

CORSO DI AGGIORNAMENTO 2025

Clinical Guidelines

TAVOLA CLINICA

 **COLTENE**

**L'EVOLUZIONE DELLA SISTEMATICA HYFLEX.
LA NUOVA SEQUENZA OGSF PER UNA
ENDODONZIA PIÙ SICURA ED EFFICIENTE**

Dr Gianluca Fumei



മകളെ ഹയറ്പങ്കായിക്കാവാമോ?

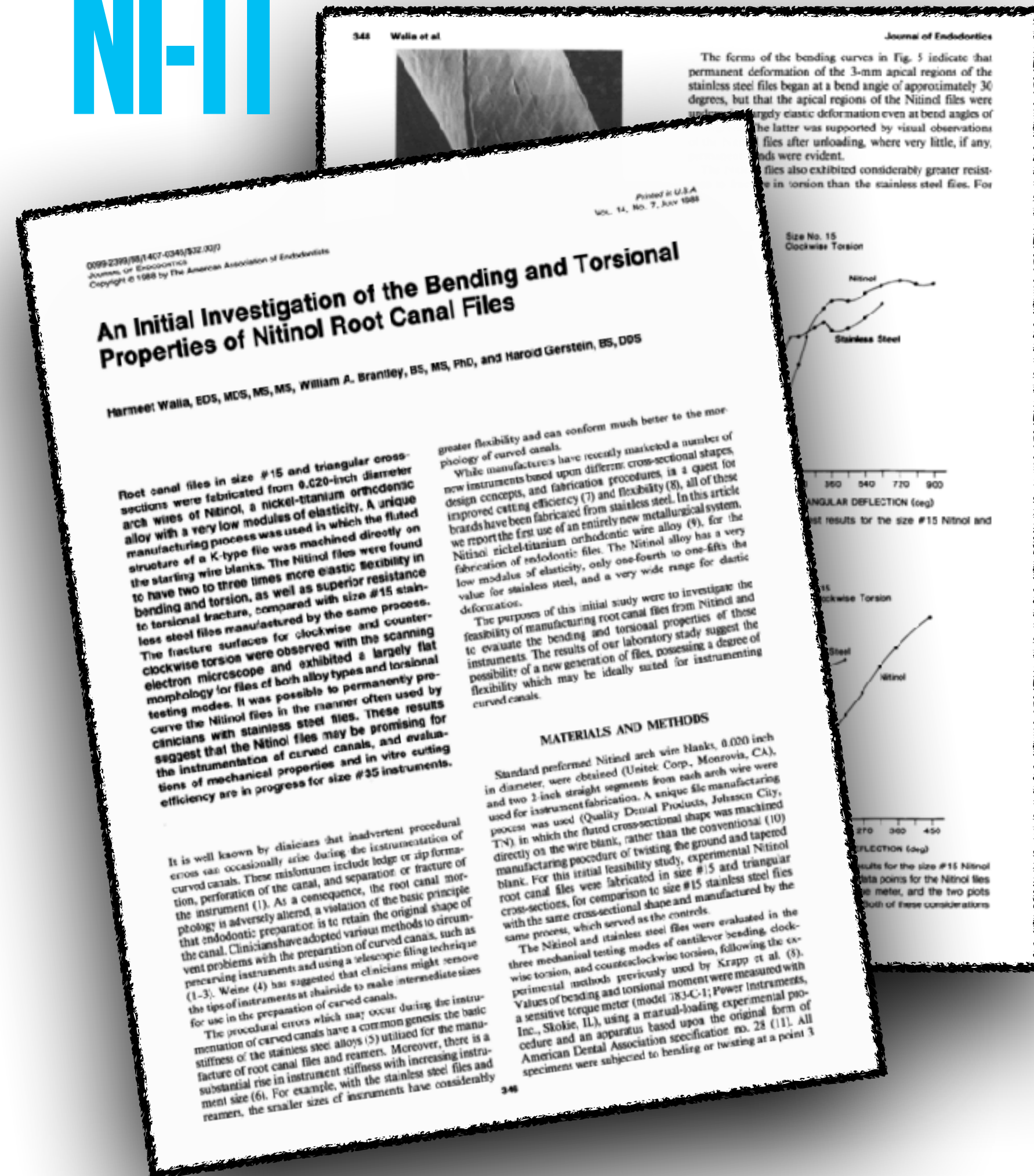




ACCIAIO



NI-TI



1988

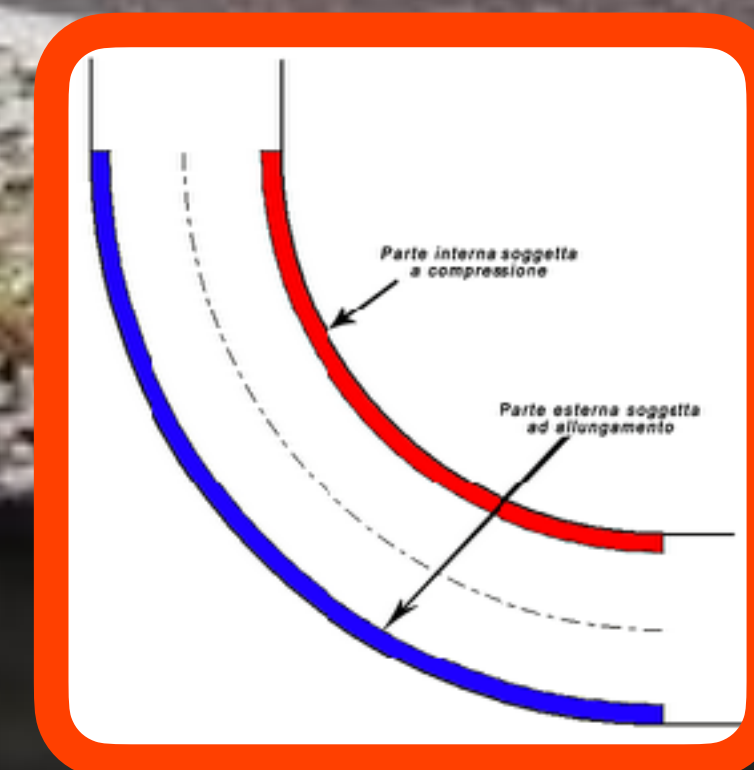
WALIA ET AL JOE

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 TORSIONALE

FRATTURA DA FATICA CICLICA



Rotary NiTi Instrument Fracture and its Consequences

2006

This has led to changes in instrument design, instrumentation protocols, and manufacturing methods.

In addition, factors related to clinician experience, technique, and competence have been shown to be influential

Peter Parashos and Harold H. Messer

NiTi Instrument Fracture and its Consequences

Peter Parashos MDSc, PhD, and Harold H. Messer MDSc, PhD

Abstract

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

Key Words

Fracture, instrument design, instrumentation protocols, rotary nickel-titanium instruments

School of Dental Science, Faculty of Medicine,

In the practice of endodontics, clinicians may encounter procedural accidents and obstacles to normally routine therapy (1). One of these procedural problems is instrument fracture. Fractured root canal instruments may include endodontic files, hand files, lateral or finger spreaders, and paste fillers (Fig. 1), and may be made of nickel-titanium (NiTi), stainless steel or carbon steel. Fracture may result from correct use or overuse of an endodontic instrument (2). It is commonly found in the apical third of a root canal (3–6). The use of rotary NiTi root canal instruments has led to a perceived high incidence of fracture (6). Furthermore, fracture of rotary NiTi instruments may occur (7–10), even with brand new instruments, whereas fracture of hand instruments is preceded by instrument distortion serving as a warning of impending failure. In some cases, distortion of rotary NiTi instruments is often not visible (11–13).

The potential difficulty in removing instrument fragments and the adverse prognostic effect of this procedural complication have led to reluctance to adoption of this innovation (6, 16). Consequently, considerable research has been undertaken to understand the reasons for instrument fracture, to prevent rather than treat. The purpose of this review is to provide an understanding of the prevalence, causes, management of instrument fracture, its impact on prognosis, and to make recommendations concerning management associated with fractured rotary NiTi instruments.

Prevalence

The clinical belief within the dental profession is that instrument fracture is more frequently seen with rotary NiTi instruments than with stainless steel hand instruments. This is based on anecdotal evidence diffused via informal communication or *ex vivo* research (17), but not on *in vivo* research. A study of discarded instruments (13) found that 21% of 378 discarded instruments were fractured from a specialist endodontist.

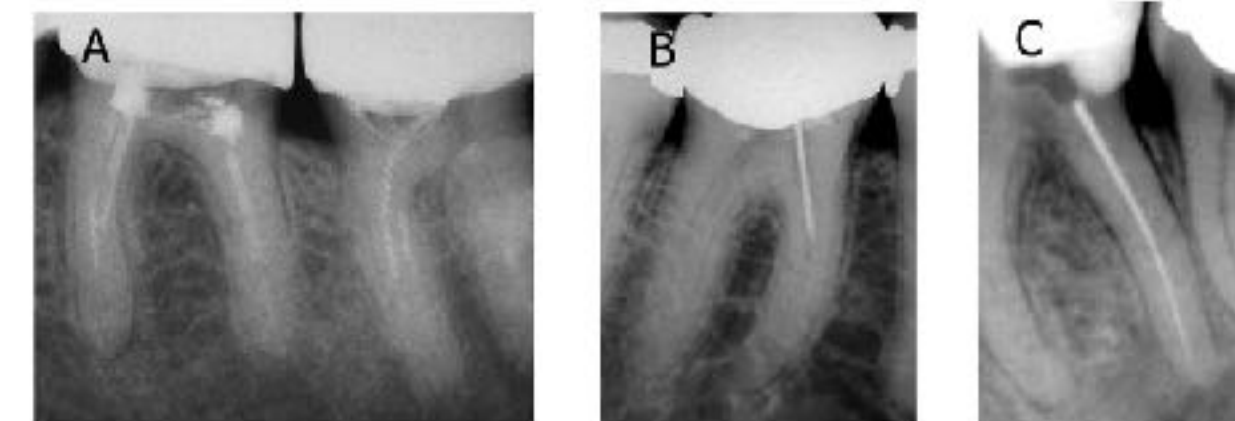


Figure 1. Examples of various types of fractured endodontic instruments. (A) Lentulo-spiral bur, (B) Gates-Glidden drill, (C) whole length of a rotary NiTi instrument. (Courtesy of Dr. Peter Spili).

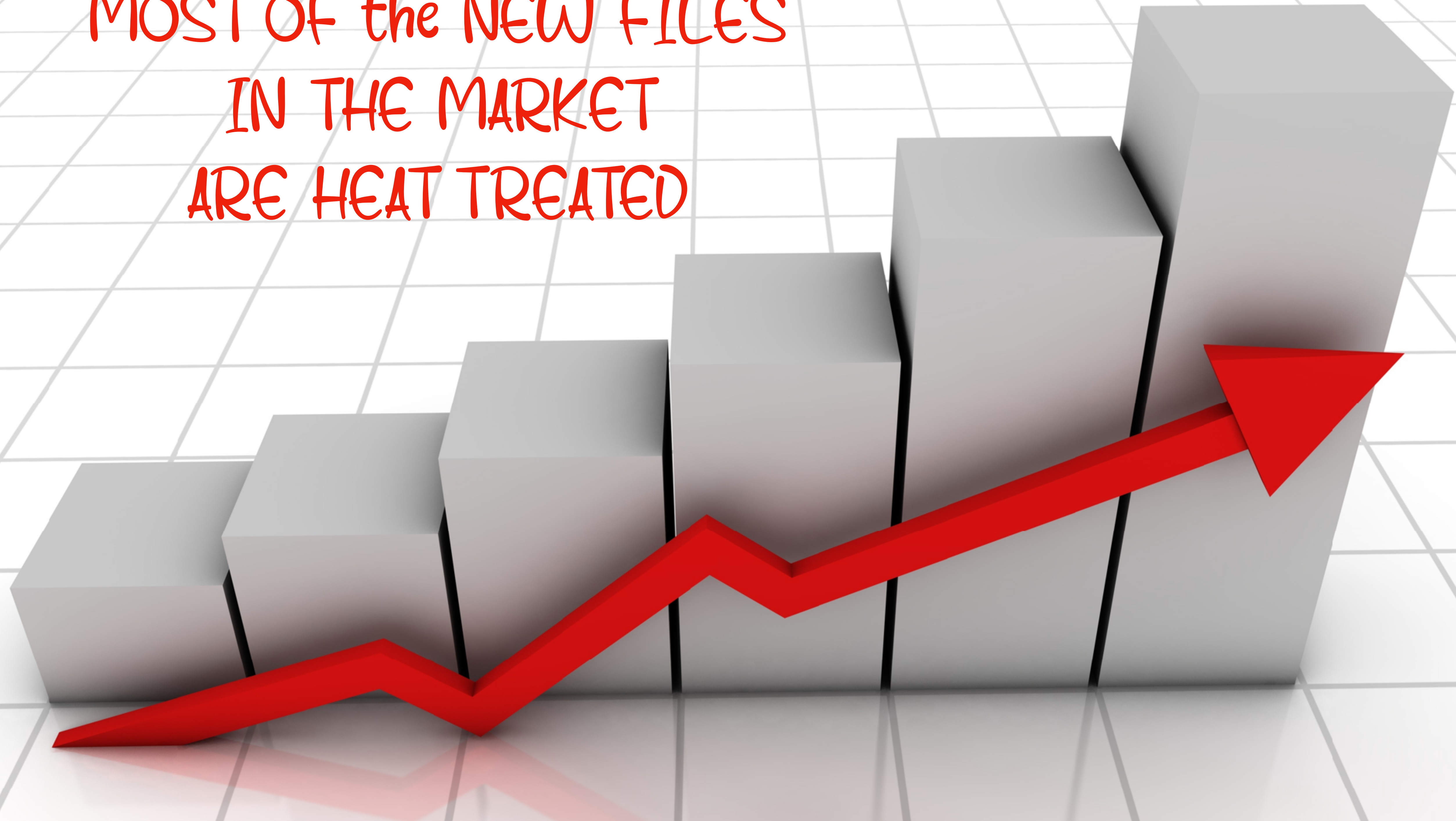


2011

Hyflex CM

Coltene cambia il DNA del Ni-Ti

MOST OF the NEW FILES
IN THE MARKET
ARE HEAT TREATED



ESE ROME 2011

NOT ONLY ROOTS

15TH BIENNIAL CONGRESS
OF THE EUROPEAN SOCIETY
OF ENDODONTOLOGY

ROME - 2011, SEPTEMBER 14TH - 17TH



COLTENE HYFLEX CM



HYFLEX CM

MEMORIA ELASTICA ≈ 0

MIGLIORE RESISTENZA
FATICA CICLICA

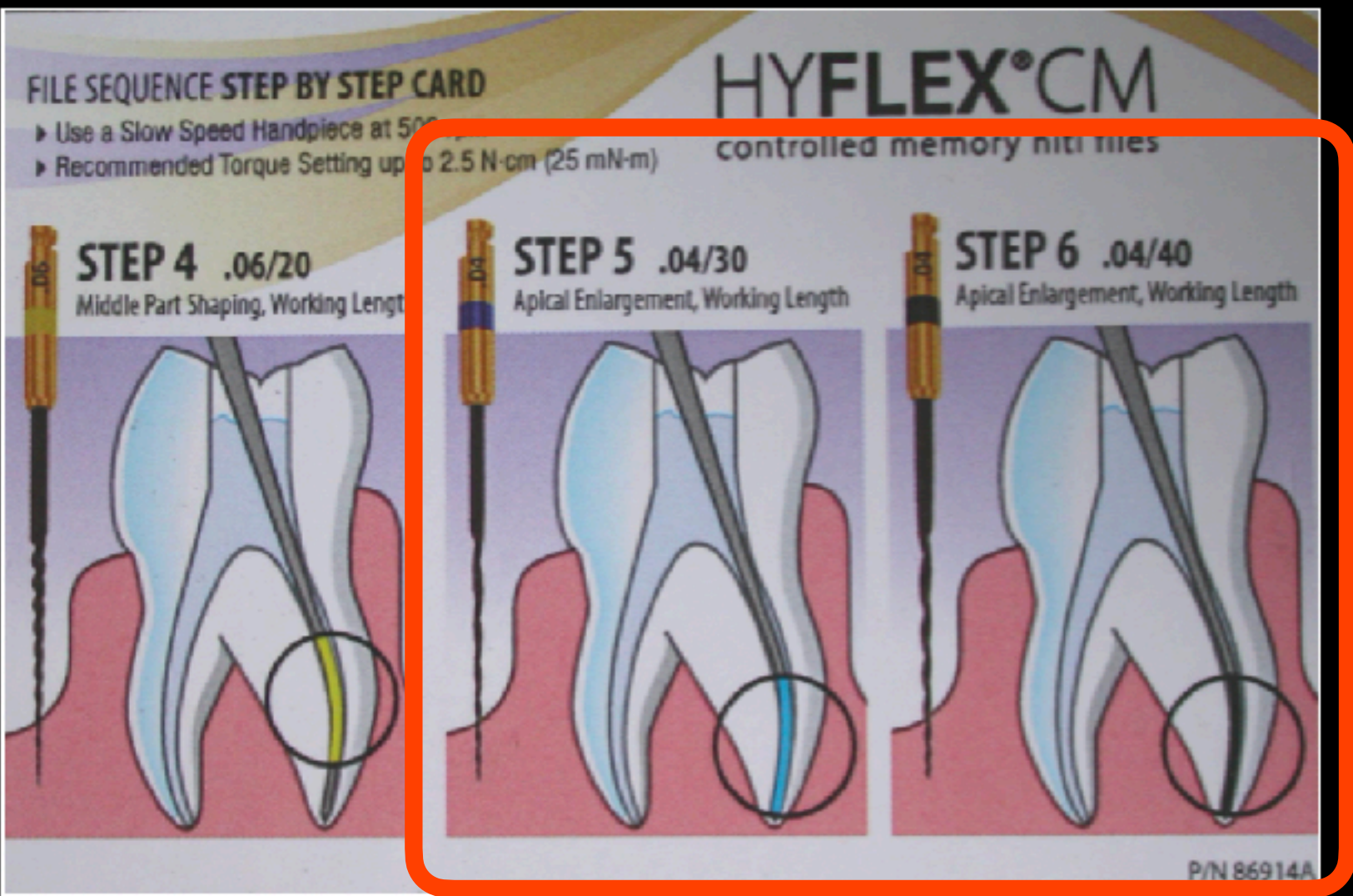
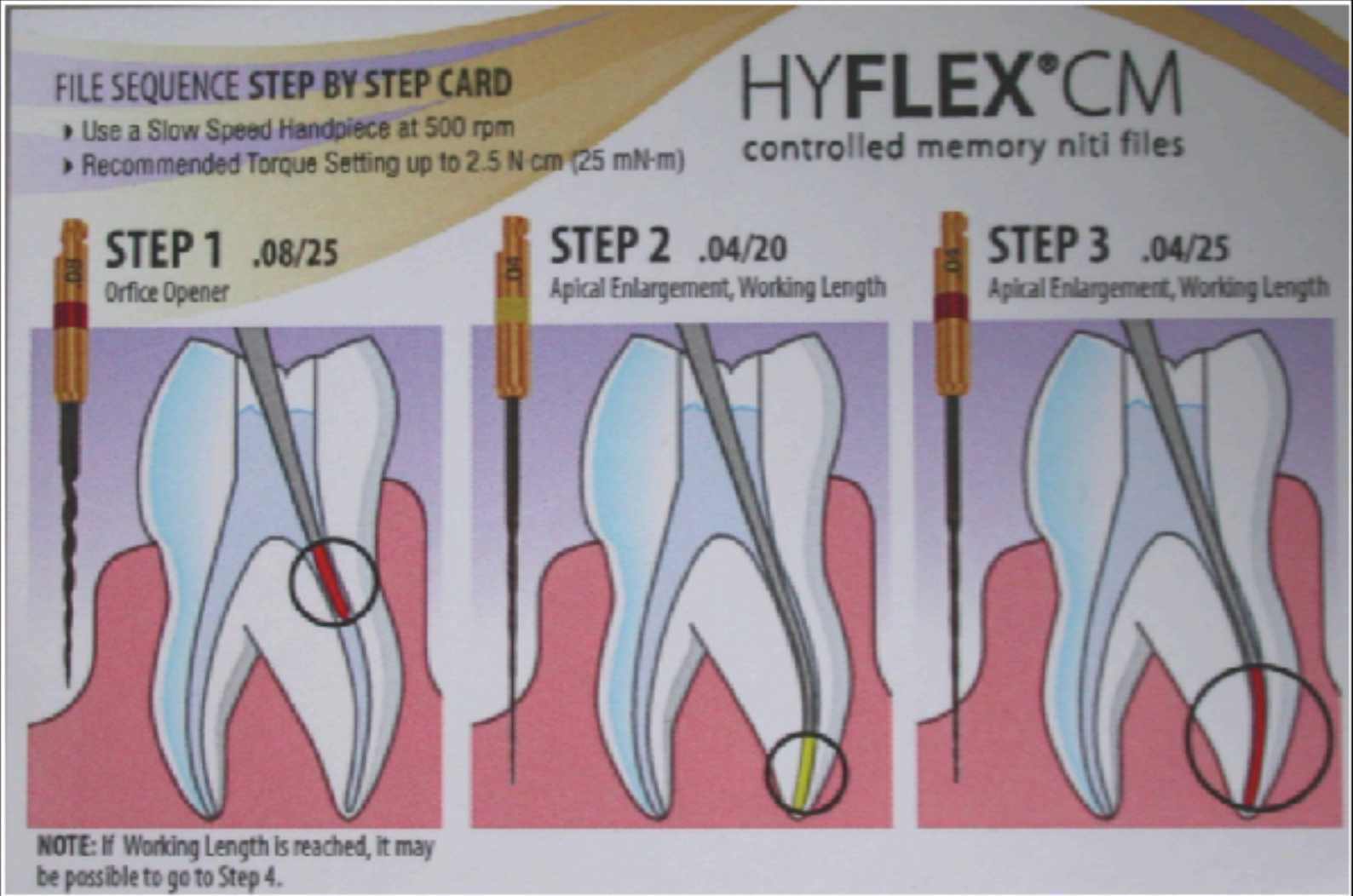
MIGLIORE RISPETTO
ANATOMIA CANALARE

REVERSIBILITA' DELLA
FORMA

52 %WT NI

- Contesto: evoluzione della strumentazione NiTi
- Obiettivo: strumenti più flessibili, resistenti e sicuri

SINGLE LENGTH



0.08/25



0.04/20



0.04/25



0.06/20



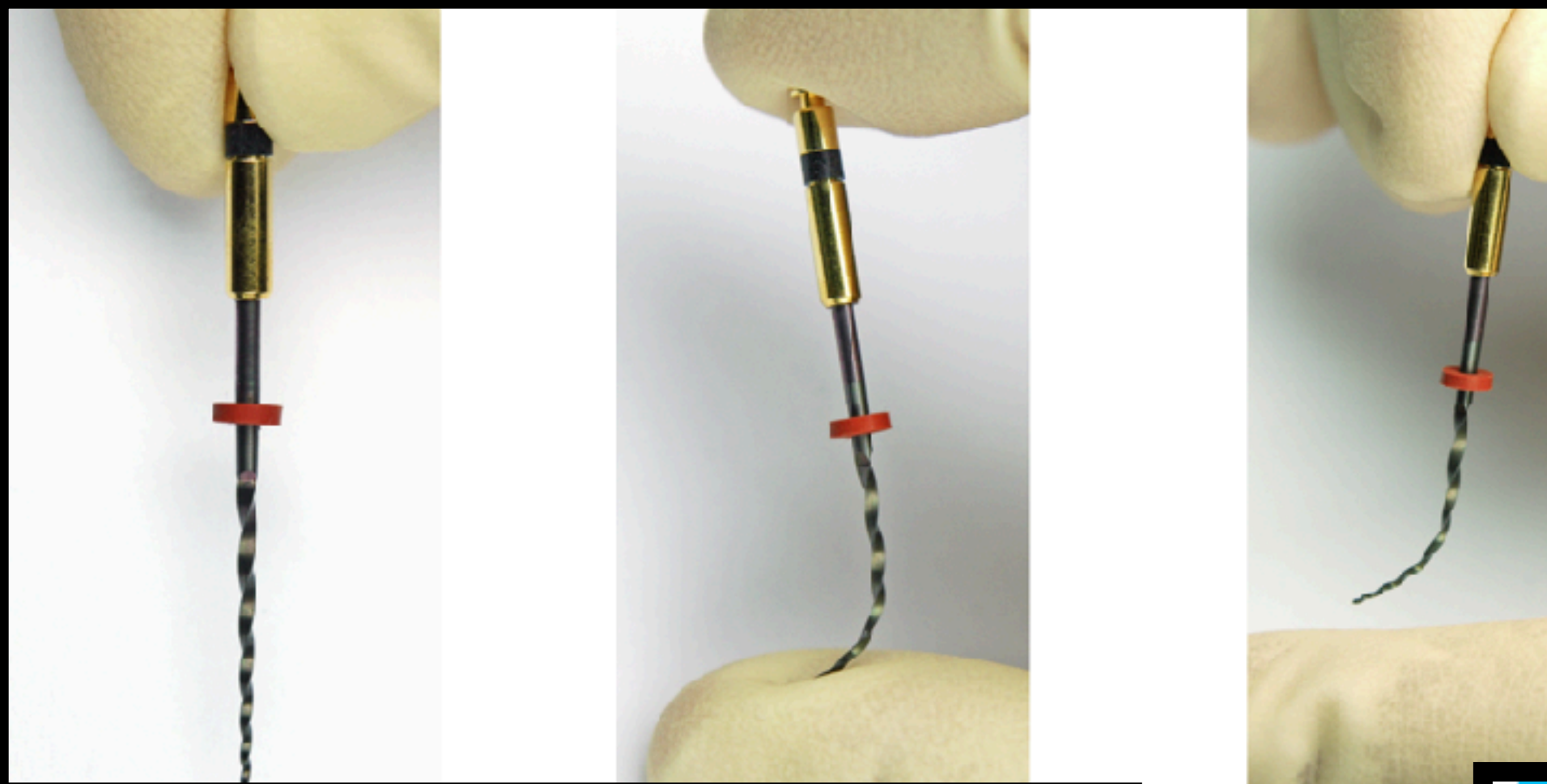
0.04/30



0.04/40

SEZIONE TRASVERSALE

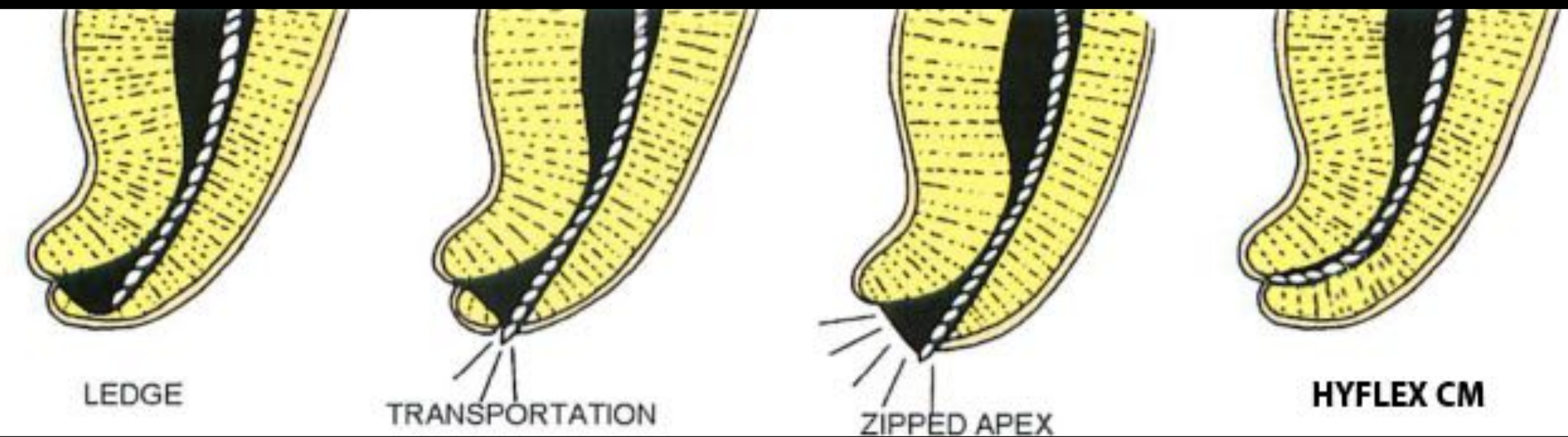
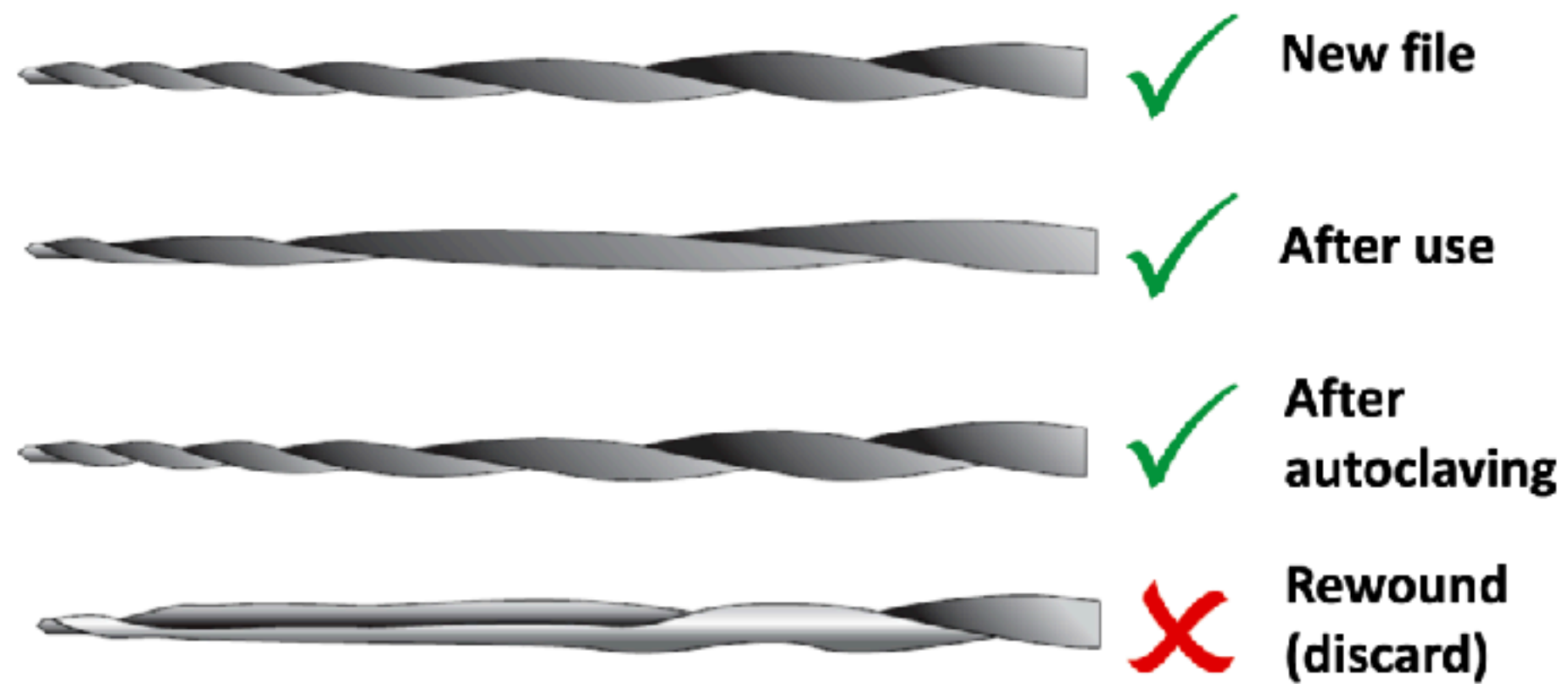
HYFLEX CM

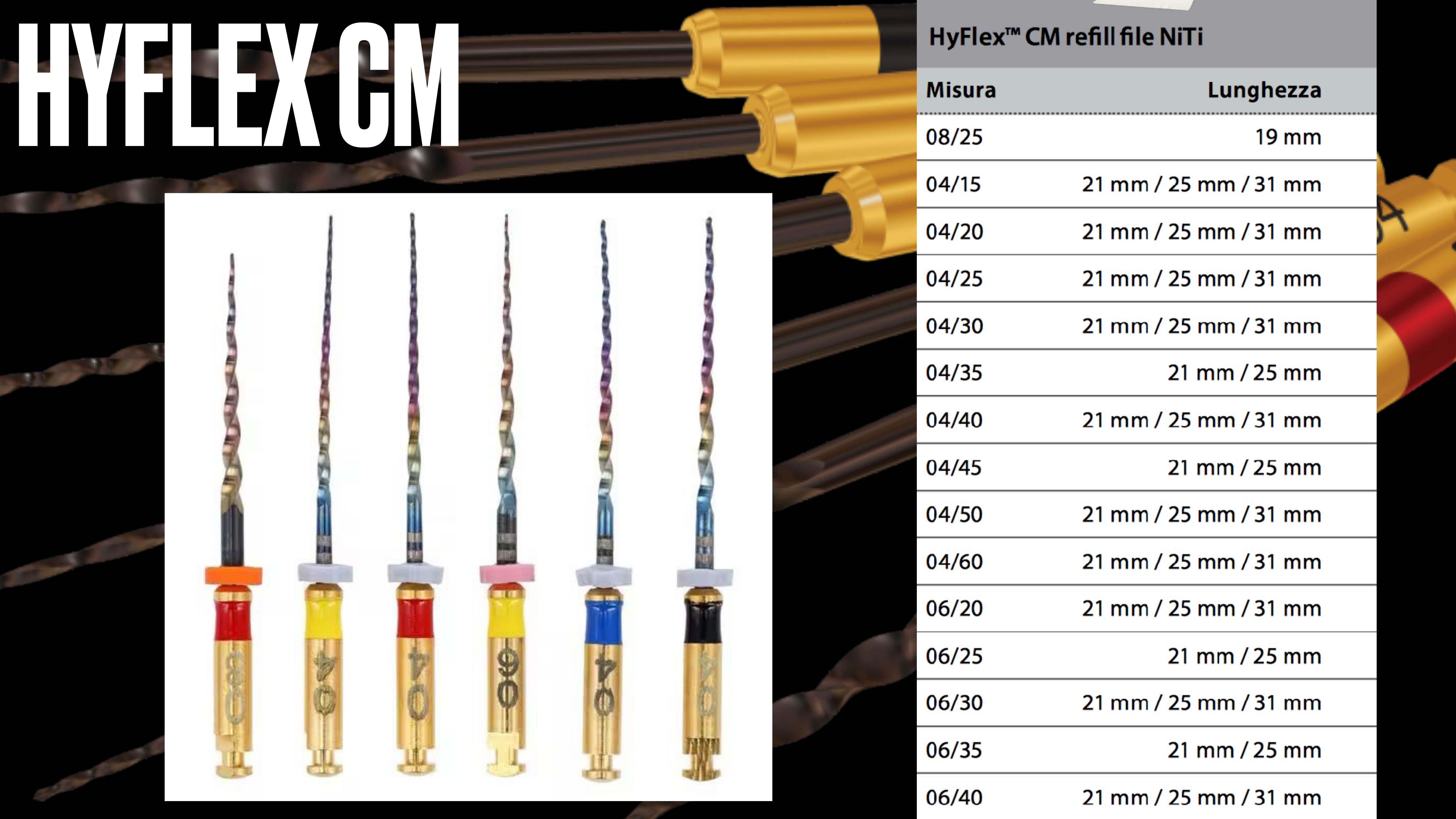


THE "HOT WATER" TRICK TO REGENERATE FILES



VISUAL CHECKING





HYFLEX CM



HyFlex™ CM refill file NiTi

Misura	Lunghezza
08/25	19 mm
04/15	21 mm / 25 mm / 31 mm
04/20	21 mm / 25 mm / 31 mm
04/25	21 mm / 25 mm / 31 mm
04/30	21 mm / 25 mm / 31 mm
04/35	21 mm / 25 mm
04/40	21 mm / 25 mm / 31 mm
04/45	21 mm / 25 mm
04/50	21 mm / 25 mm / 31 mm
04/60	21 mm / 25 mm / 31 mm
06/20	21 mm / 25 mm / 31 mm
06/25	21 mm / 25 mm
06/30	21 mm / 25 mm / 31 mm
06/35	21 mm / 25 mm
06/40	21 mm / 25 mm / 31 mm

52%

TABLE 1. Mean Values ± Standard Deviation of the Values Obtained in the Stiffness Test

Instrument	g/cm
Hyflex	14.46 ± 2.7 ^a
EndoSequence	46.01 ± 3.9 ^b
ProFile	64.18 ± 4.2 ^c
Hero	67.11 ± 5.7 ^c
FlexMaster	68.39 ± 4.9 ^c

The lower the value, the more flexible the instrument is. Different superscript letters indicate statistically significant differences.

ARTICOLI SULLA LEGA MARTENSITICA

HyFlex[®] CM rotary files: an excellent innovation for endodontic treatment

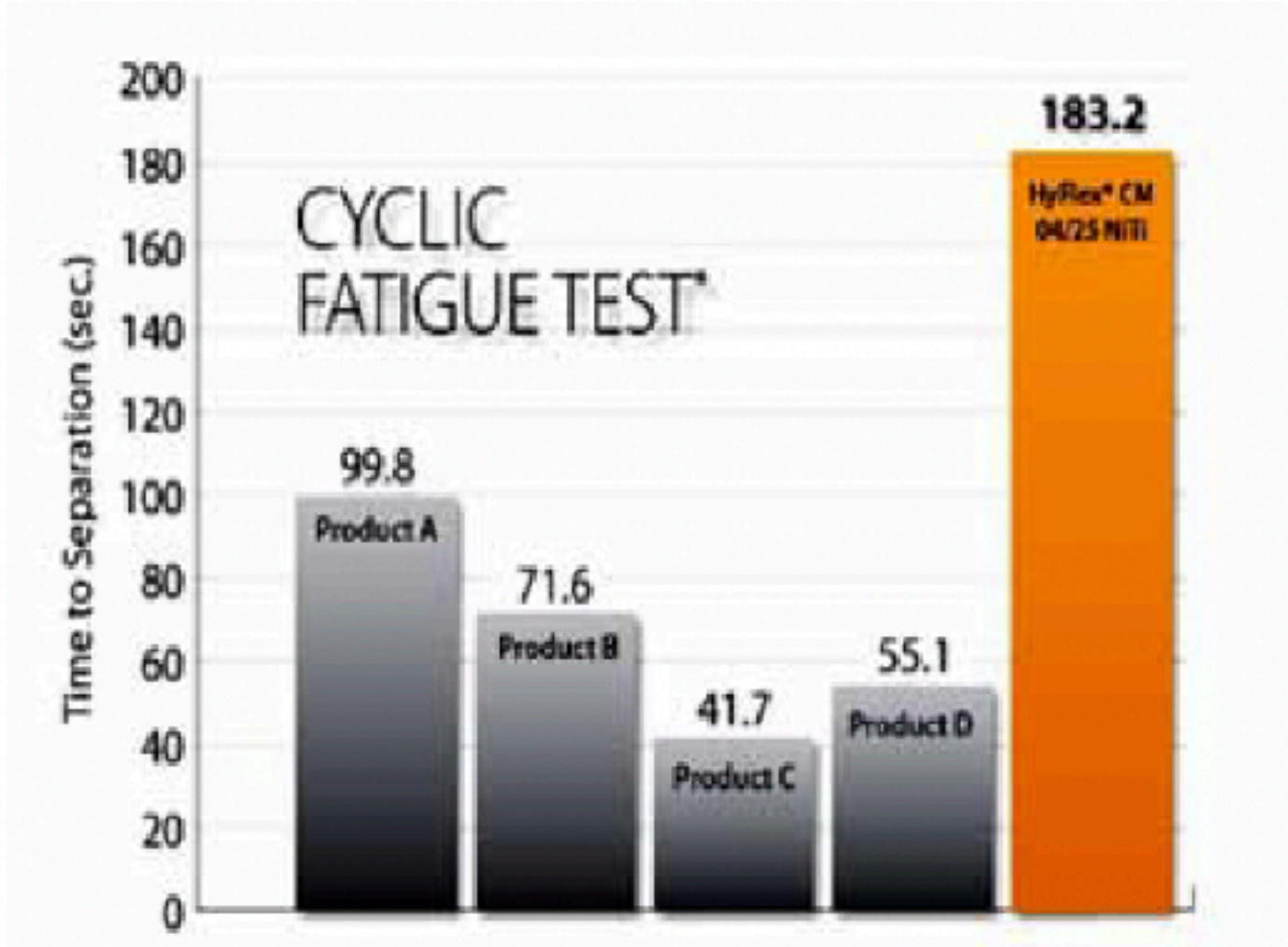
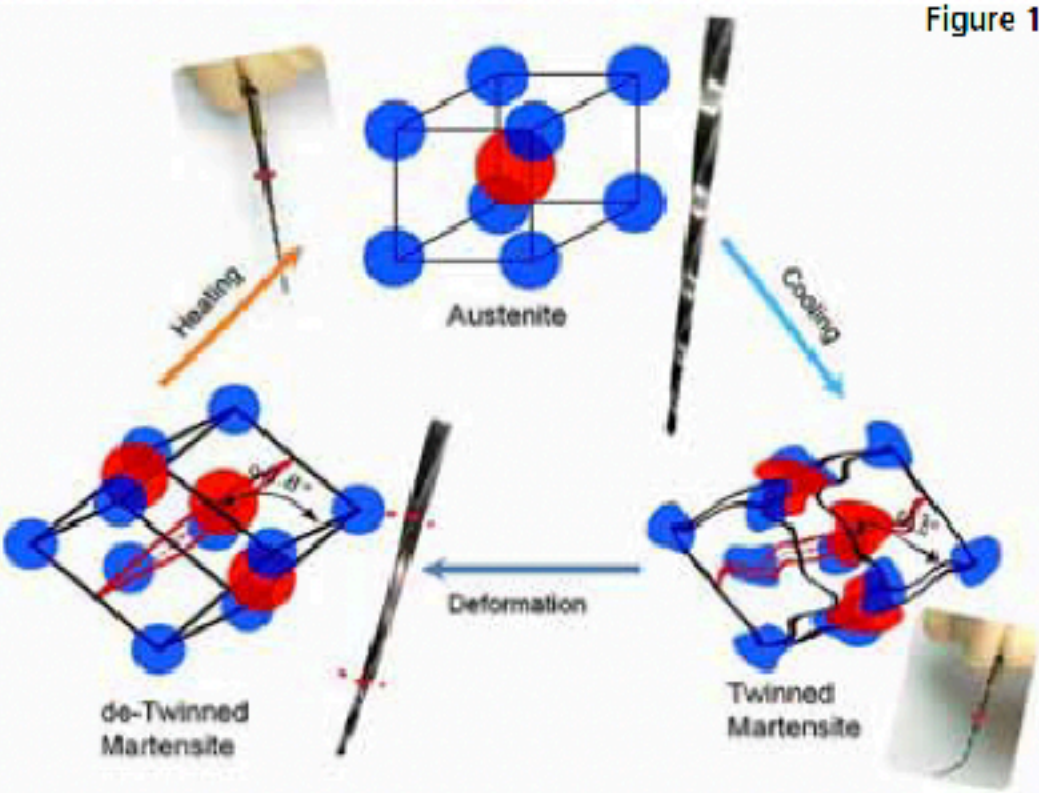
Drs. Ricardo Caicedo and Stephen J. Clark describe the use of HyFlex[®] CM controlled memory NiTi files, presenting the technique and four case reports

Abstract

New Nitinol files with controlled memory (CM), a metal alloy of nickel and titanium, have been introduced and manufactured by Coltene/Lindo. The company reports that this file is more resistant to cyclical fatigue compared to other NiTi files, which reduces the incidence of file fracture. Some clinicians have multiple file systems in their offices to meet the demands of different clinical situations. The purpose of this new rotary file is to simplify root canal treatment and to optimize cleaning and shaping of the canal. The cutting profile of each HyFlex[®] CM file facilitates penetration in the canal, and presents a root canal shape corresponding with the original anatomy. This system also offers precise apical finishing, leaving the structural integrity of the root intact after endodontic therapy and allowing the adaptation of the tapered gutta-percha point to the canal anatomy.

Introduction

One of the primary goals of endodontic therapy is the complete



Graph 1

Controlled Memory Wire Test Results NiTi Size 25/.04				
	Name	Criteria (ISO 3630-1, ADA)	Results	Comparison
1	Torque	1.77 mNm Min	6.02 mNm	Equivalent
2	Angular Deflection	360° Min	558°	x1.4
3	Cyclical Fatigue	25 seconds at 90°	Mean of 160.79 seconds with a Standard Deviation of 38 seconds	x6.4
4	Flexibility	50 mNm at 45°	Mean of 18 mNm @ 45°	x2.7 less

Table 1

01-2012

Il caso HyFlex™ CM

Dr. Mario Marrone, Palermo



Dr. Mario Marrone
www.mariomarrone.it

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

Una delle più importanti innovazioni in campo endodontico è stata l'introduzione della lega Nichel-Titanio (NiTi) nel 1988 e l'immissione in commercio di molti strumenti con differenti disegni delle lame, angolo di taglio, punte e conicità ma la qualità e le caratteristiche delle leghe sono rimaste, in questi anni, sostanzialmente invariate.

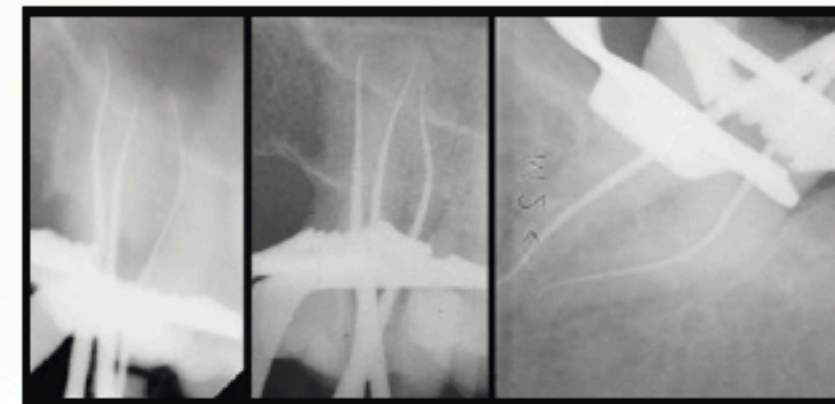
Solo recentemente sono stati introdotti strumenti con lega NiTi a memoria di forma denominata CM-wire (controlled memory-wire): gli HyFlex CM sono privi del ritorno elastico e hanno la capacità di adattarsi all'anatomia del canale.

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

spire) che permette il disimpegno dello strumento e lo preserva dalle fratture. Inoltre, caratteristica unica della lega CM-wire è il self-restoring (rigenerazione): lo strumento recupera la forma originaria con il trattamento termico. La sterilizzazione in autoclave agisce quindi da indicatore del grado di usura: quando non si ha più il recupero di forma lo strumento va scartato.

Altra caratteristica unica del 'self-restoring' è la capacità di rigenerarsi anche in termini di resistenza alla fatica ciclica, caratteristica che sembrerebbe far aumentare la resistenza alla frattura. (1)

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



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



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

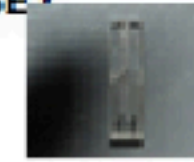


15.04 25.06 2 FILE

How often can a 06/25 HYFLEX CM be used?

GROUP A VS B (HEATED AFTER USE)

1 USO



6 USI



2 USI



7 USI



3 USI



8 USI



4 USI



9 USI



5 USI



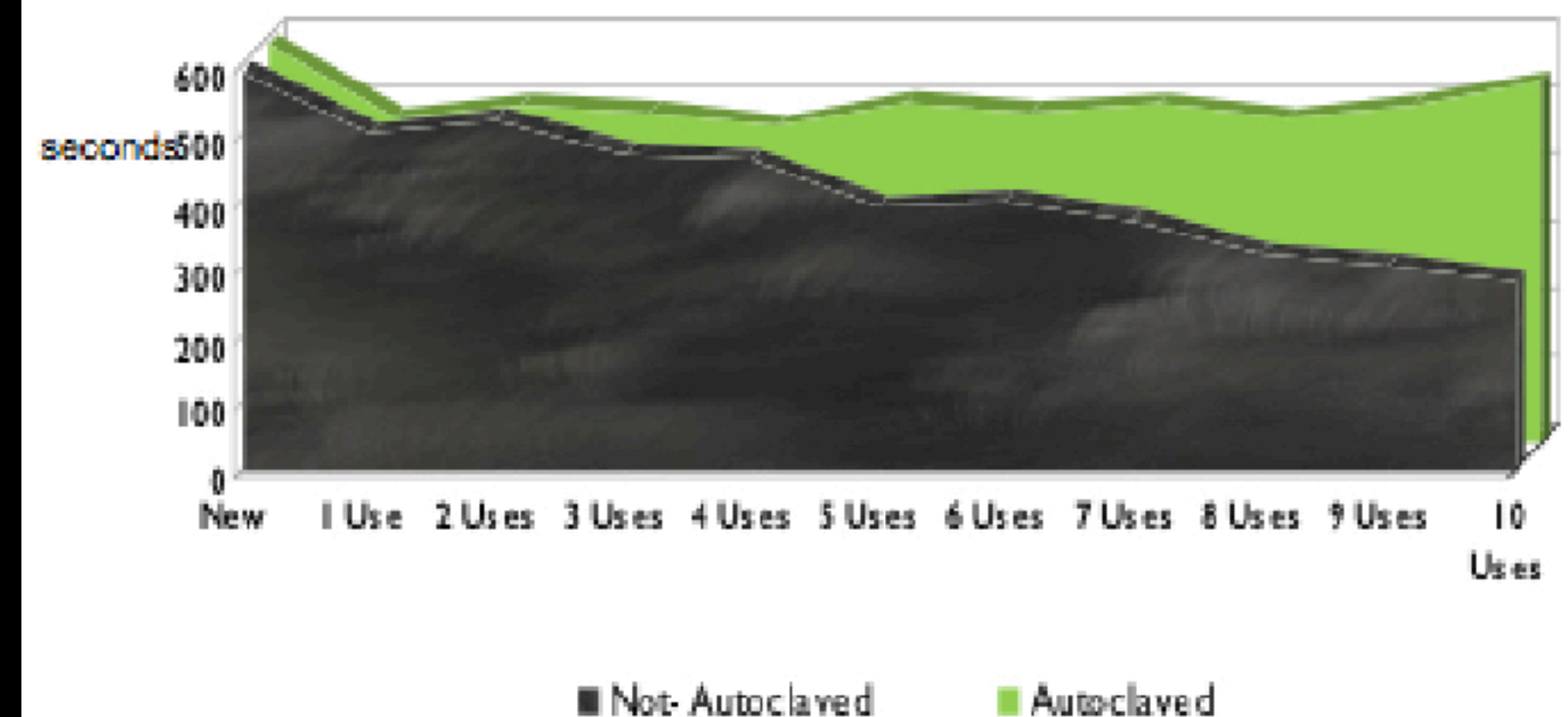
10 USI



Regenerative properties

Heat treatment → regained the instruments morphology

Heat treatment → regains lost instruments strength



2013

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

Abstract
Introduction: The performance and mechanical properties of nickel-titanium (NiTi) instruments are influenced by the cross-section, flute design, and heat treatment processes. Many thermomechanical treatment methods have been developed to improve the properties of NiTi instruments. However, these methods are often complex and require specialized equipment. The purpose of this study was to evaluate the mechanical properties of NiTi instruments after thermomechanical treatment and to compare them with those of conventional NiTi instruments.

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

Over the past 2 decades, nickel-titanium (NiTi) instruments have become an important part of the armamentarium for root canal treatment. They are increasingly used by endodontists and specialists to facilitate the cleaning and shaping of root canals. However, there is a potential risk of "unexpected" fracture of these instruments during use. Even though there have been considerable improvements in the design and manufacturing of NiTi instruments, the fracture of these instruments remains a significant problem. The purpose of this study was to evaluate the mechanical properties of NiTi instruments after thermomechanical treatment and to compare them with those of conventional NiTi instruments.

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

Instrument	Phase transformation	Flexible property	Cyclic fatigue	Torsional fracture
CM Wire (HyFlex CM, TYPHOON Infinite Flex NiTi)	Shen et al, 2011 (44)	Testarelli et al, 2011 (105); Zhou et al, 2012 (42)	Shen et al, 2011 (39); Shen et al, 2012 (40); Peters et al, 2012 (92)	Casper et al, 2011 (95); Peters et al, 2012 (92)
M-Wire (ProFile GT Series X, ProFile Vortex, Vortex Blue)	Alapati et al, 2009 (47); Shen et al, 2011 (44); Ye and Gao, 2012 (45)	Gao et al, 2012 (41)	Gambarini et al, 2008 (66); Johnson et al, 2008 (68); Larsen et al, 2009 (69); Kramkowski and Bahcall, 2009 (90); Gao et al, 2010 (38); 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, TF)	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); Rodriguez et al, 2011 (72); Pedullà et al, 2011 (73); Hilfer et al, 2011 (84)	Gambarini et al, 2009 (98); Park et al, 2010 (93); Gambarini et al, 2010 (97); Casper et al, 2011 (95); King et al, 2012 (96)

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

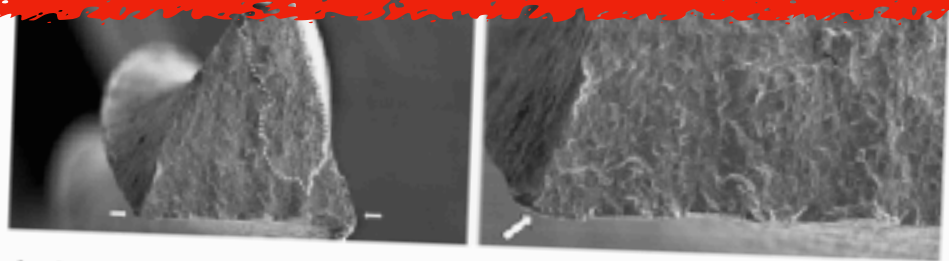
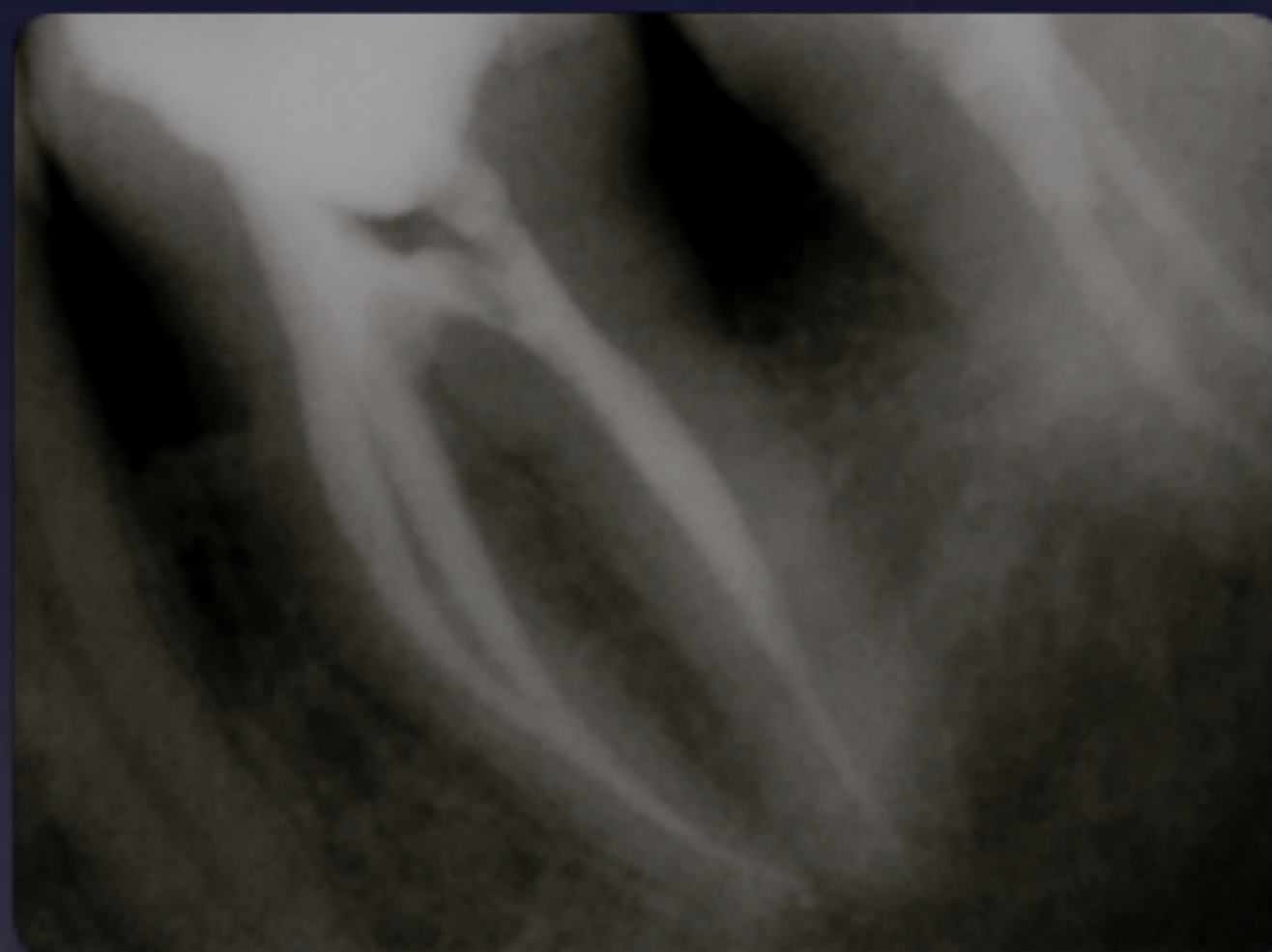


Figure 2. Photomicrographs of a fracture surface of TYP files with the region of fatigue crack propagation and dimple area outlined (dotted line) with crack origins (arrows). (A) The overall view of the TYP file ($N_f = 315$, dimple area is 69%). (B) A high-magnification view of the crack origin (arrow). (C) An overall view of the TYP CM file with 2 crack origins (arrows) ($N_f = 1280$, dimple area is 36%). (D) A high-magnification view of 1 crack origin (arrow).

YA SHEN et AL





Primi CASI CLINICI

HyFlex[®] NT

NITI FILES



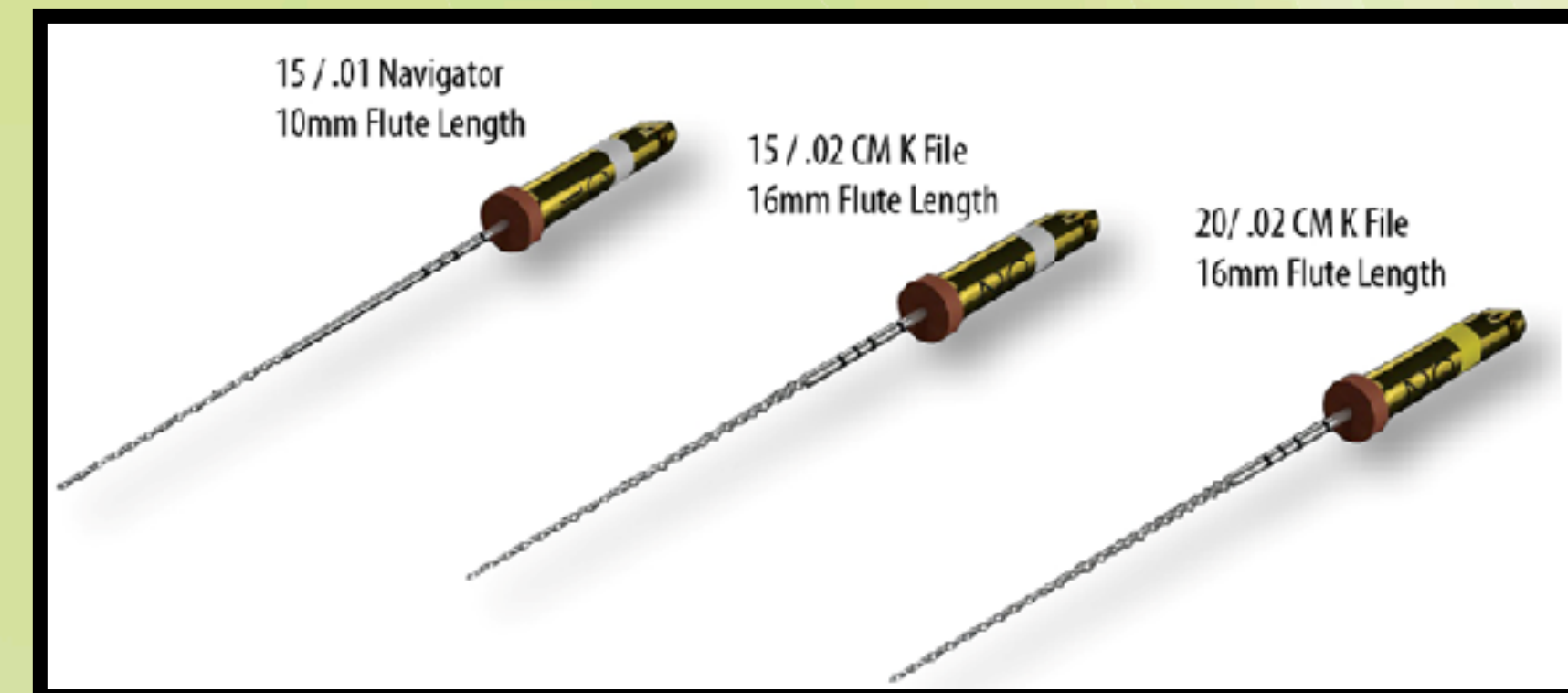
HyFlex NT endodontic rotary NiTi file is designed to work in specific clinical situations, such as calcified canals, straight canals, retreatments and removing Gutta-Percha. HyFlex NT files are available in .06 and .04 tapers in 21 mm and 25 mm.

HyFlex[®] GPF[™]

GLIDE PATH FILES



An established glide path can reduce torsional stress and increase the lifespan of the rotary instrument used for canal preparation, decrease chance for transportation and ledging that often occurs with hand instrumentation, lessen hand fatigue and save valuable chair time. HyFlex GPF will permit the clinician to negotiate working length quickly and efficiently. The HyFlex GPF Controlled Memory Files track well in the apical third and allow safer, more efficient preparations. They are available in 21, 25 and 31 mm lengths.





Perché

CM?

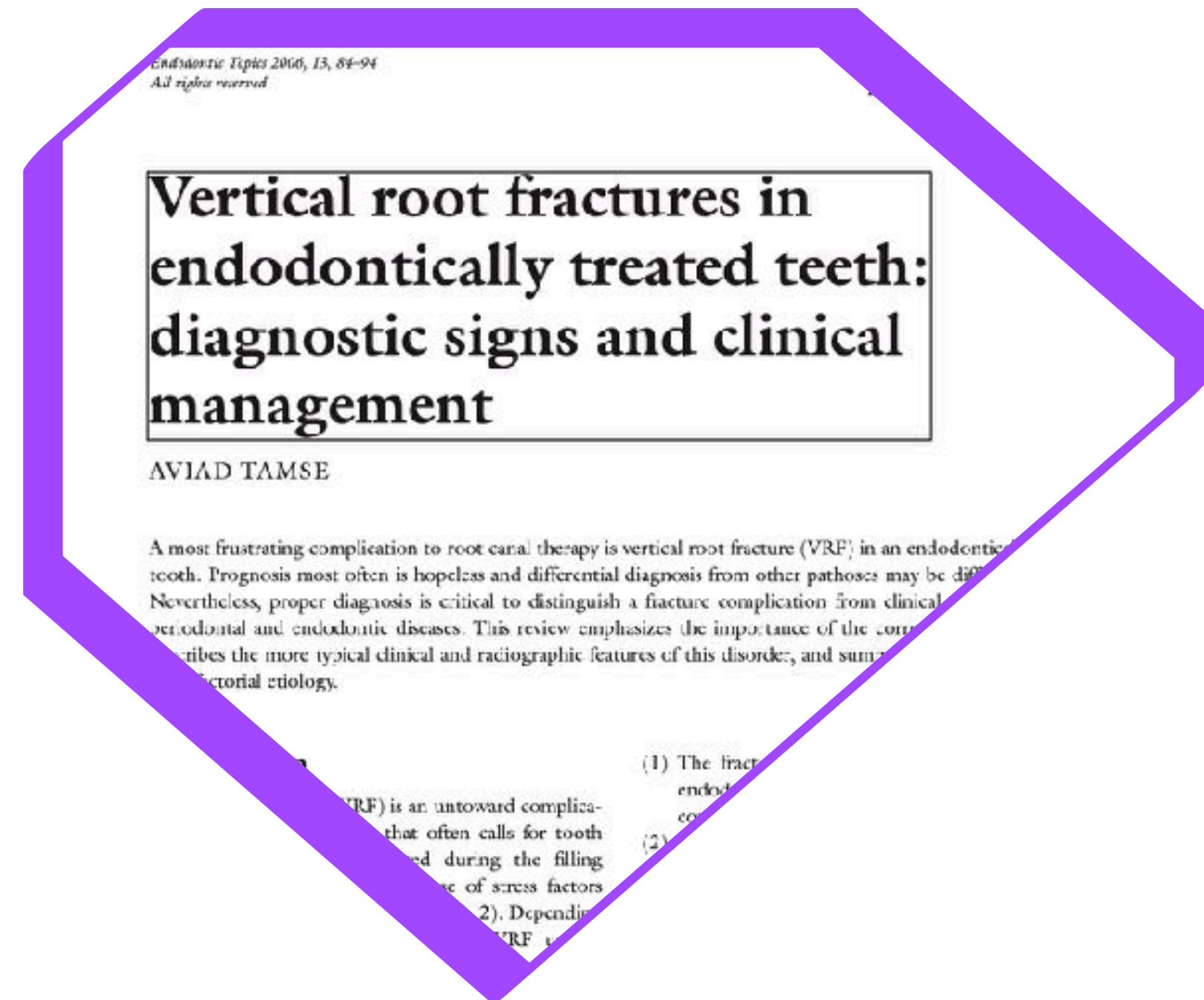


Minimally

Invasive

Endodontics

TAMSE 2006



“I fattori predisponenti includono la **perdita di sostanza dentale sana**, ... che aumenta il rischio di crepe nelle pareti dentinali che possono poi propagarsi fino alla frattura”

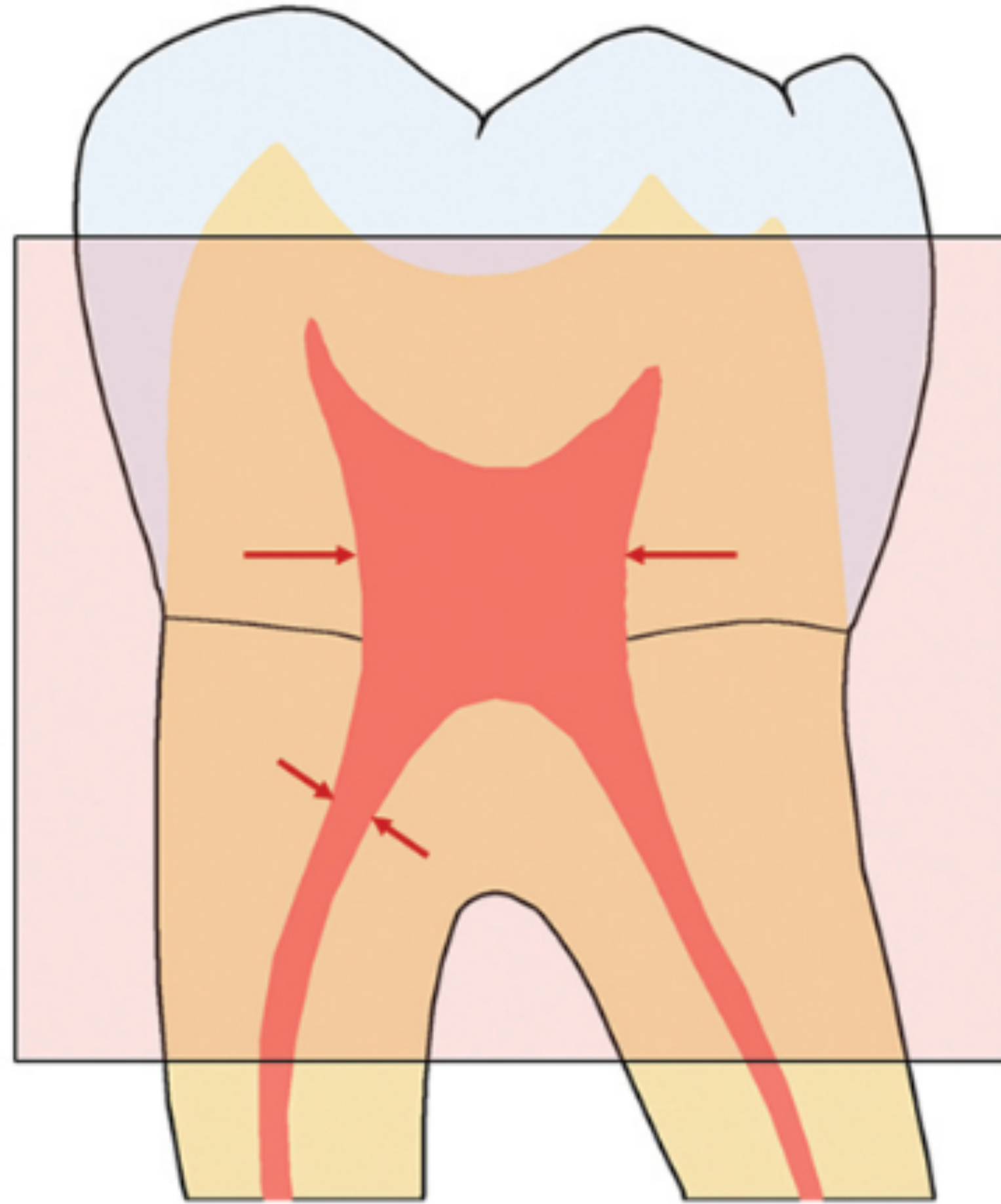
“...tagliare la dentina seguendo **linee rette lungo le curvature indebolisce la struttura radicolare**...
In particolare nei canali radicolari infetti, si dovrebbe quindi ricercare **un equilibrio tra la necessità di rimuovere la dentina infetta e il mantenimento di uno spessore radicolare sufficiente** a resistere alle forze della masticazione.”

“Particolare **attenzione al mantenimento di una quantità sufficiente di dentina residua** dovrebbe essere prestata ai denti e alle radici più suscettibili alla frattura, ovvero i premolari mascellari e mandibolari e le radici mesiali dei molari mandibolari.”

APPROCCIO CONSERVATIVO

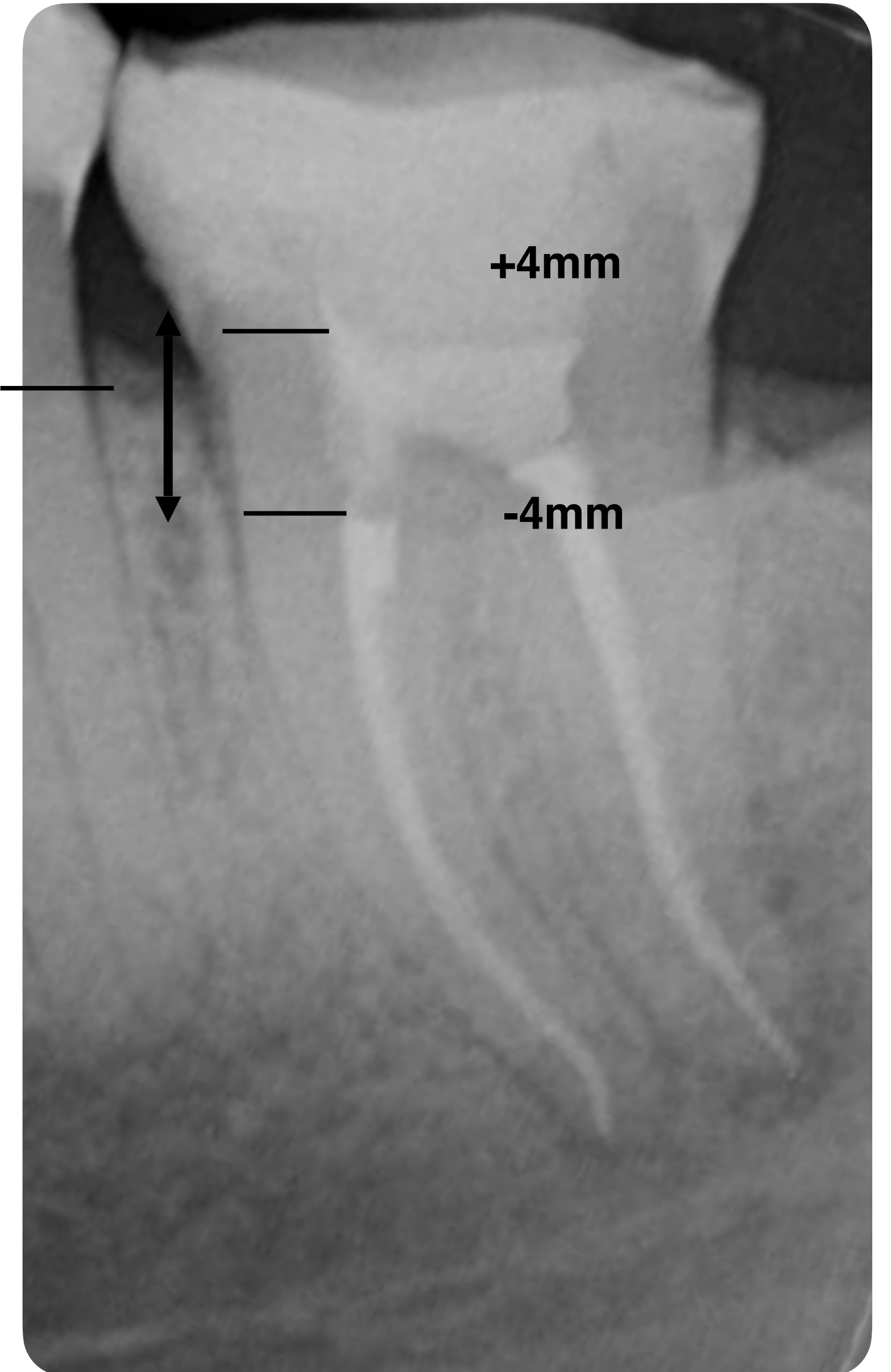
APPROCCIO CONSERVATIVO

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



Treatment
Plan

ANATOMY

diagnosis

knowledge

skills

Tips & tricks

Structure
Preservation

tools

longevity

new technologies

research

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

Schäfer E¹, Diez C, Hoppe W, Tepel J.

+ Author information

Abstract

Canal curvatures of 700 permanent h
part of the canal. For each type of to
into the canals, and the teeth were ra
computerized digital image processi
with radii < 40 mm. Thirteen percent
were investigated had curves > 35 de
To define the canal curvature mather

**1163 roots examined:
980 (84%) curved**

ne 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 < or = 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°
30% angle 27-35°
9% angle > 35°**

A vintage motorized bicycle, possibly a motor scooter or a small motorcycle, is parked on a street. It has a large, cushioned seat, a high handlebar, and a large front wheel. The background shows a street with trees and a building.

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

Grossman 1967



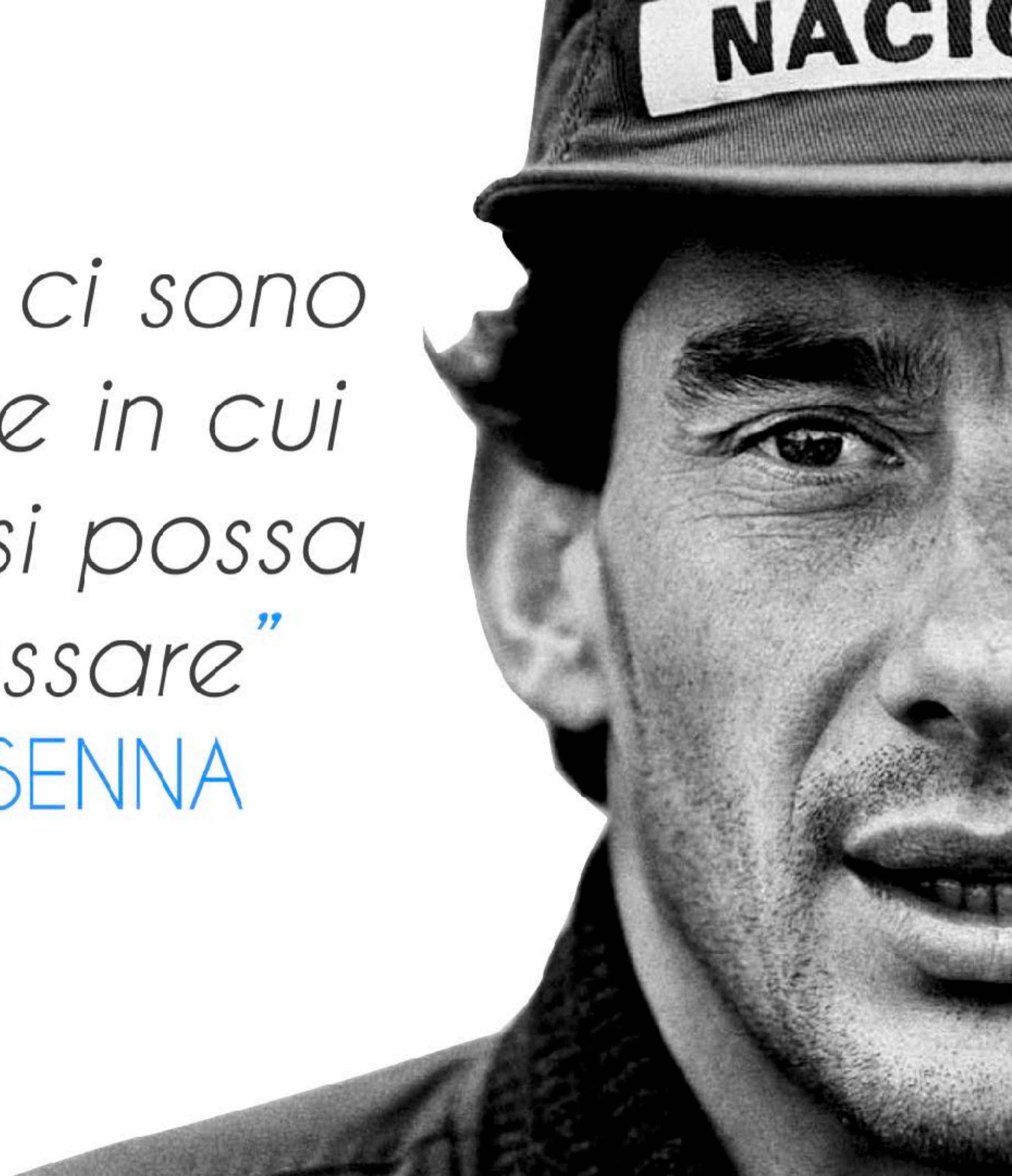
*“Non ci sono
curve in cui
non si possa
passare”*
A. SENNA

PRESERVARE LA MASSIMA QUANTITÀ DI TESSUTO
DENTALE DURANTE LA TERAPIA ENDODONTICA

SAFETY

ED “EVITARE” LA
FRATTURA DEGLI
STRUMENTI ROTANTI

FLESSIBILITÀ E RESISTENZA



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

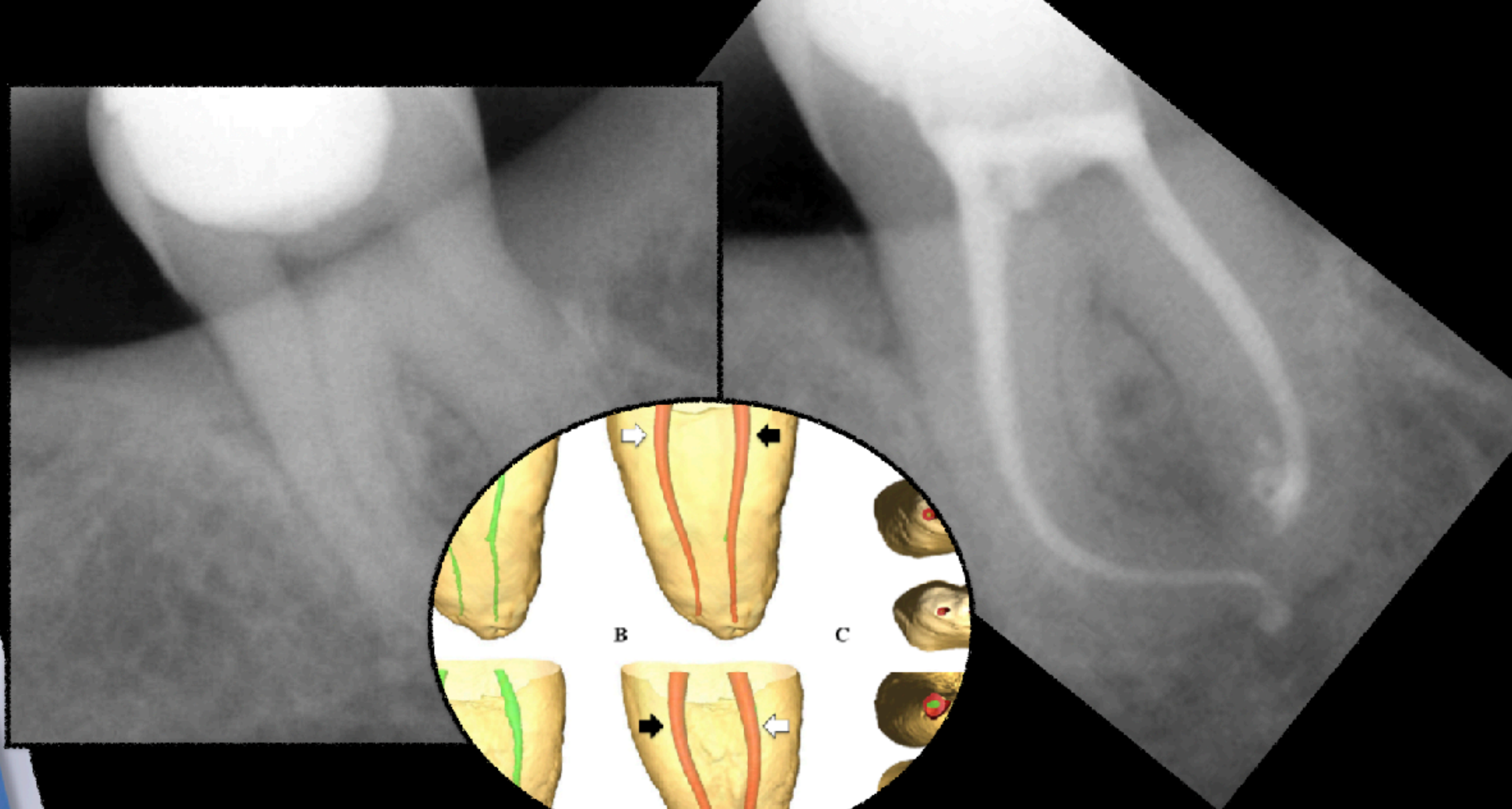
**E. Pedullà, G. Plotino, N. M. Grande,
G. Avarotti, G. Gambarini, E. Rapisarda
& F. Mannocci**

ONLINE
FIRST

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

Clinical Oral
Investigations

1
2016



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

A detailed image of a HyFlex EDM tool. The tool features a long, thin, silver-colored electrode with a double-flute design. It is connected to a black handle via a red and orange coupling. The background is dark blue with light effects.

HyFlex™ EDM

2015 ELETTROEROSIONE

HYFLEX EDM SEQUENCE

2015



CM-wire machined by Electrical Discharge Machining

HyFlex CM (CM-wire)



CM treatment = Martensite = Deformable at room T°

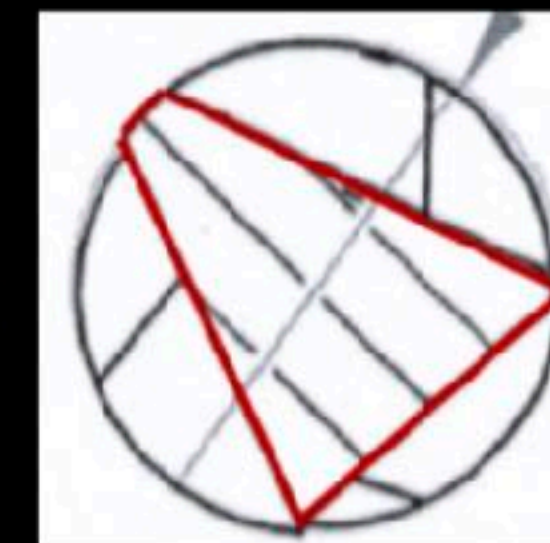
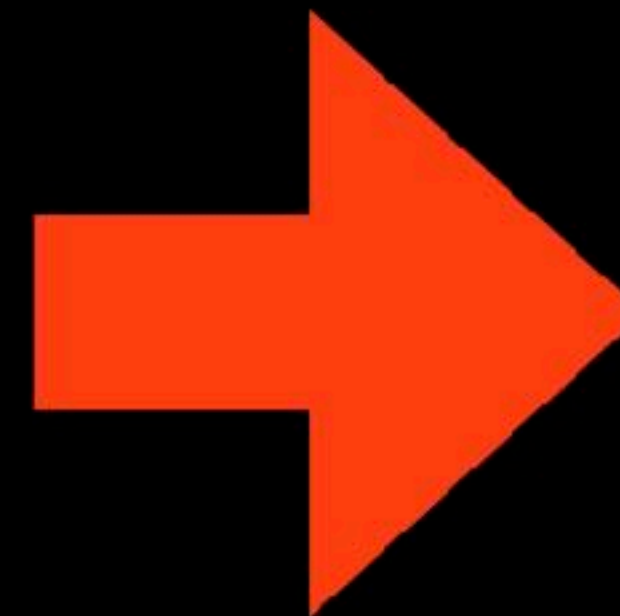
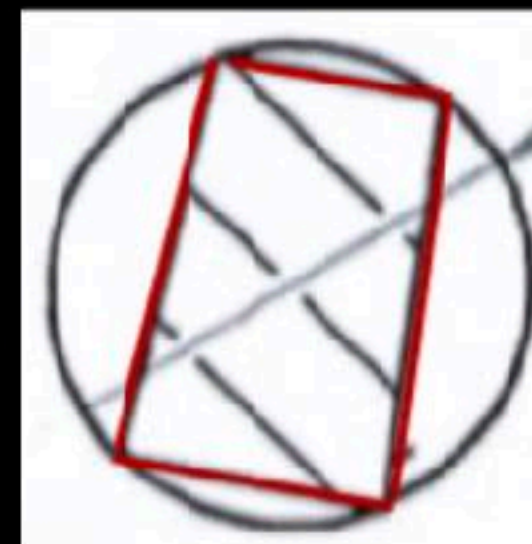
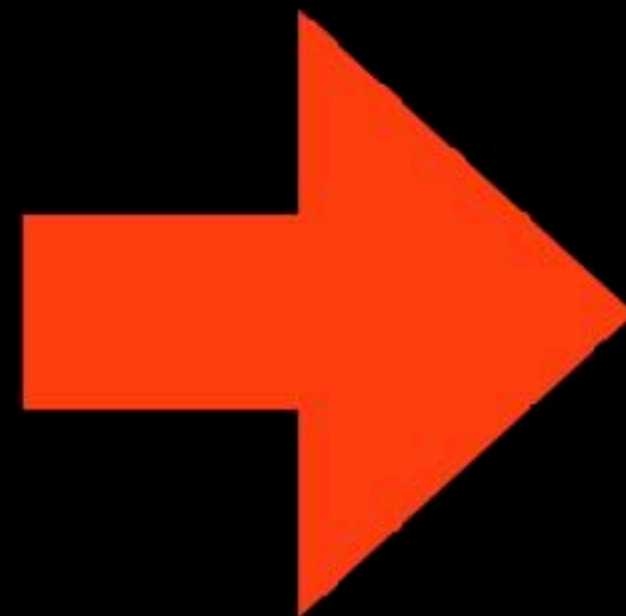
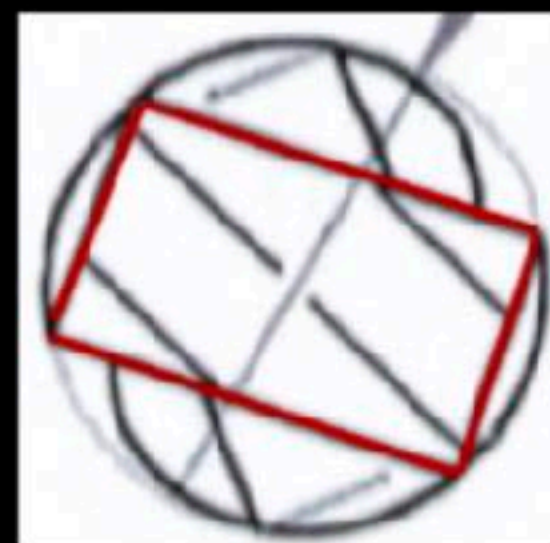
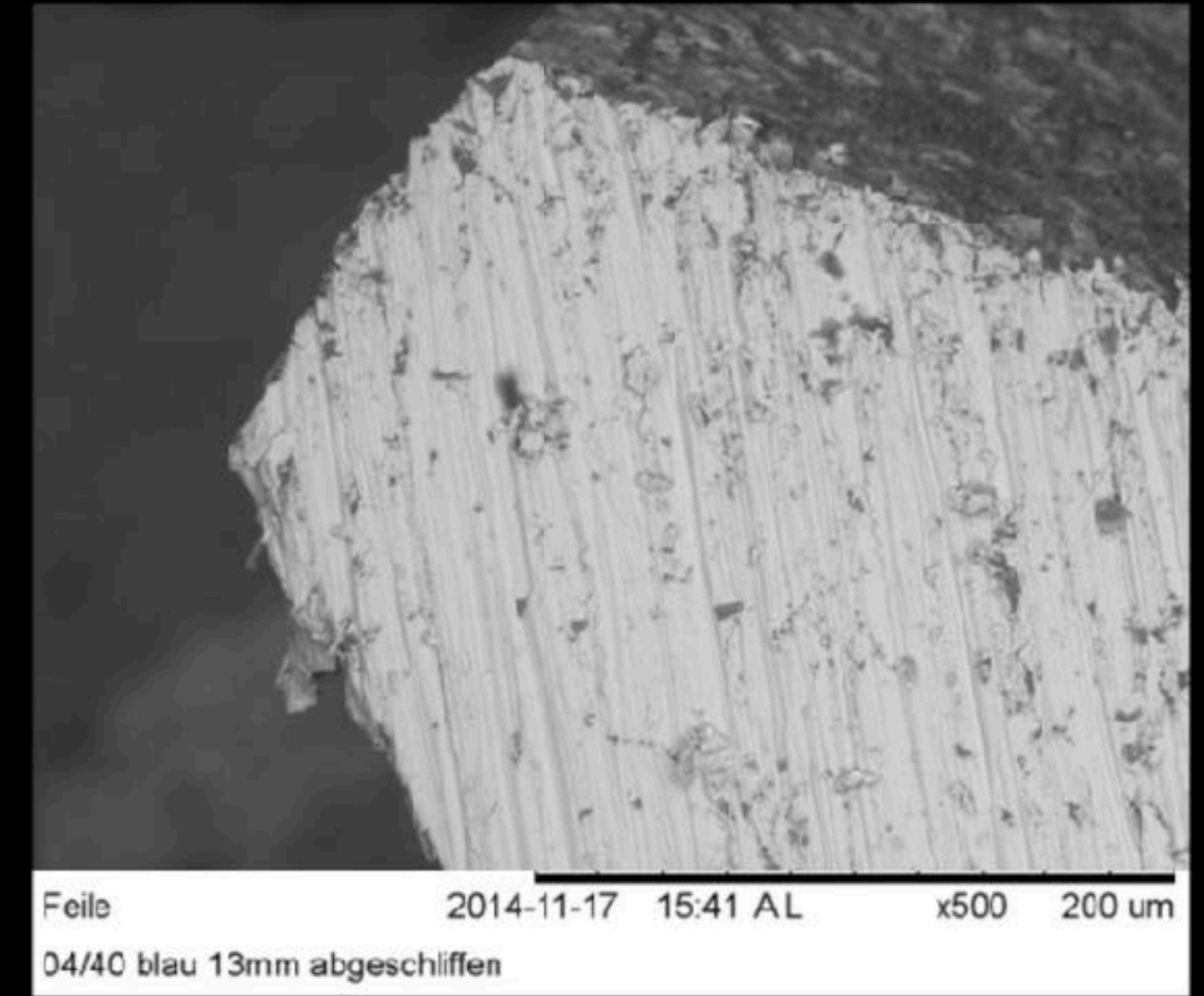
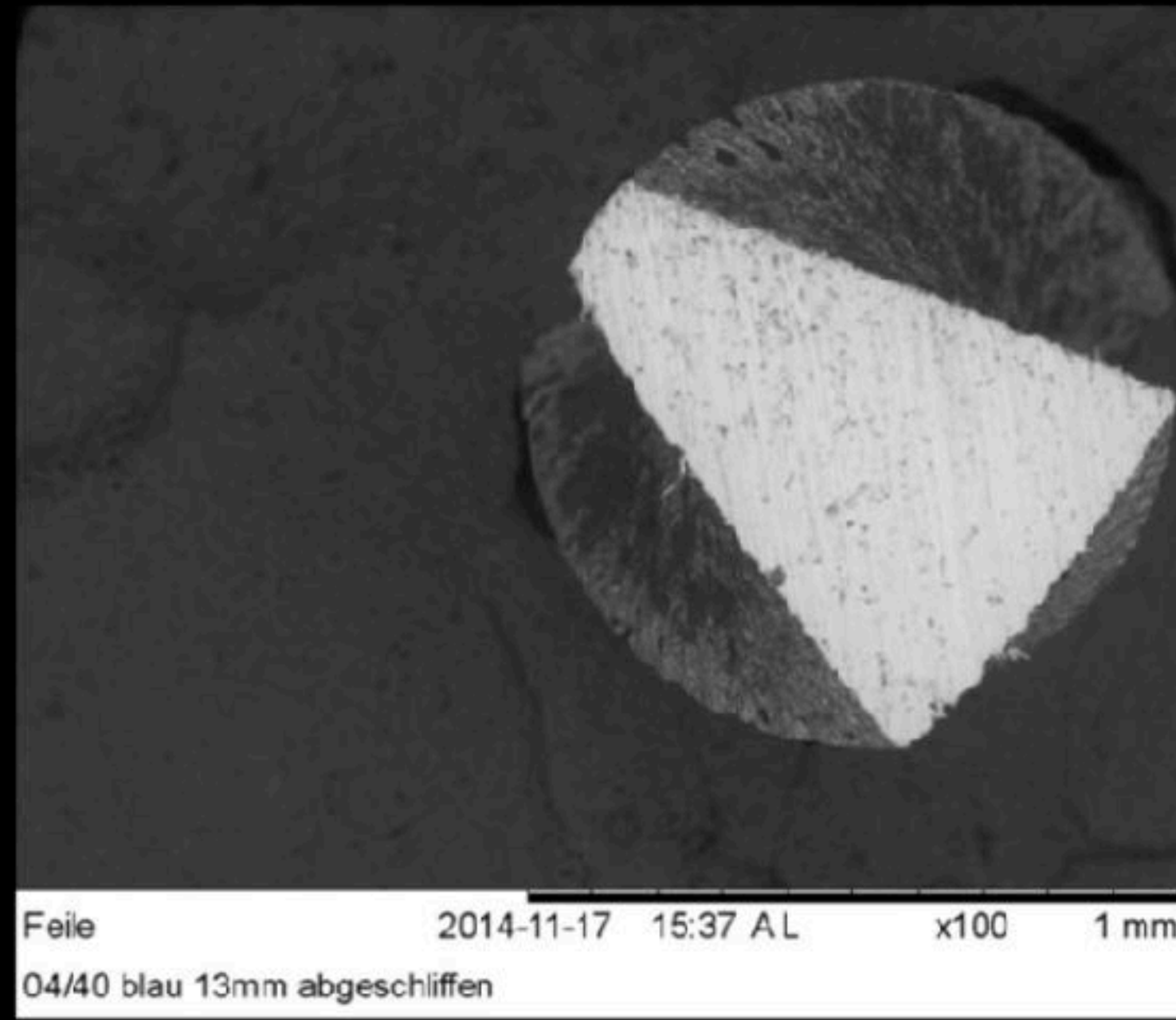
EDM (CM-wire)

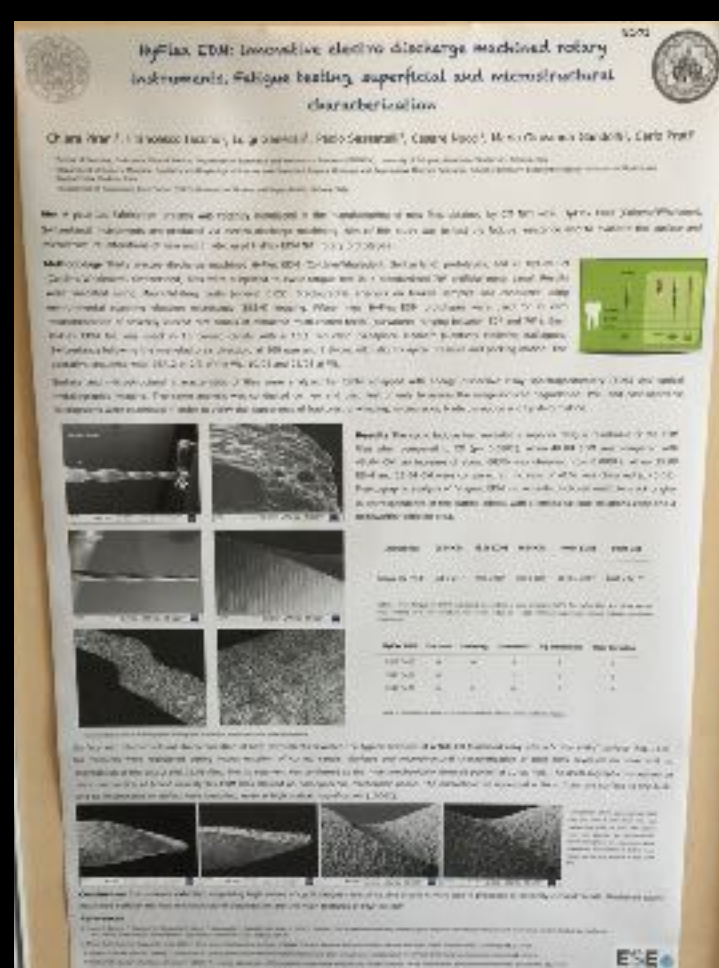


Ni-Ti EDM files

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

parte lavorante individualizzata





CM vs EDM

SURFACE DIFFERENCES



ALTA DUREZZA DI SUPERFICIE
ALTA EFFICENZA DI TAGLIO

10kV X100 100µm 140546

10kV X500 50µm 140559

Dr Chiara Pirani & Dr Francesco Iacono
Universita' di Bologna

Glider



10.5

Shaper



25 $\approx$ 8

Glider



10.5

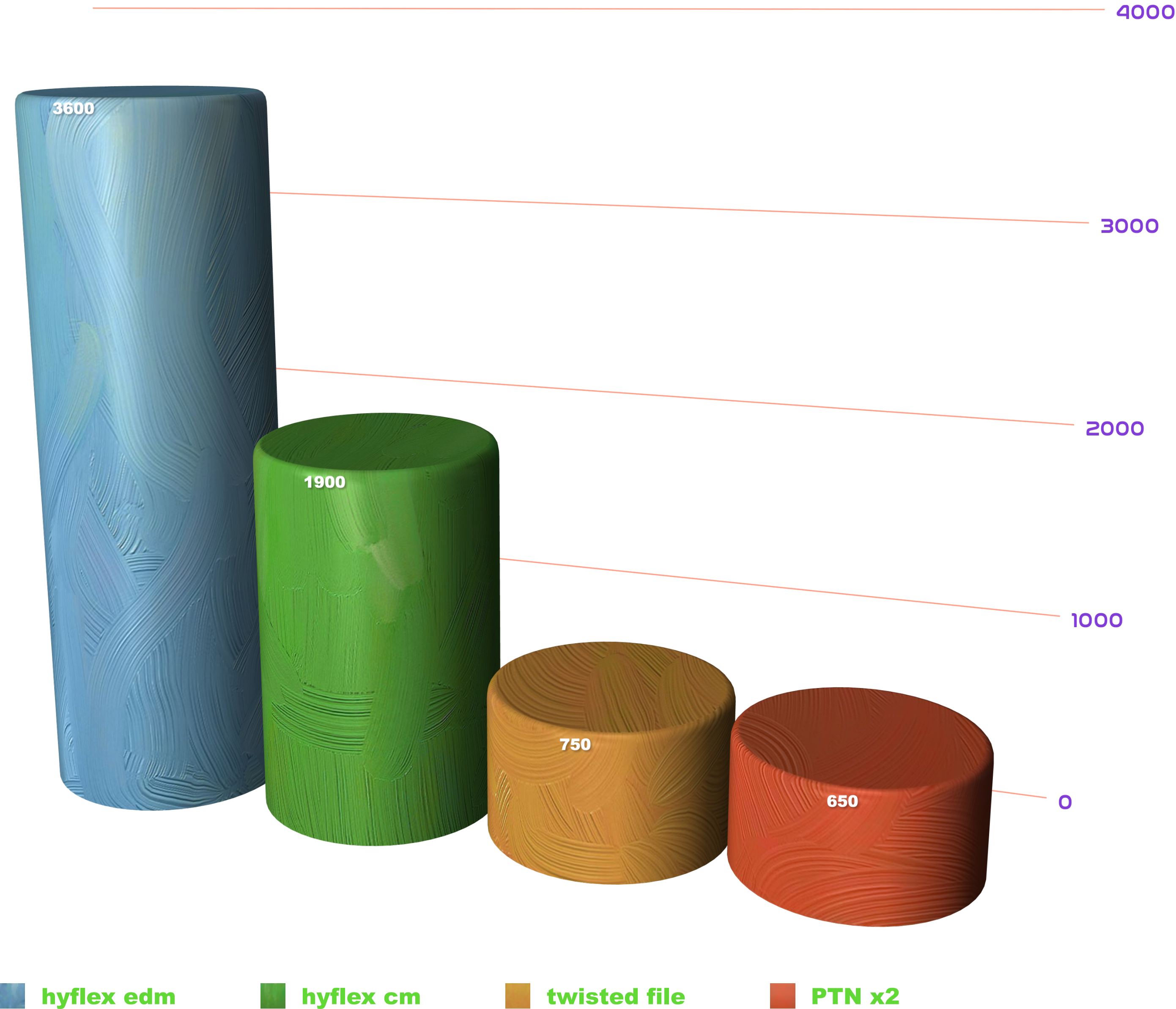
Shaper



25 $\approx$ 8

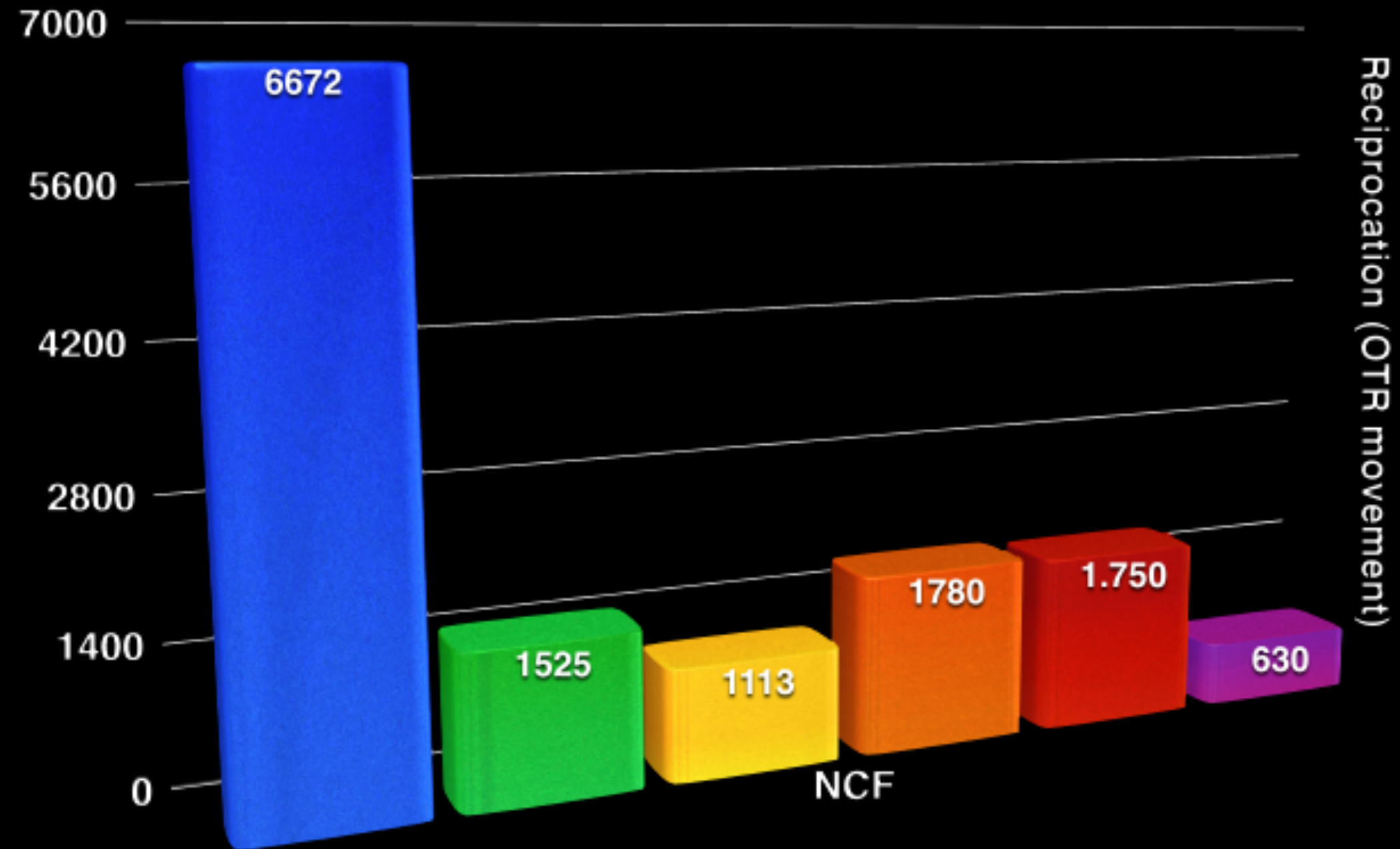
2 FILE ?....

Numbers of cycles to failure



Cyclic Fatigue Resistance

■ *Hyflex EDM OneFile*
■ *Reciproc R25*
■ *WaveOne Primary*
■ *WaveOne Gold*
■ *F6 SkyTaper*
■ *OneShape*



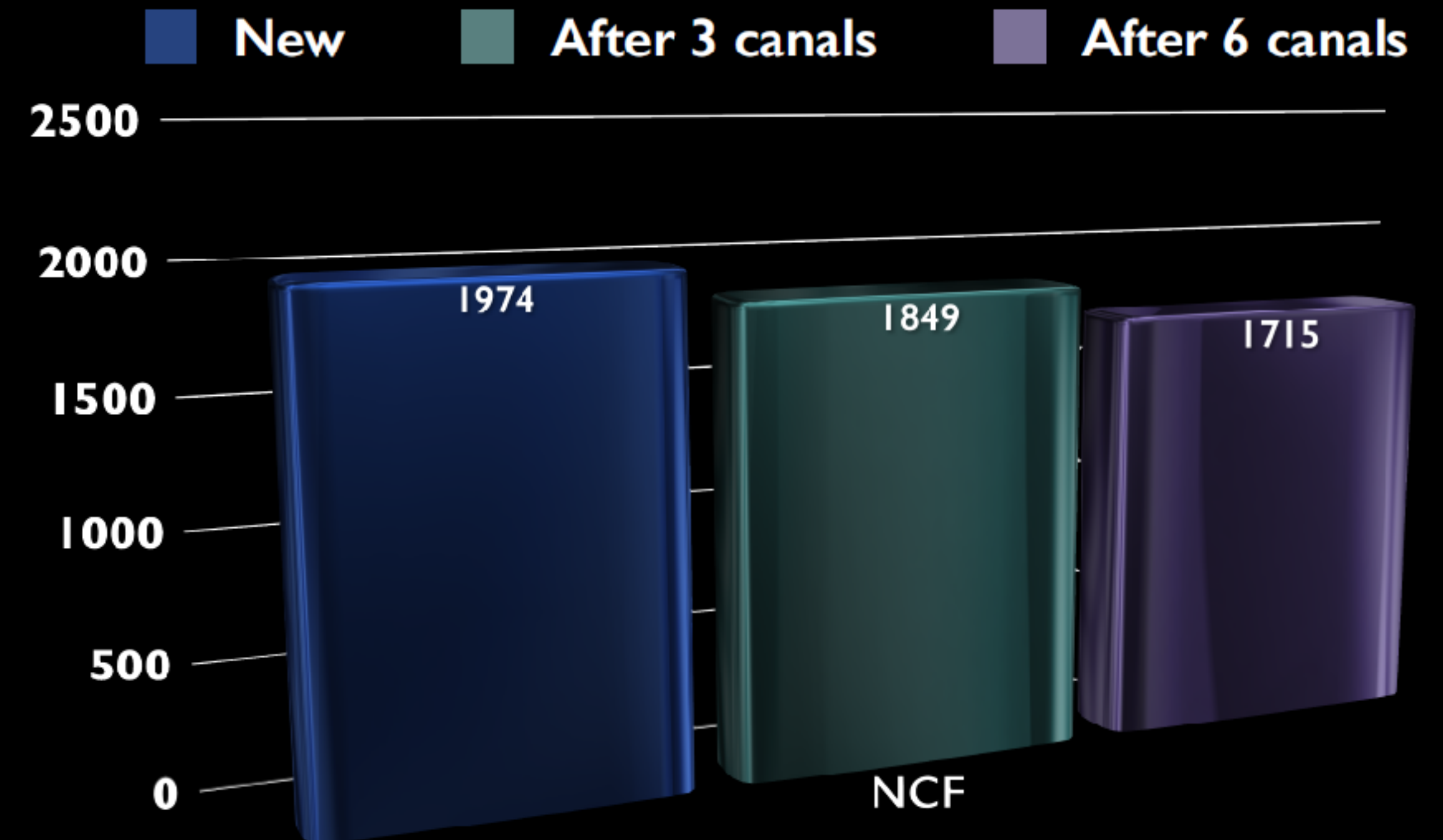
**New
Dynamic
Cyclic
Fatigue
Test
Device**



Cyclic Fatigue Resistance

Hyflex EDM 40.04

New or Used



Finishing file



40.4



50.3

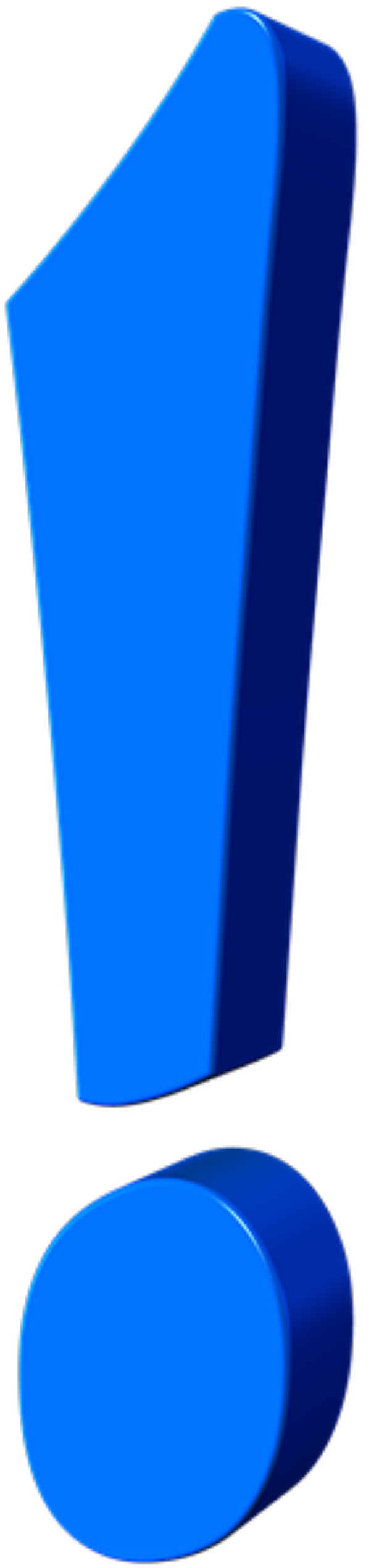


60.2

PERCHÈ I FINISHER SONO IMPORTANTI??



DETERSIONE MECCANICA



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

Shafer 2009

DIAMETRO DELLA PREPARAZIONE

in apici poco preparati il disinfettante arriva meno



TRATTAMENTO TERMICO DEL NI-TI



TRATTAMENTO TERMICO DEL NI-TI

EDM. Aumento diametro e riduzione conicità



DIST:50.3
PAL:60.2



MB1: 30.4
MB2: 30.4



Niti Trattato termicamente EDM



2019

50.3

2025

Different Curvatures



Different
Sequence HT-niti



Non adattiamo
l'anatomia
alla sequenza di file

Adattiamo la
sequenza
di file all'anatomia



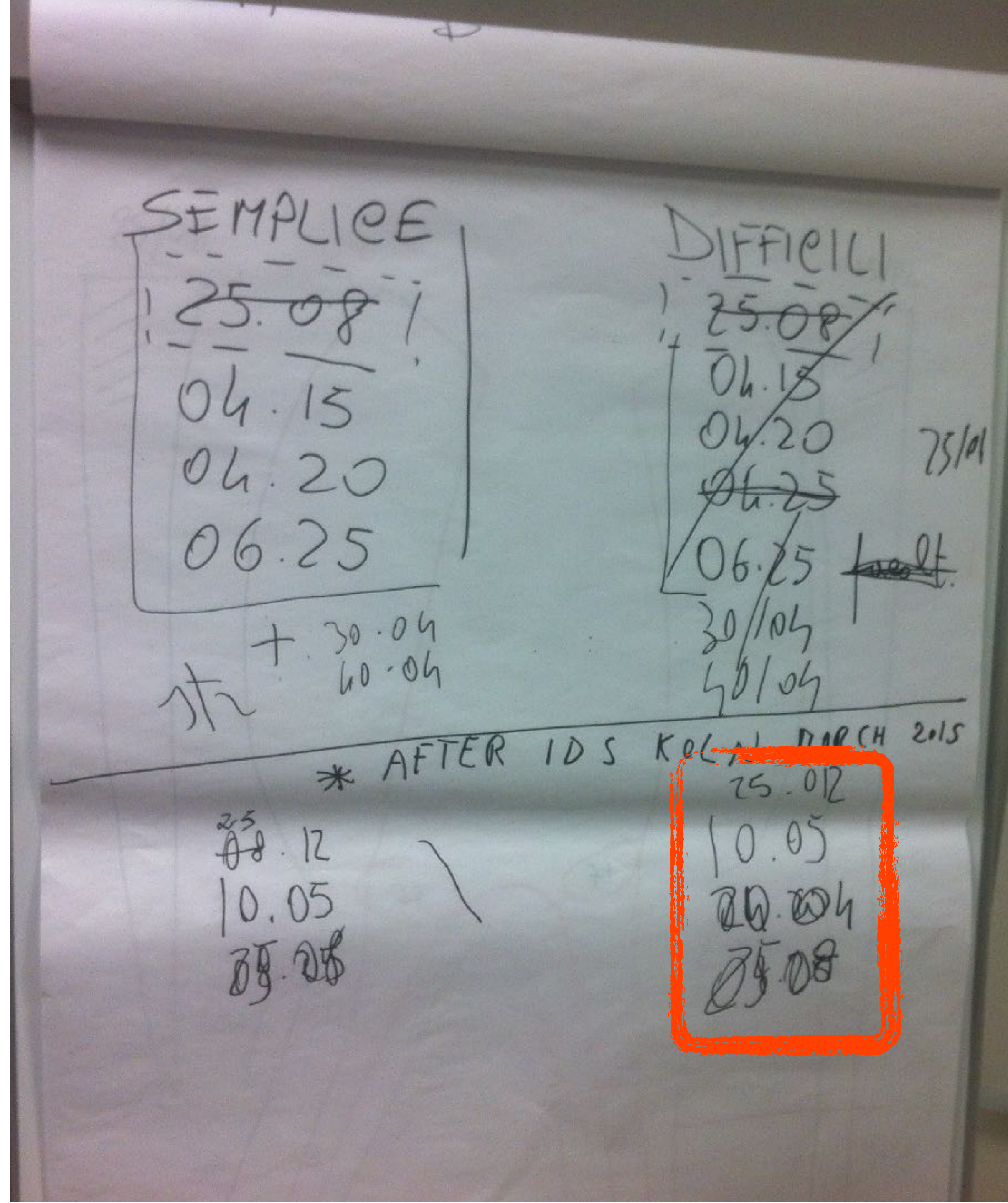
“Tailored” Endodontics



2017



20.5





2017

Hyflex EDM/CM

400 RPM 3.0 N

400 RPM 3.0 N

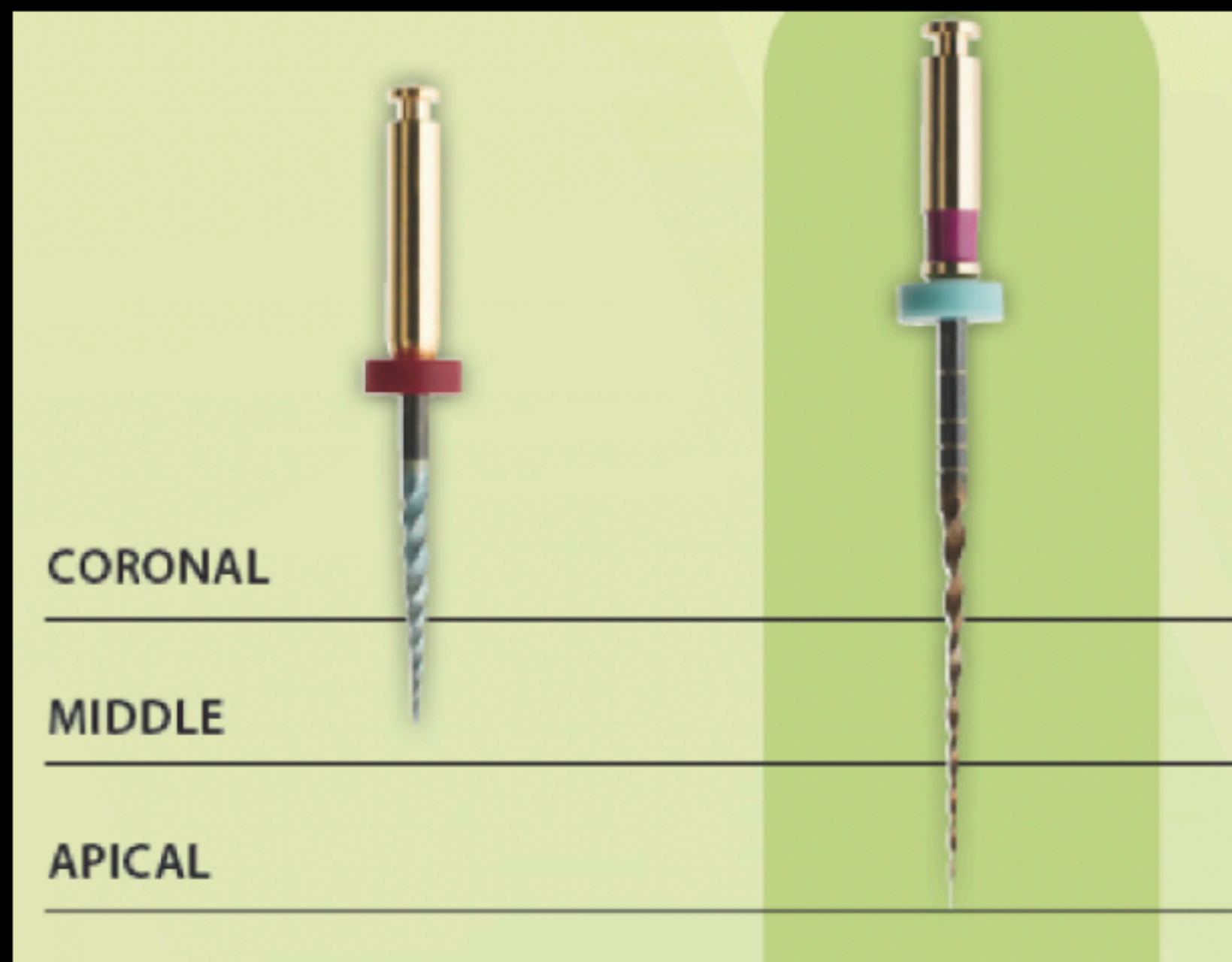
variable taper

Medium
Canals



400 RPM
3.0 N

300 RPM
1.8 N



Opener
25.12

Glide Path
10.05

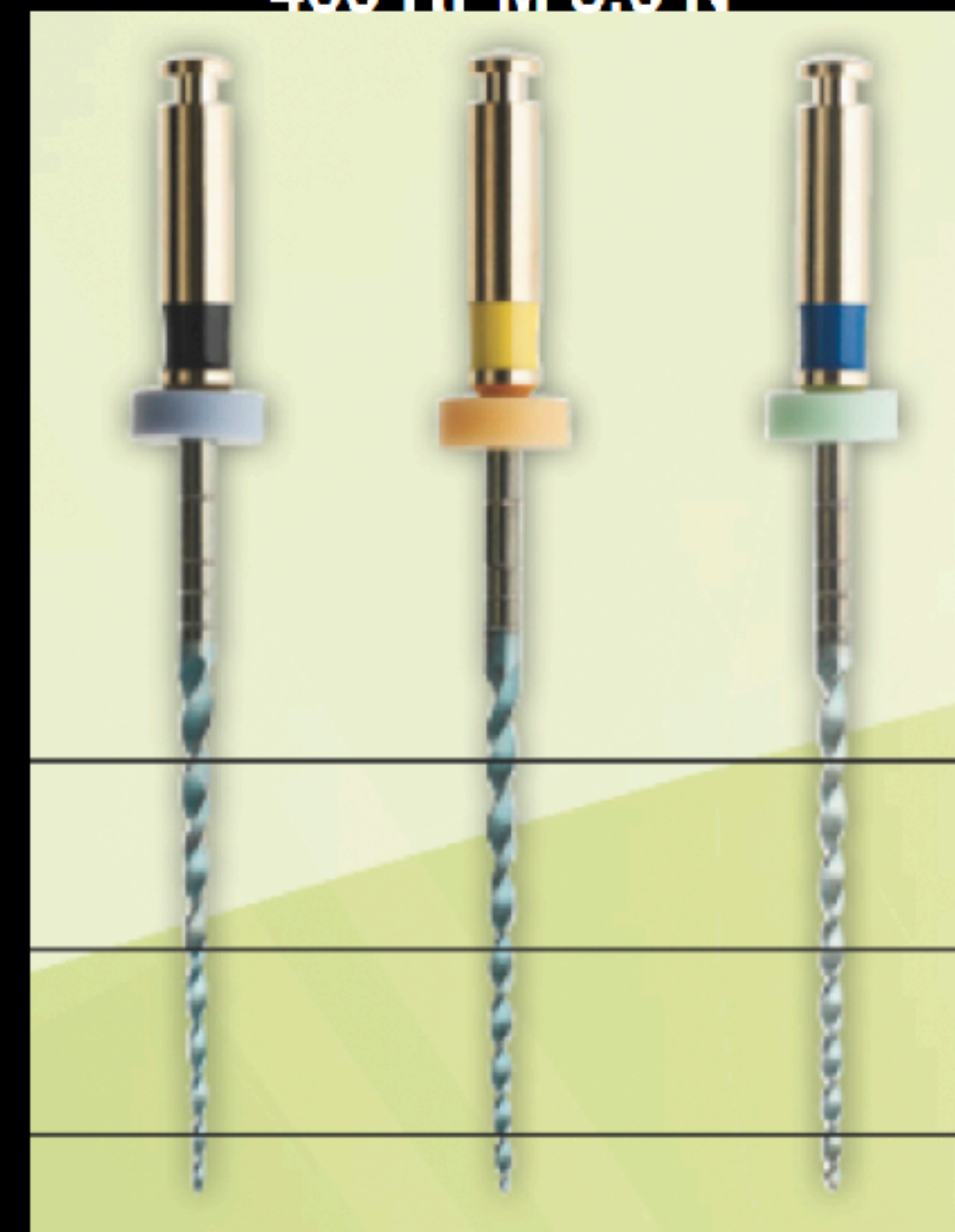


Hyflex EDM
20.05



Hyflex EDM
OneFile
25.08

400 RPM 3.0 N

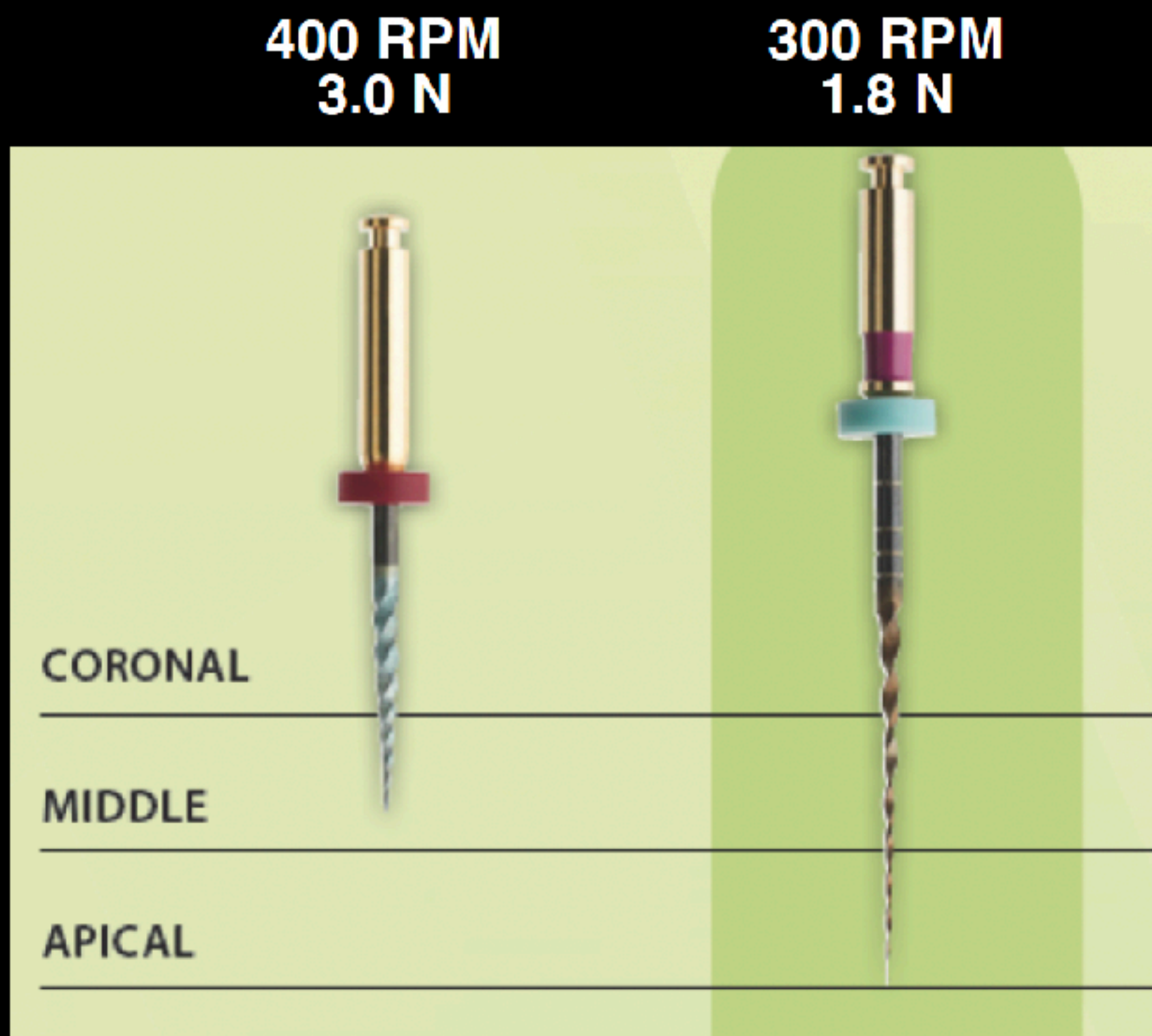


Finishing
40.04 50.03 60.02



Hyflex EDM/CM

**Difficult
Canals**



**Opener
25.12**

**Glide Path
10.05**

400 RPM 3.0 N

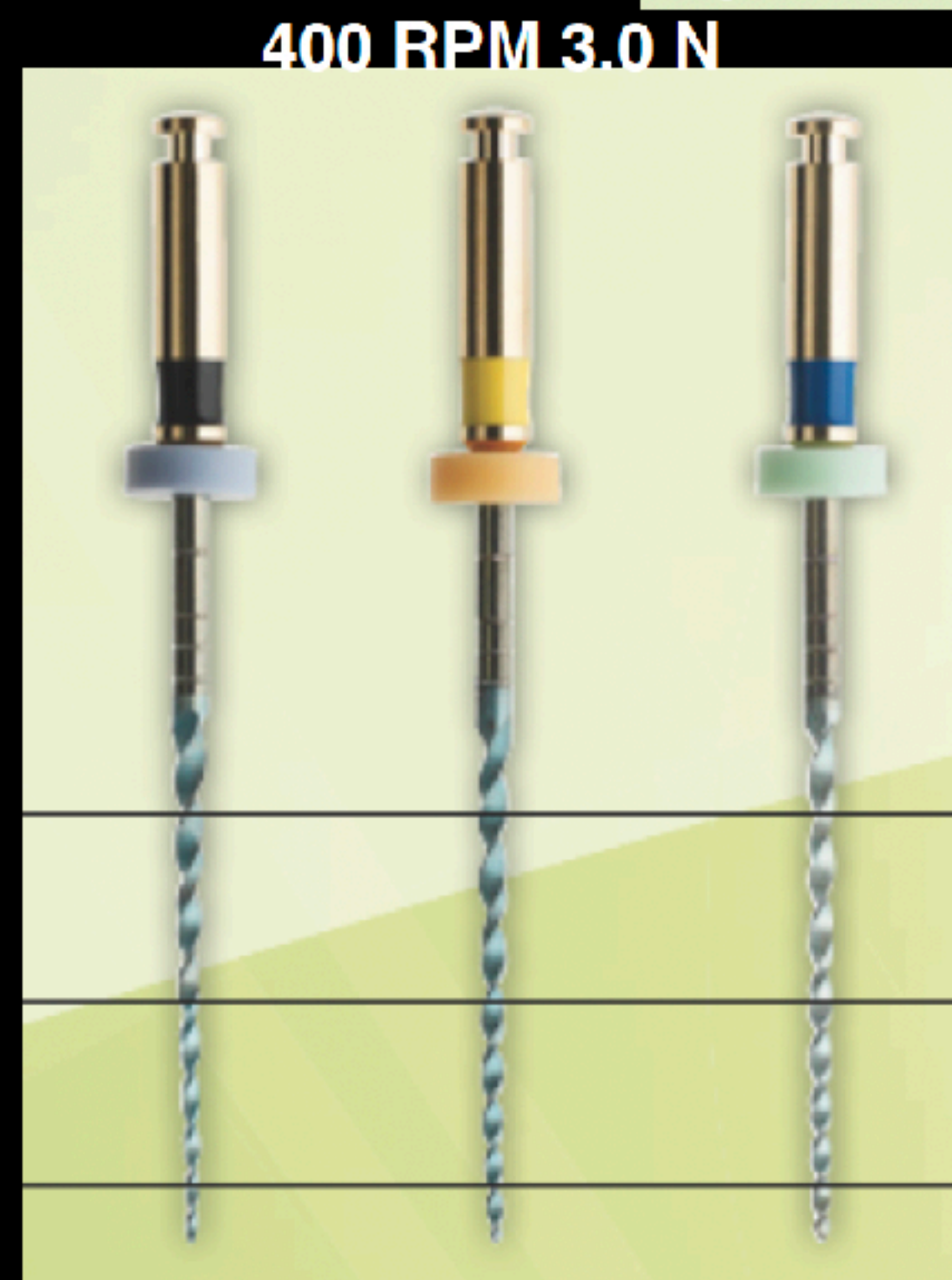


**Hyflex EDM
20.05**

400 RPM 3.0 N



**Hyflex CM
30.04**



**Finishing
40.04 50.03 60.02**

HYFLEX EDM OGSE

2024



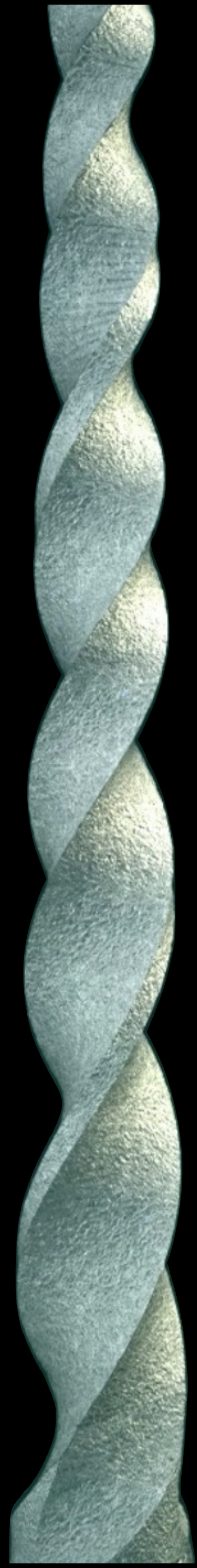


O rifice Opener: EDM 18/11

G lide: EDM 15/.03

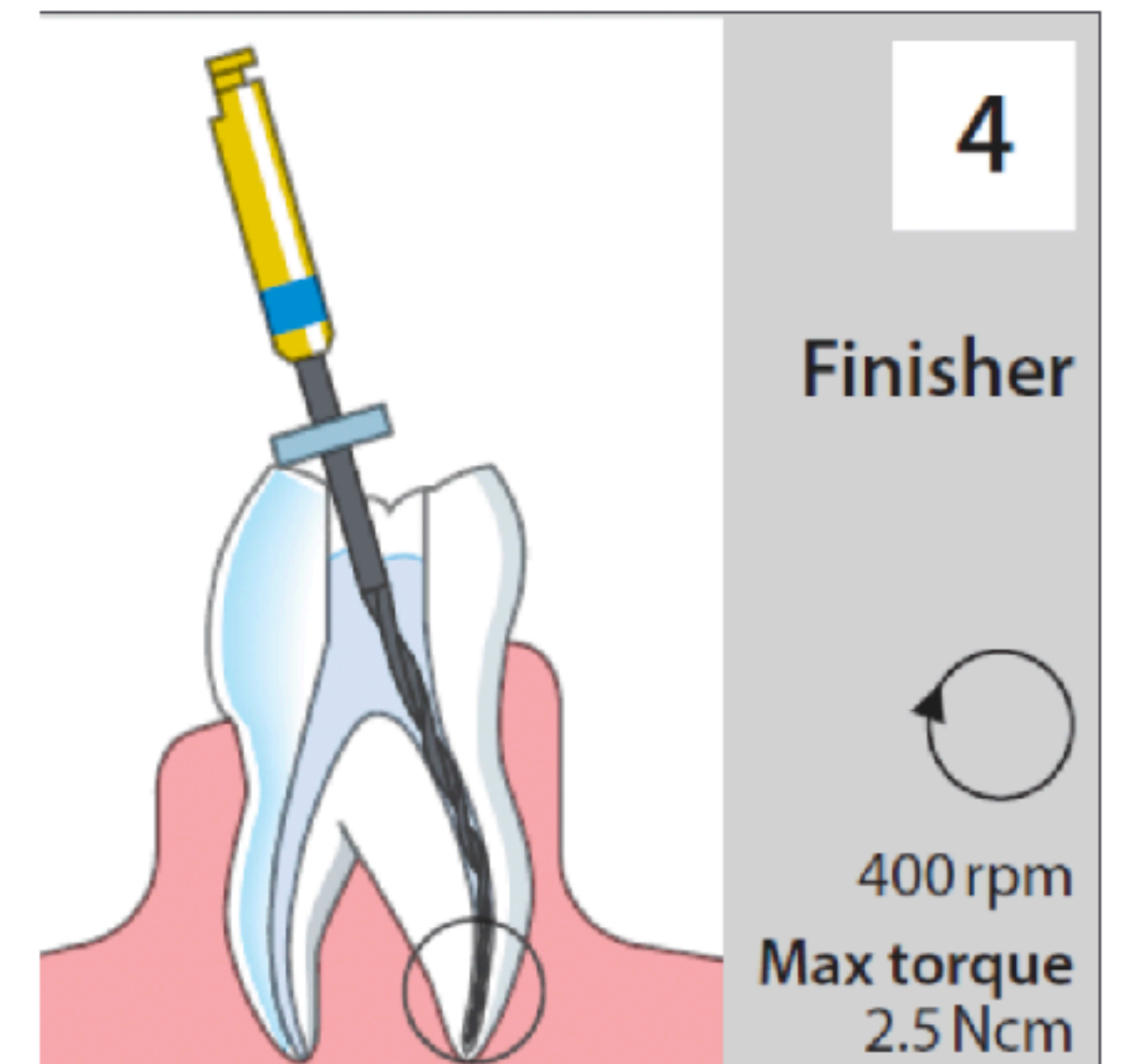
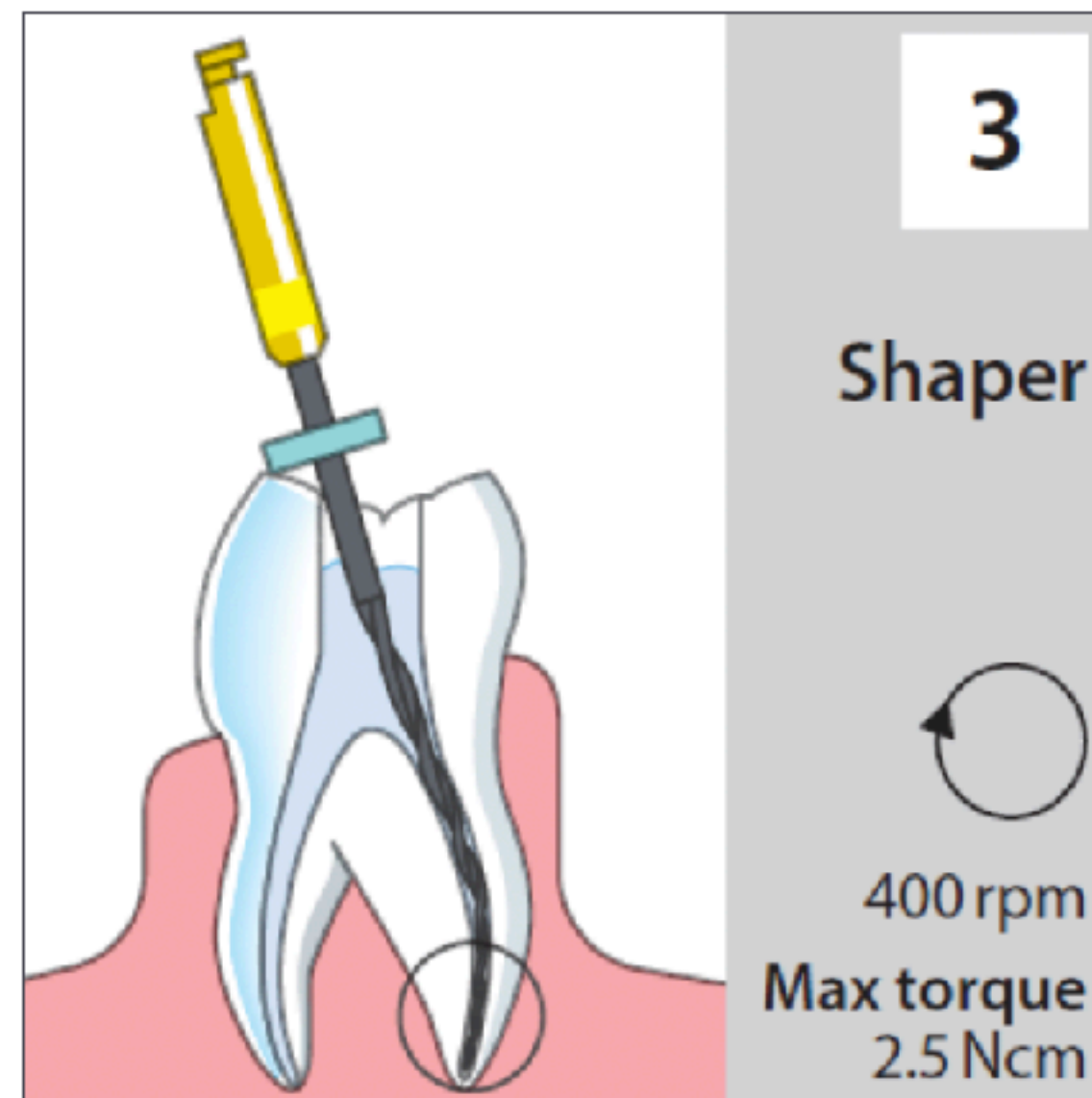
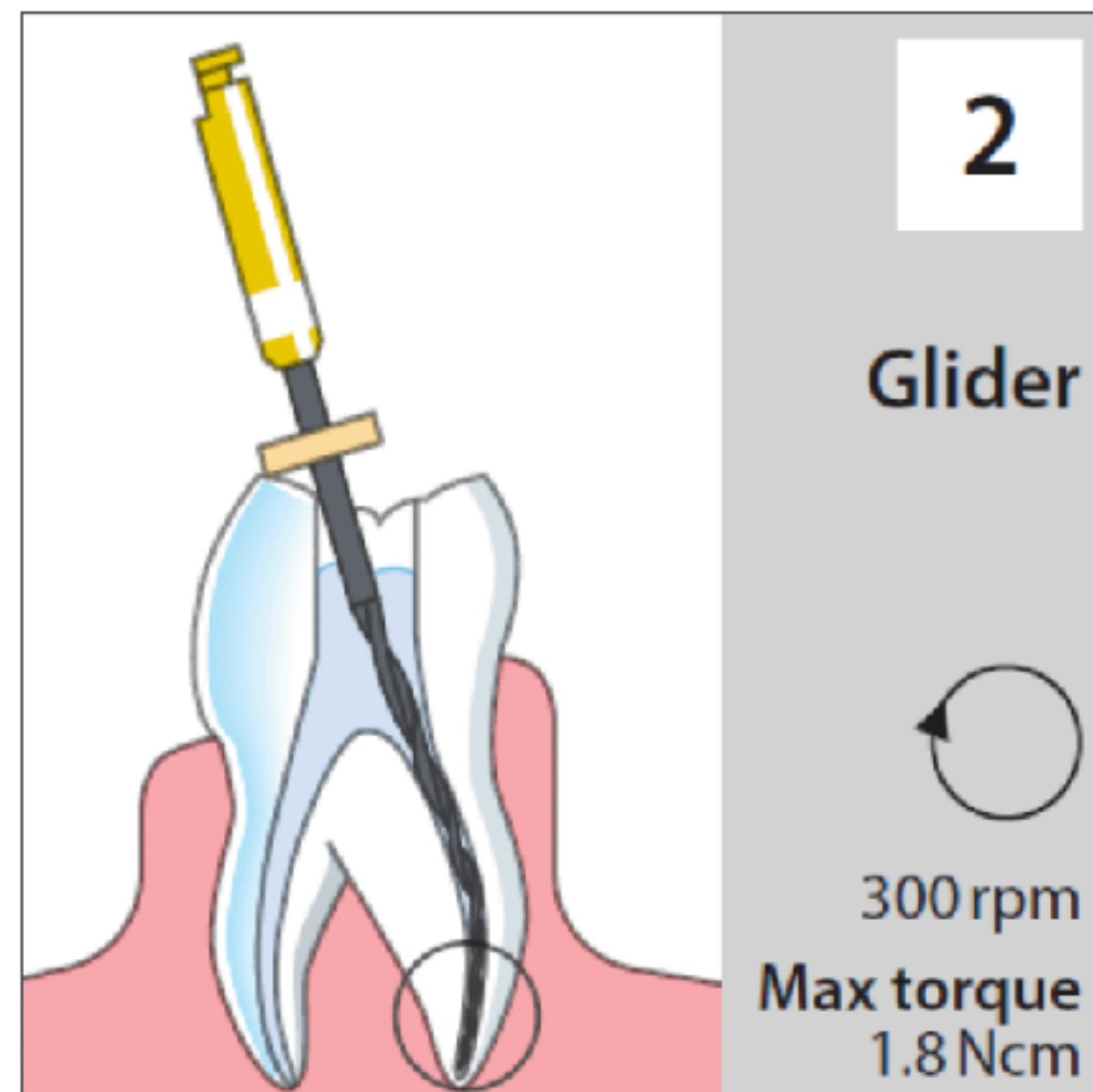
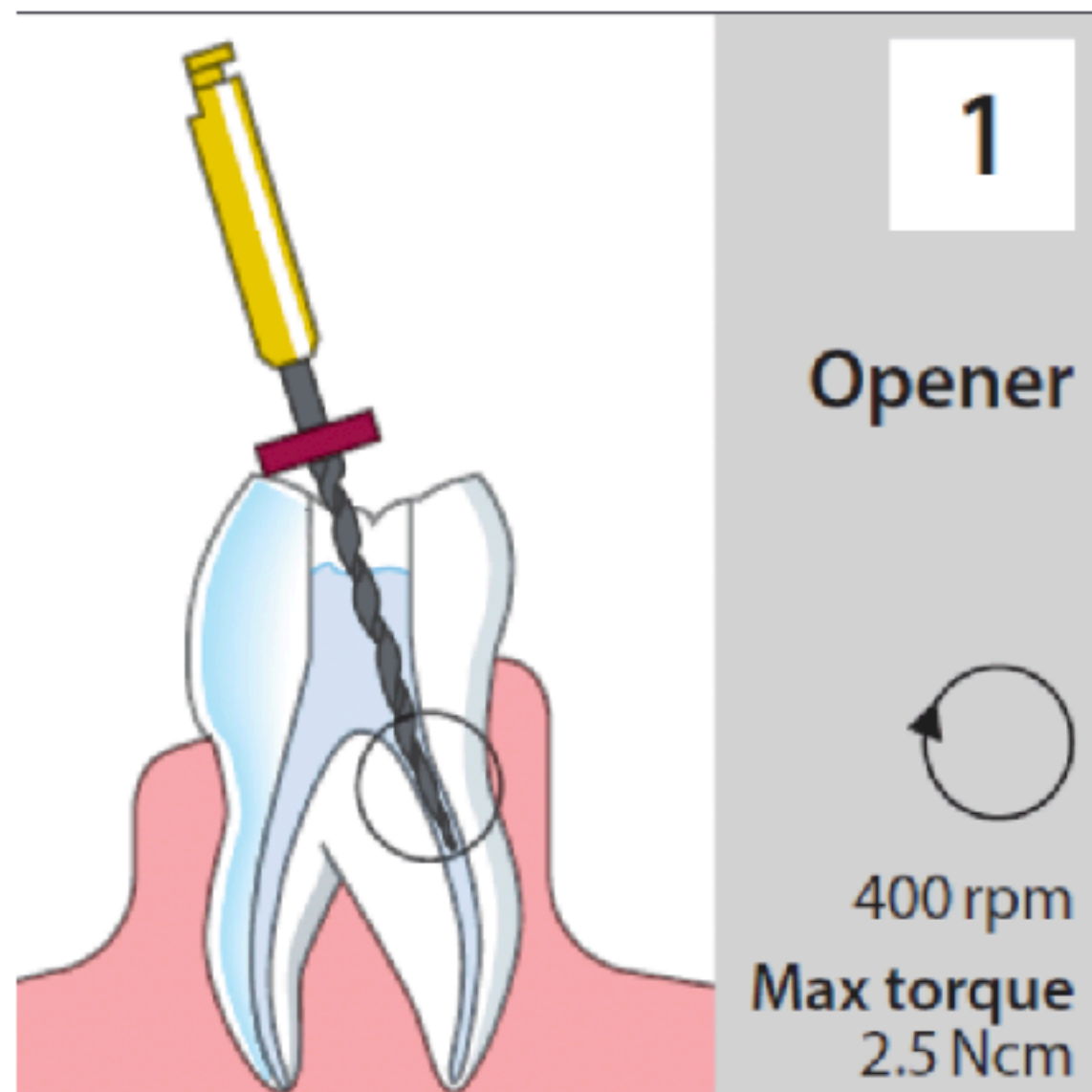
S haping File: EDM 18/.045

F inishing File: EDM 30/.04



SETTING HYFLEX OGSF

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



O_{pener}

EDM 18/11

G_{lider}

EDM 15/.03

S_{haper}

EDM 18/.045

F_{inisher}

EDM 30/.04

Science behind the developments:

Orifice opener take out the stress of the other files

18.11

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

Sang Won Kwak, DDS, MS, PhD¹; Jung-Hong Ha, DDS, MS, PhD²; Ya Shen, DDS, PhD³; Markus Haapasalo, DDS, PhD³ ; and Hyeon-Cheol Kim, DDS, MS, PhD¹ 

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

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

Note: ^{a,b,c}Different lower-case superscripts indicate significant differences amongst the groups in rows ($P < 0.05$).

Abbreviation: OC, OneCurve; OF, OneFlare; OG, OneG.

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



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

ABSTRACT

Introduction: The aim of this study was to compare the influences from different access angles and curvature radii on cyclic fatigue resistance of nickel-titanium rotary files.

Methods: Two file systems (2Shape [TS; MicroMega, Besençon, France] and HyFlex CM [HCM; Coltène/Whaledent, Allstätt, Switzerland]) were used. A total of 192 instruments of TS #25/.04 (TS1), TS #25/.06 (TS2), HCM #25/.04, and HCM #25/.06 were evaluated at 3 insertion angles (0°, 10°, and 20°) and 2 radii (5 mm and 3 mm) in 18-mm stainless steel artificial canals with a 60° curvature. Cyclic fatigue resistance was determined by the number of cycles to failure (NCF) using a customized testing device. Data were analyzed statistically with the significance level established at 95%. **Results:** In the 3-mm radius canal, the instruments showed lower cyclic fatigue resistance than in the 5-mm radius canal ($P < .05$). HCM #25/.06 and all .04 taper instruments had a significant NCF reduction at 20° and 10° in the 3-mm radius canal ($P < .05$), whereas TS2 showed no significant differences. In the 5-mm radius of curvature, although .06 taper instruments had no significant NCF reduction for each angle tested, .04 taper files exhibited significant NCF reduction when tested at 20° ($P < .05$). Comparing the same size instruments, HCM had higher NCF than TS ($P < .05$). Instruments with a .04 taper exhibited higher NCF than the .06 ones with the same heat treatment ($P < .05$). **Conclusions:** An inclined insertion into the canals decreased cyclic fatigue resistance of thermal-treated instruments with a .04 taper at all radii of curvature tested. The synergistic effect of a small radius of curvature and access angulation of heat-treated instruments decreases their fatigue resistance. (*J Endod* 2020;46:431–436.)

KEY WORDS

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

SIGNIFICANCE

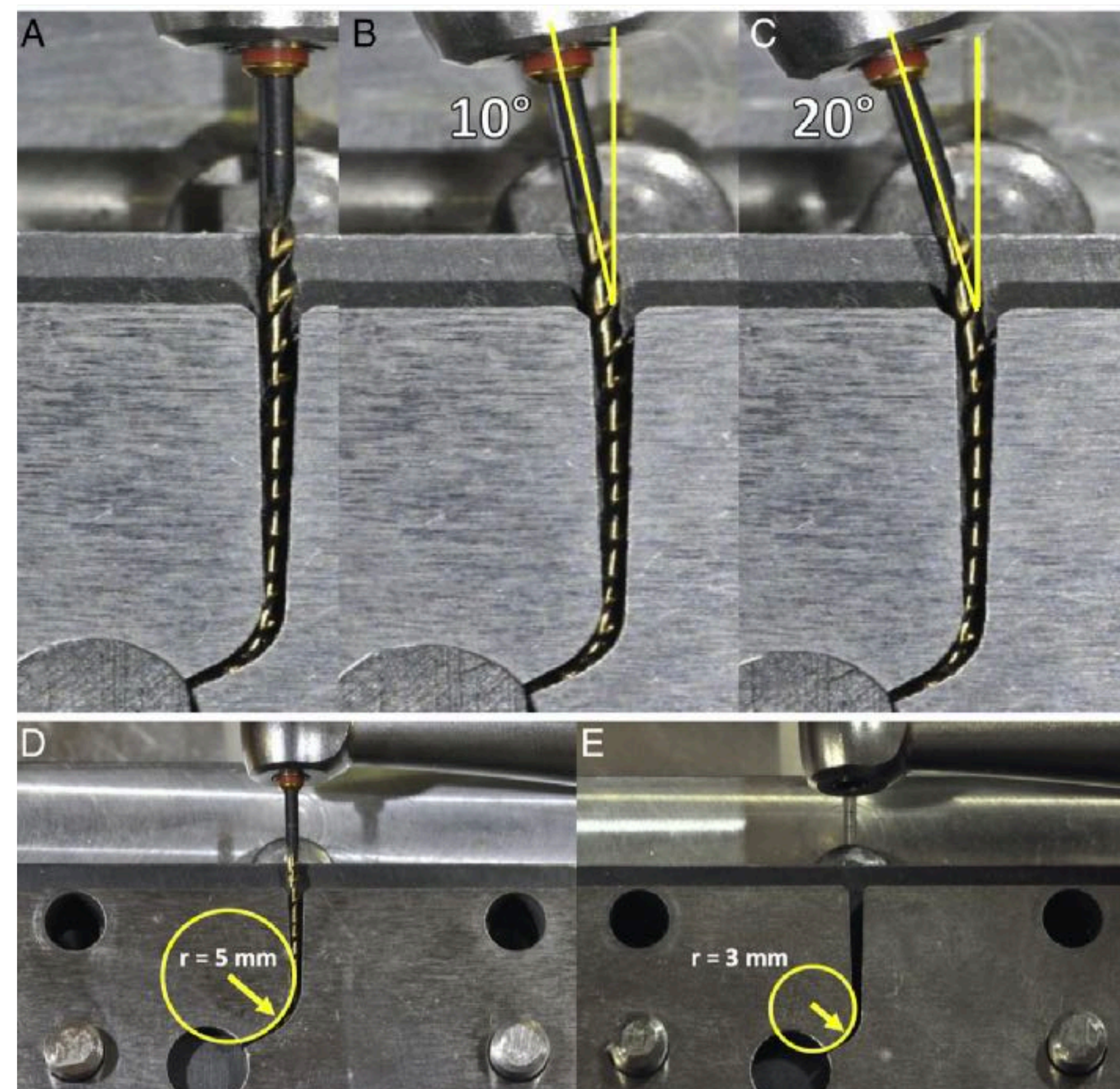
The angulated file access and/or severe curved canal curvature with a small radius could influence (reduce) cyclic fatigue resistance of heat-treated nickel-titanium instruments.

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

Nickel-titanium (NiTi) rotary instruments may exhibit a higher risk of intraoperative fracture within the root canal¹. Fracture may occur due to torsional² or more prevalent cause of “unexpected” break crack propagation caused by repeated tensile canal^{3,4}.

Several factors influence the fracture of treatment, and metallurgic properties of instrument fracture is the radius of curvature⁵ shaped curvatures^{6,10}. Another parameter is anatomic access configuration and operator endodontics, the recent contracted endodontic NiTi instruments¹².

Heat treatments have been attempted characteristics of traditional NiTi instruments¹³



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

Preflaring and Apical Diameter

Preflaring of the cervical and middle thirds of the root canal improves the determination of the anatomical diameter



Influence of cervical preflaring on apical file size determination

J. D. Pecora¹, A. Capelli¹, D. M. Z. Guerisoli¹, J. C. E. Spanó¹ & C. Estrela²

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

Abstract

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

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

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

each tooth. The apical region was then observed under a stereoscopic magnifier. Images were recorded digitally and the differences between root canal and maximum file diameters were evaluated for each sample.

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

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

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

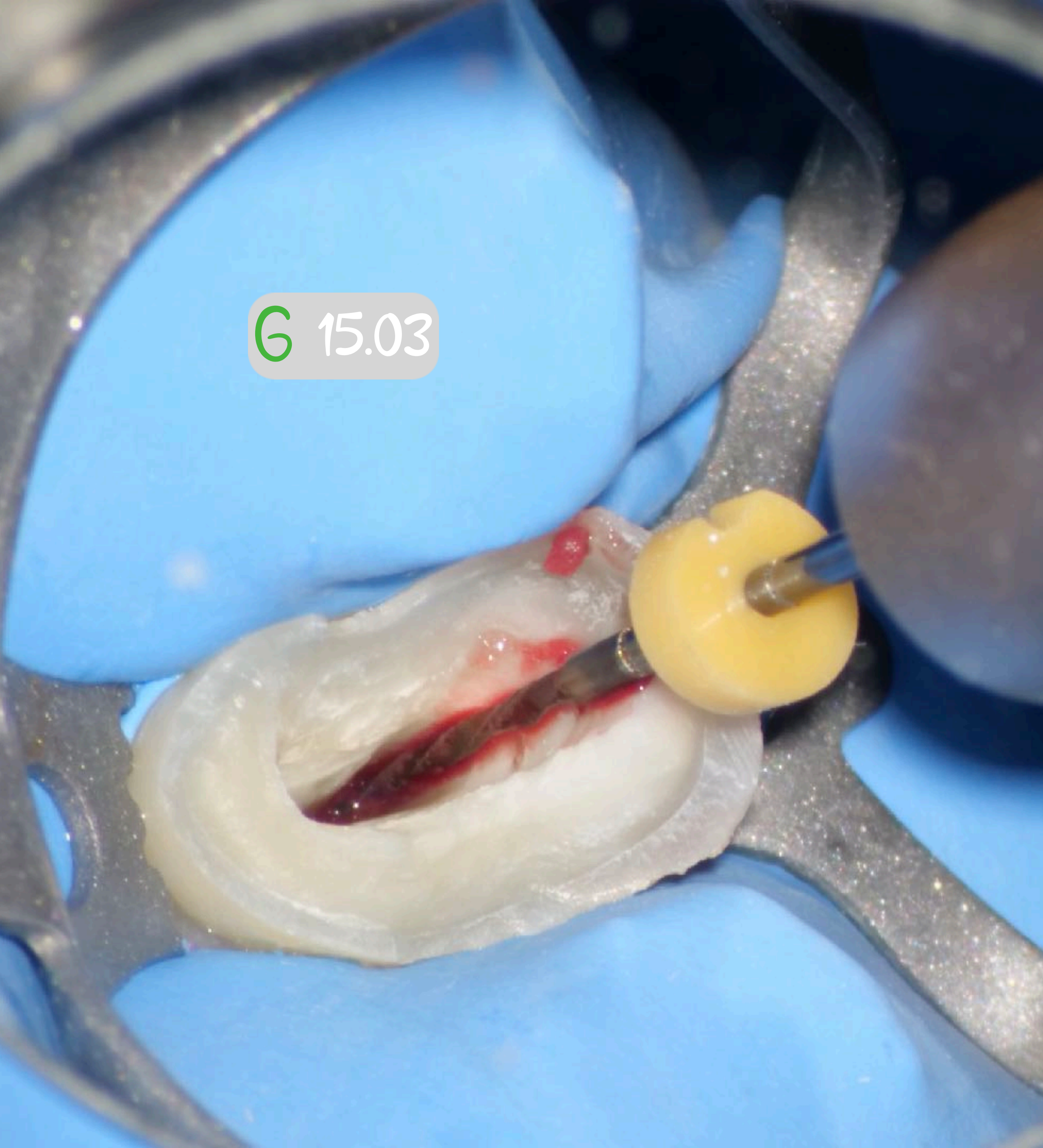
Received 21 May 2003; accepted 10 January 2005

Introduction

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

Correspondence: Prof. Dr Jesus D. Pecora, Departamento de Odontologia Restauradora, Faculdade de Odontologia de Ribeirão Preto, Universidade de São Paulo, 14040-904, Ribeirão Preto, SP, Brazil (Tel.: +55 16 602 3982; fax: +55 16 633 0999; e-mail: pecora@brp.usp.br).

G 15.03



S 18.045



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

Maryam Gharechahi, Harir Ahmadi¹, Maryam Forghanirad, Melika Hoseinzadeh², Anahita Nouri³

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

Abstract

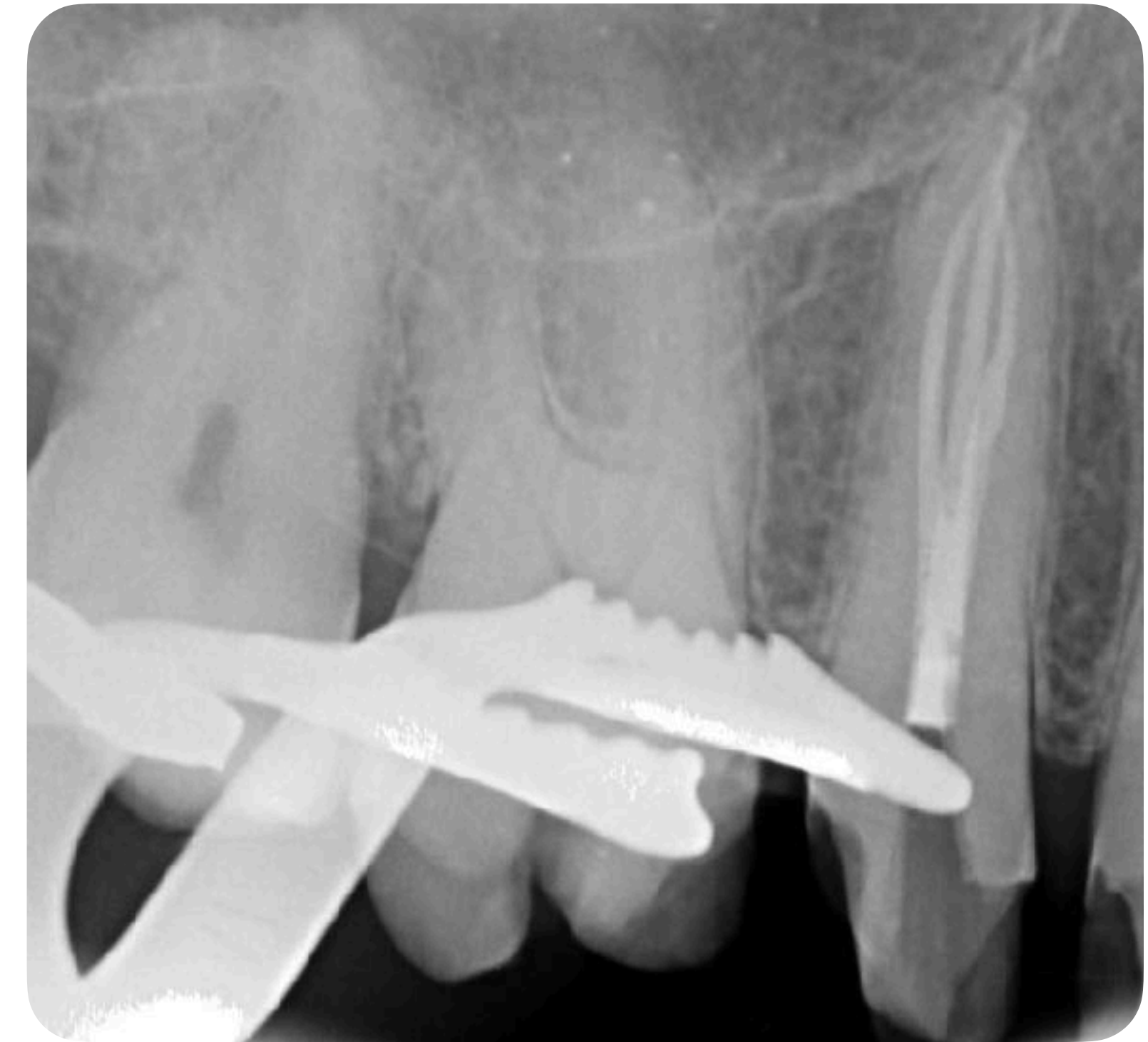
Introduction: The necessity of using a glide path before the canal preparation is inconclusive. Therefore, this study aimed to assess the shaping ability of two rotary systems in the maxillary first molars' first mesiobuccal canal (MB1), with or without employing the glide path files.

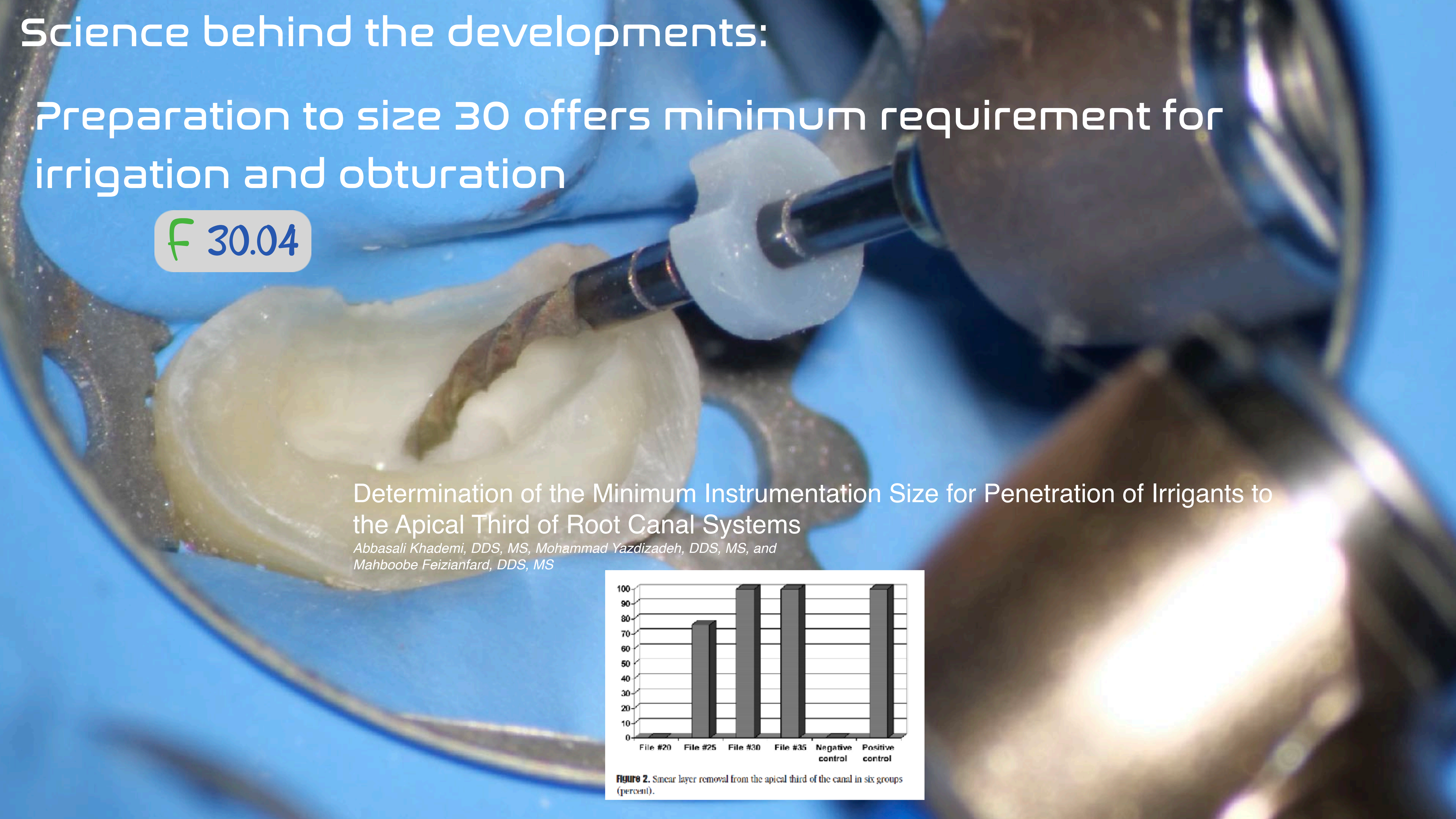
Materials and Methods: The MB1 canals of 100 extracted molars were randomly prepared using either HyFlex EDM (HEDM) or ProTaper Gold (PTG) systems ($n = 50$ each). Half of the samples in each group were prepared using ProGlider (PG) or HyFlex EDM Glide (HEG). The cone-beam computed tomography scanning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

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

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

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





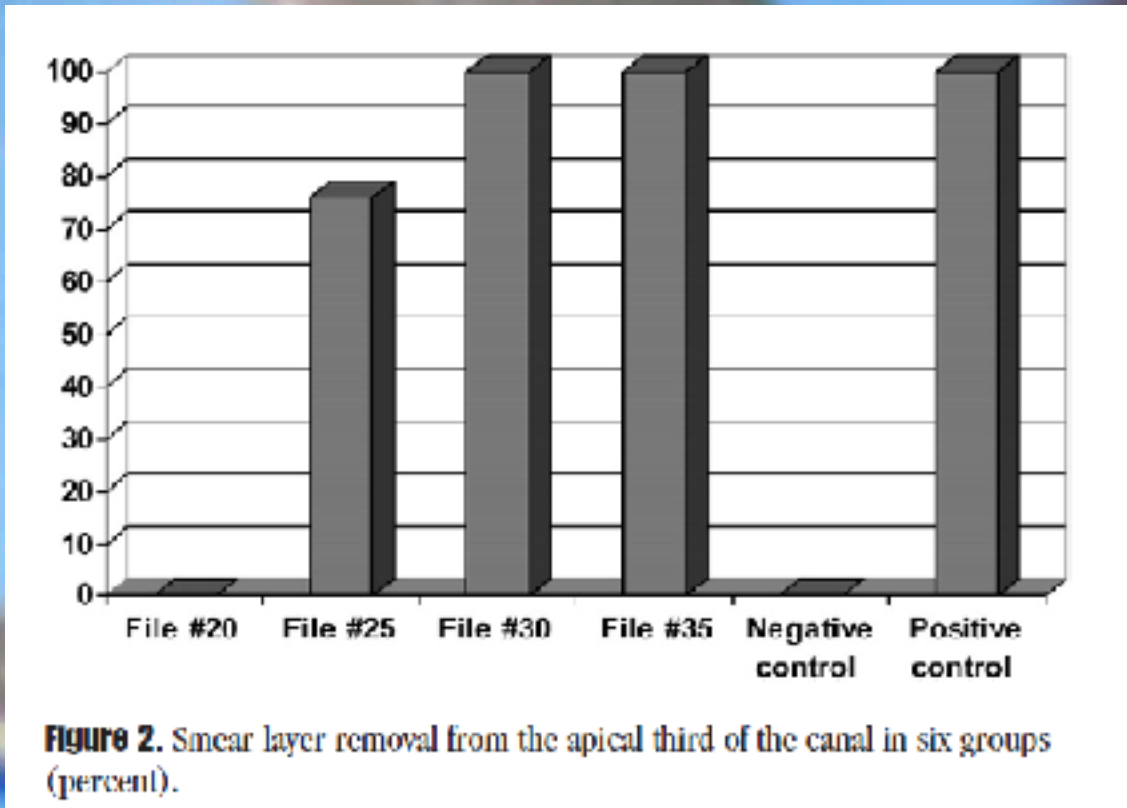
Science behind the developments:

Preparation to size 30 offers minimum requirement for irrigation and obturation

f 30.04

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

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



DIAMETRO DELLA PREPARAZIONE

ALLARGAMENTO
APICALE



MIGLIORA EFFICACIA
IRRIGANTI



MIGLIORE DISINFEZIONE
MECCANICA



DIAMETRO DELLA 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: 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 Sujayendranatha Reddy⁴, Someshwar Battu⁵, Swathi Aravelli¹

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

2025

OGSF



Nuovi colori e nuova lunghezza 31mm

2025

EDM



Nuovi colori e nuova lunghezza 31mm

L'EVOLUZIONE DELLA SISTEMATICA HYFLEX.

LA NUOVA SEQUENZA OGSF PER UNA
ENDODONZIA PIÙ SICURA ED EFFICIENTE

- HyFlex CM ha rivoluzionato la strumentazione NiTi
- HyFlex EDM ha incrementato sicurezza ed efficienza



ONE MORE THING

THE FUTURE IS NOW

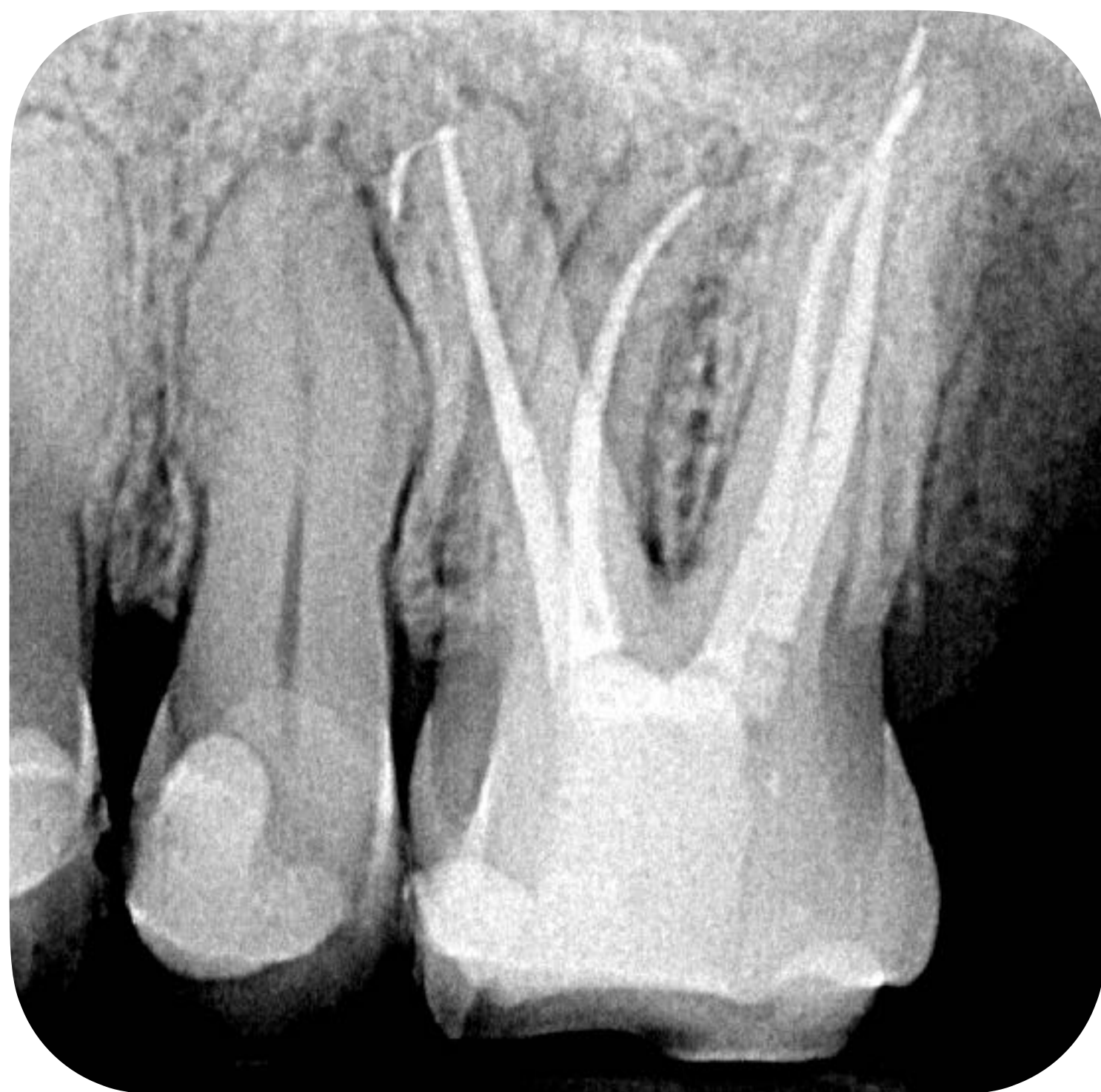
CanalPro™ Jeni



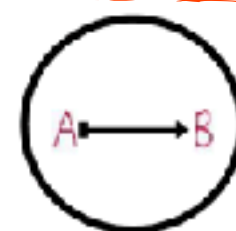


REGOLE

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



4 PROGRAMMI : HYFLEX EDM, HYFLEX CM,
MM ONECURVE, MM 2SHAPE



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

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

NOTIFICA DI IRRIGAZIONE AUTOMATICA
(BEEP LUNGO)



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

NOTIFICA DI CAMBIO FILE
AUTOMATICA (PIÙ BEEP BREVI)

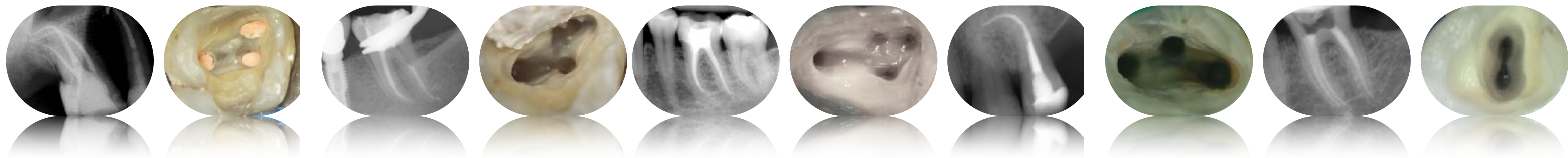


IL MOTORE INDICA CHE IL FILE DEVE ESSERE CAMBIATO DOPO UN CERTO NUMERO DI UTILIZZI (PER EVITARE LA ROTTURA)





The end



Dr Gianluca Fumei



GFUMEI@TISCALI.IT



DRGFUMEIENDODONTICS



WWW.SHAPE-IT-ENDO.SOCIALACADEMY.COM



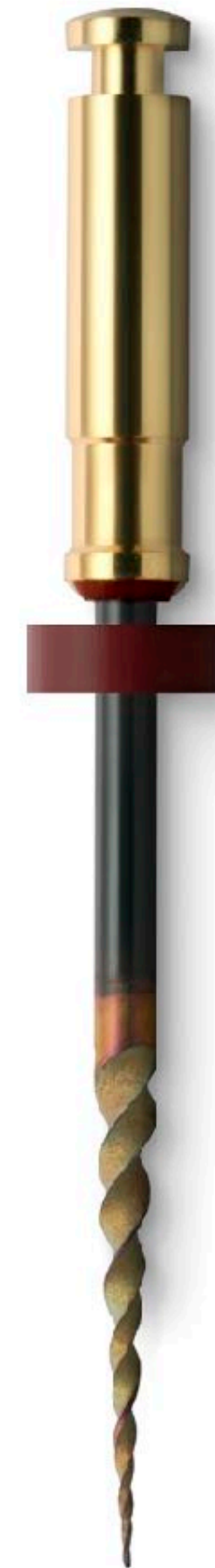
I STEP

LUNGHEZZA DI LAVORO



II STEP

Opener EDM 18.11



400 rpm
T 2,5 Ncm

III STEP

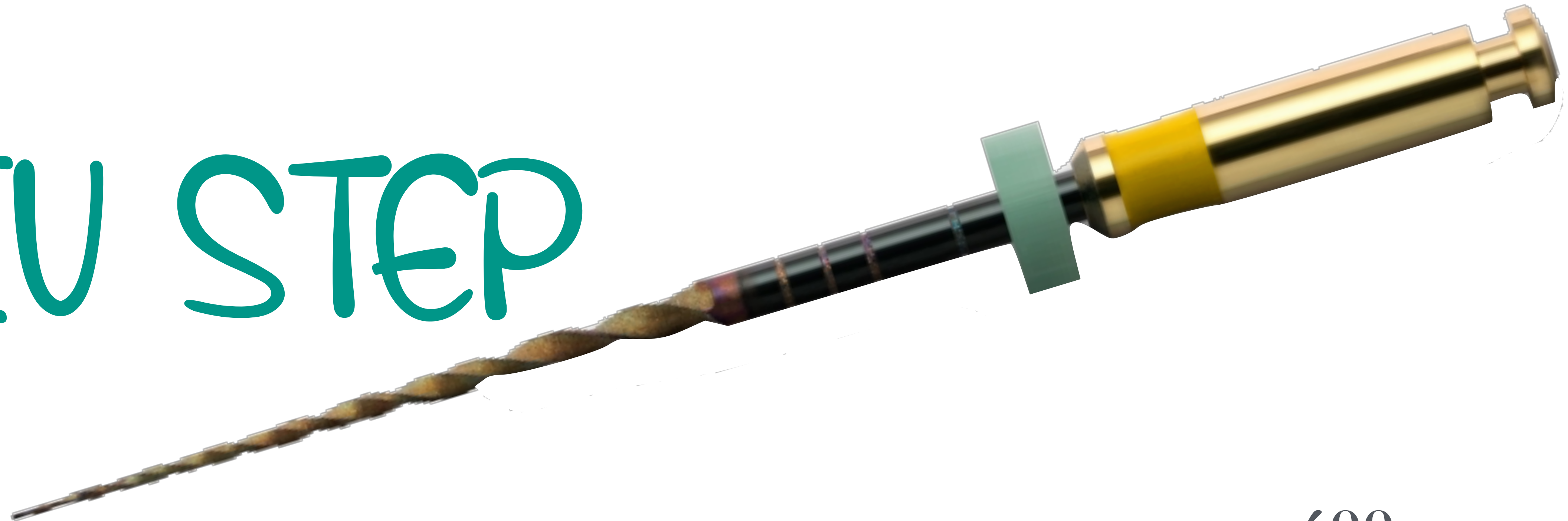
EDM GLYDER 15.3



300 rpm
T 1,8 Ncm

IV STEP

EDM SHAPER 18.045



400 rpm
T 2,5 Ncm

V STEP

EDM FINISHER 30.4

400 rpm
T 2,5 Ncm

