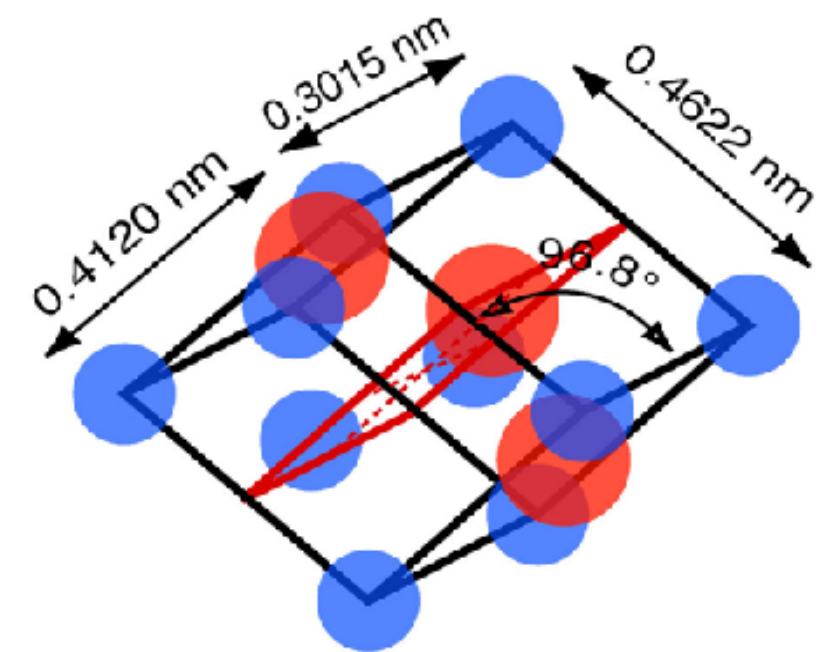
# Austenite



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



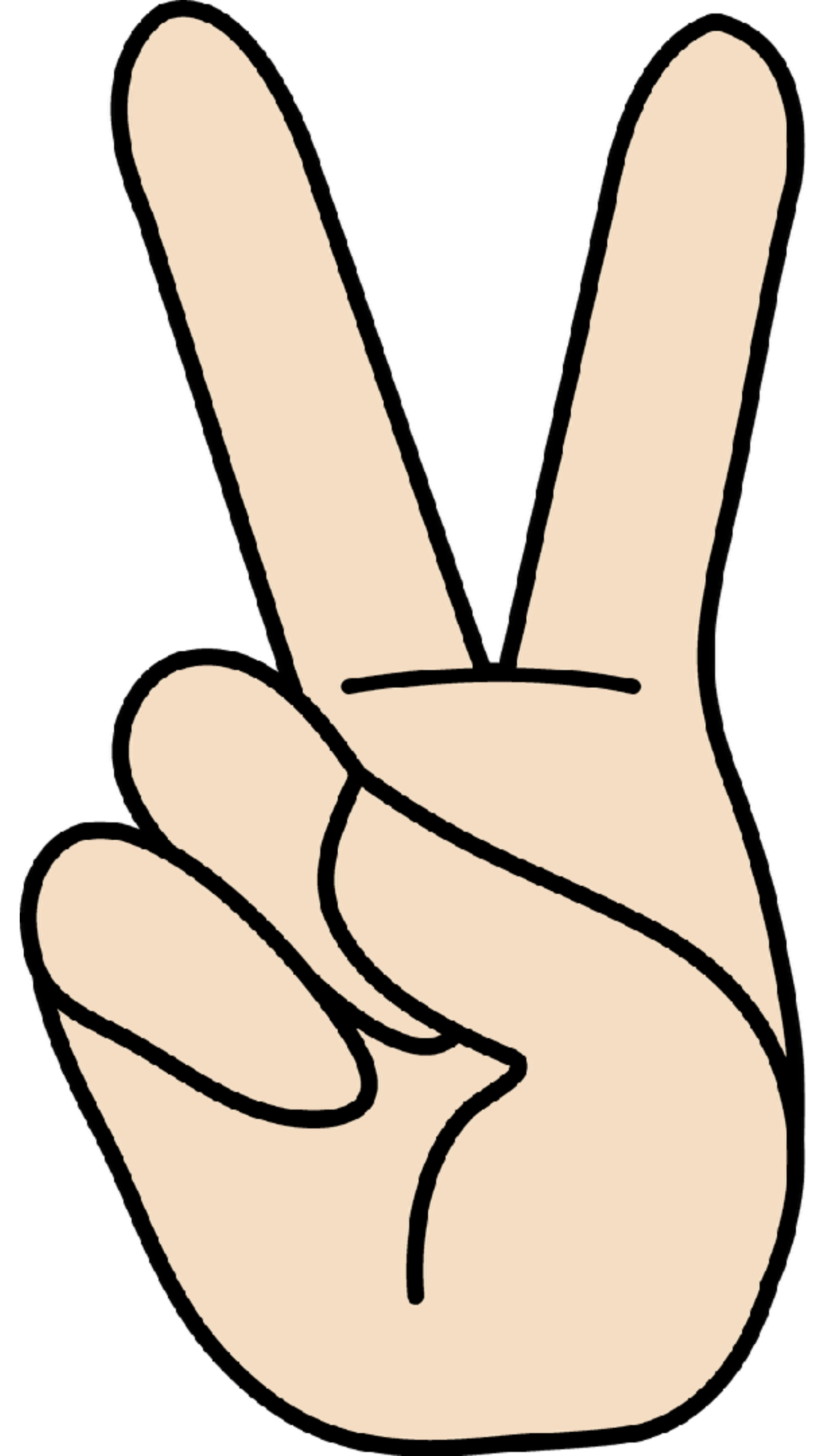
# Martensite





# NITINOL

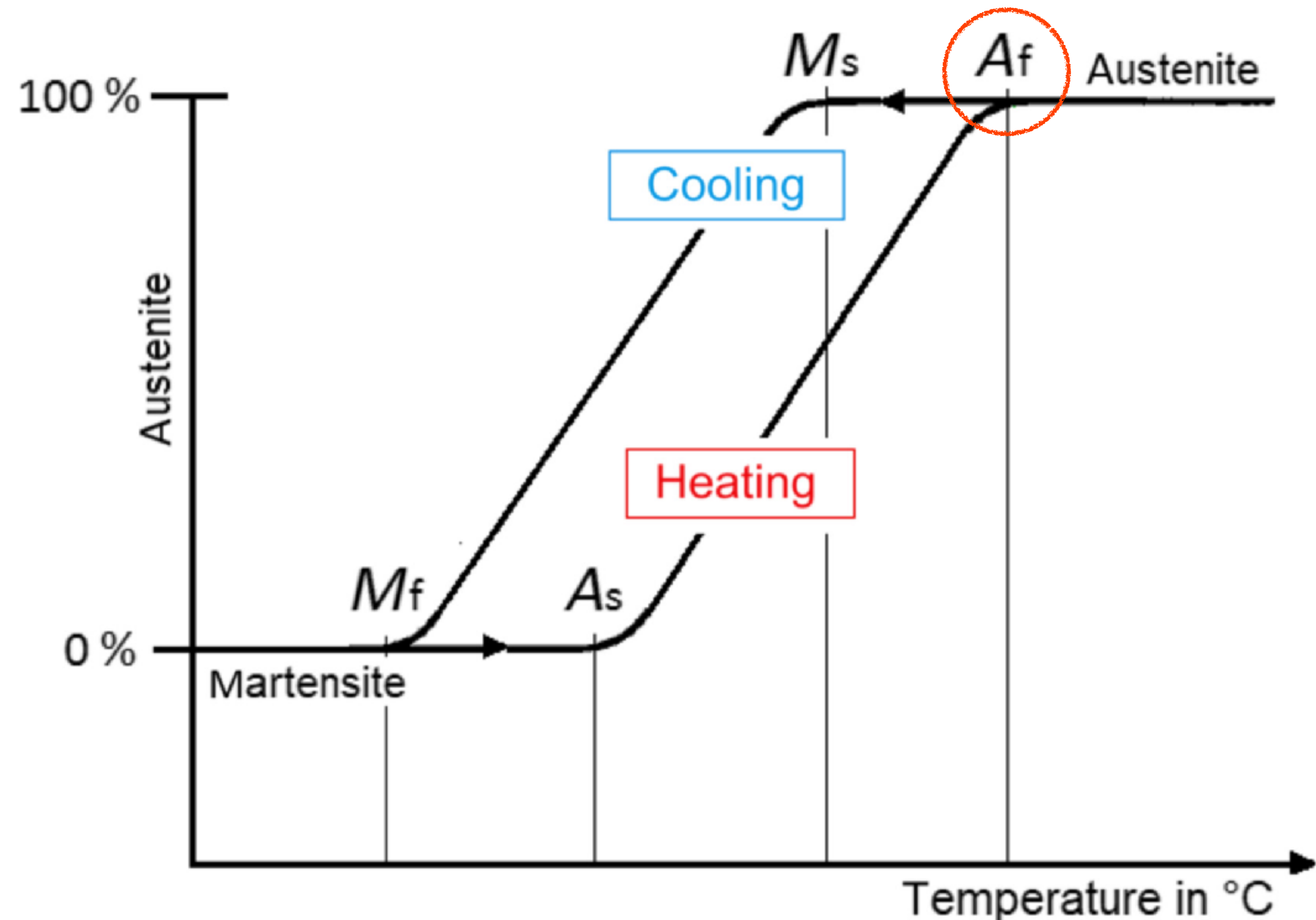
- Pseudoelasticità o Superelasticità
- Memoria di forma





# TRANSIZIONE AUSTENITE-MARTENISTE

- L'importanza della  $A_f$

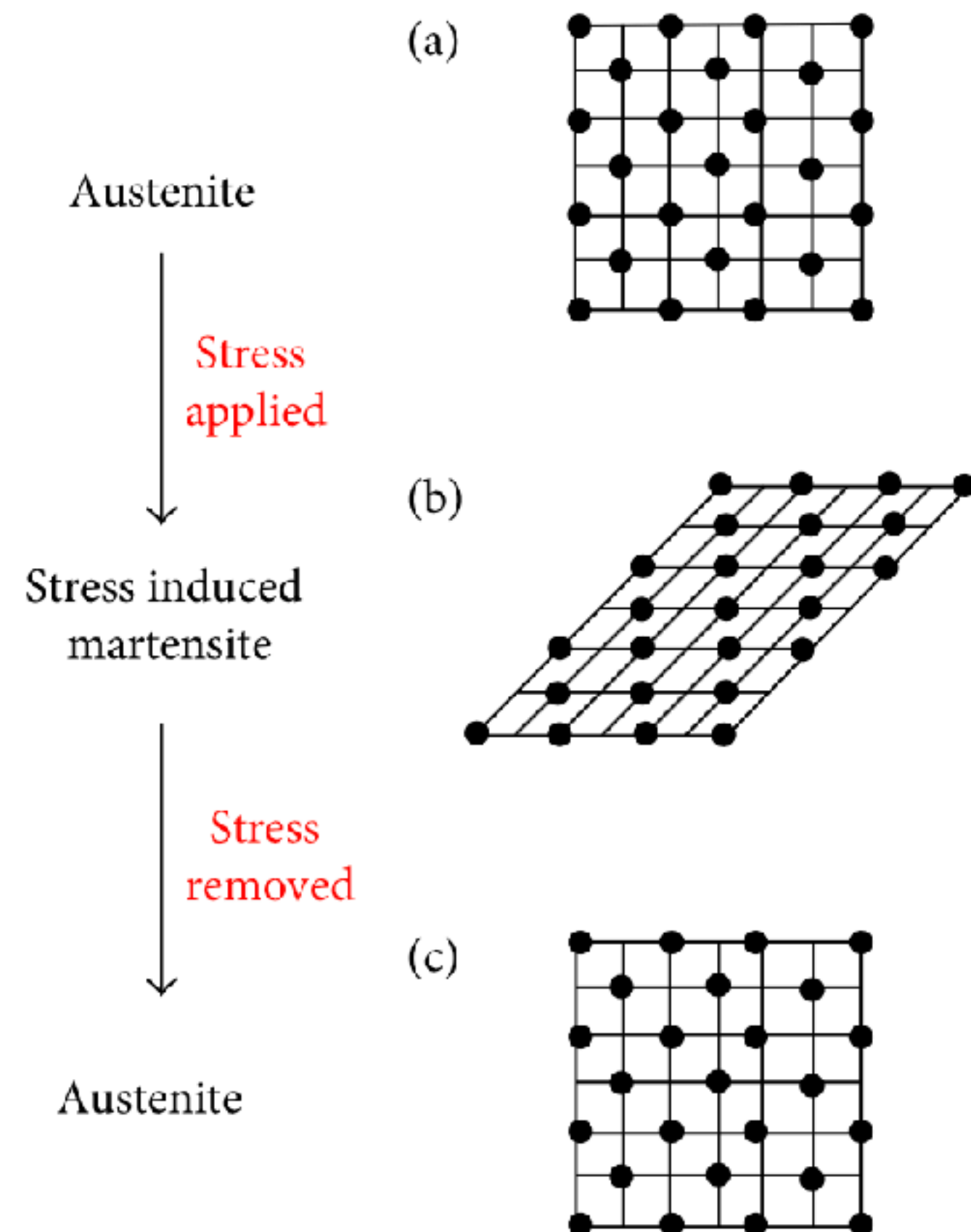




# TRANSIZIONE AUSTENITE-MARTENSITE INDOTTA DA STRESS (SIM) TEMPERATURA AMBIENTE $> A_f$

## SUPERELASTICITÀ' O PSEUDOELASTICITA'

- La lega può subire **ampie deformazioni** reversibili in campo elastico, sotto **carico costante**, per un cambiamento della struttura cristallina ( 8%)
- La temperatura alla quale avviene la transizione è maggiore della  $A_f$  ( lega completamente in fase autentica)
- Il Carico determina una transizione da Austenite a martensite indotta da stress ( SIM)
- 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 ( restoring force/spring back)**

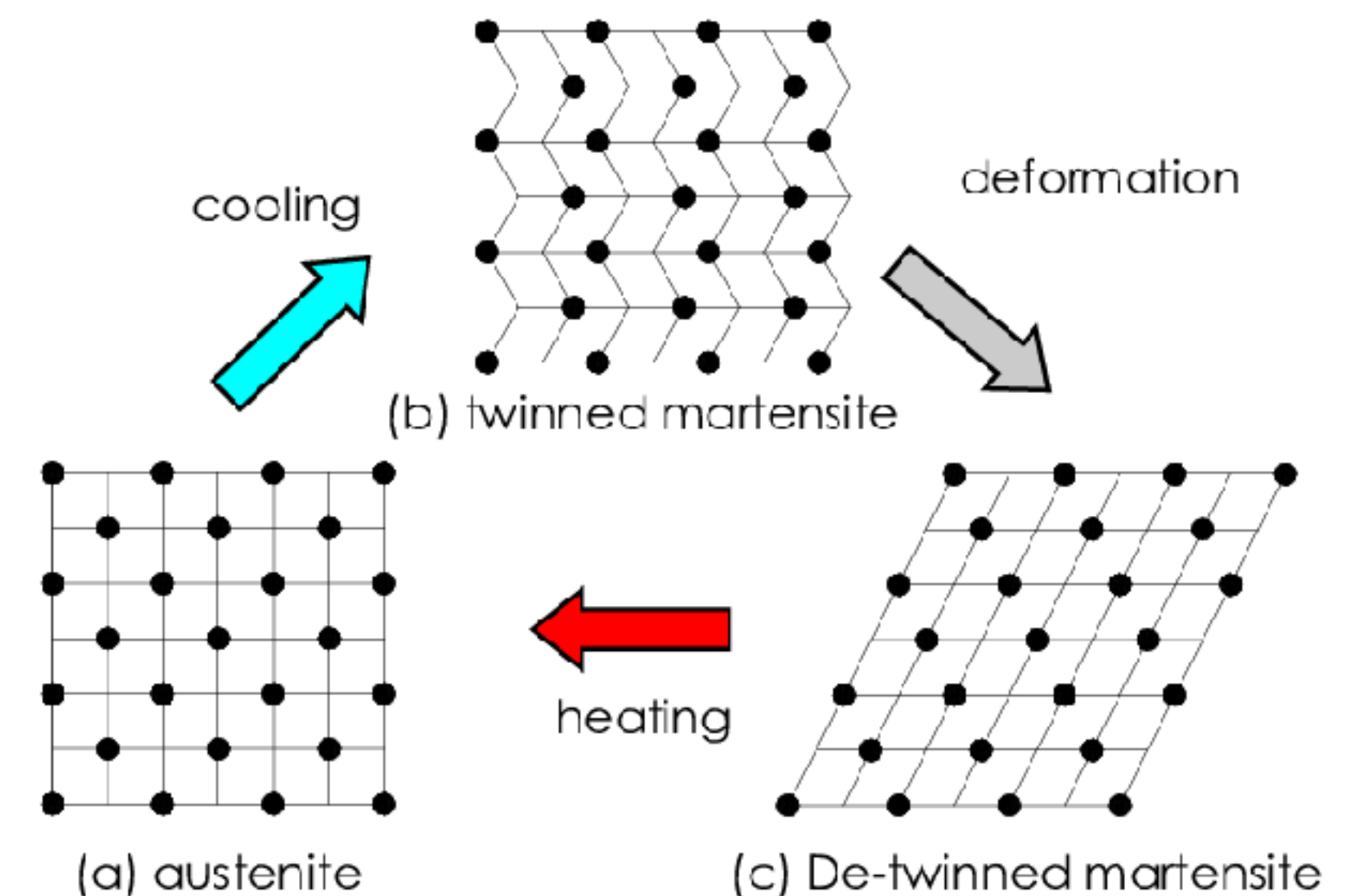




# MEMORIA DI FORMA

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

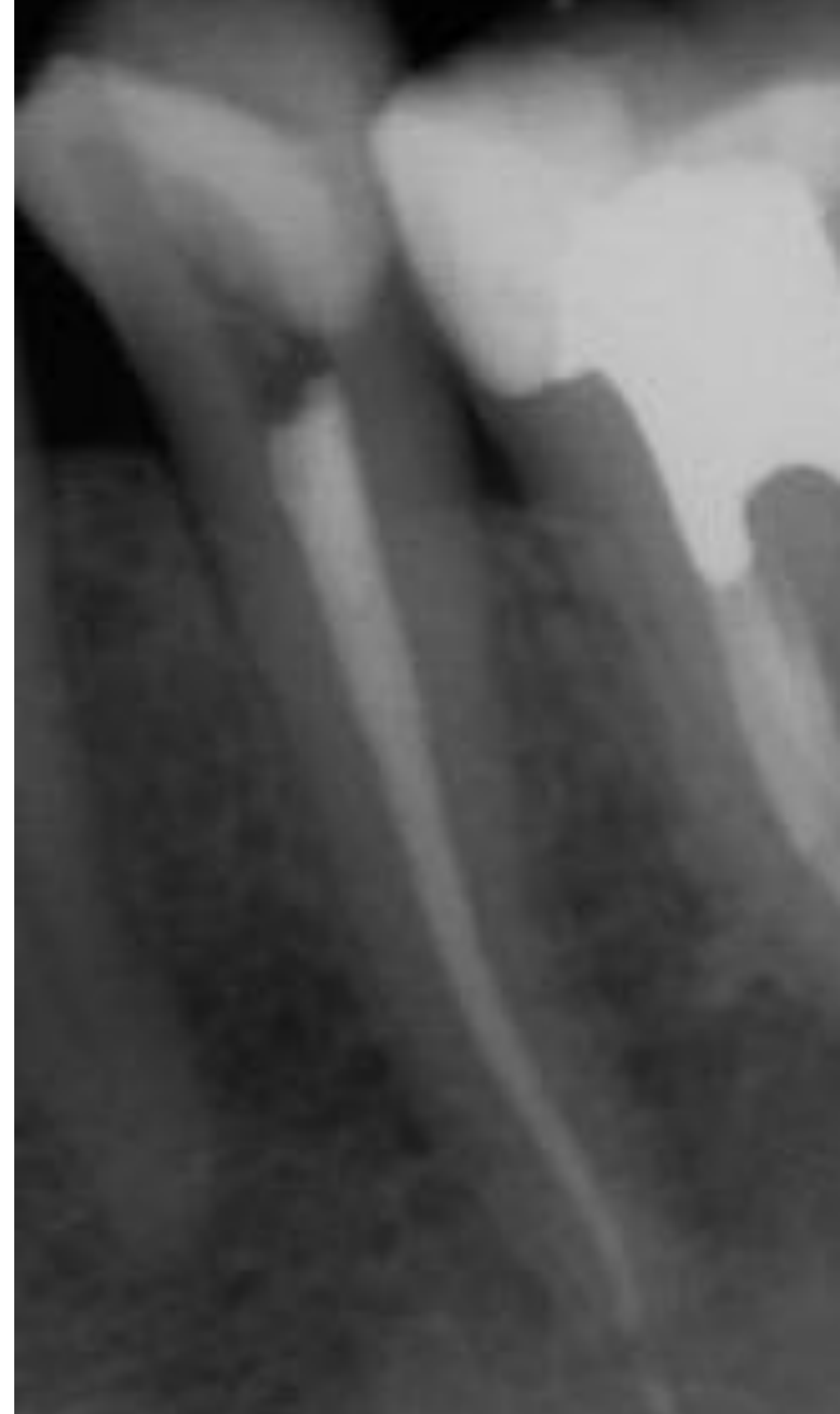
TRANSIZIONE AUSTENITE-MARTENSITE  
INDOTTA DALLA TEMPERATURA (TIM)  
TEMPERATURA AMBIENTE  $< A_F$





La lega **austenitica** sarà dura,  
rigida e con maggiori proprietà di  
esercitare la Superelasticità.

La lega **martensitica** d'altra parte  
sarà morbida, duttile e  
facilmente deformabile e con  
proprietà di Memoria di Forma.





NEL  
DENTE?

Nitinol

More Flexible

More Resistant

VS

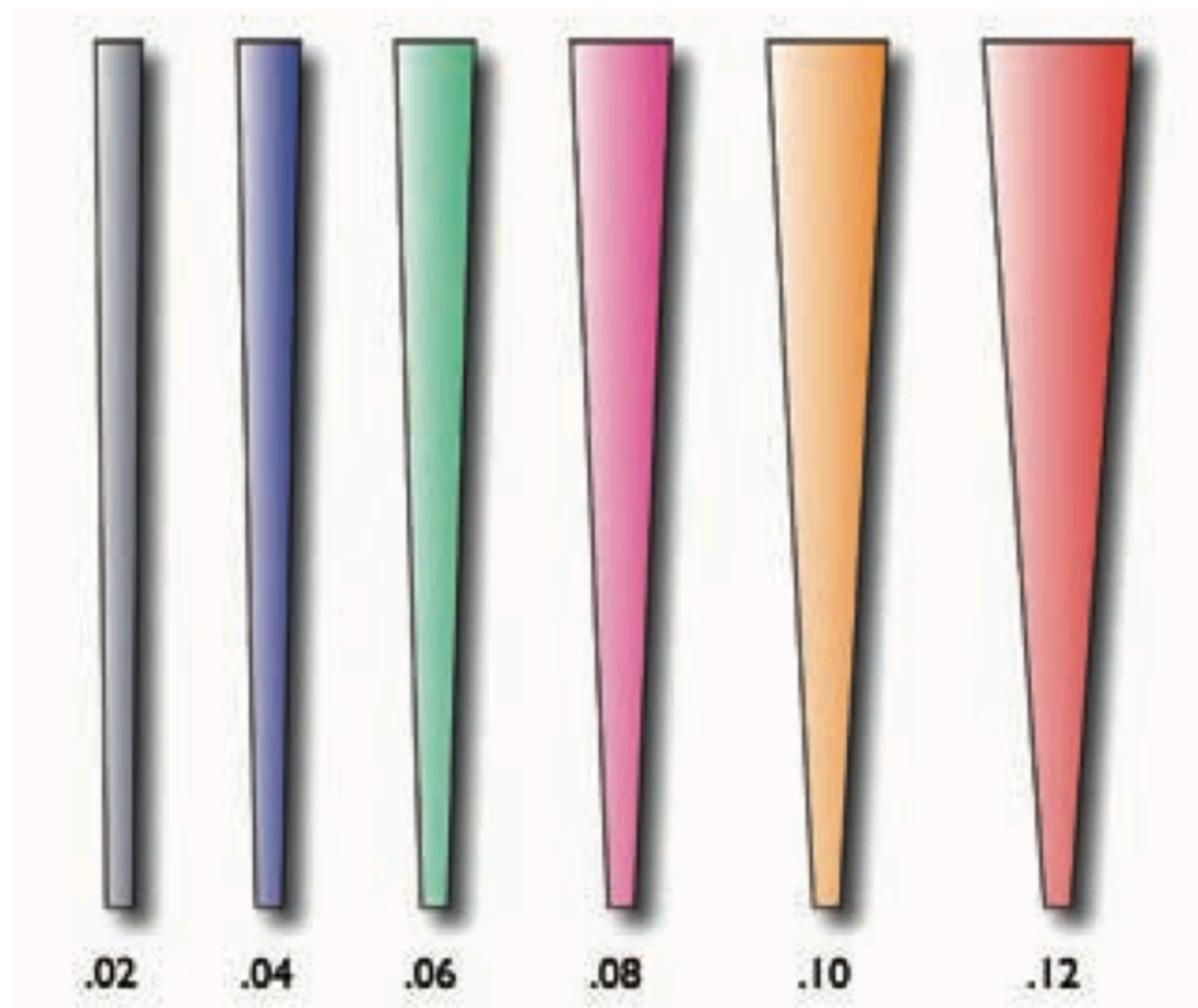
Stainless  
Steels





# LEGA NI-TI

- Strumenti a conicità aumentata



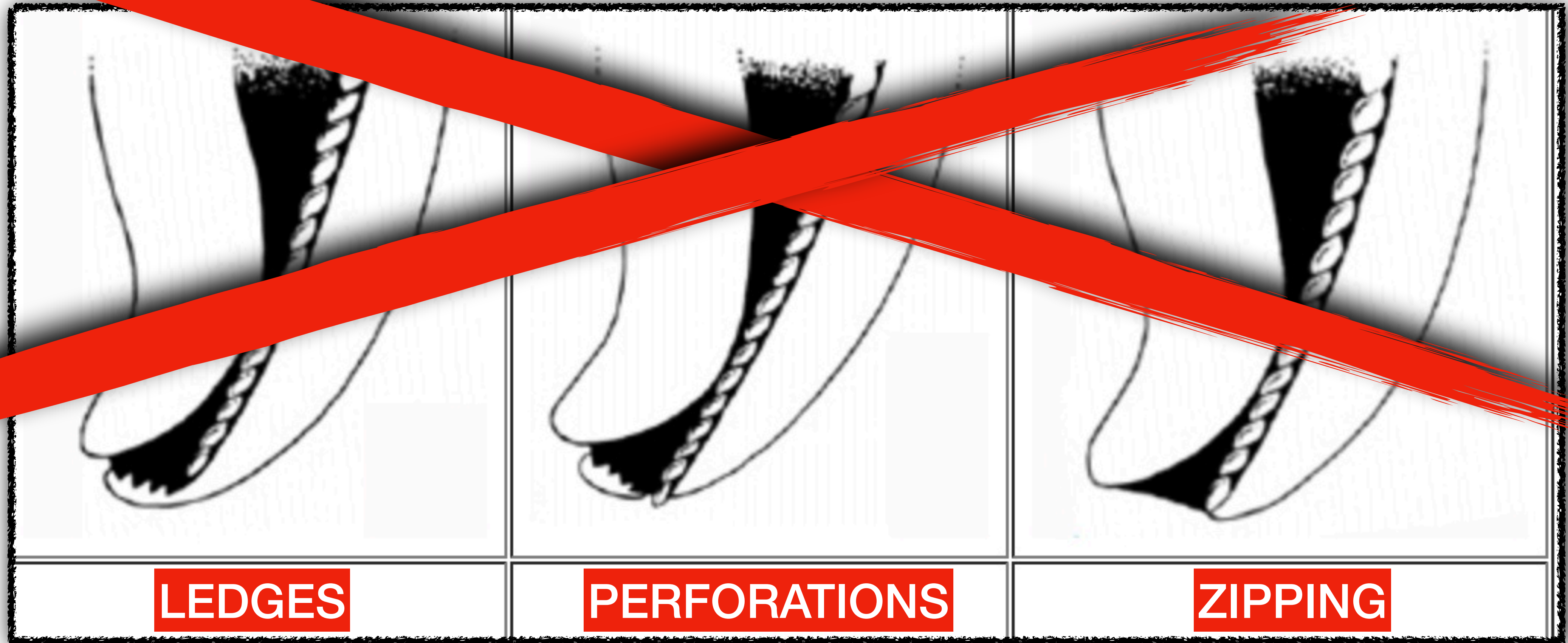
# NI-TI ROTARY FILE

- \*PreServare l'anatomia
- \*Rimanere centrato nel canale
- \*Efficienza di taglio
- \*Numero ridotto di paSSaggi / Sequenza breve
- \*ReSiStente

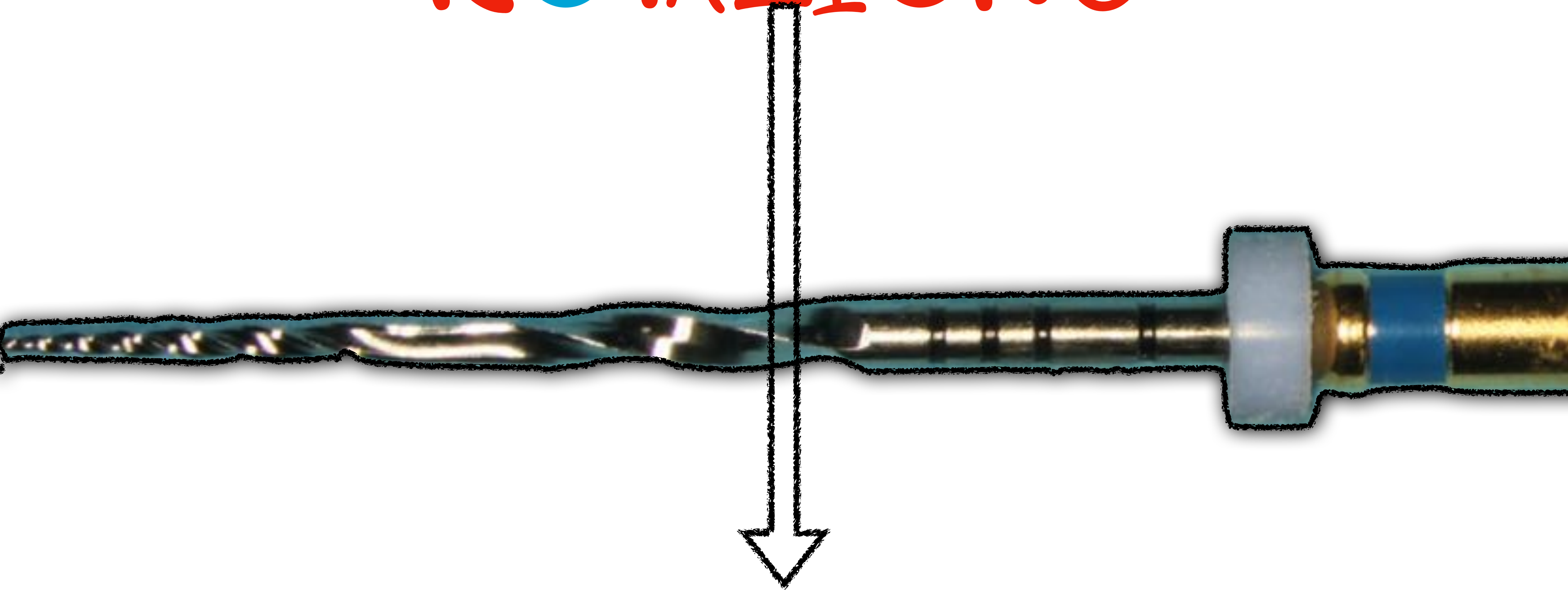




# Less Errors Than Stainless Steel



# ROTAZIONE



I FILE POSSONO FRATTURARSI





**FRATTURA TORSIONALE**

**FRATTURA DA FATICA CICLICA**

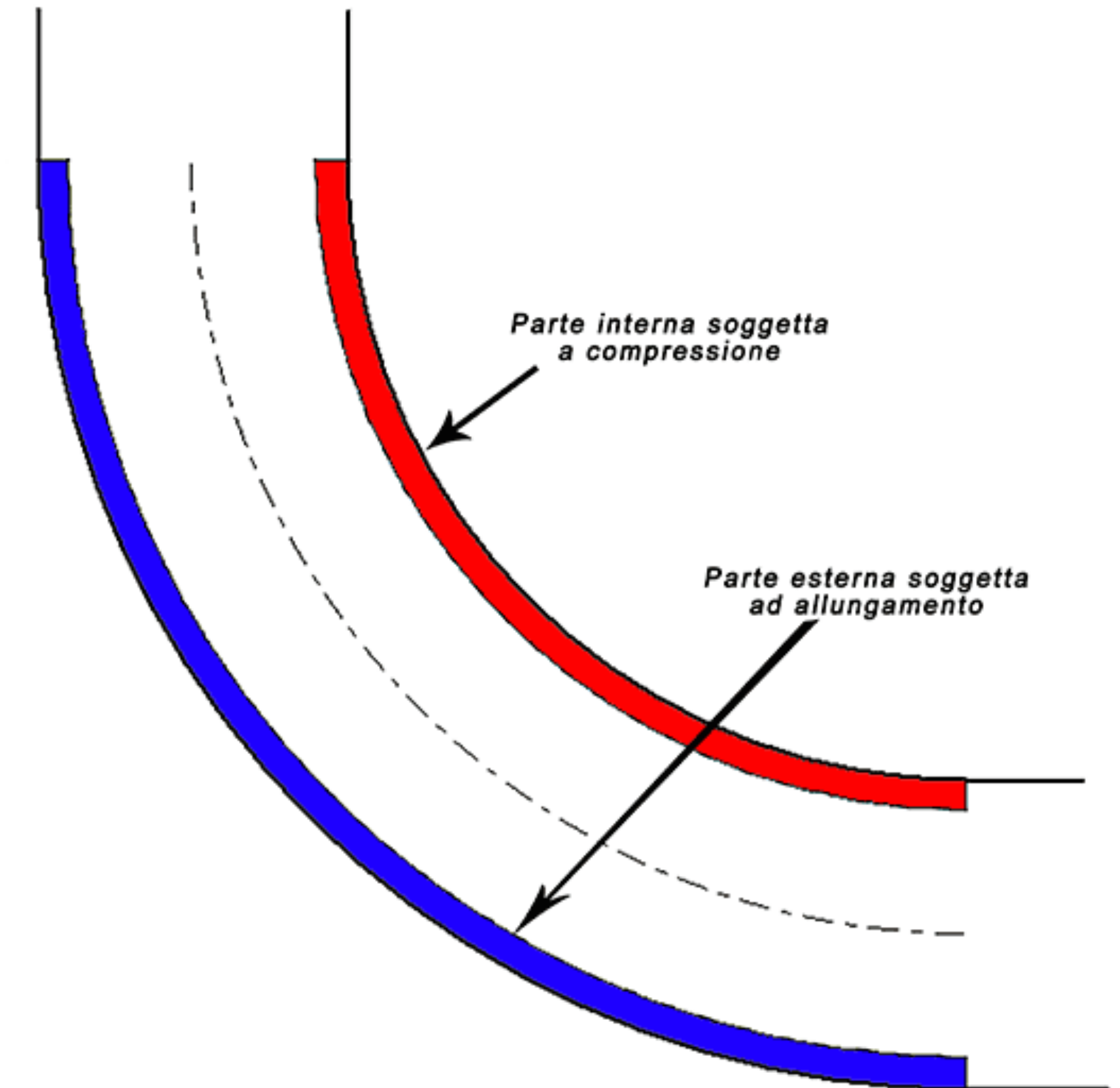




# FRATTURA DA TORSIONE

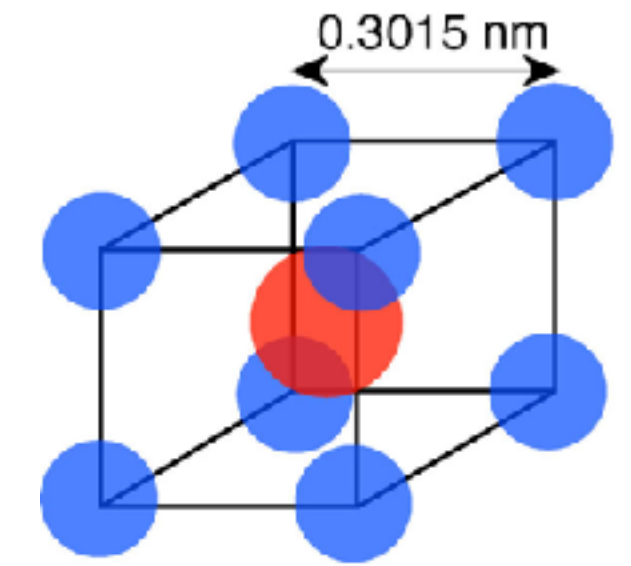
- Si realizza quando una parte dello strumento rotante ( solitamente la punta) si blocca e la restante parte continua a ruotare alla velocità preimpostata per azione del torque del motore endodontico.

# FRATTURA DA FATICA CICLICA

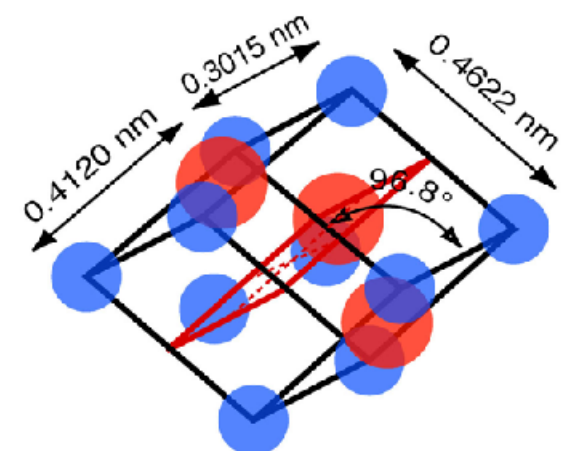




**l'Austenite** in virtù della sua maggiore rigidità avrà una maggiore resistenza allo sforzo torsionale.



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







Heat  
Treated/activated  
Alloys



# DENTAL OFFICE

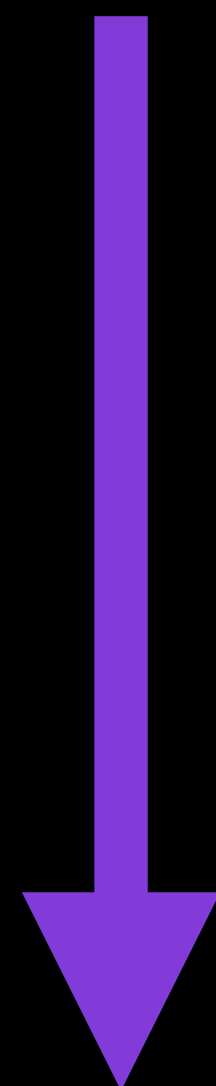


I FILE TRATTATI  
TERMICAMENTE A T°  
AMBIENTE SONO IN FASE  
MARTENSITICA





**TEMPERATURA AMBIENTE**



$T^{\circ}$



Temperatura Transizione

IN FASE MARTENSITICA  
A  $T^{\circ}$  AMBIENTE

**STRUMENTO TRATTATO TERMICAMENTE**

**TEMPERATURA AMBIENTE**



$T^{\circ}$



Temperatura Transizione

IN FASE AUSTENITICA  
A  $T^{\circ}$  AMBIENTE

**STRUMENTO TRADIZIONALE**



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

**Current Challenges and Concepts of the Treatment of Nickel-Titanium Instruments**  
Ya Shen, DDS, PhD,\* Hui-min Zhou, DDS, PhD,<sup>†</sup> Yu-feng Zheng, PhD,<sup>‡</sup> Bin Peng, DDS, PhD,<sup>§</sup> and Markus Haapasalo, DDS, PhD\*

## Abstract

**Abstract** The performance and mechanical properties of nickel-titanium (NiTi) instruments are influenced by factors such as cross-section, flure design, raw material, and manufacturing processes. Many improvements have been proposed by manufacturers during the past decade to provide clinicians with safer and more efficient instruments. **Methods:** The mechanical performance of NiTi alloys is sensitive to their microstructure and associated thermomechanical treatment history. Heat treatment or thermal processing is one of the most fundamental approaches toward adjusting the transition temperature in NiTi alloy, which affects the fatigue resistance of NiTi endodontic files. The newly developed NiTi instruments made from controlled memory wire, M-Wire (Dentsply Tulsa Dental Specialties, Tulsa, OK), or R-phase wire represent the next generation of NiTi alloys with improved flexibility and fatigue resistance. The advantages of NiTi files for canal cleaning and shaping are decreased canal transportation and ledging, a reduced risk of file fracture, and faster and more efficient instrumentation. The clinician must understand the nature of different NiTi raw materials and their impact on instrument performance because many new instruments are introduced on a regular basis. **Results:** This review summarizes the metallurgical properties of next-generation NiTi instruments, the impact of thermomechanical treatment on instrument flexibility, and the resistance to cyclic fatigue and torsion. **Conclusions:** The of this review was to provide clinicians with the edge necessary for evidence-based practice, maximizing the benefits from the selection and application of NiTi rotary instruments for root canal (J Endod 2013;39:163-172)

**Key Words:**  
Controlled  
nickel-titan

Over the past 10 years, the use of the device has increased significantly. Despite the fact that the device is not yet FDA-approved, it has been used by more than 100,000 patients in the United States and more than 1 million patients worldwide. The device is used to treat a wide range of conditions, including fractures, dislocations, and soft tissue injuries. It is also used to treat chronic pain and to improve mobility in patients with arthritis and other joint disorders. The device is a non-invasive, non-surgical treatment option that can be used in a variety of settings, including hospitals, clinics, and at home. It is a safe and effective treatment option that can help patients recover from their injuries and improve their quality of life.

[illegible]

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

conventional NiTi wire (Fig. 24-D). Hence, it is not surprising that CM series files had fatigue resistance superior to that of files made from conventional NiTi alloy.

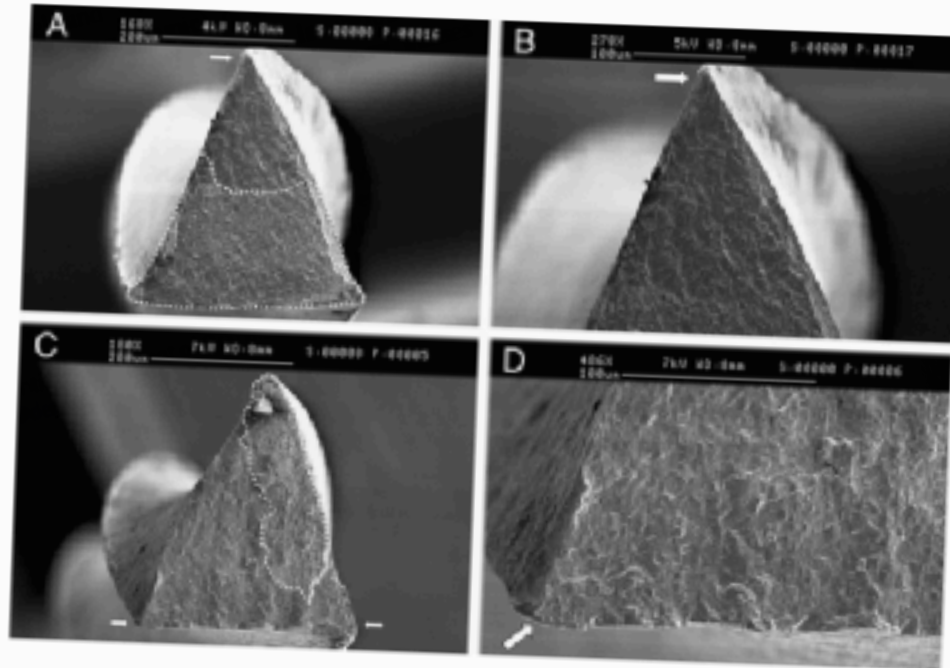
Endodontic instruments are used to prepare the root canal in the presence of an irrigating solution. A recent study (40) showed that 2 CM Wire instruments (ie, TYP CM and NEY CM) yielded a 4-9 times longer fatigue life than conventional NiTi files with the same design under various solutions. The fatigue life of 3 conventional SE NiTi instruments was unaffected by the environments, whereas the fatigue life of the 2 CM file types was much longer in liquid media than in air. This may imply that the fatigue of NiTi alloys is sensitive to temperature, both locally and environmentally. A function of the aqueous media in metal fatigue behavior is to carry the heat away from the metal-to-metal contact. Therefore, an aqueous

medium seems to serve as an effective heat sink to facilitate the long fatigue life of the CM instrument.

### M-Wire

A few years ago, a modification of the SE508 NiTi alloy used for endodontic instruments was developed (65) by Dentsply (M-Wire). Several studies have examined the fatigue resistance of M-Wire NiTi files (38, 41, 66-68). However, the results from these studies cannot easily be compared with one another because of variations in the experimental design and testing model.

A major drawback of most laboratory testing of the fatigue behavior of NiTi rotary instruments is the inability to eliminate several confounding factors, such as material properties, design, and



**Figure 2.** Photomicrographs of a fracture surface of TYP files with the region of fatigue crack propagation and dimple area outlined (dotted line) with crack origins (arrows). (A) The overall view of the TYP file ( $N_f = 315$ , dimple area is 69%). (B) A high-magnification view of the crack origin (arrows). (C) An overall view of the TYP CM file with 2 crack origins (arrows) ( $N_f = 1280$ , dimple area is 56%). (D) A high-magnification view of 1 crack origin (arrows).

# YA SHEN et AL JOE



# 2013

# YA SHEN et AL

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



# Niti Trattato termicamente

- Ridotto ritorno elastico ( restoring force)
- Memoria di forma attivata dal calore
- Maggiore resistenza alla fatica ciclica



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



# Trattamenti termici NiTi

SE Ni-Ti

M-Wire

R-phase

Blue Wire

Gold Wire

Cm-Wire

$\pm 0^\circ$

$\pm 55^\circ$

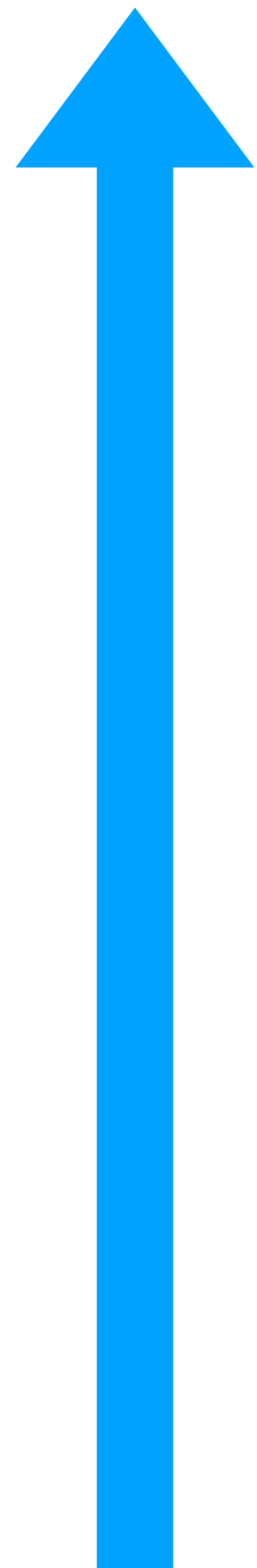
Austenitic Phase (High  $T^\circ$ , Stiff)

Martensitic Phase ( Low  $T^\circ$ , Soft)

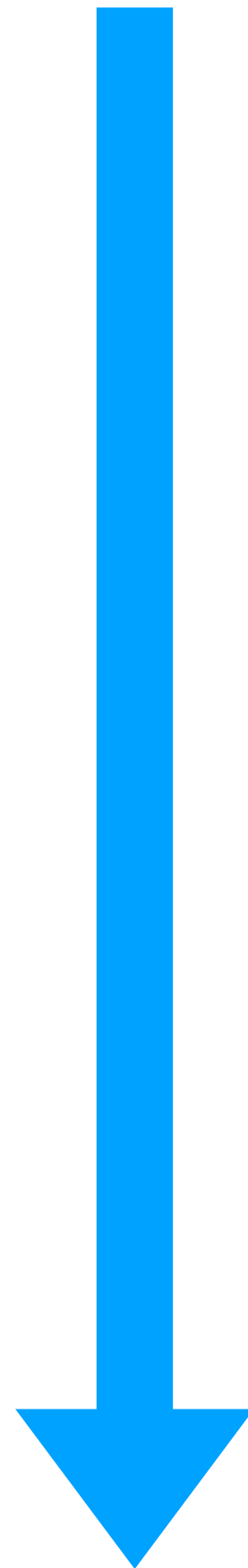
TRANSITIONAL  $T^\circ$  IS  $\pm$  OR  $>$  DENTAL OFFICE/MOUTH  $T^\circ$

# Endodontic Heat Treated Ni-Ti Rotary Files

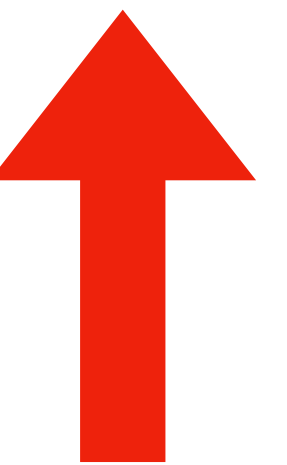
**Cyclic Fatigue**



**Torsional Stress**



**250-300**  
**500-800**



**TORQUE**  
**FORCE**

**Low**  
**1,5-2,5 N/cm**



# Disinfection Protocol to Reduce the bacterial Load Beneath A Subcritical threshold



# SINERGIA TRA GLI IRRIGANTI CANALARI

IPOCLORITO DI SODIO

EDTA

CLOREXIDINA





# Diametro di preparazione

**Allargamento  
Apicale**



**Migliora efficacia  
irriganti**



**Migliore  
disinfezione  
meccanica**





# Diametro di preparazione

## 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: 28<sup>th</sup> January 2015   Accepted: 20<sup>th</sup> April 2015   Conflicts of Interest: None*

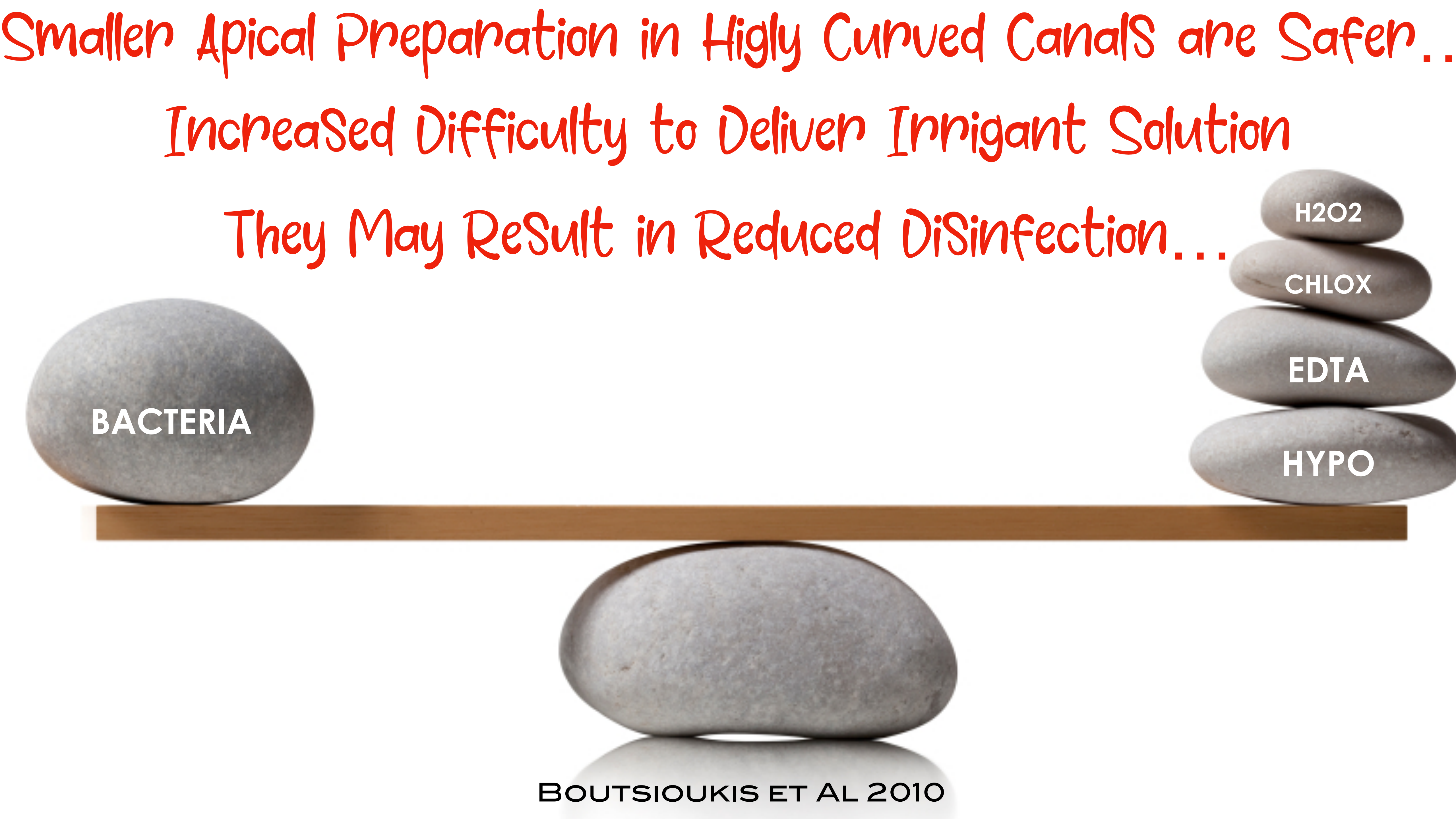
**Original Research**

*Source of Support: Nil*

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

*P Srikanth<sup>1</sup>, Amaravadi Gopi Krishna<sup>2</sup>, Siva Srinivas<sup>3</sup>, E Sujayeendranatha Reddy<sup>4</sup>, Someshwar Battu<sup>5</sup>, Swathi Aravelli<sup>1</sup>*





Smaller Apical Preparation in Higly Curved Canals are Safer...

IncreaSed Difficulty to Deliver Irrigant Solution

They May ReSult in Reduced DiSinfection...

BACTERIA

H2O2

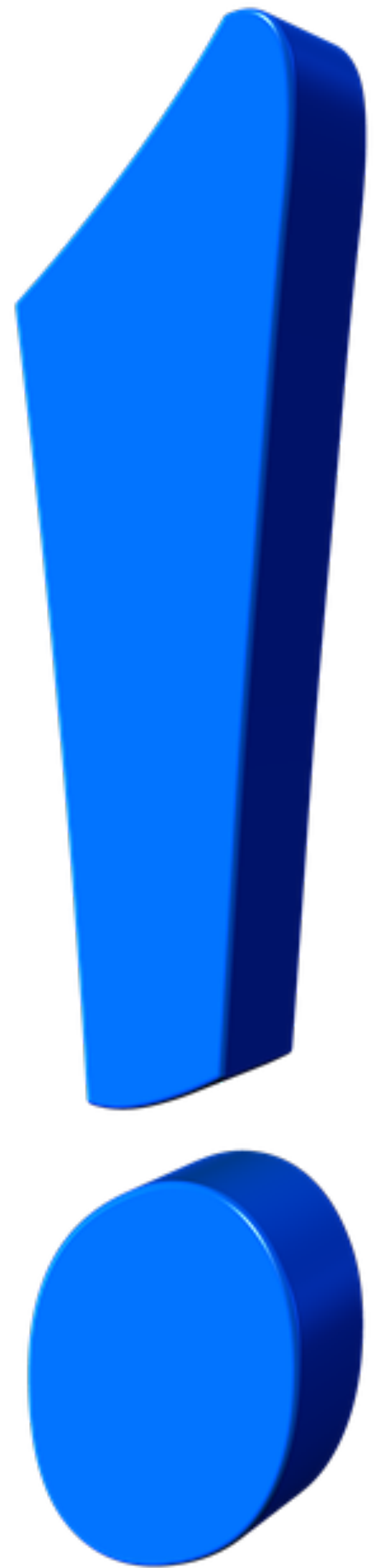
CHLOX

EDTA

HYPO

Usually, the More Severe the Canal Curvature,  
The Greater the Risk of Transportation And  
Unexpected Fracture  
...When Larger Apical Preparations Are Targeted

Shafer 2009





PROBLEM SOLVING



Increasing diameter

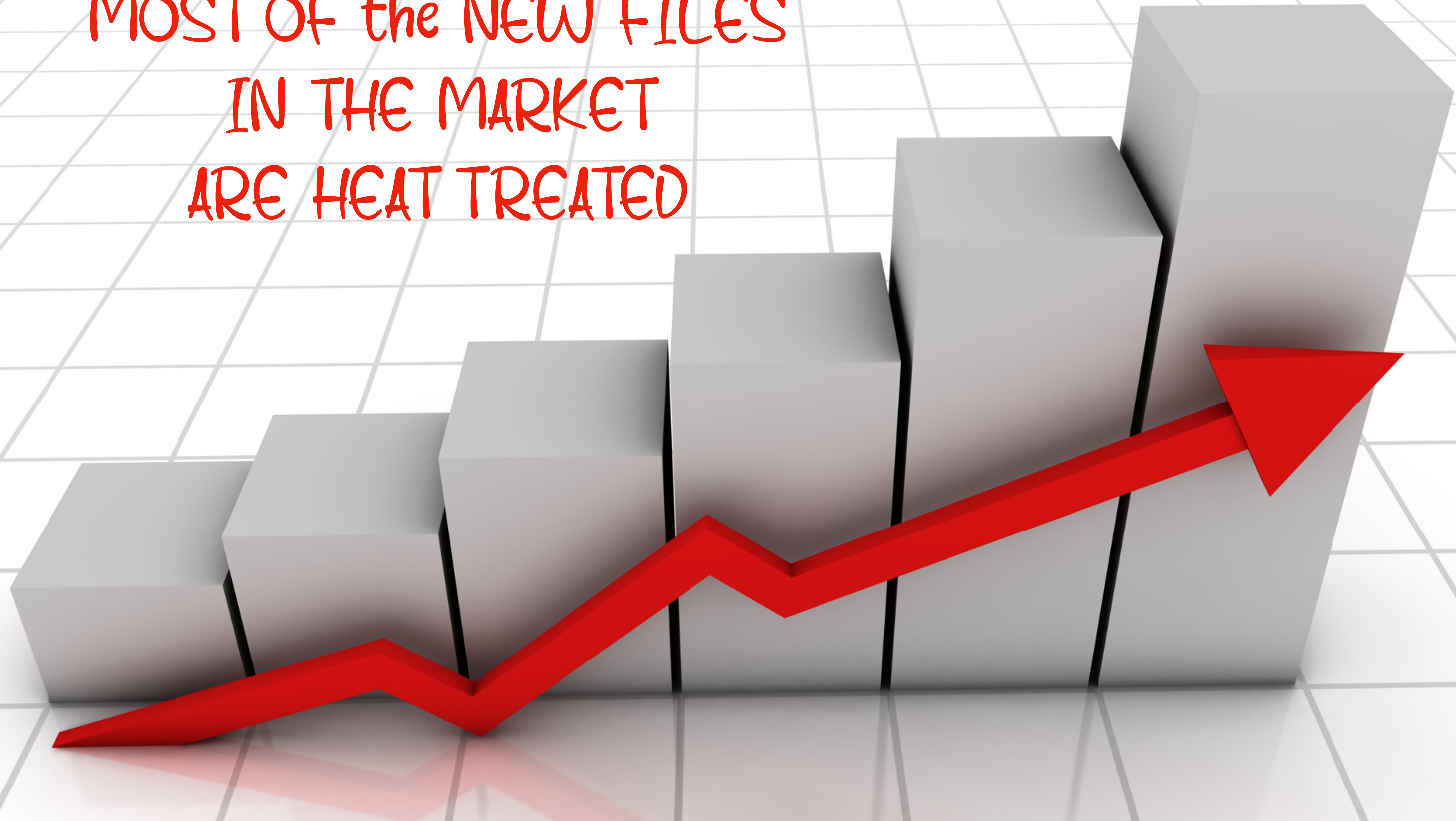


Decreasing taper

HT-NITI



MOST OF the NEW FILES  
IN THE MARKET  
ARE HEAT TREATED





*Adapting The Anatomy  
to the File/Sequence ?*

*Or*

*Adapting The FileSequence  
to the Anatomy ?*





**MAKE OUR**

**ENDO UNIQUE**

# "TAILORED" ENDODONTICS





# NI-TI ROTARY FILES: TIPS AND TRICKS

## CANALI CALCIFICATI

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



## CANALI CURVI

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

# NI-TI ROTARY FILES: TIPS AND TRICKS

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



# SISTEMATICHES NI-TI ROTANTI HEAT ACTIVATED



# PRO FLEX NHA

NANO RIVESTITO ATTIVAZIONE TERMICA

ESTREMA  
FLESSIBILITÀ

MAGGIORE  
RESISTENZA

TECNOLOGIA  
CONTROL MEMORY

RIVESTIMENTO  
NANO-COATED

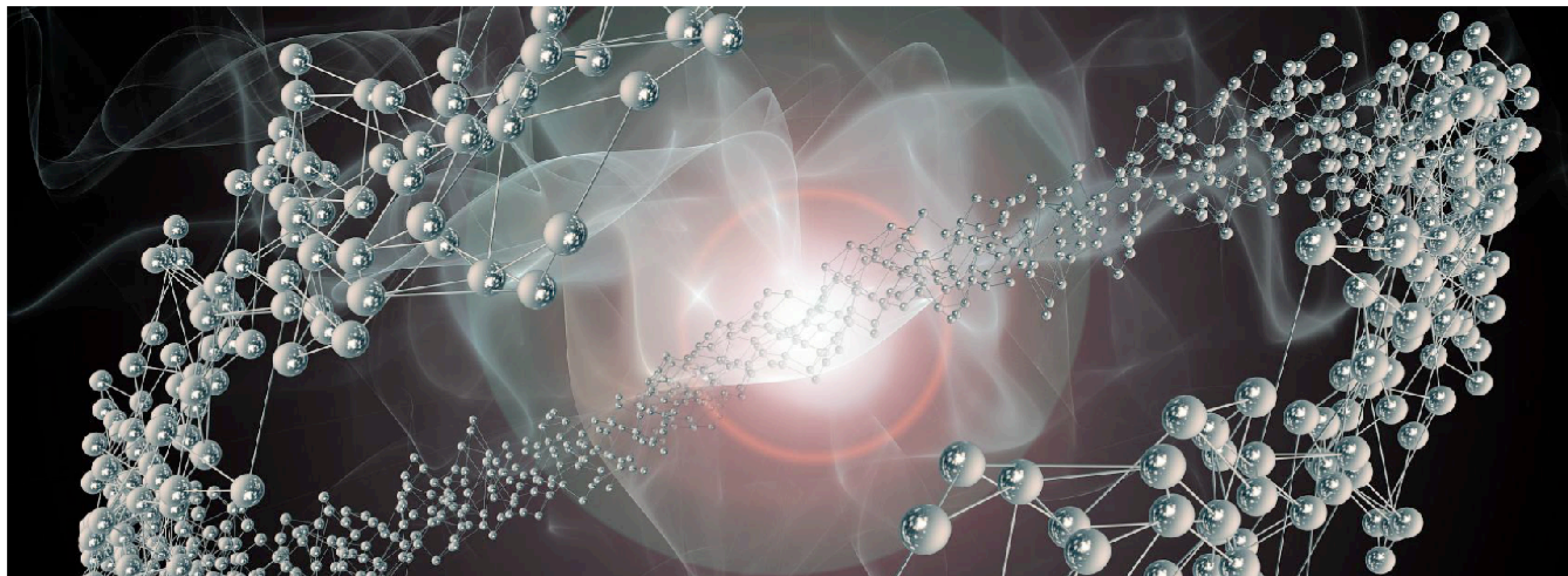
NEW  
ENTRY!!!

NEW  
ENTRY!!!

NEW  
ENTRY!!!



# Cos'è il nano-rivestimento

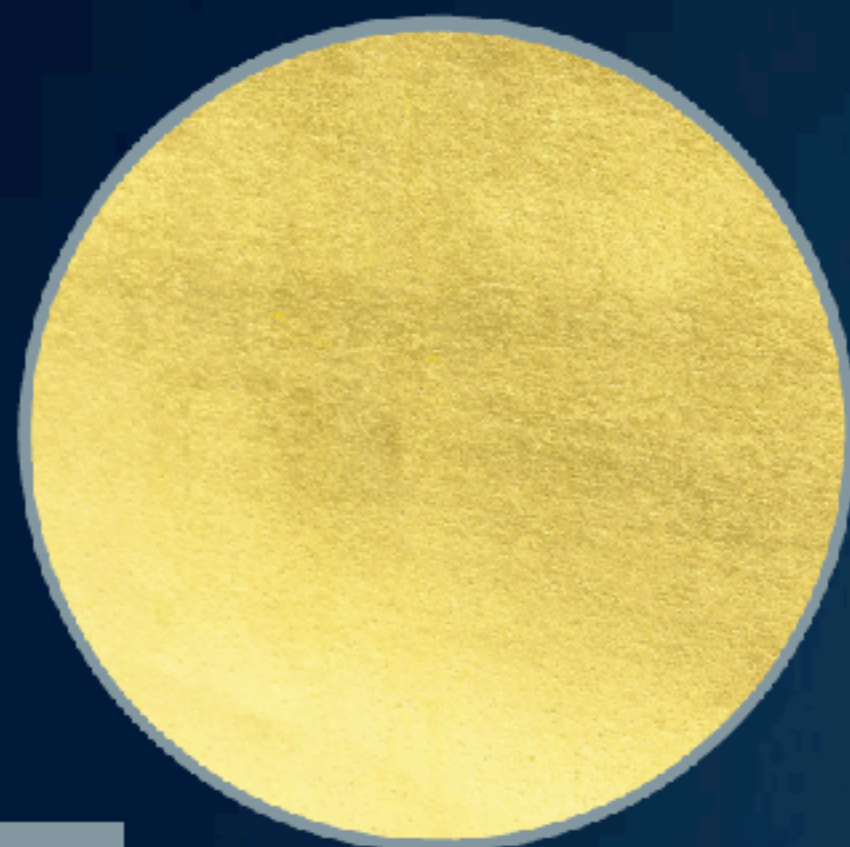


I nano-rivestimenti (noti anche come nano-film) hanno funzioni uniche in termini di proprietà ottiche, elettriche, termiche e meccaniche.



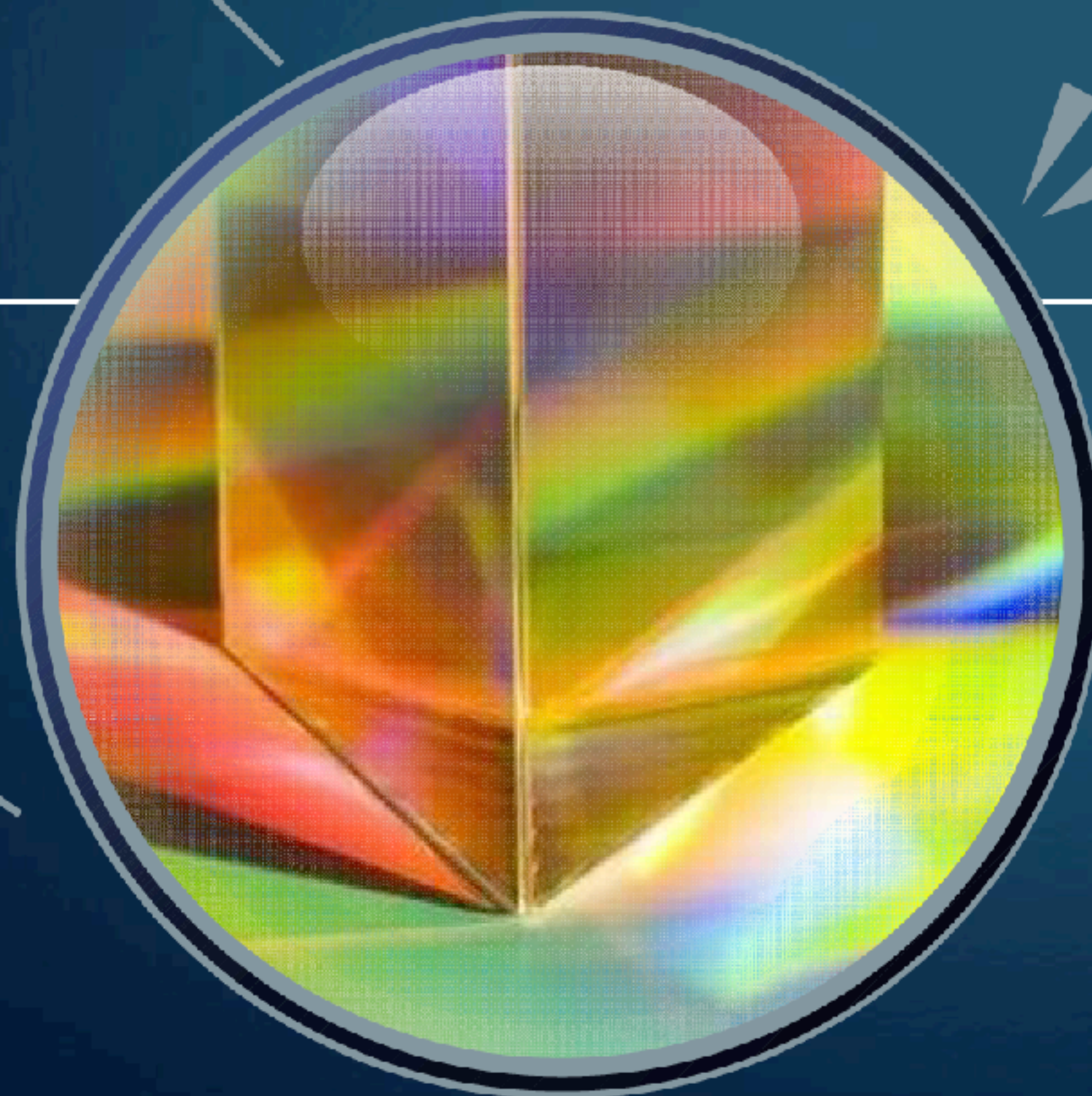
# Caratteristiche del nano-rivestimento

Materiale  
metallico



Nitruro di titanio

Il nitruro di titanio (TiN) (talvolta noto come “Tinite” o “TiNite” o “TiN”) è un materiale ceramico estremamente duro, spesso utilizzato come rivestimento su leghe di titanio, acciaio, carburo e componenti in alluminio per migliorare le proprietà superficiali del substrato. Applicato come rivestimento sottile, il TiN viene utilizzato per indurire e proteggere le superfici di taglio e di scorrimento, per scopi decorativi (grazie al suo aspetto dorato) e come rivestimento non tossico per gli impianti medici. Nella maggior parte delle applicazioni, viene applicato un rivestimento inferiore a 5 micrometri (0,00020 in).



**DUREZZA**

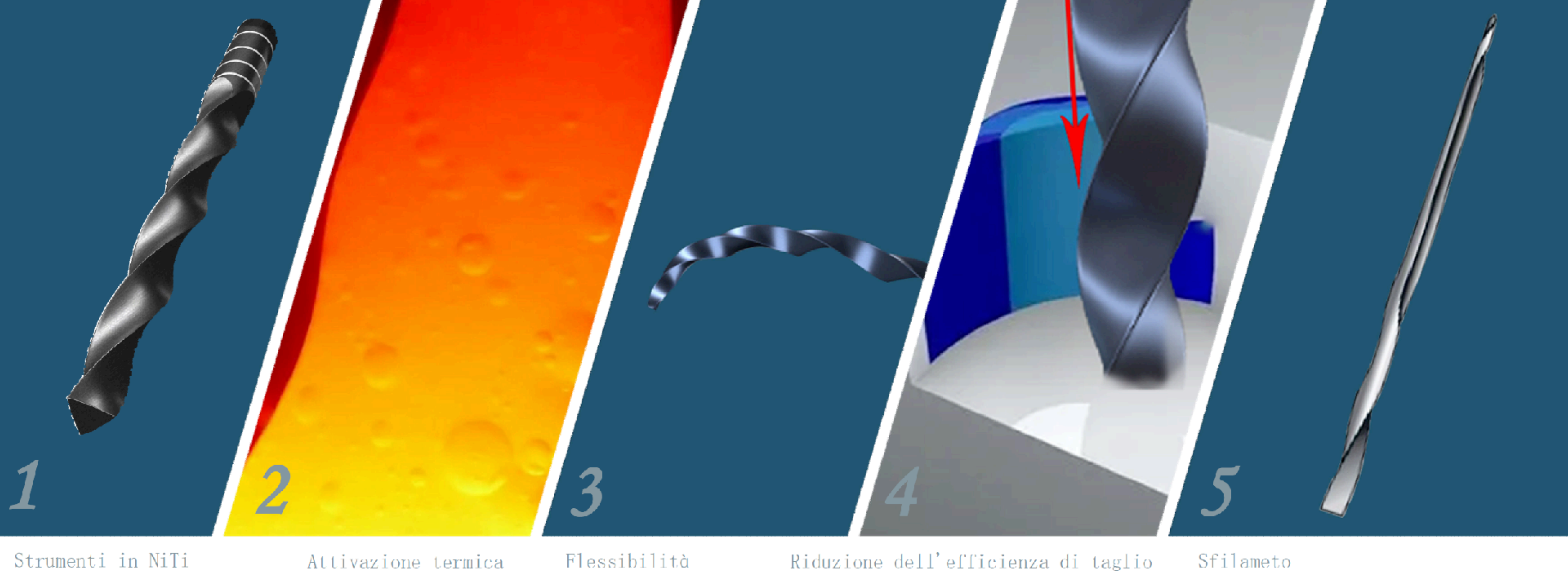
**RESISTENZA**

**COMPATTEZZA**



Materiale ceramico





1

Strumenti in NiTi

2

Attivazione termica

3

Flessibilità

4

Riduzione dell'efficienza di taglio

5

Sfilameto

## Tecnologia di attivazione termica convenzionale:



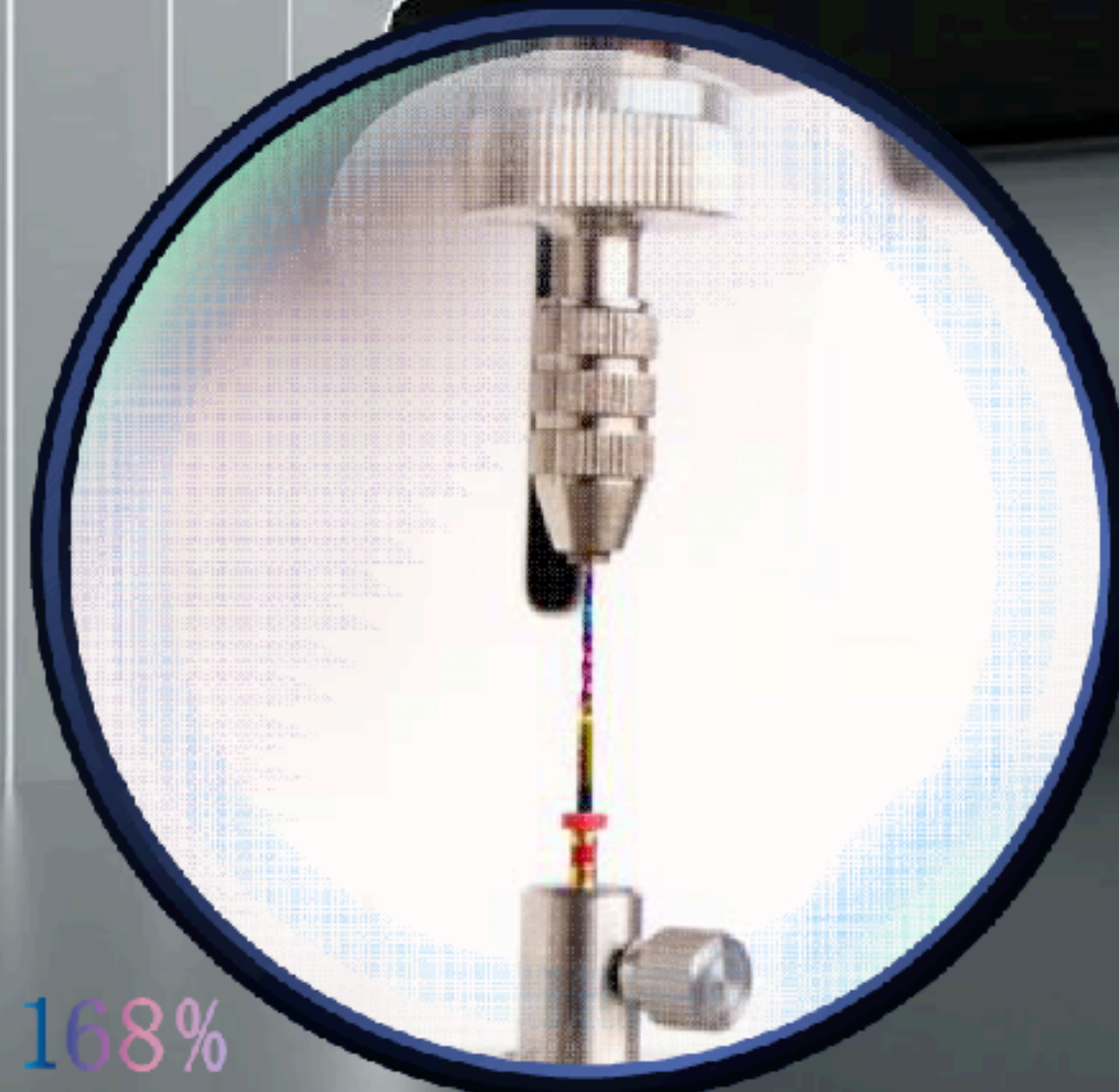
Oggi gli strumenti canalari in nichel-titanio sono prodotti con una tecnologia di trattamento termico che rende la lama più flessibile e risolve in gran parte il problema della rottura dello strumento nei canali radicolari curvi. Tuttavia, poiché la lama diventa più flessibile, la sua forza di taglio si riduce e tende a sfilarsi quando incontra canali radicolari calcificati.



# Caratteristiche del nano-rivestimento

Sulla base del trattamento termico del materiale in nichel-titanio, la tecnologia di tempra laser viene utilizzata per aumentare la durezza superficiale degli strumenti canalari del 168%. Il nano-rivestimento riempie gli interstizi della struttura reticolare sulla superficie, formando una nuova tecnologia di strumenti canalari in nichel-titanio che combina attivazione termica, tempra laser e nano-rivestimento.

168%



**ATTIVAZIONE TERMICA**

**TEMPRA LASER**

**NANO-RIVESTIMENTO**

- Aumento della resistenza all'abrasione di 3-10 volte.
- Miglioramento della qualità della superficie e riduzione dei difetti.
- Rivestimento sottile e uniforme con un basso coefficiente di attrito.
- Nano-rivestimento sottile, circa 3  $\mu\text{m}$ ; pertanto, non influisce sull'accuratezza dimensionale del taglio.

Strumenti in NiTi

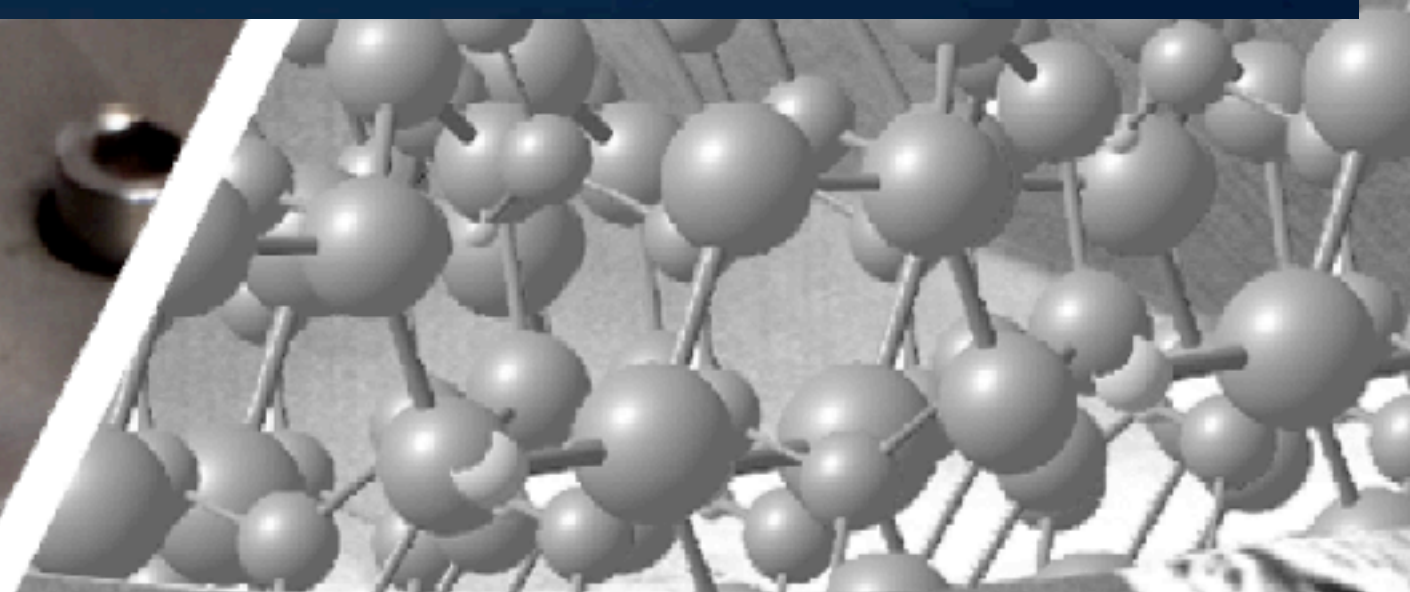
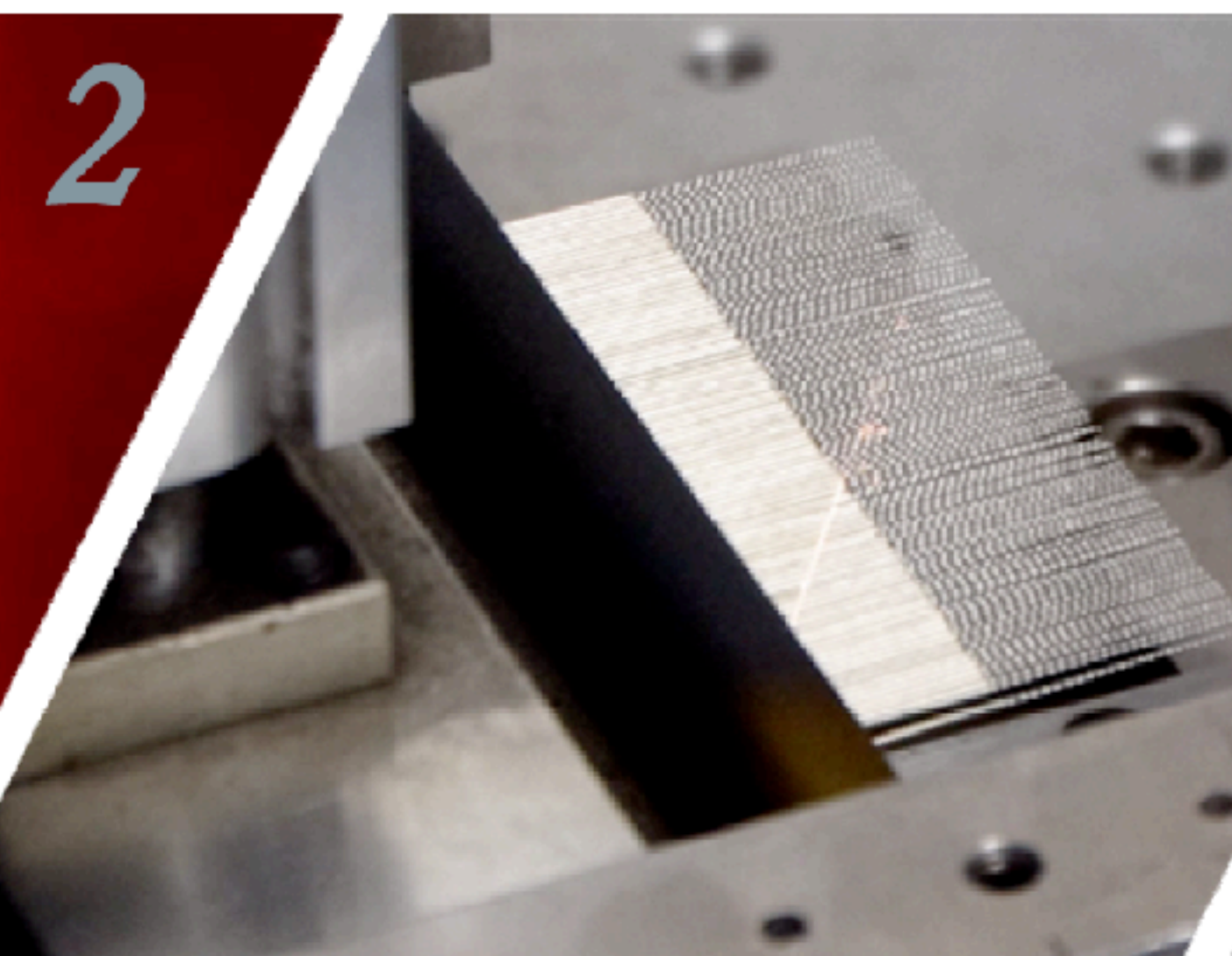
Attivazione termica

Tempra laser



1

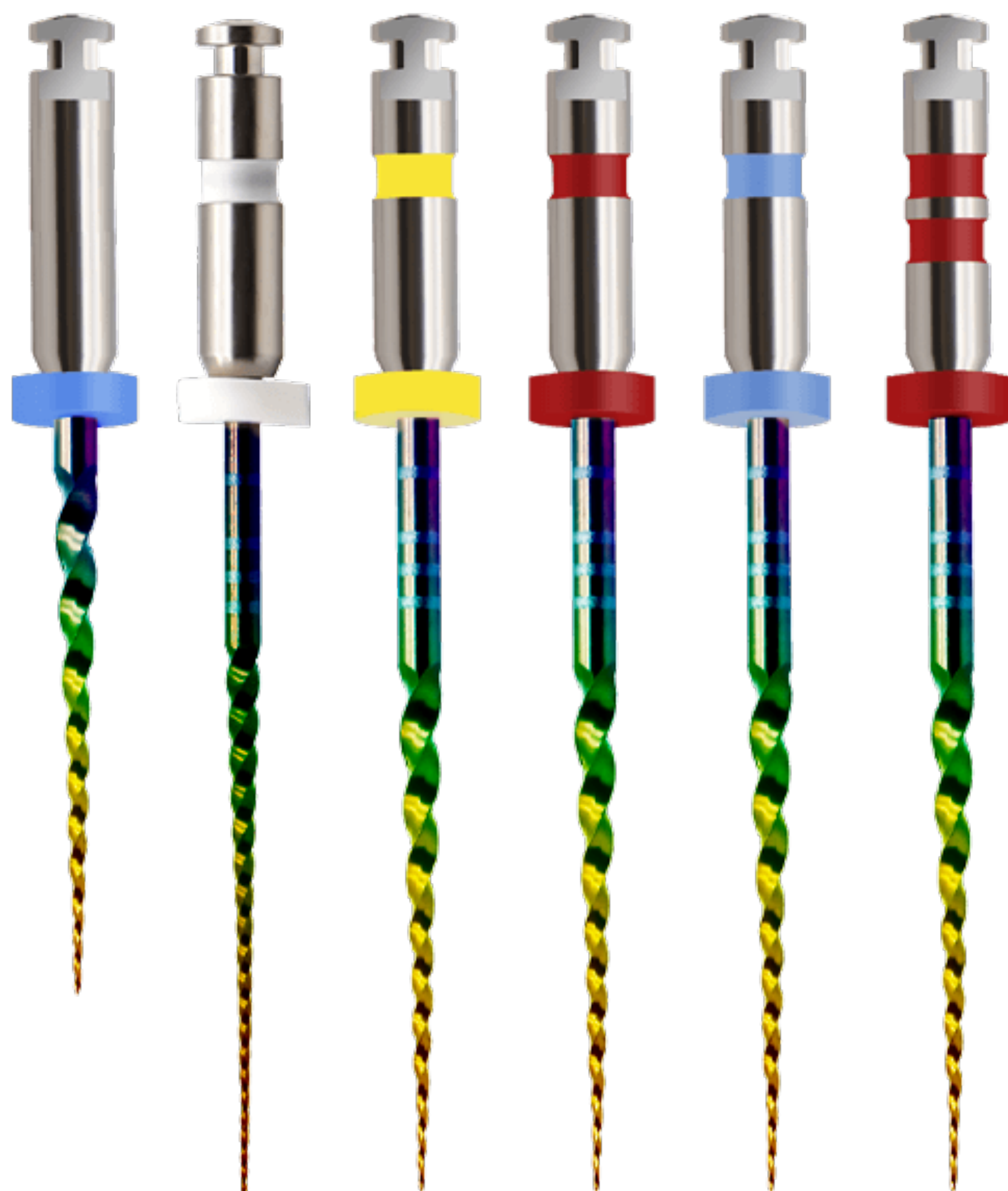
2





# 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     | Cross-section |
| 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.

# SEQUENZA PRO FLEX H.A.

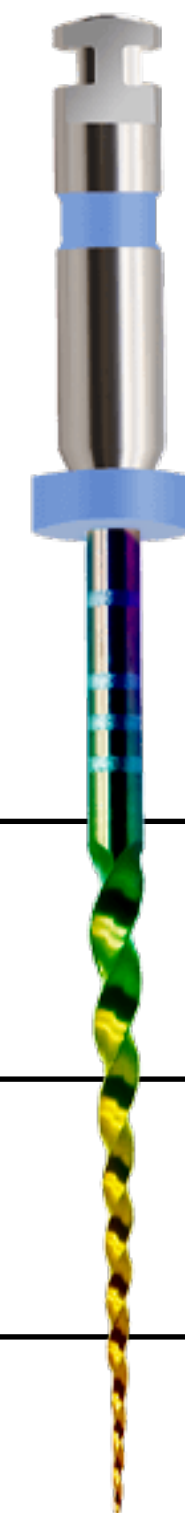
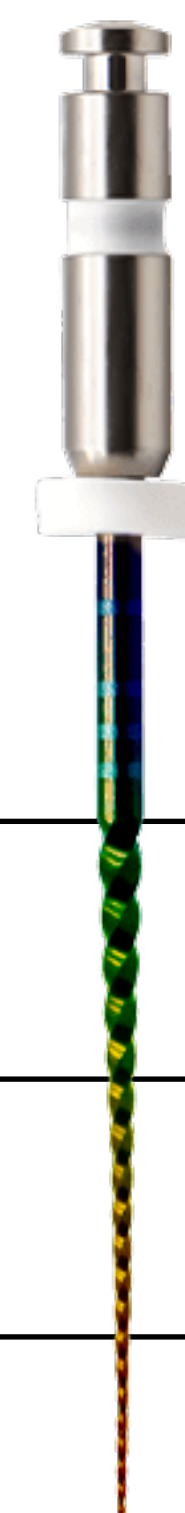
20.10

15./2-6

20.04

25.04

30.04



1/3 CORONALE

1/3 MEDIO

1/3 APICALE



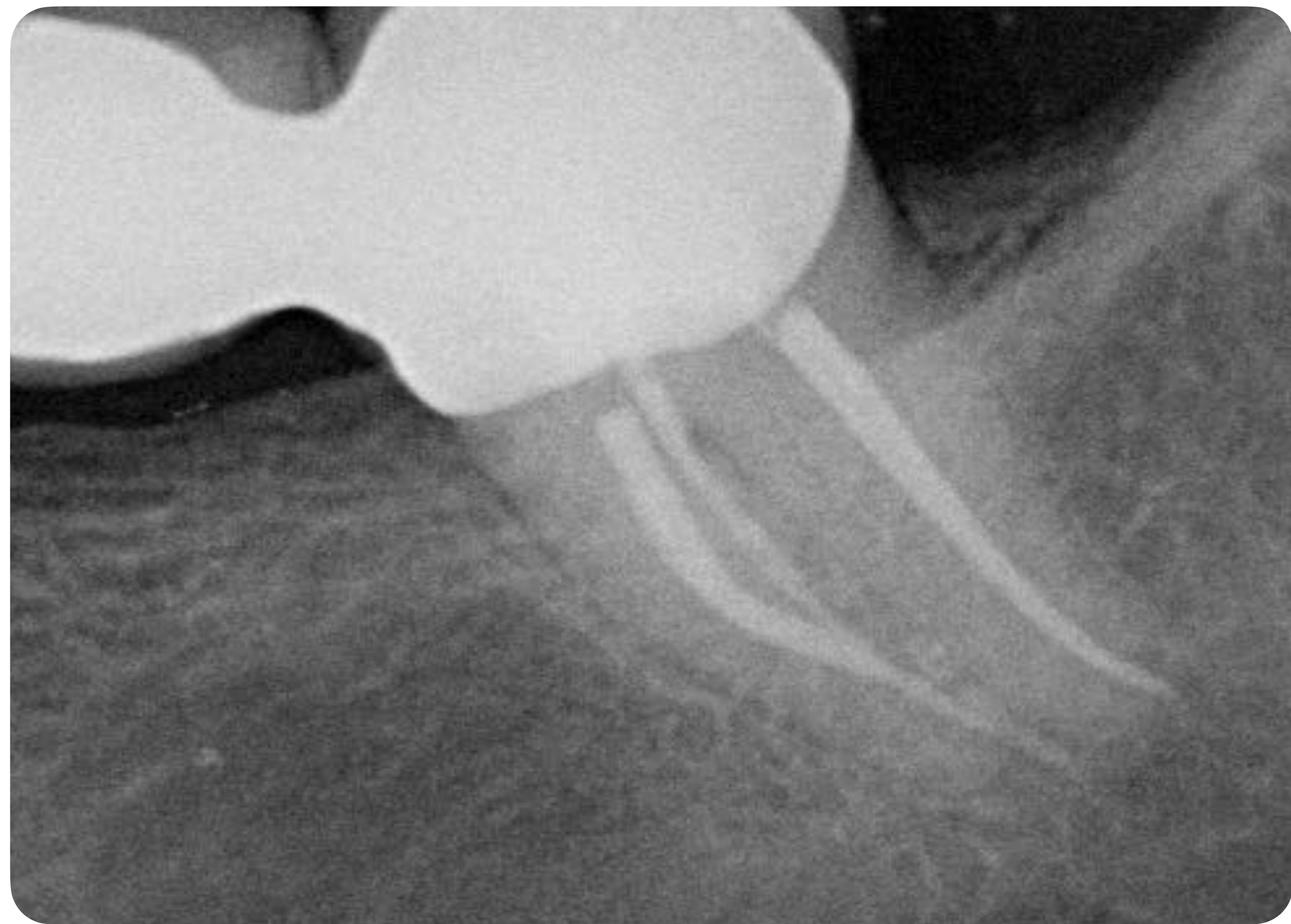


# PRO FLEX NHA

NANO RIVESTITO ATTIVAZIONE TERMICA









**CONDENSAZIONE  
IDRAULICA  
NO TAPER**



# I Cementi Bioceramici: la storia



CALCEVIVA  
+  
MATERIALE VULCANICO



# I Cementi Bioceramici: la storia



MTA

TORABINEJAD 1993

# I Cementi Bioceramici: chimica

## REAZIONE DI IDRATAZIONE



## REAZIONE DI PRECIPITAZIONE





# 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



Alta Biocompatibilità

Non tossici

Idrofilici

Radiopacità

AdeSione alla dentina

DimenSionalmente Stabili

Bioattivi ed Osteoinduttivi

BaSSa riSpOSta infiammatoria

Formazione IdroSSiapatite

Antibatterici (ph baSico)

Facile utilizzo e manipolazione

**VANTAGGI**

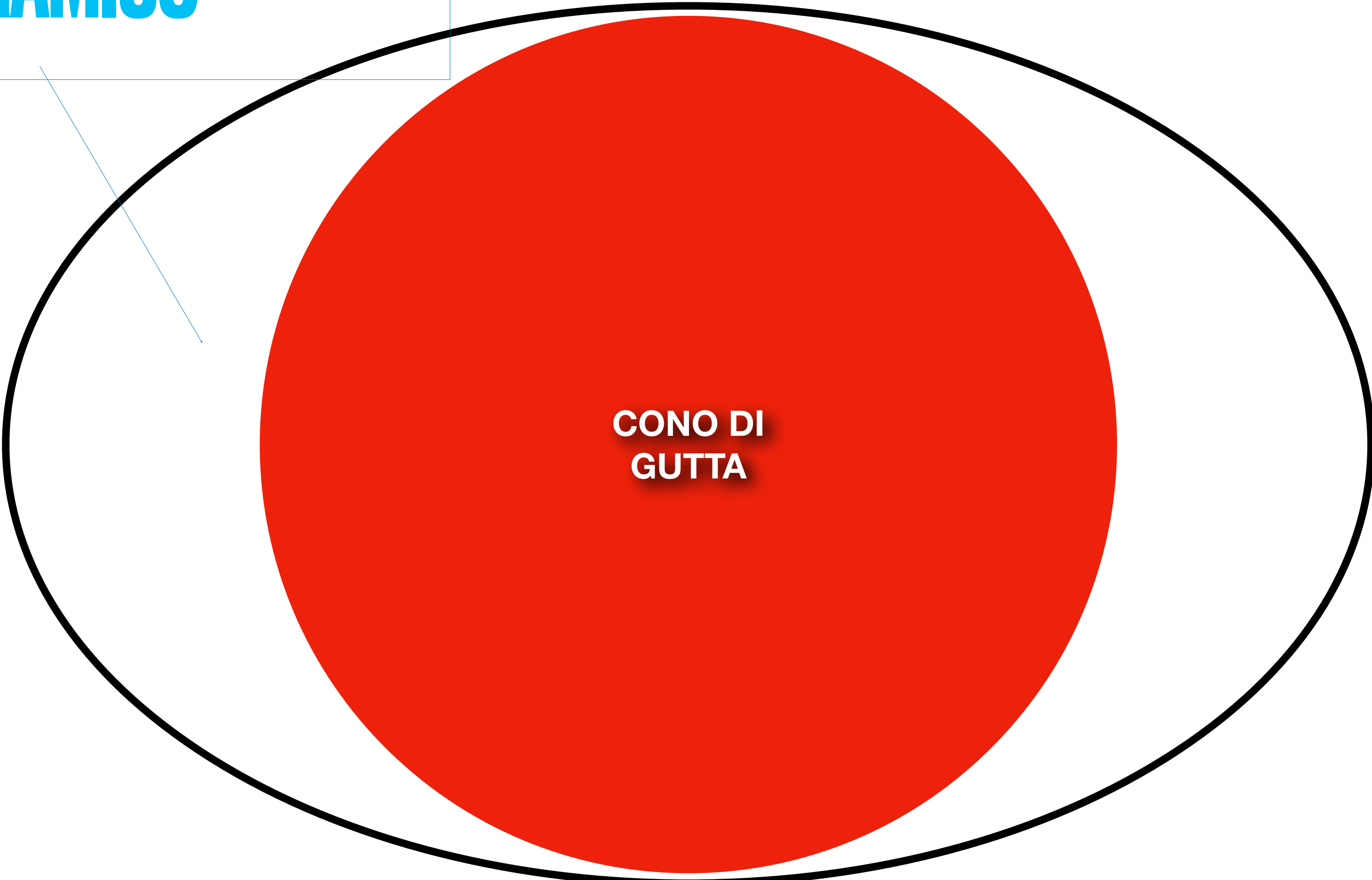




# OTTURAZIONE CANALARE: CONDENSAZIONE IDRAULICA

**BIOCERAMICO**

**CONO DI  
GUTTA**

A diagram illustrating a root canal filling. A large black oval represents the root canal. Inside it, a red circle represents the filling material. The text 'CONO DI GUTTA' is centered within the red circle. A label 'BIOCERAMICO' is positioned to the left of the oval, with a thin blue line pointing from the text to the red filling area.



# OTTURAZIONE CANALARE: CONDENSAZIONE IDRAULICA

**BIOCERAMICO**

**FILLER**

**CONO  
DI  
GUTTA**

**CARRIER**

QUESTA TECNICA DI CHIUSURA NON RICHIEDE CONICITA' IMPORTANTI COME LA CONDENSAZIONE VERTICALE A CALDO



# Condensazione idraulica



Sealer “Bioceramici”



# Remake Root HT

Pre-mixed bioceramic sealant.

FLOW hydraulic cement based on calcium aluminosilicate.

- Generation of calcium hydroxide
- Three-dimensional adherent sealing
- Generation of hydroxyapatite
- Chemical bonding to gutta-percha and dentin
- Setting time: work (25 min.)
- Setting time: total (2.5 hours)
- No contraction
- Wet field activation
- Resistance 100 MPa

- Calcium aluminosilicate with high degree of purity
- Resin-free
- Eugenol-free
- Ready to use
- Pre-mixed injectable one-component paste
- Compatible with Thermafil







# OUTCOME

## Outcome of Non-Surgical Root Canal Treatment Using a Single-cone Technique with a Sequence Bioceramic Sealer: A Retrospective Analysis

Elizabeth A. Chybowski, DDS,\* Gerald N. Glickman, DDS, MS,† Alex Fleury, DDS, MS,† Eric Solomon, DDS, MS,† and Jianing J.

### Abstract

**Introduction:** One of the important steps in root canal treatment is to create a well-sealed root canal system. Sequence BC Sealer (BC; Brasseler USA, Savannah, GA) has several beneficial properties and thus has been incorporated into the practitioner's armamentarium. No study to date have evaluated the clinical success of using Sequence BC Sealer. The purpose of this study was to evaluate the outcome of nonsurgical root canal treatment using a single-cone technique and BC technique and to identify factors associated with success or failure. **Methods:** This retrospective study included patients treated in a private practice between 2009 and 2015. All teeth that required root canal treatment and retreatment, were obturated with a single-cone technique with a minimum of 2 mm of sealer. Treatment factors were recorded.

**An important goal of root canal treatment is to properly seal the root canal system after cleaning and shaping. However, irregularities such as fins, isthmuses, and lateral canals are often present and can pose challenges to clinicians during obturation. Anatomical spaces can have irregularities that may not be treated (5). Historically, root canal treatment with poor root canal obturation technique has been associated with poor outcome.**

**Results:**

12-month follow-up of primary root canal treatment of teeth obturated with a hydraulic

Giulia Bardini<sup>1</sup> • Laura Casula<sup>2</sup> • Emanuele Ambu<sup>1</sup> • D.

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

### Abstract

**Objectives** This randomized, controlled, pilot study compared the outcome of root canal treatment either with a novel bioactive sealer and warm vertical compaction.

**Materials and methods** Sixty-nine patients were included in the study. The teeth were treated with a single-cone technique with BioRoot™ RCS (Septodont, France) and warm vertical compaction.

**Results** The results showed that the

## Root Canal Treatment of Necrotic Teeth with a Bioceramic-Based Sealer

Bel Haj Salah,<sup>1</sup> Sabra Jaâfoura,<sup>2</sup> Mahdi tili,<sup>1</sup> Marwa Ben Ammar,<sup>1</sup> and Angelo Zavattini<sup>1</sup>

**Conservative Odontology, Laboratory of Dento-Facial Clinical and Biological Approach (ABC), Faculty of Dentistry, Oral & Maxillofacial Medicine, University of Monastir, Avicenne Avenue, Monastir 5019, Tunisia**  
**Dental Biomaterials, Laboratory of Dento-Facial Clinical and Biological Approach (ABC), Faculty of Dentistry, Oral & Maxillofacial Medicine, University of Monastir, Avicenne Avenue, Monastir 5019, Tunisia**  
**Practice in Sahloul-Sousse, Laboratory of Dento-Facial Clinical and Biological Approach (ABC), Faculty of Dentistry, Oral & Maxillofacial Medicine, University of Monastir, Avicenne Avenue, Monastir 5019, Tunisia**

Correspondence should be addressed to Sabra Jaâfoura; sabritaw@yahoo.fr

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Bel Haj Salah et al. This is an open access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Among the most common pathologies in endodontics, root canal treatment is the modern practice of endodontics.

## Outcome of Root Canal Treatment with a Calcium Silicate Root Canal Sealer: A Non-Randomized Clinical Study

Angelo Zavattini<sup>1,\*</sup>, Alan Knight<sup>1</sup>, Federico Foschi<sup>1</sup>

**Department of Endodontics, Faculty of Dentistry, Oral & Maxillofacial Medicine, University of Monastir, Avicenne Avenue, Monastir 5019, Tunisia**  
**Hospital, London SE1 9RT, UK; eknight@hotmail.it**

Correspondence: angelo.zavattini@kcl.ac.uk (F.M.)

**Therapeutic Dentistry I. M. Sechenov First Moscow Medical University, Moscow 119121, Russia**

**Received: 11 March 2020; Accepted: 11 March 2020; Published: 18 March 2021**

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**Abstract:** The aim of this study was to evaluate the outcome of root canal treatment with a calcium silicate root canal sealer and warm vertical compaction.

**Introduction:** One of the important steps in root canal treatment is to create a well-sealed root canal system.

**Methods:** This retrospective study included patients treated in a private practice between 2009 and 2015.

**Results:** The results showed that the

**Conclusion:** The aim of this study was to evaluate the outcome of root canal treatment with a calcium silicate root canal sealer and warm vertical compaction.

# Miglioramento Outcome e

# Maggior velocità di guarigione





2023







2023

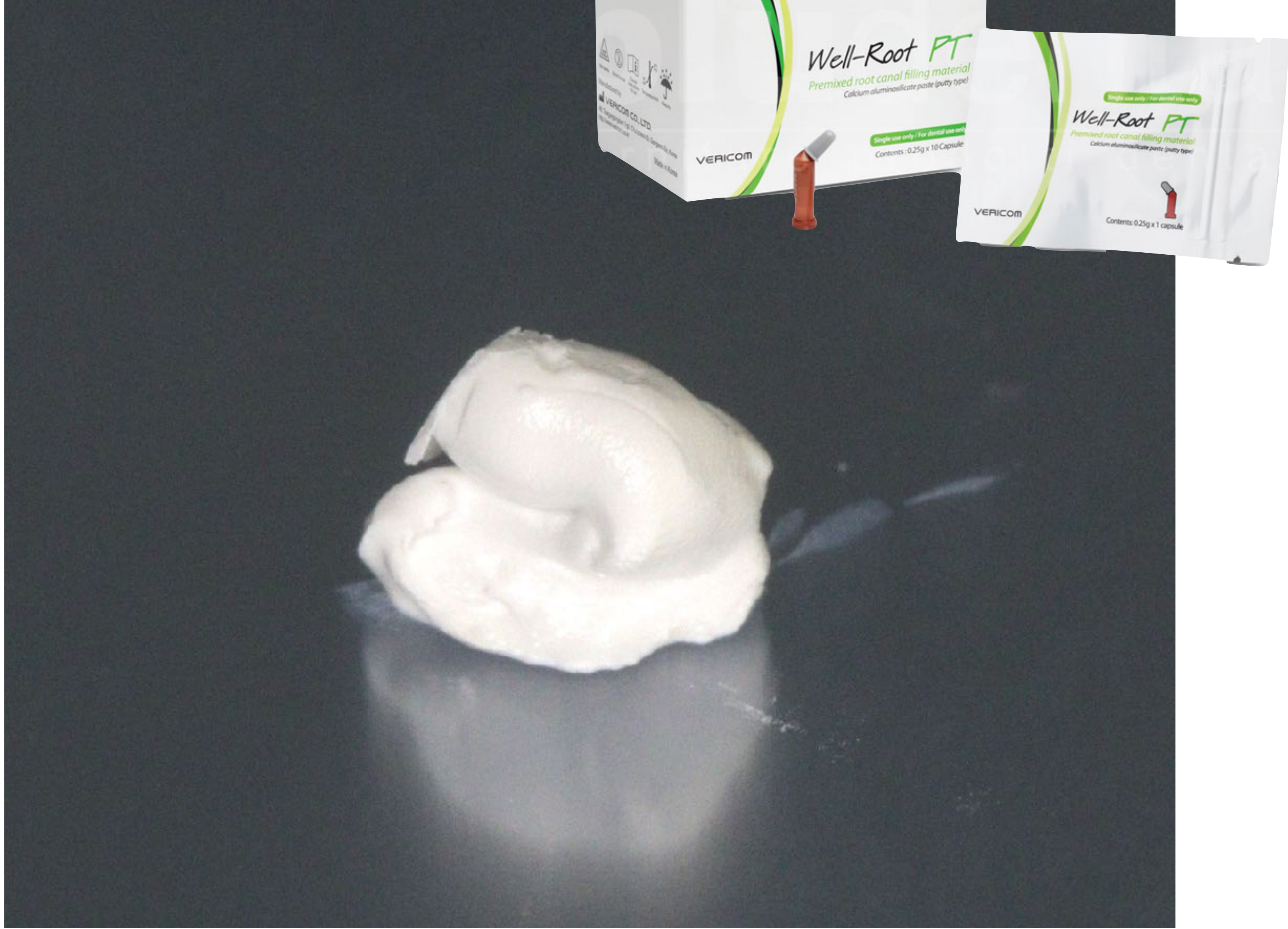


2024



**BIO CERAMIC PUTTY**





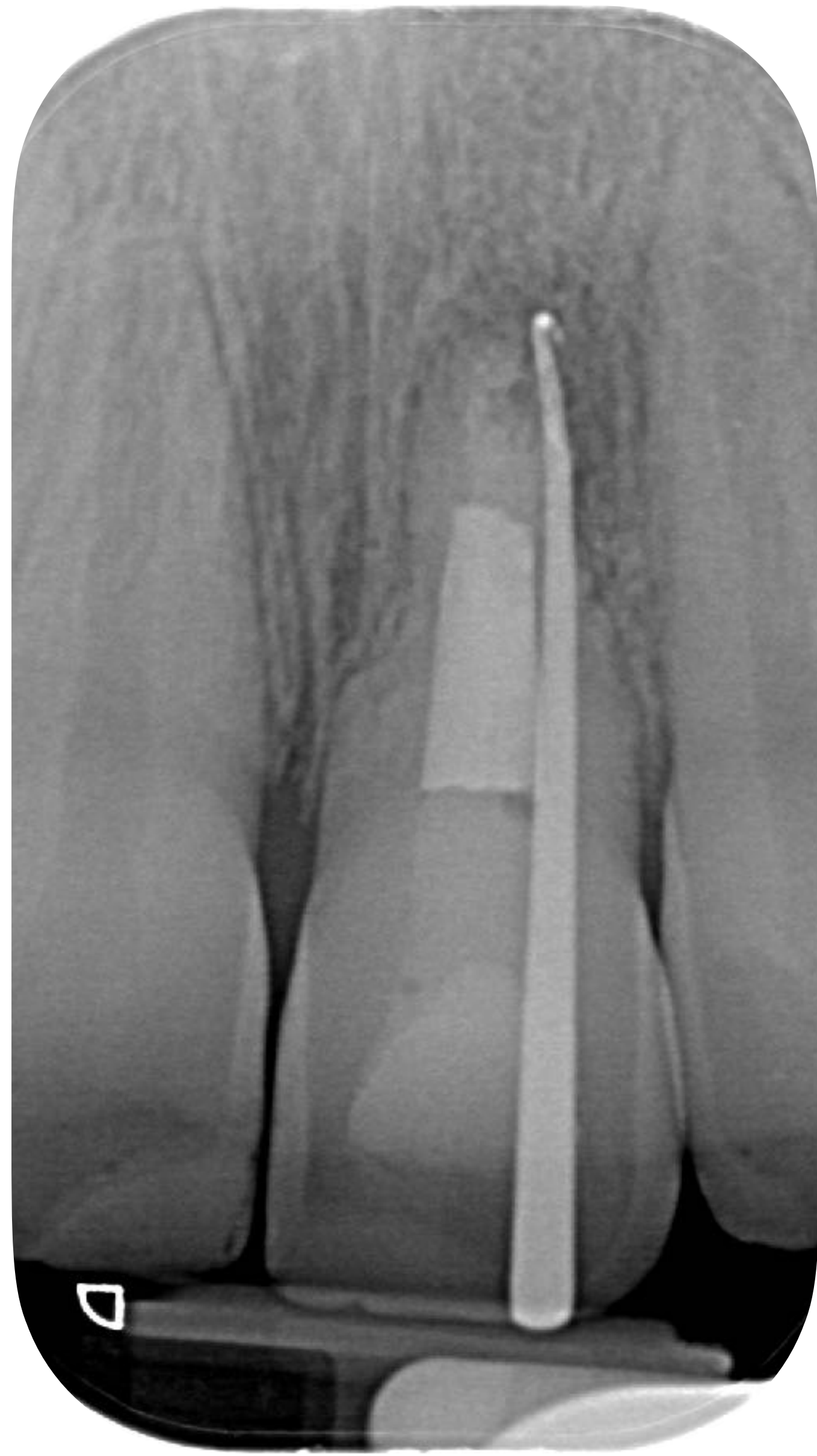


2019

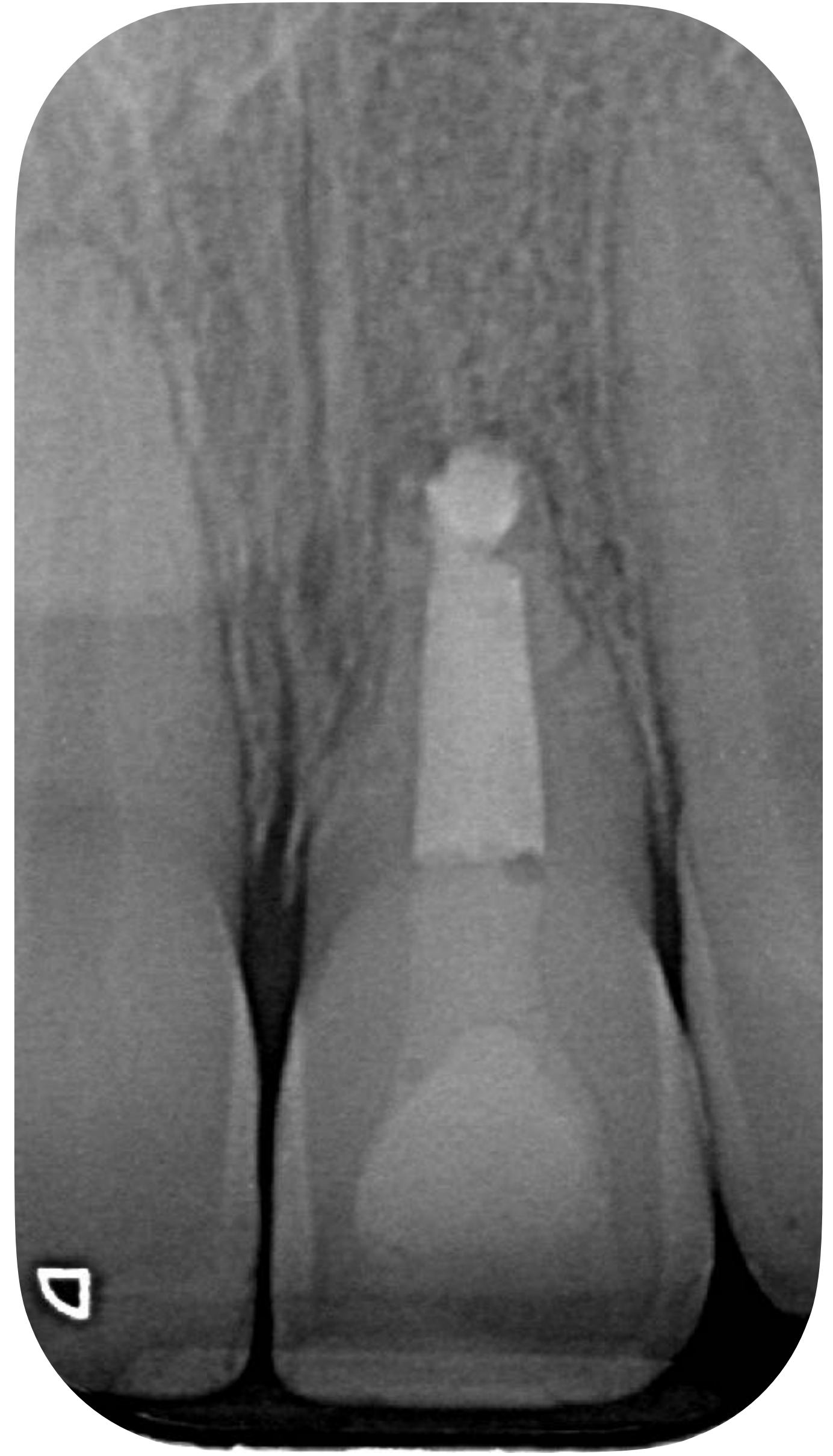




2022

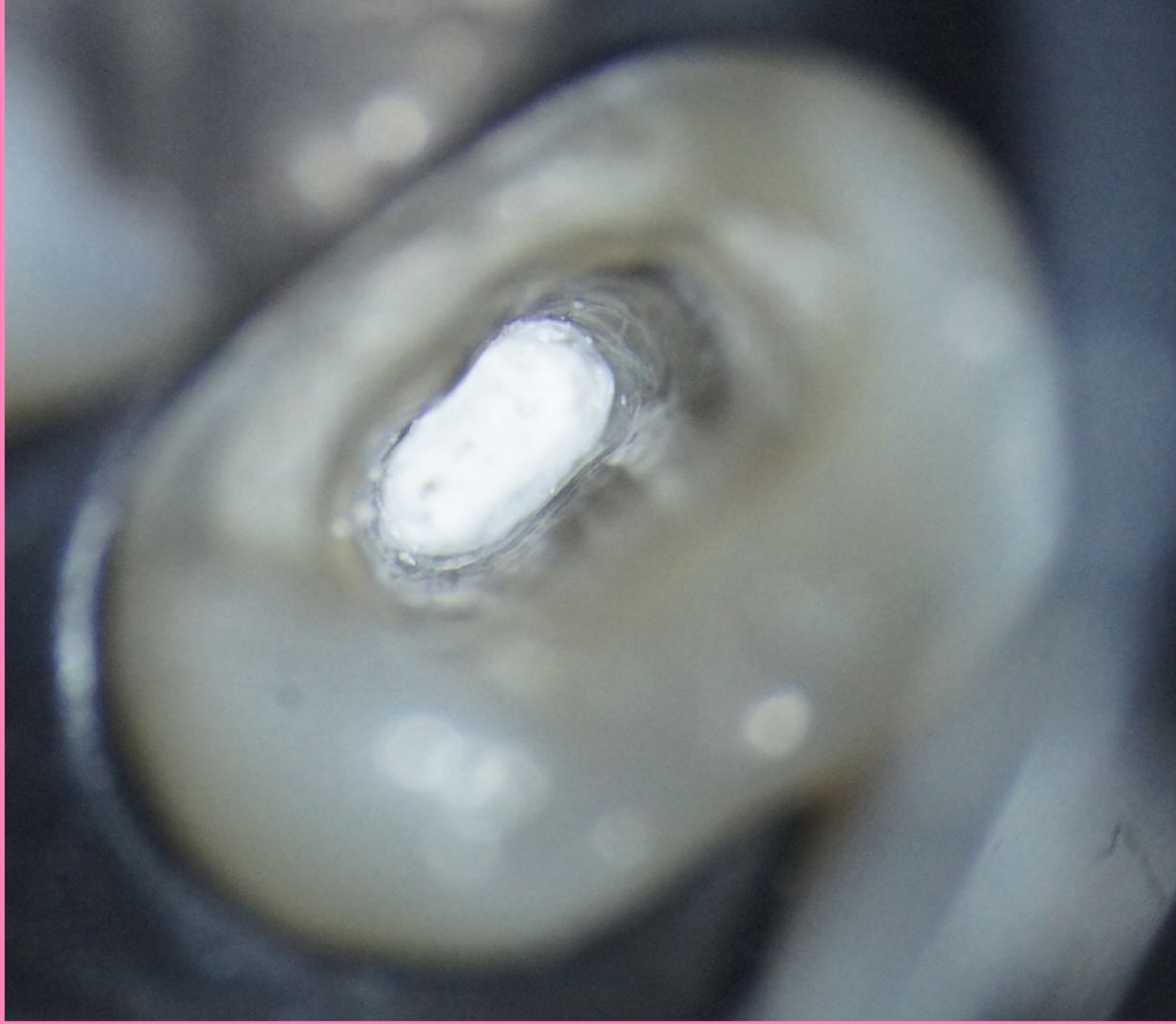


2024



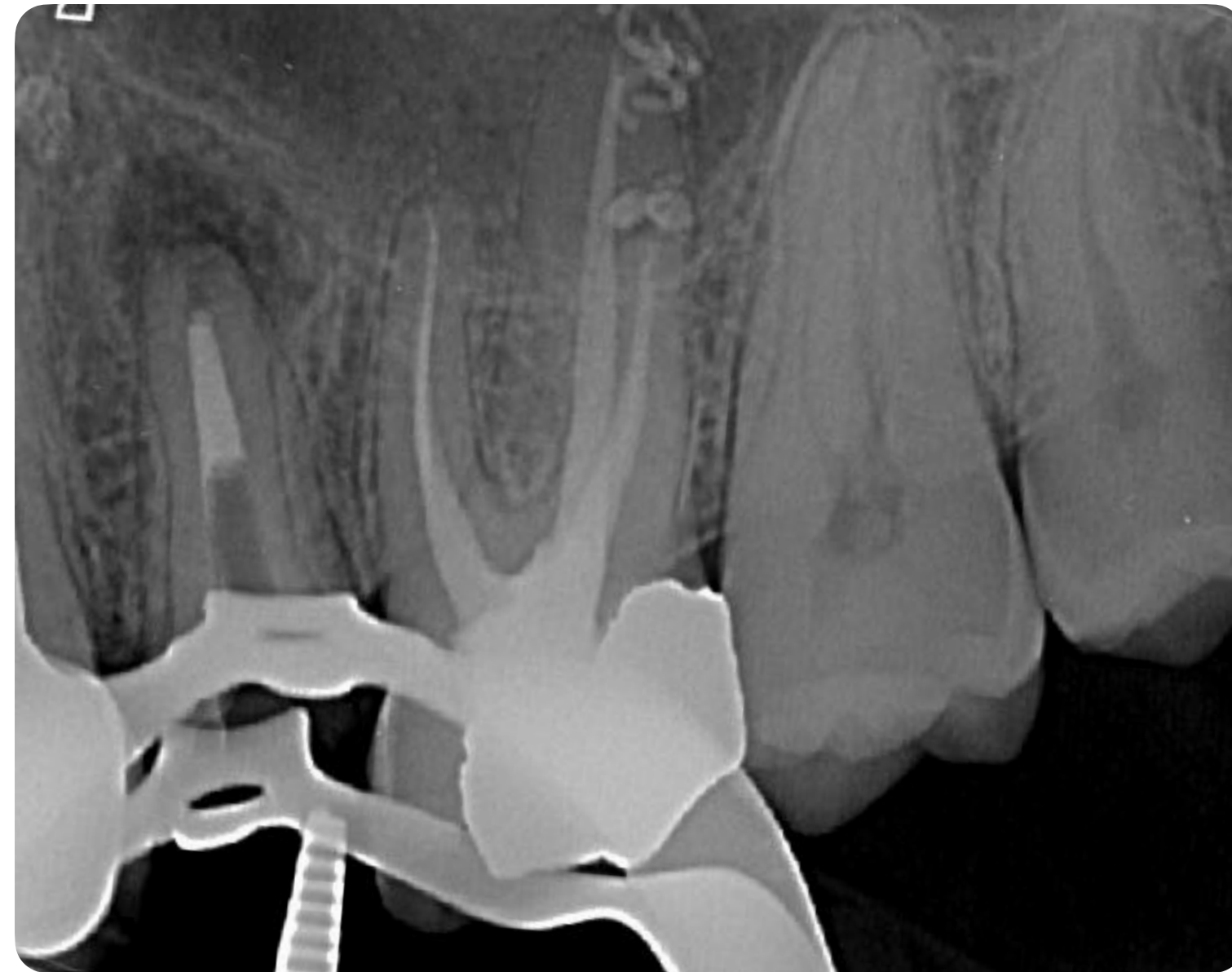
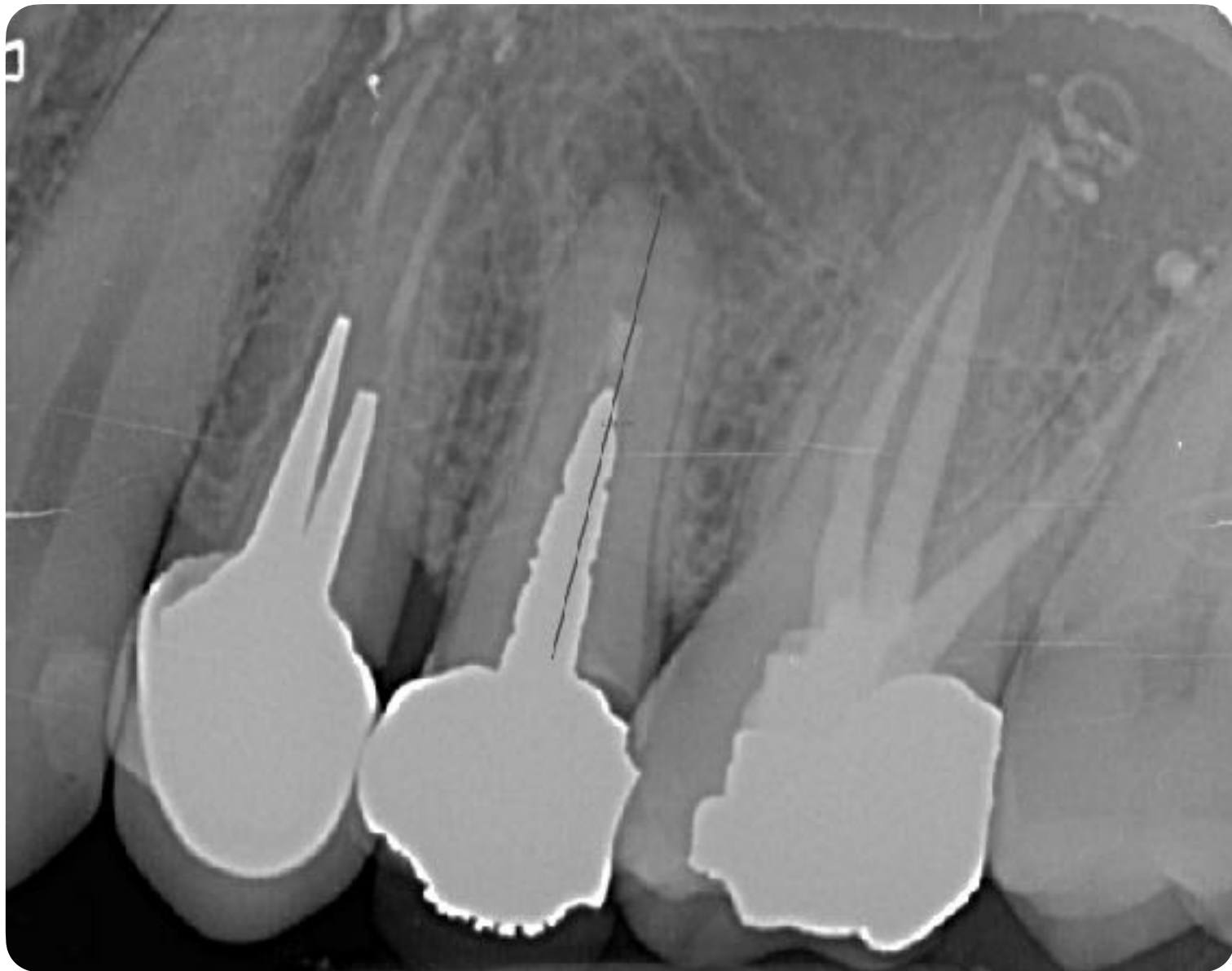


# APICAL PLUG





**2021**



**2022**

**APICAL PLUG**





# KEY POINT



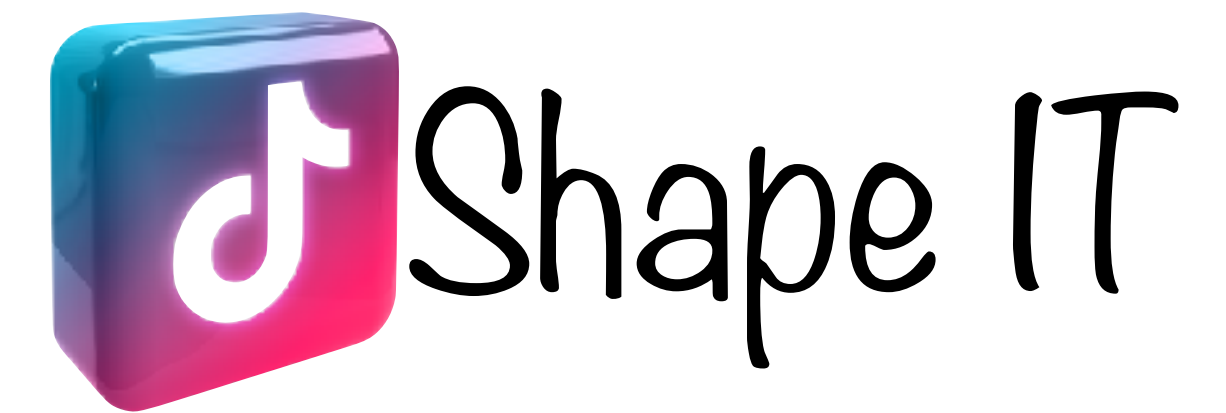
**TRATTAMENTO ENDODONTICO MINI-INVASIVO**

**RAGGIUNGIMENTO DEGLI OBIETTIVI MECCANICI E BIOLOGICI**

**FILE ROTANTI NI-TI ATTIVATI TERMICAMENTE  
E CEMENTI BIO CERAMICI**









# GRAZIE

Shaperit



DR. GIACOMO SUARDI



DR. FABIO PICCOTTI



DR. ANDREA BALOCCO



DR. MARCO BUCCI



DR. GIANLUCA FUMEI