

# **Power driven endodontics**

# History

- Stainless steel – no rotation, oscillation, translation, combination – risk of perforation, ledging.
- Nickel titanium alloy – rotation, reciprocation, oscillation

# Ni Ti instruments

## Controlled rotation



## NiTi alloy

56 % Ni, 44% Ti,

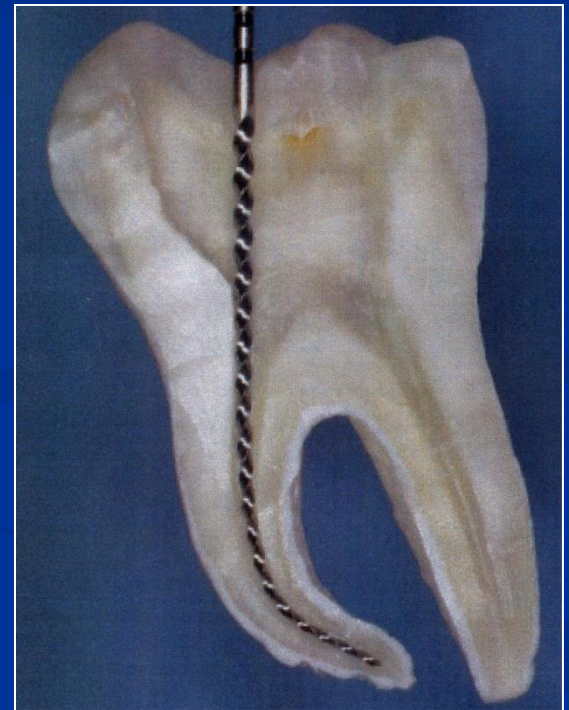
60%Ni, 40 % Ti

Flexibility

Memory effect

Effectiveness

Fractures ?







# Martensitic transformation

Austenit



Martensit



Heating or releasing of bending stress –  
back to austenit - superelasticity

# Contemporary trends

- Treatment of the wire

- Heating

- Mechanical forming

Increasing: effectiveness

Decreasing: the risk of the fracture

- Design (taper, shape of the cutting part, centralization)

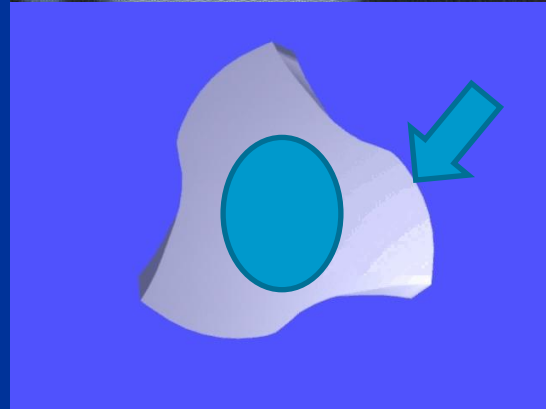
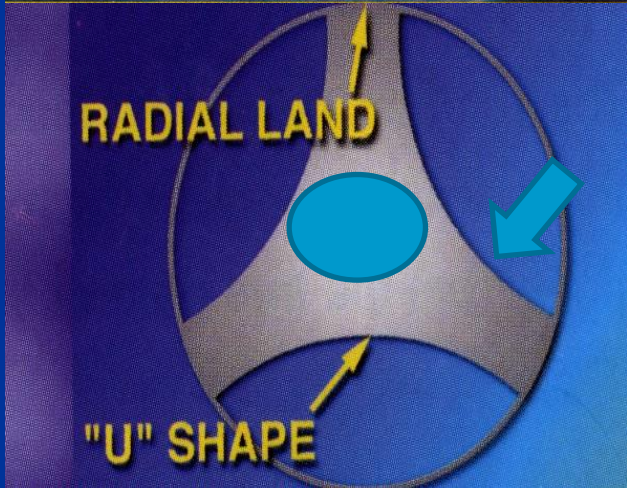
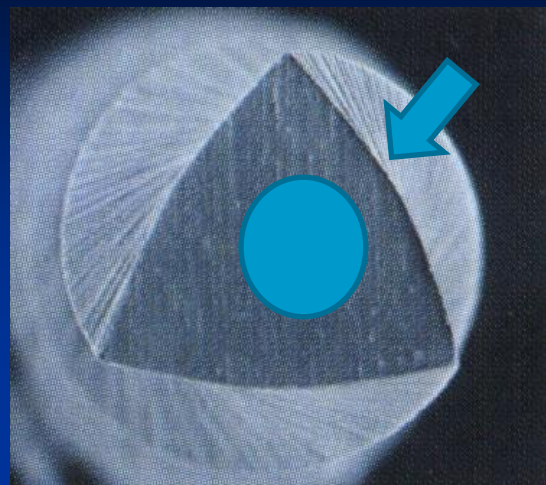
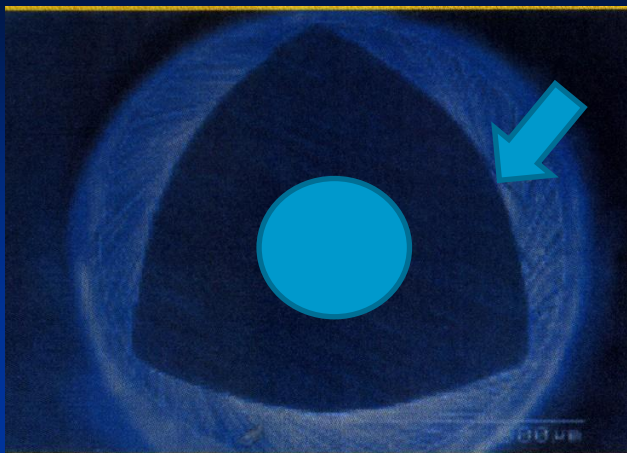
# Shape

- Core



- Cutting part

- Space for the transport of dentin chips

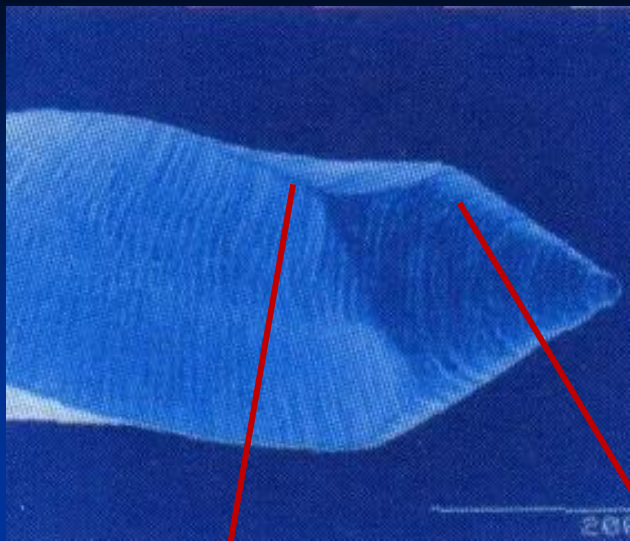


CORE



CUTTING EDGES





Sharp edges



Grooves after the grinding

Radial land – flat „edges“



Tip

# Controlled rotation

Low rpm

Torque control





Handpieces – no complete control



# Gear

**Electromotor: 128:1**

**Air motor: 64:1**

# Motors

- Controlled rotation
- Reciprocation
- More programmms
- Dr's choice



Motors:

More programmes  
Dr's choice





# X-SMART™ DUAL



Motor &  
Apex Locator

# X-SMART *DUAL*: twice as SMART

## 3 MODES OF USE:

- Motor alone
- Apex locator alone
- *DUAL* mode - Motor and apex locator combined

## SAFER with an Endo motor

- Torque control & auto reverse limit risk of file breakage
- Auto reverse / stop at the apex mode limits the risk of over-preparation\*



## SPACE SAVING & CONVENIENCE

Endo motor and apex Locator in one device

## SIMPLE TO USE

- Automatic start / stop when the file enters / is withdrawn from the canal
- Programmable
- Intuitive keyboard
- Large LCD screen

\* Follow the recommended clinical sequence

# X-SMART DUAL: twice as SMART



# X-SMART EASY : cordless and user friendly

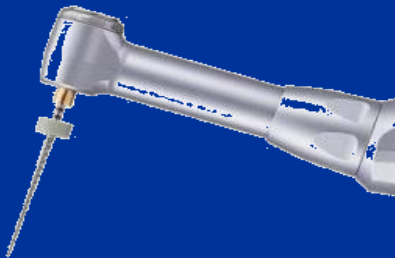
X-SMART

friendly

“The cordless version of X-SMART

- freedom of movement
- Safe – torque control, auto
- Miniature contra-angle as X-SMART
- User friendly – featuring LCD display + very explicit intuitive control panel
- Ergonomic fits well in the hand, anti-slip grip

Miniature contra-angle head



The X-SMART EASY on its charging base

FORWARD

REVERSE

Torque 0.6-4 Ncm

Speed 100-800 rpm

Auto reverse ON/OFF

INCREMENTS +/-

SELECT  
(torque /speed /  
auto reverse)





- Niti alloy enables using of higher taper  
(4%, 6%)



**Taper 2%**

$d_2$

$$d_2 = d_1 + 0,32$$

$d_1$

0,02 mm / 1mm



**Taper 4%**



$d_2$

$d_2 + 0,64$

$d_1$

0,04mm / 1 mm

**Taper 6%**



$d_2$

$$d_2 = d_1 + 0,96$$

$d_1$

0,06mm / 1 mm

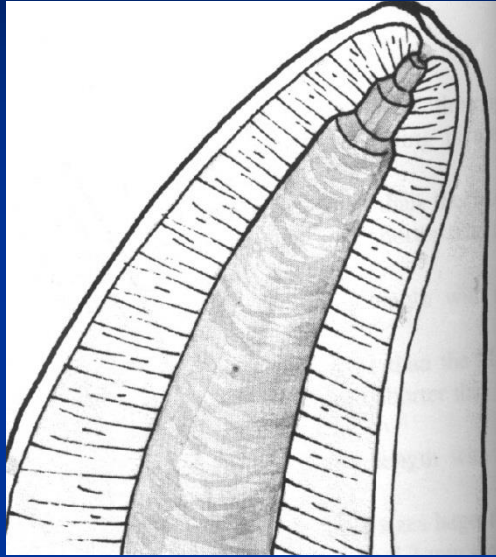
# Higher taper

**Coronal flaring**

**Higher effect of irrigation**

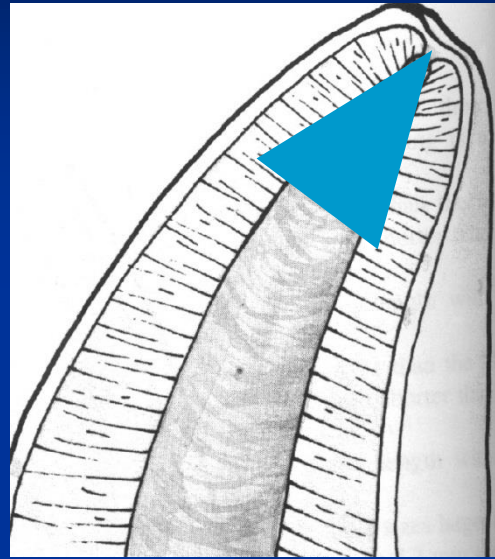
**Good approach to apical part**

**Good conditions for 3D  
filling**



### 2% taper

|    |                    |         |
|----|--------------------|---------|
| 30 | at the apex        | 0,30 mm |
| 35 | 1 mm from the apex | 0,35 mm |
| 40 | 2 mm from the apex | 0,40 mm |
| 45 | 3 mm from the apex | 0,45 mm |



### 6% taper

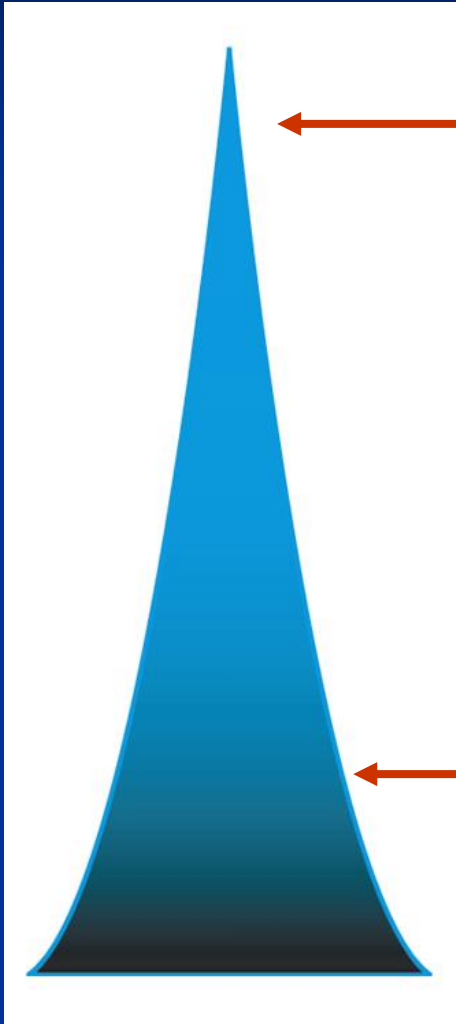
|    |                    |         |
|----|--------------------|---------|
| 30 | at the apex        | 0,30 mm |
| 30 | 1 from the apex    | 0,36 mm |
| 30 | 2 from the apex    | 0,42 mm |
| 30 | 3 mm from the apex | 0,48 mm |

## Shape of the apical

# Classification of instruments acc. to the taper

- Fixed taper
  
- Variable taper
  - Progressive
  - Regressive

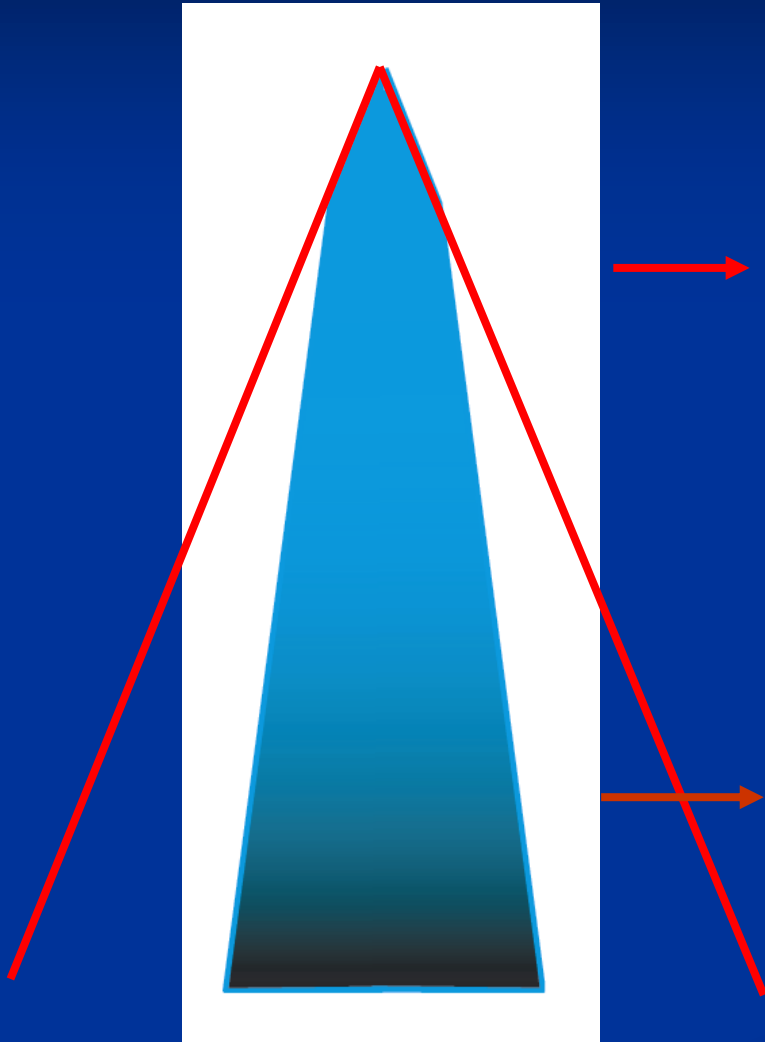
# Progressive taper



Flexibility, penetration,  
small shaping

Resistance maximal  
opening of the root canal,  
approach to the apical part

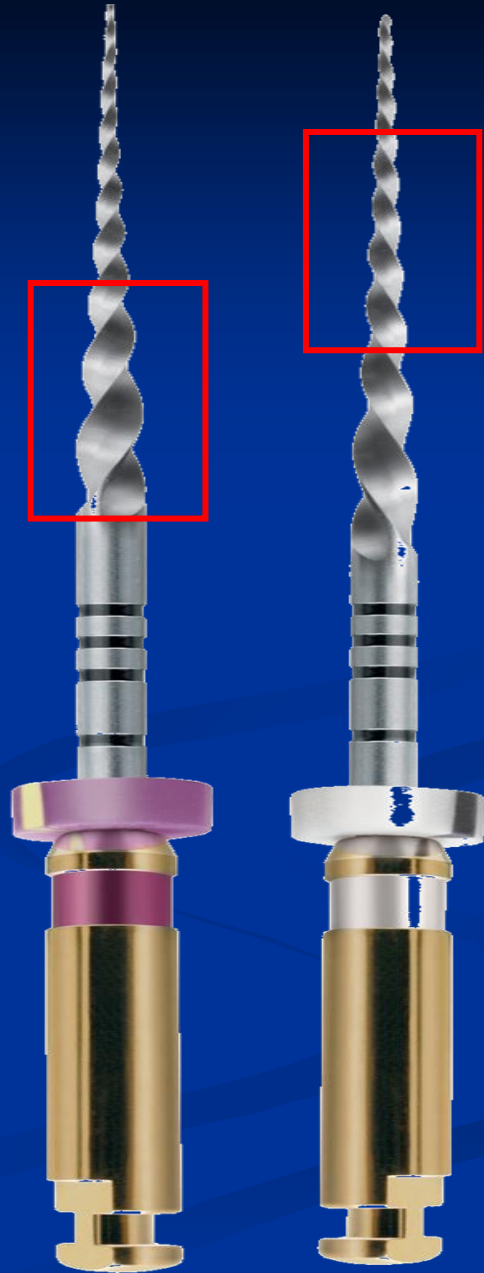
# Regressive Taper



Stability in the apical part

Finishing Files



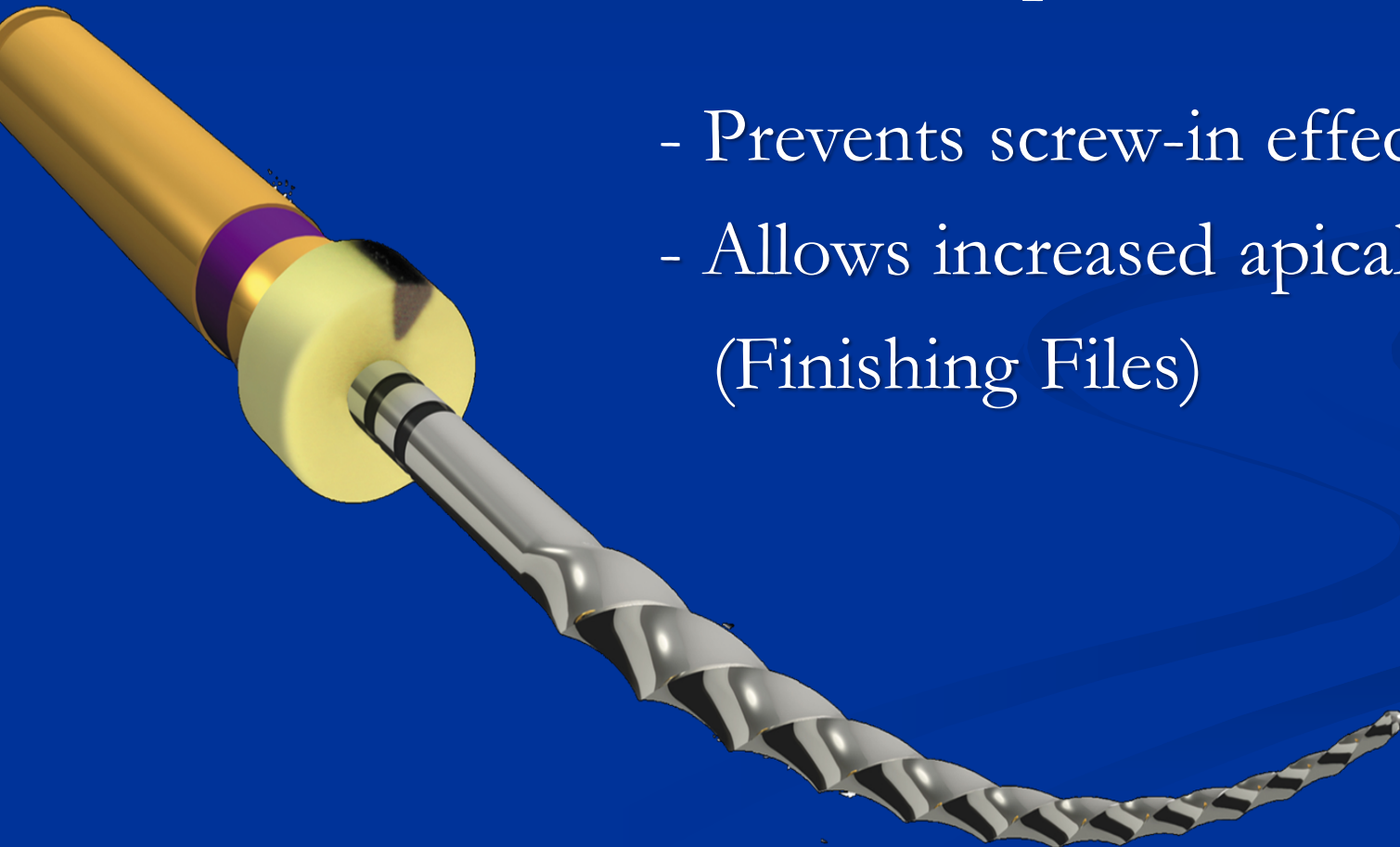


# VARIABLE TAPERED INSTRUMENTS

- Variable Taper:

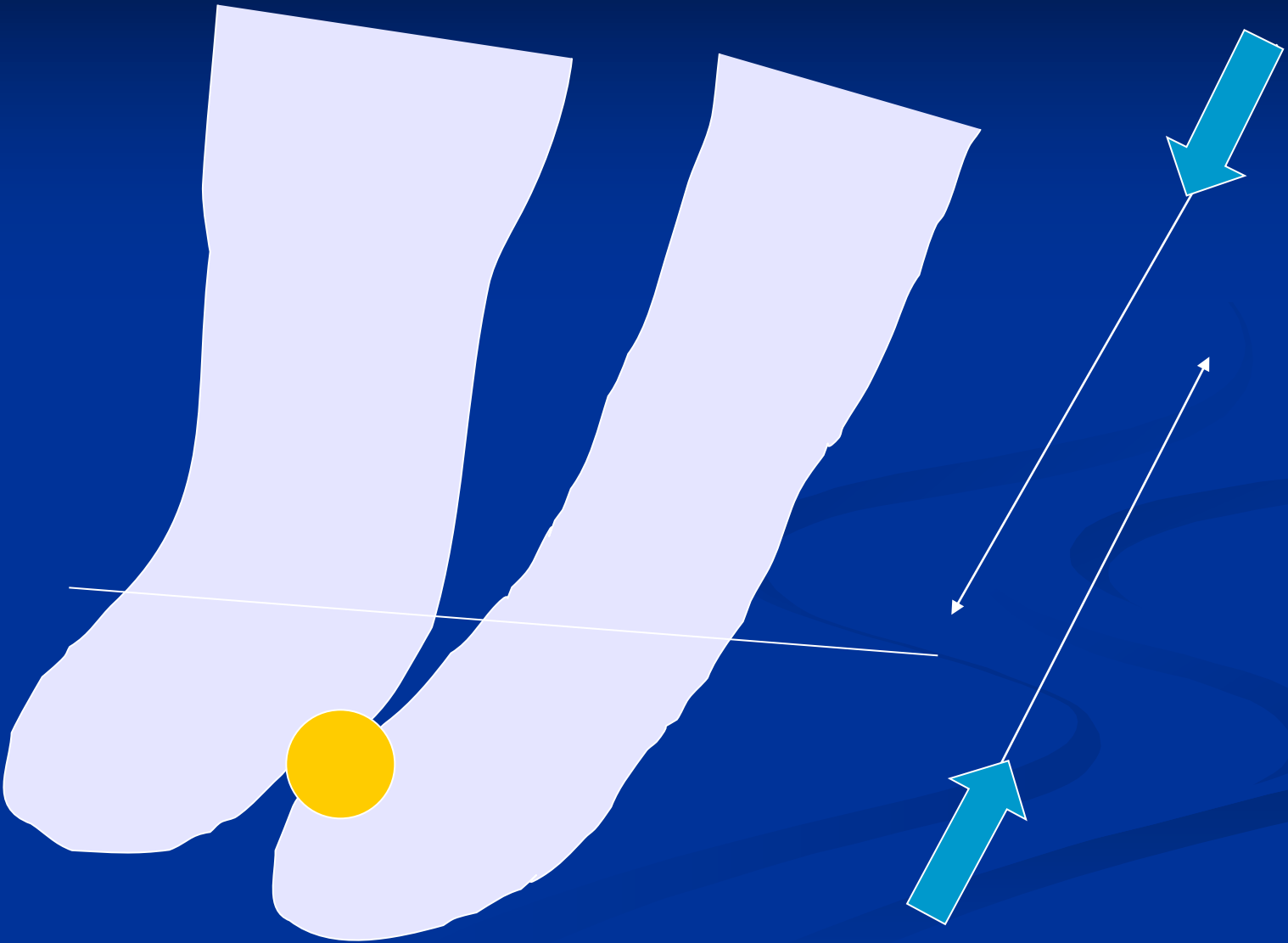
- Prevents screw-in effect

- Allows increased apical tapers  
(Finishing Files)





**Crown down**



# Flex Master organizér

**Crown down:**

Modrá

Červená sekvence

Žlutá

**Apikální**

**preparace:**

Zelená sekvence

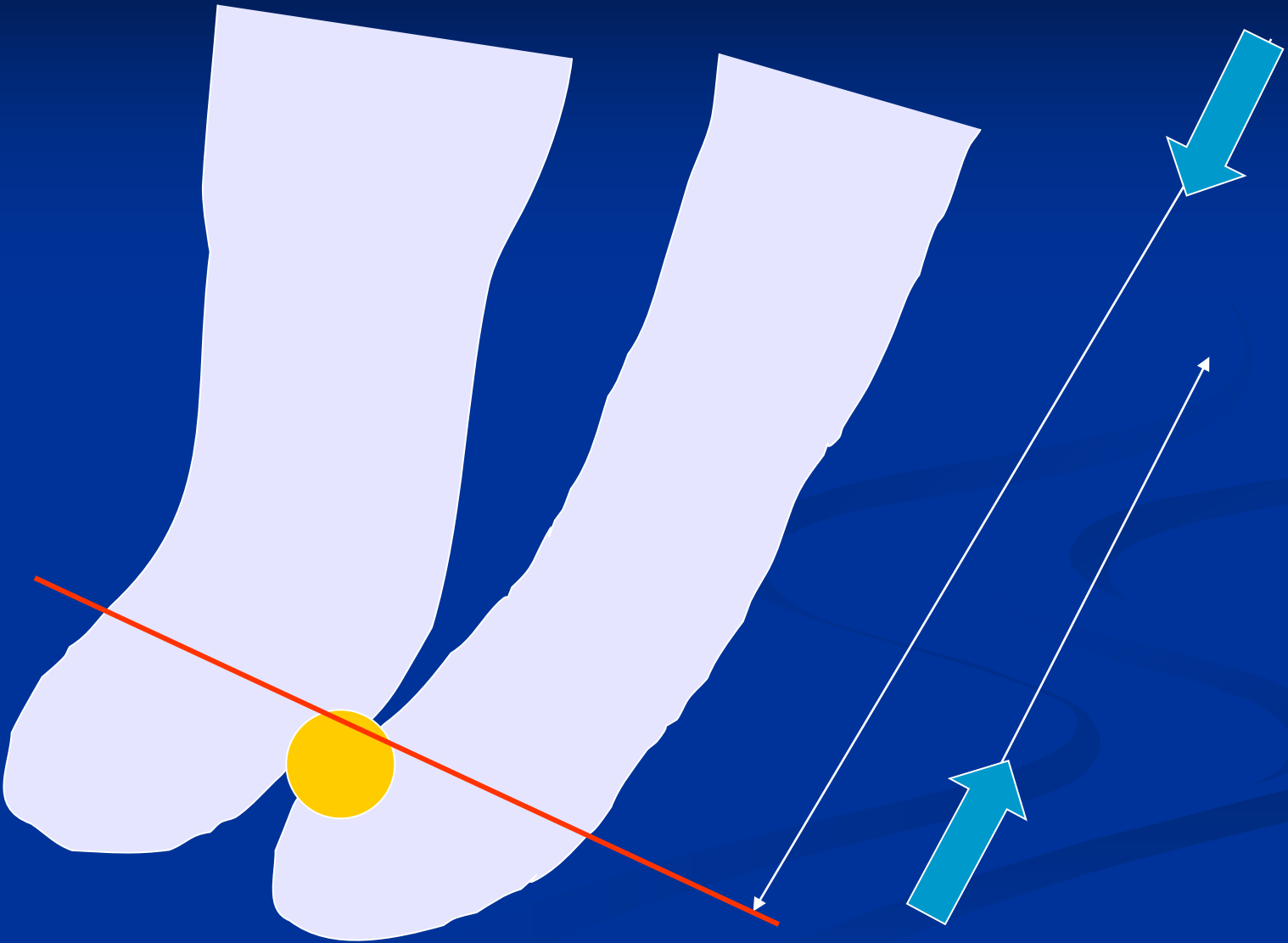


# Apical - coronal

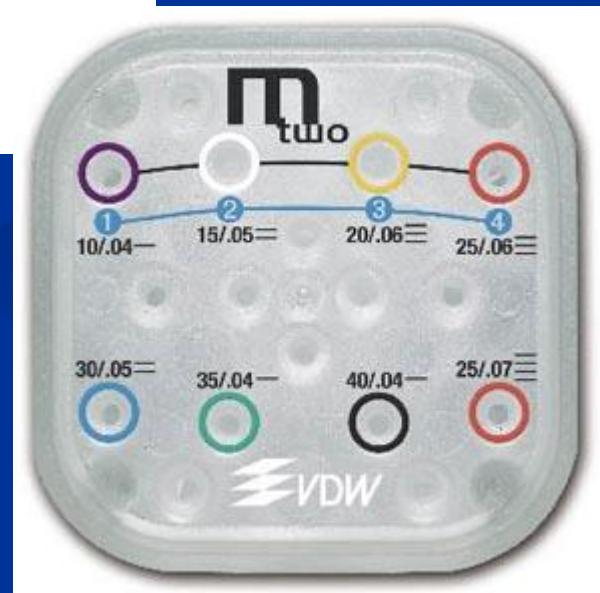


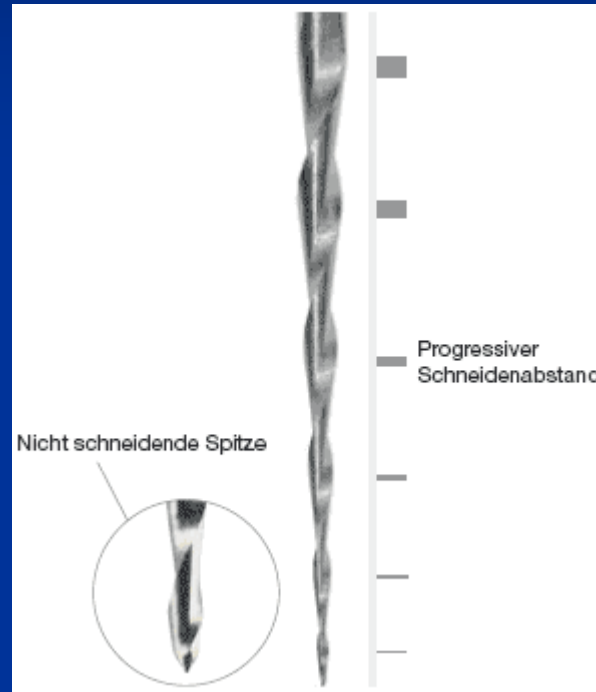
**Step back**











# System ProTaper

- Universal
- Gold
- Next

# System ProTaper

- Universal

- Gold

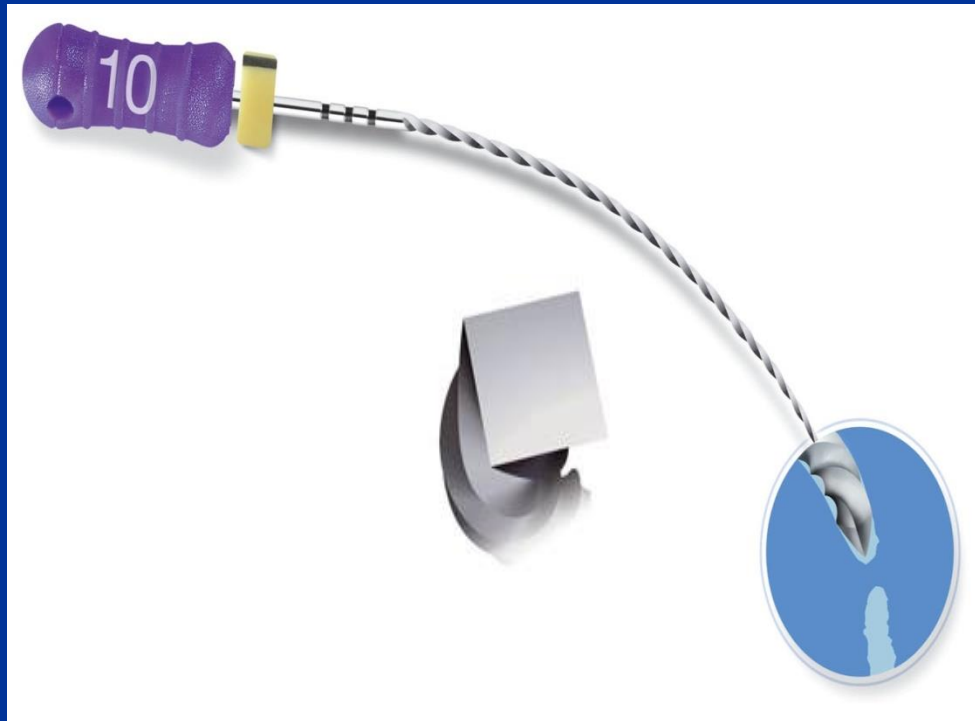


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y 18/0  
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r/ 24

# INITIAL FLARING – GLIDE PATH



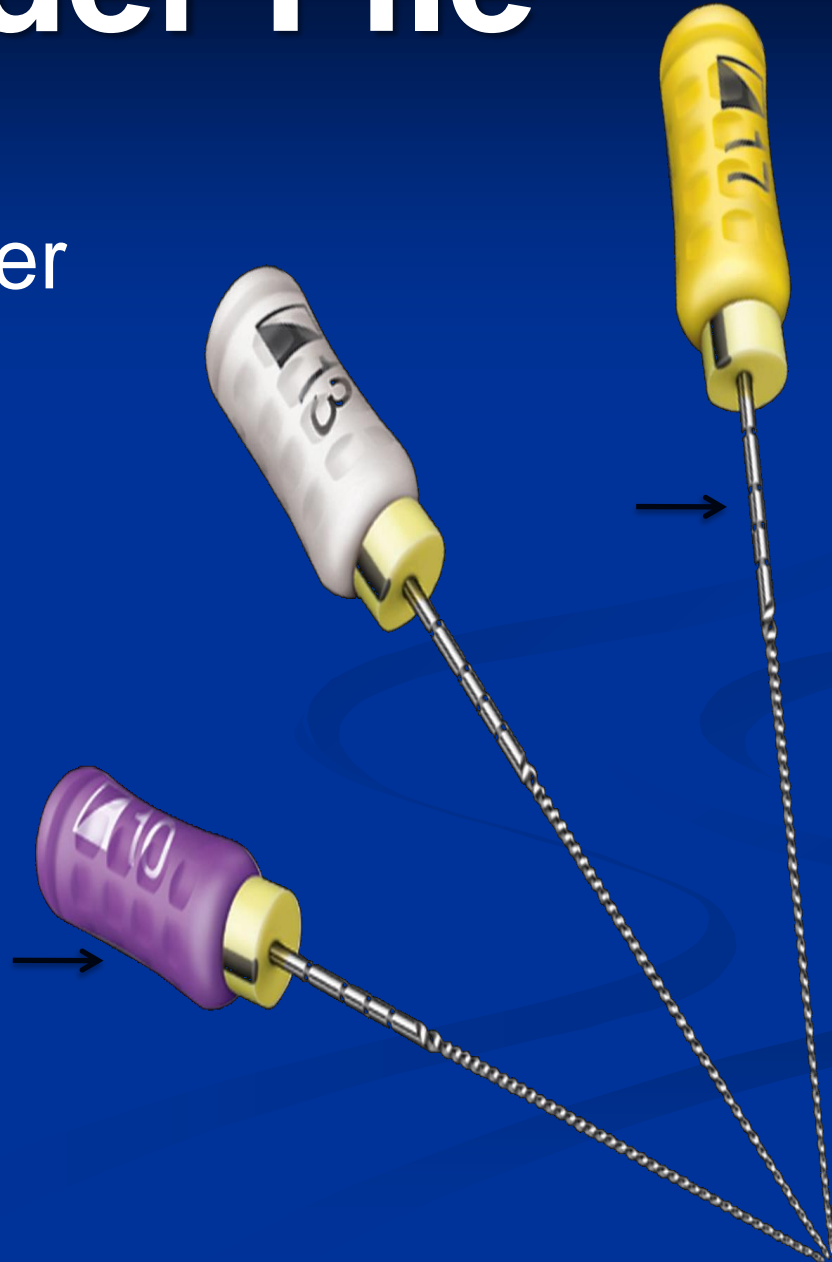
# C- File



# ProFinder File

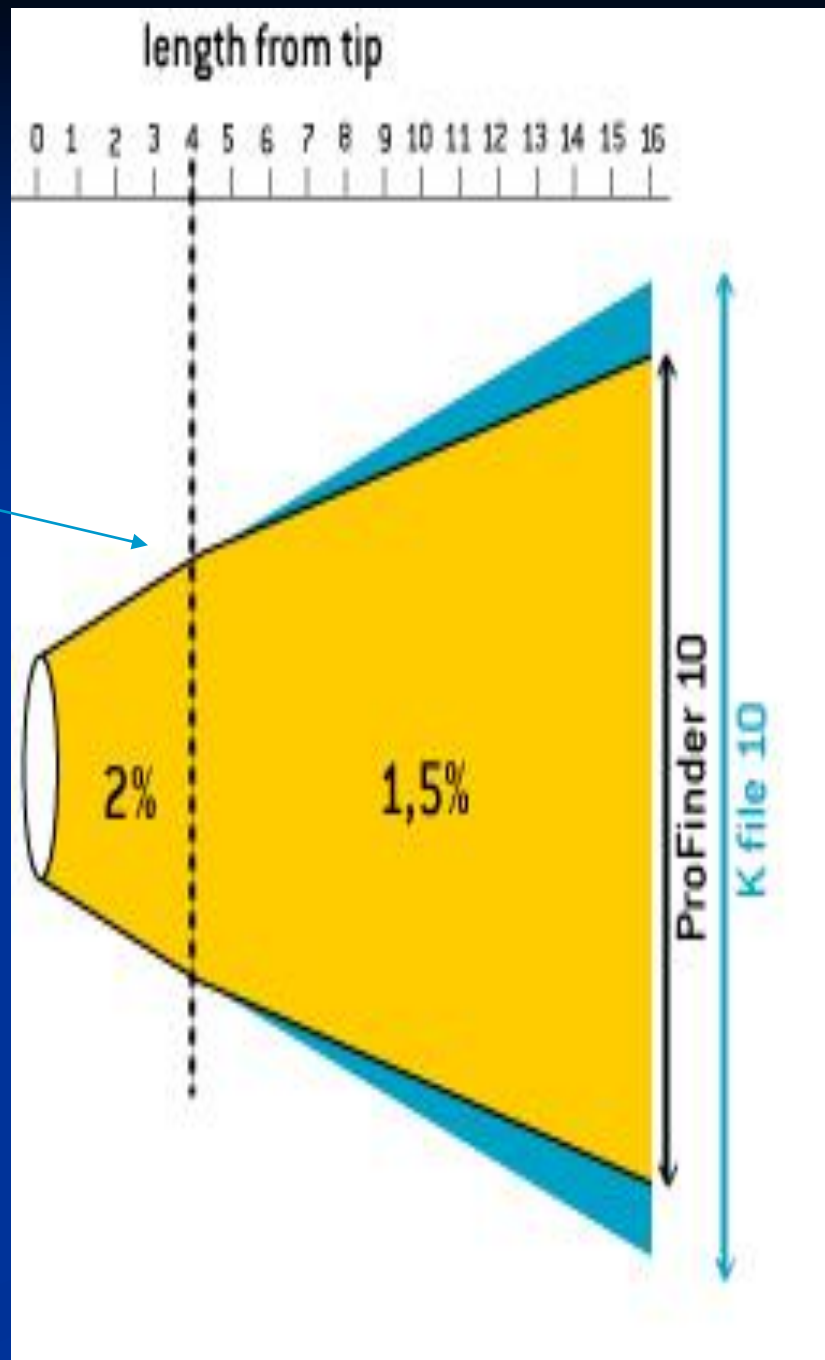
Regressive taper

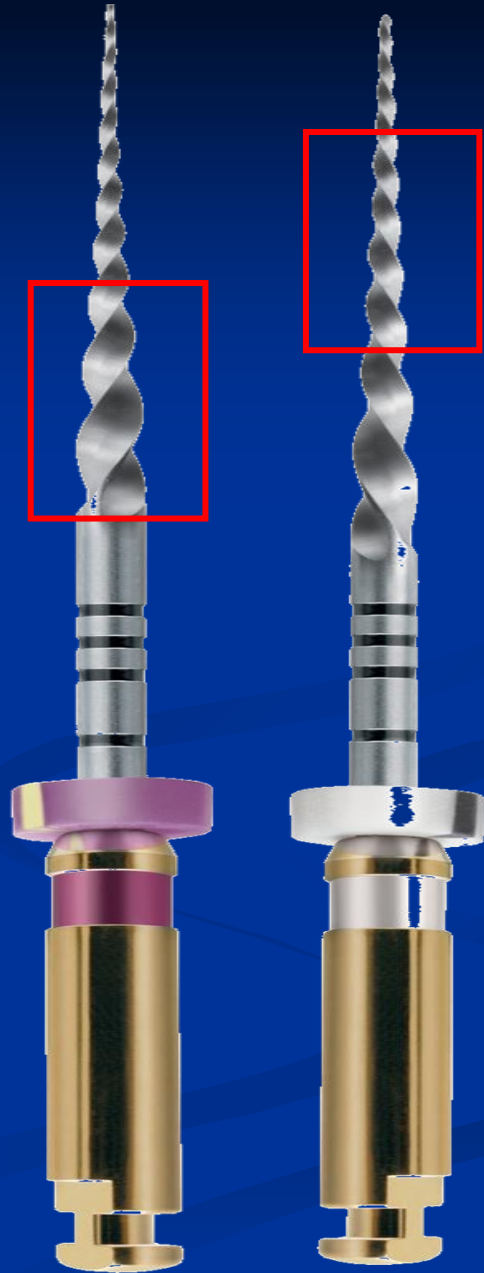
Silicone grip





# Stability



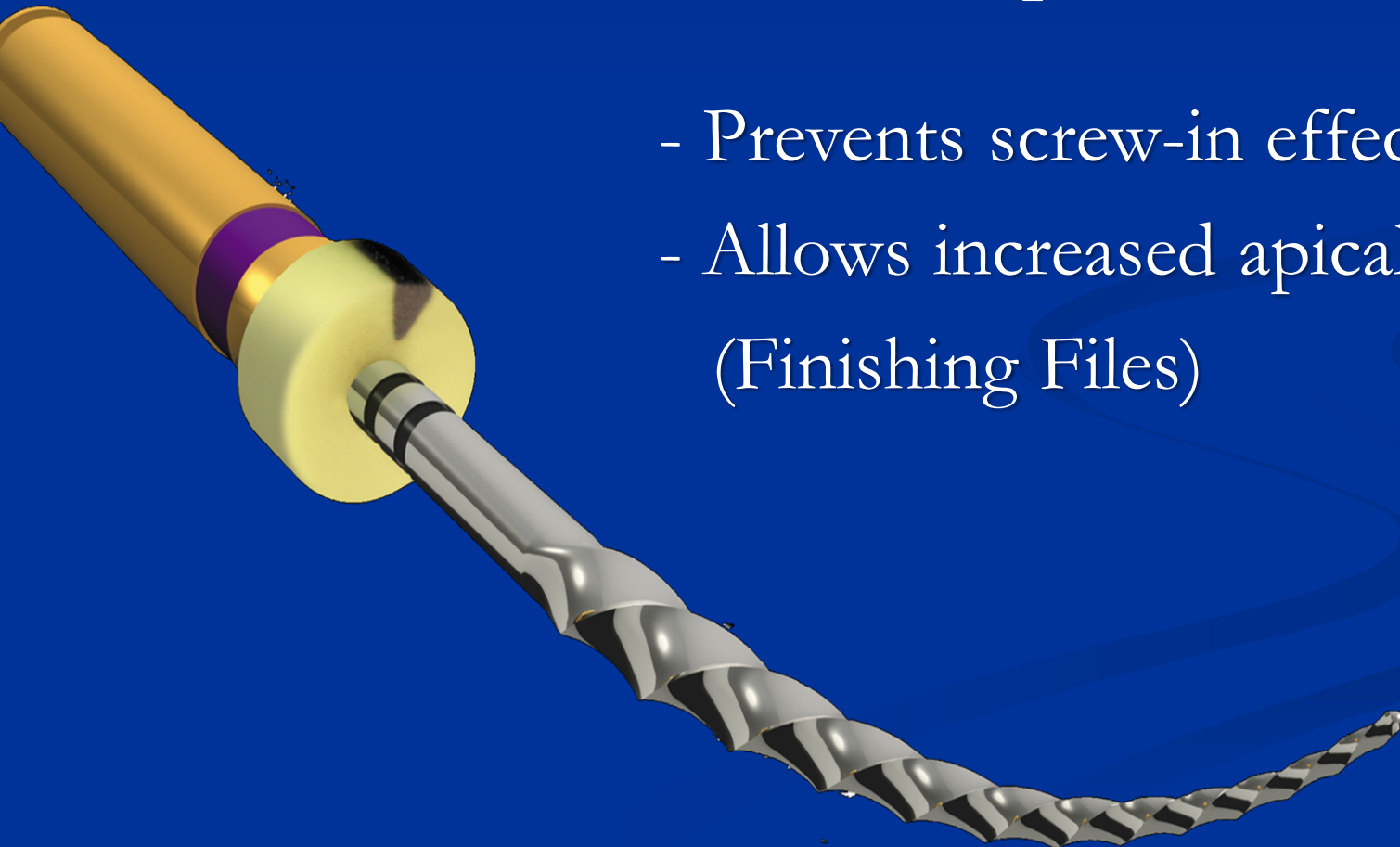


# VARIABLE TAPERED INSTRUMENTS

- Variable Taper:

- Prevents screw-in effect

- Allows increased apical tapers  
(Finishing Files)



# Shaping Files

(S1 & S2 – Accessory Sx)



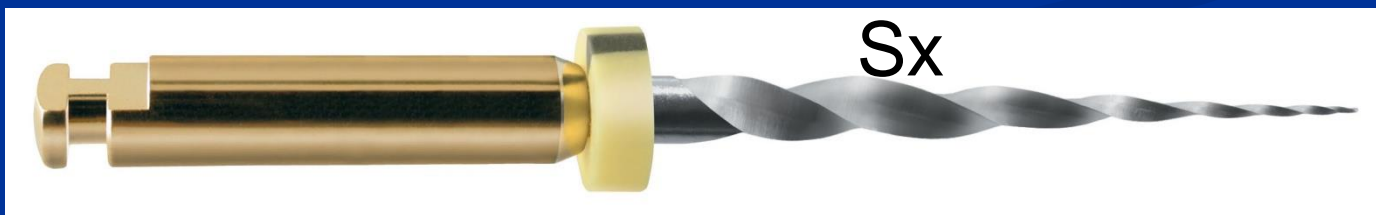
Shape the coronal and  
the middle third of the canal



# Shaping Files

## Variable Increasing Taper (Eiffel Tower shape)

S2



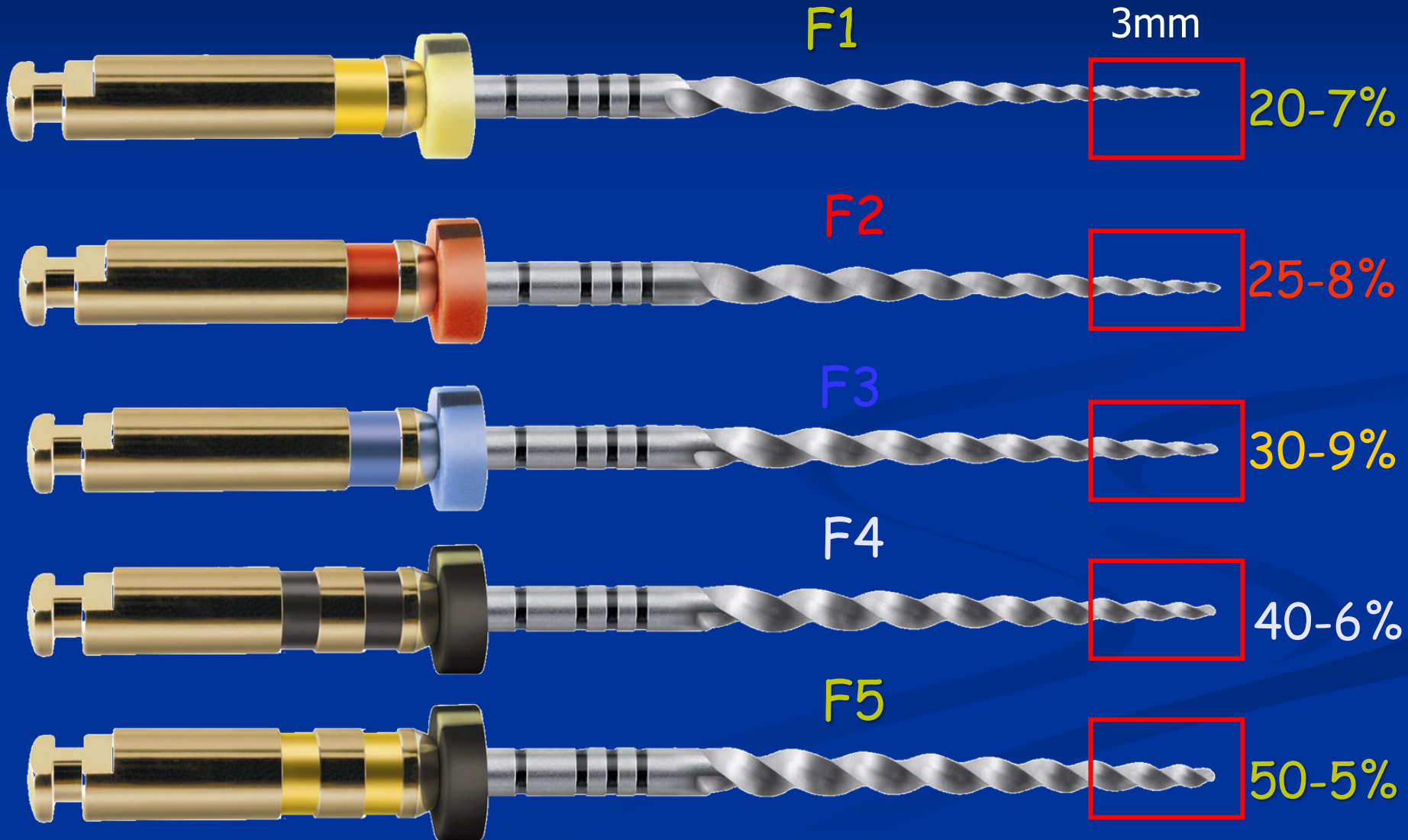
# Finishing Files F1, F2, F3, F4, F5



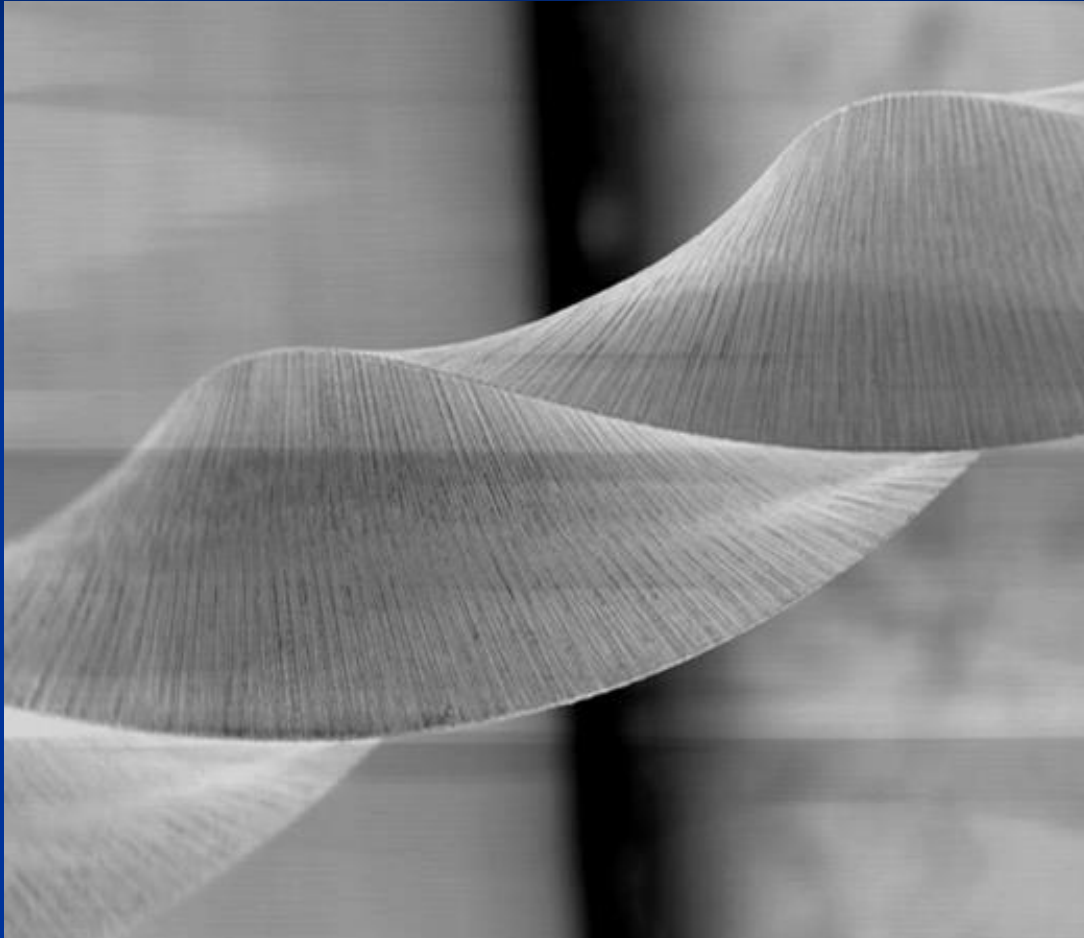
Shape the Apical part of the canal



# Finishing Files (Variable Decreasing Taper)



# Morphology

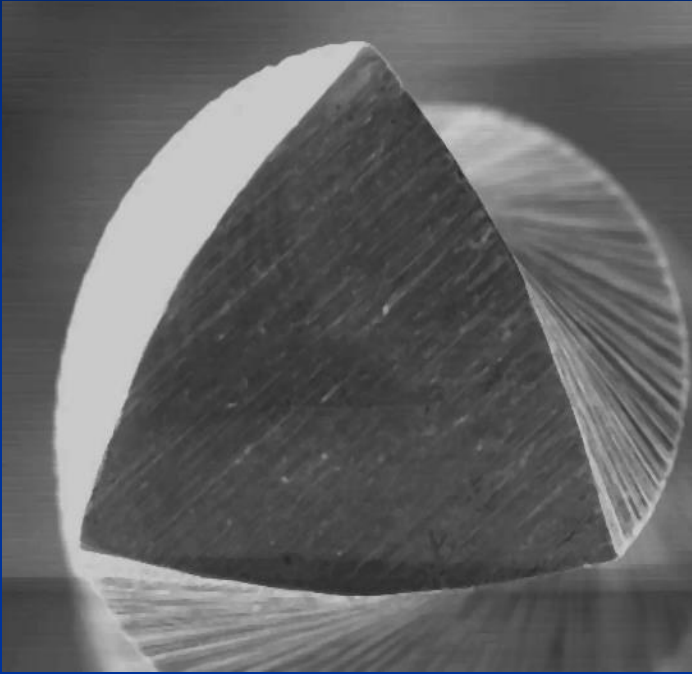


- Cutting blade (no radial land) : Efficiency



# Characteristics

## « Triangular » Cross-Section



*Convexe : S1, S2, SX, F1, F2*

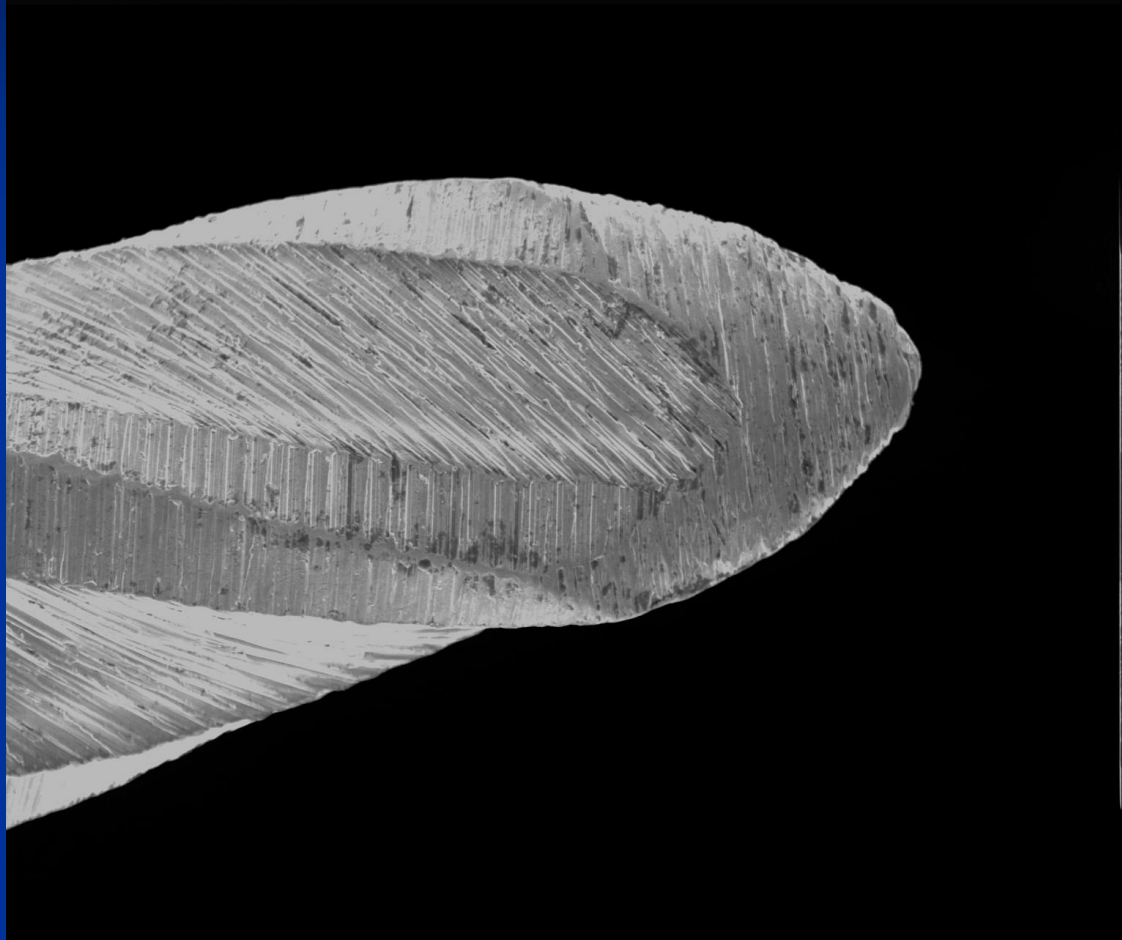


*Concave : F3, F4, F5*

- Triangular concave cross-section : Flexibility
- Triangular convexe cross-section : Resistance

# Characteristics

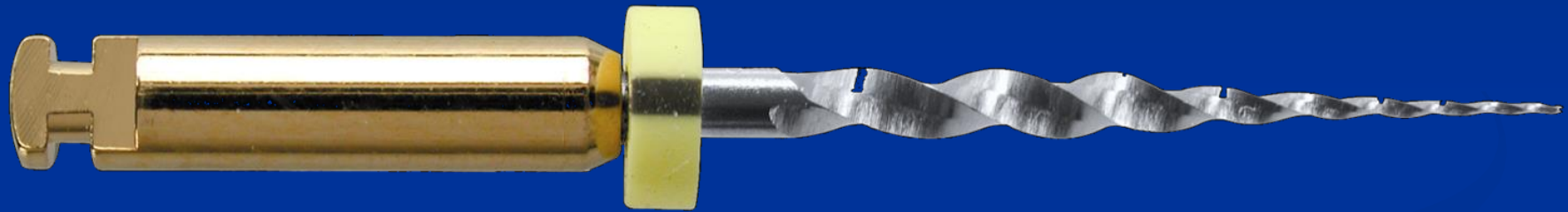
154X 20KV WD:40MM S:01480 P:00011  
200UM



Radial land

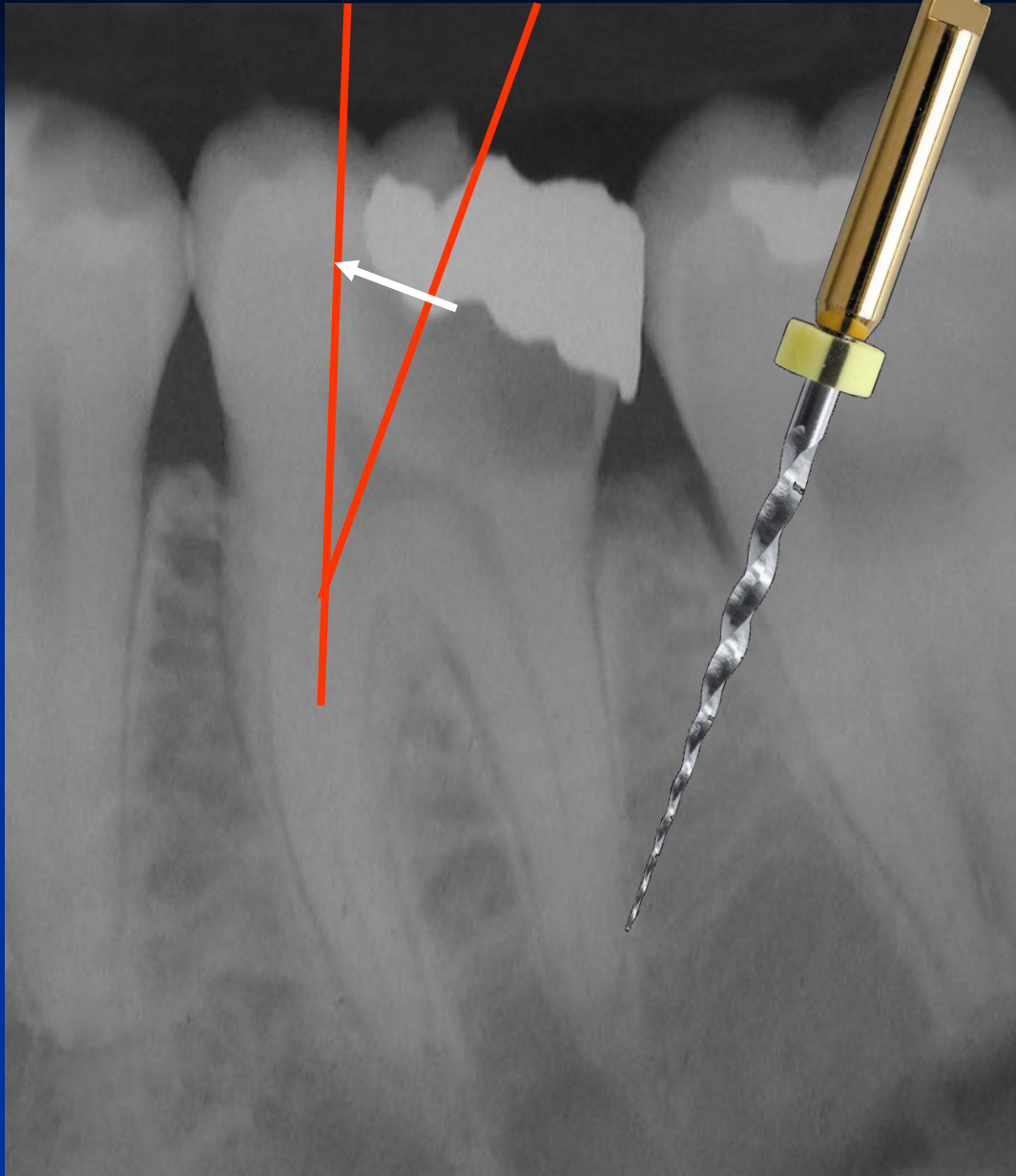
- Safe non cutting tip : acts as a guide

# Short instrument with high taper



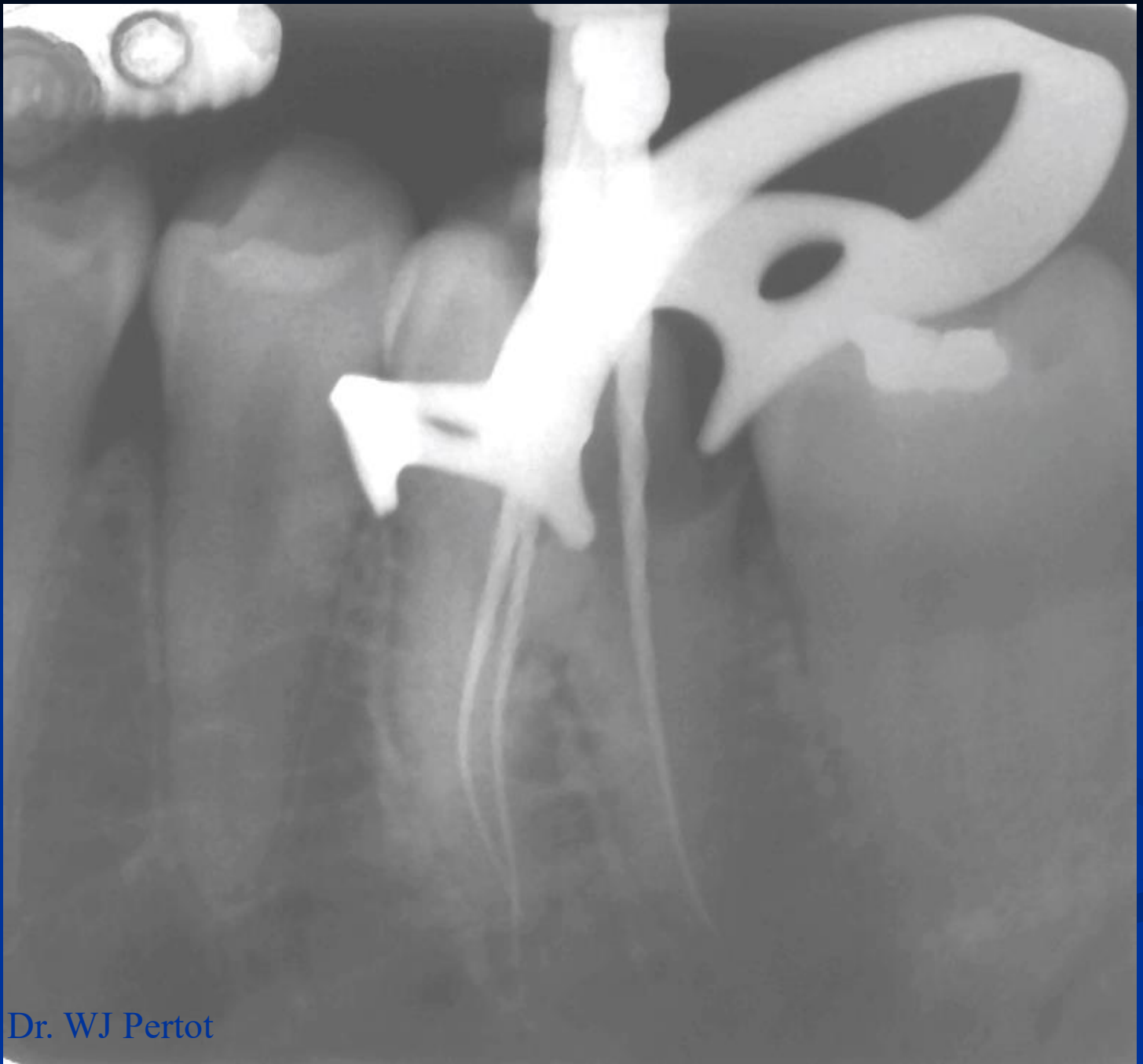
19

For Relocating Canal Orifice  
(only when needed)



Sx is used with a  
**brushing motion**

to relocate  
the orifice and insure a  
**straight line access**



Dr. WJ Pertot



Dr. WJ Pertot

# SCOUTING THE CANAL :



K-File 008 or 010

Then hand instruments  
to the level they are accepted in the canal.

Stainless steel



Hand Files  
3,17

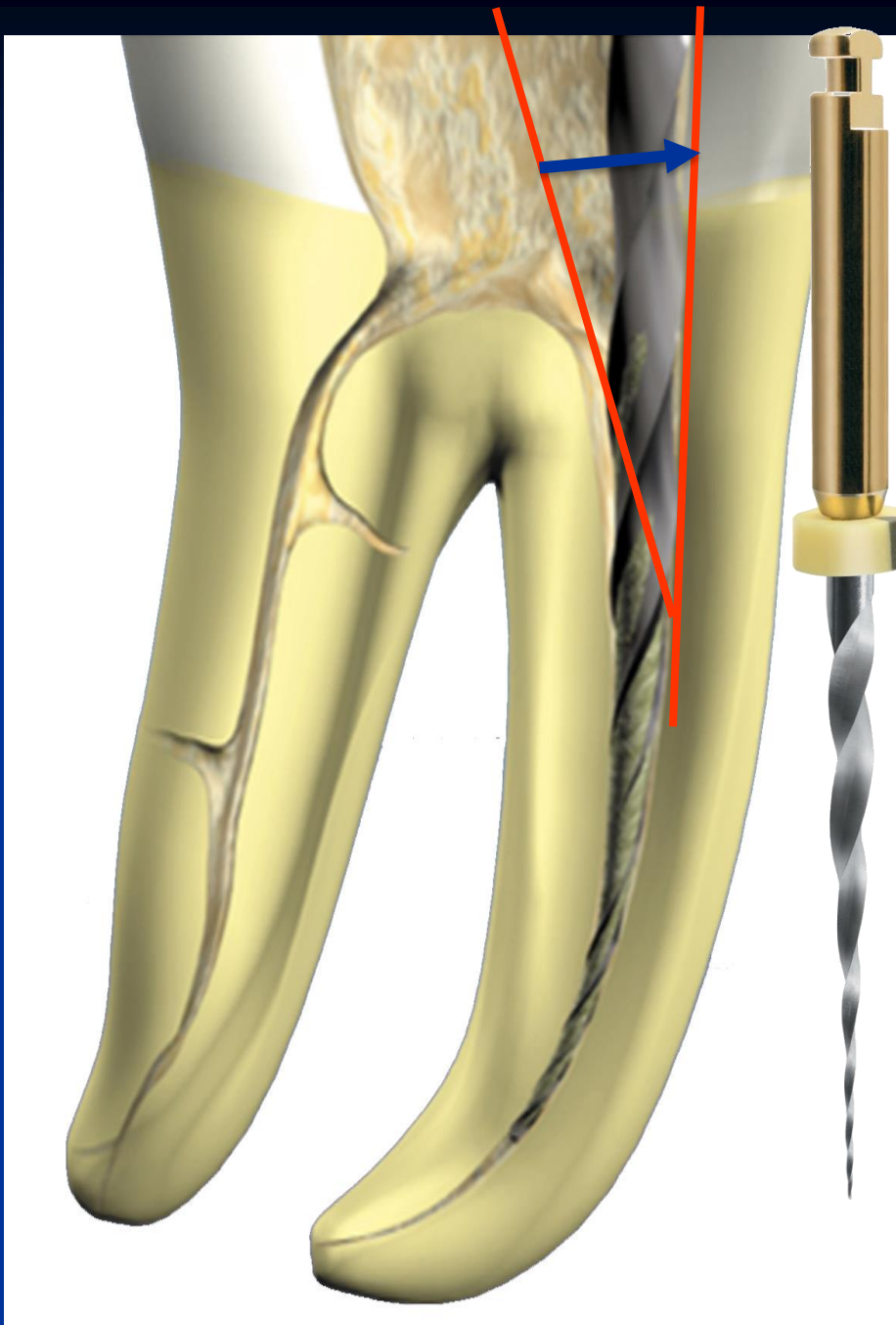
Stainless steel



Hand File  
0,15

OR NiTi ROTARY INSTRUMENTS : Pathfiles

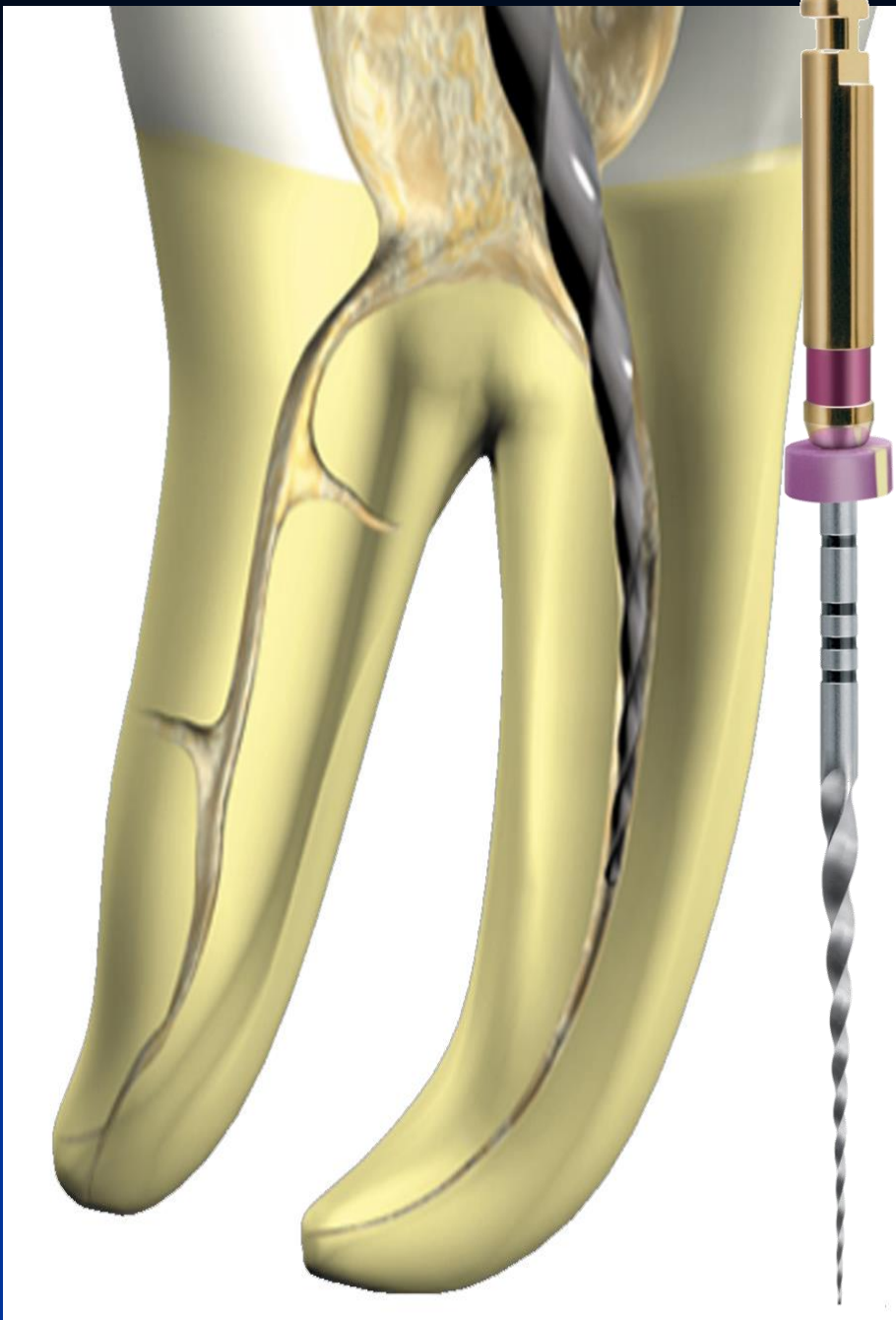




If needed, use SX with a brushing motion to relocate the orifice of the canal and create a straight line access

(don't use Sx deep in the canal)



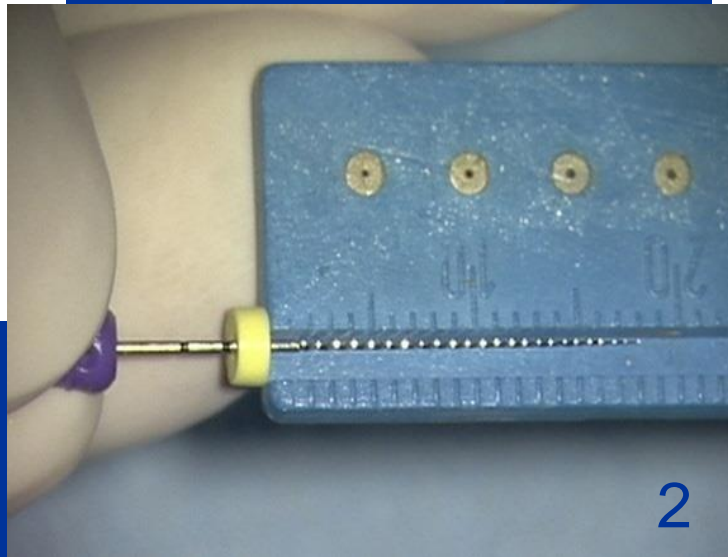
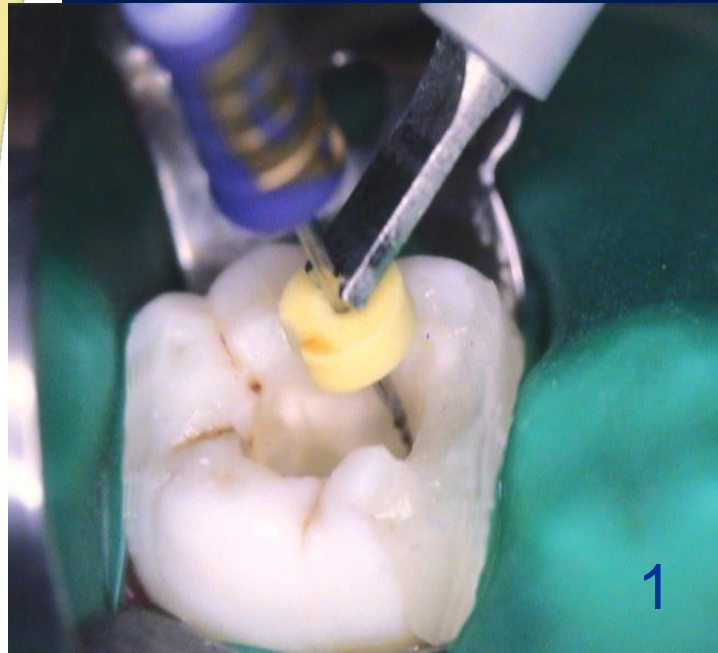
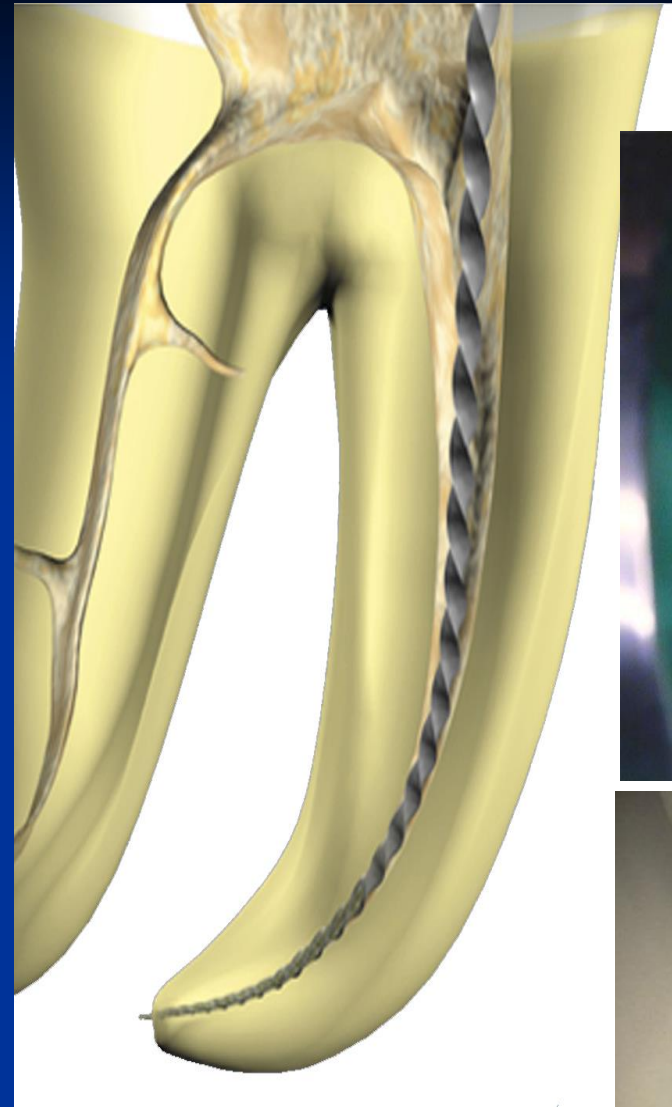


Use S1 with a brushing motion and enlarge the canal, *no deeper* than the level of the penetration of the scouting file

(to make sure that the tip of S1 is never blocked)

Using Pathfile, go to working length that you established right before

# Determine WL



Apex Locator



After going to length with a stainless steel file size 15, use :

S1 to working length

with a brushing motion.

*Using Pathfile this step is skipped*



When S1 reaches working length, use :

S2 to working length

with a brushing motion



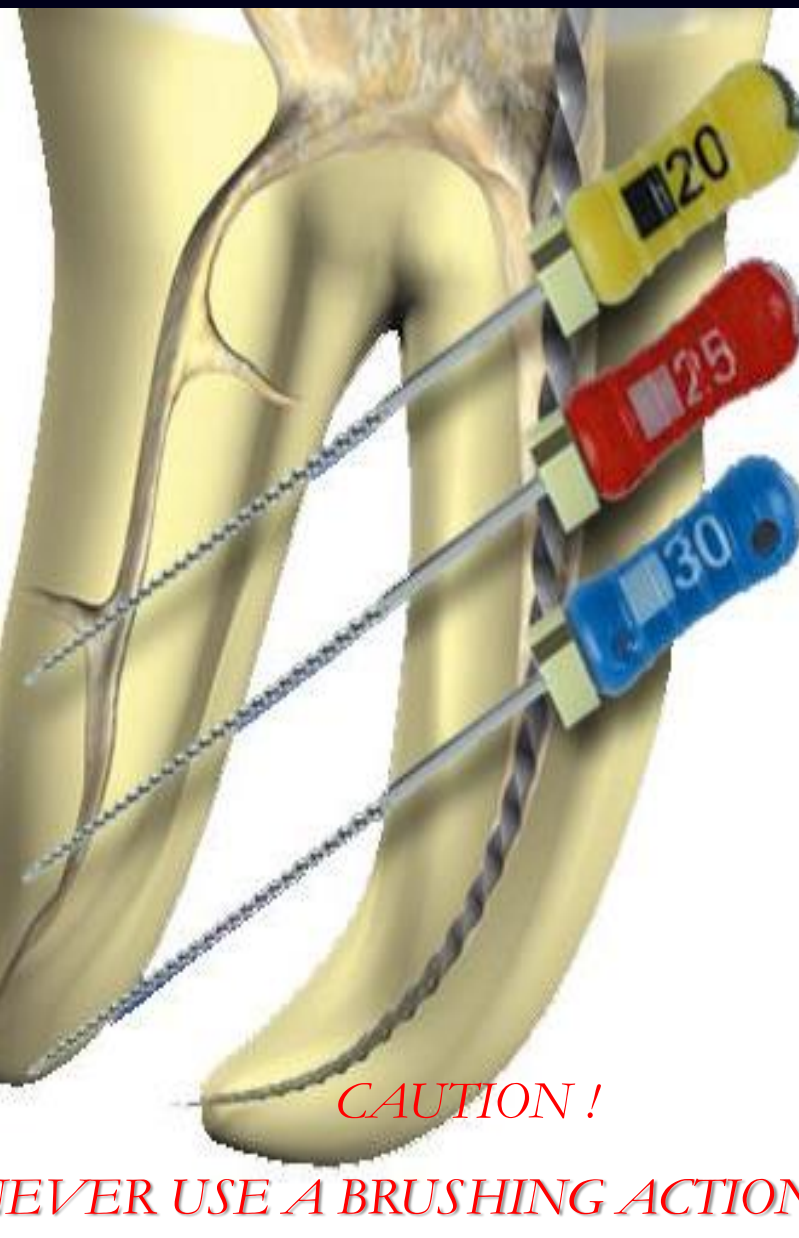


When S2 reaches working length, use :

F1 to working length.

**CAUTION !**  
**NEVER USE A BRUSHING**  
**ACTION**  
**WITH THE FINISHING FILES !!!**

*When a finishing file reaches the working length,  
It is immediately withdrawn.*

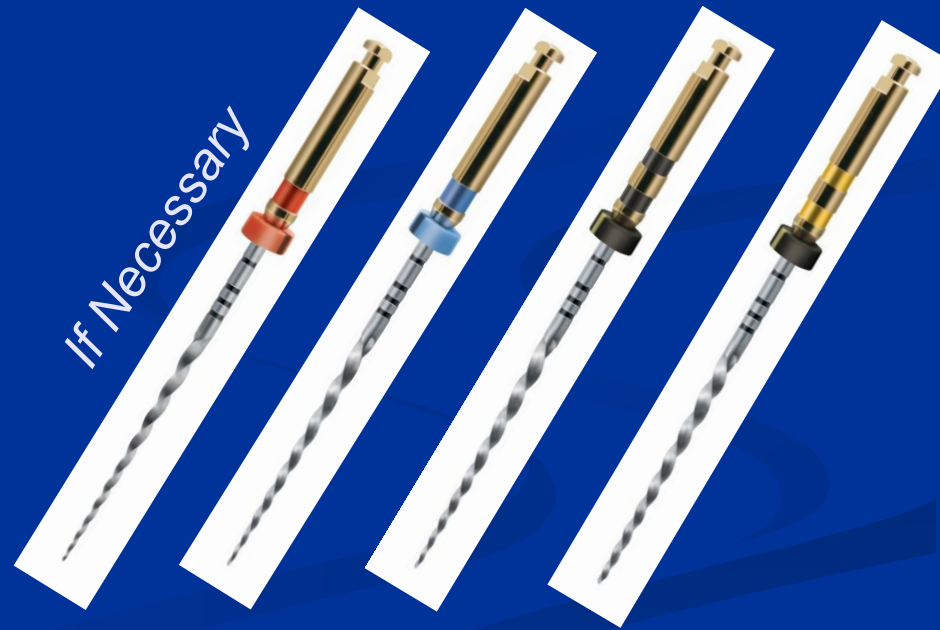


**CAUTION!**

**NEVER USE A BRUSHING ACTION WITH THE FINISHING FILES !!!**

*When a finishing file reaches length, it is immediately withdrawn.*

**Gauge** the diameter of the foramen with stainless steel files and if the foramen is larger than 20, use F2, F3, F4 or F5 to working length, according to the real apical diameter.





# PROTAPER<sup>®</sup>

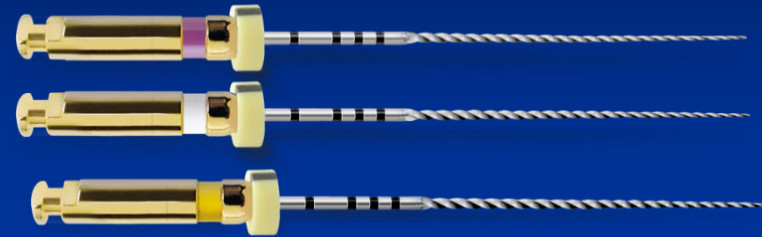
## Rotary instruments sequence

# VIDEO



# Power driven instruments in creating of the glide path

- Pathfile



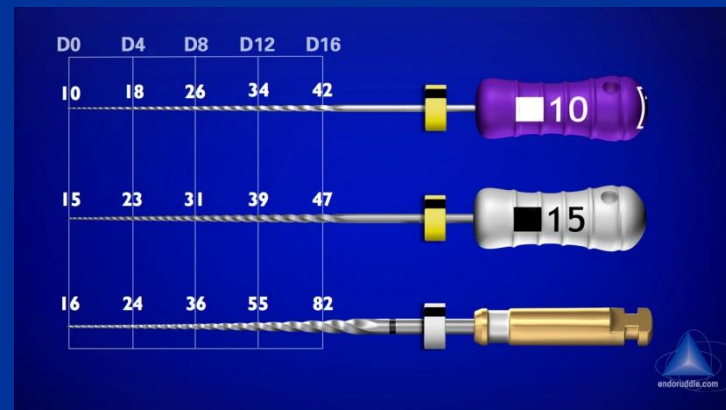
- Proglider file

Progressive taper 2% - 8%

„glide path“

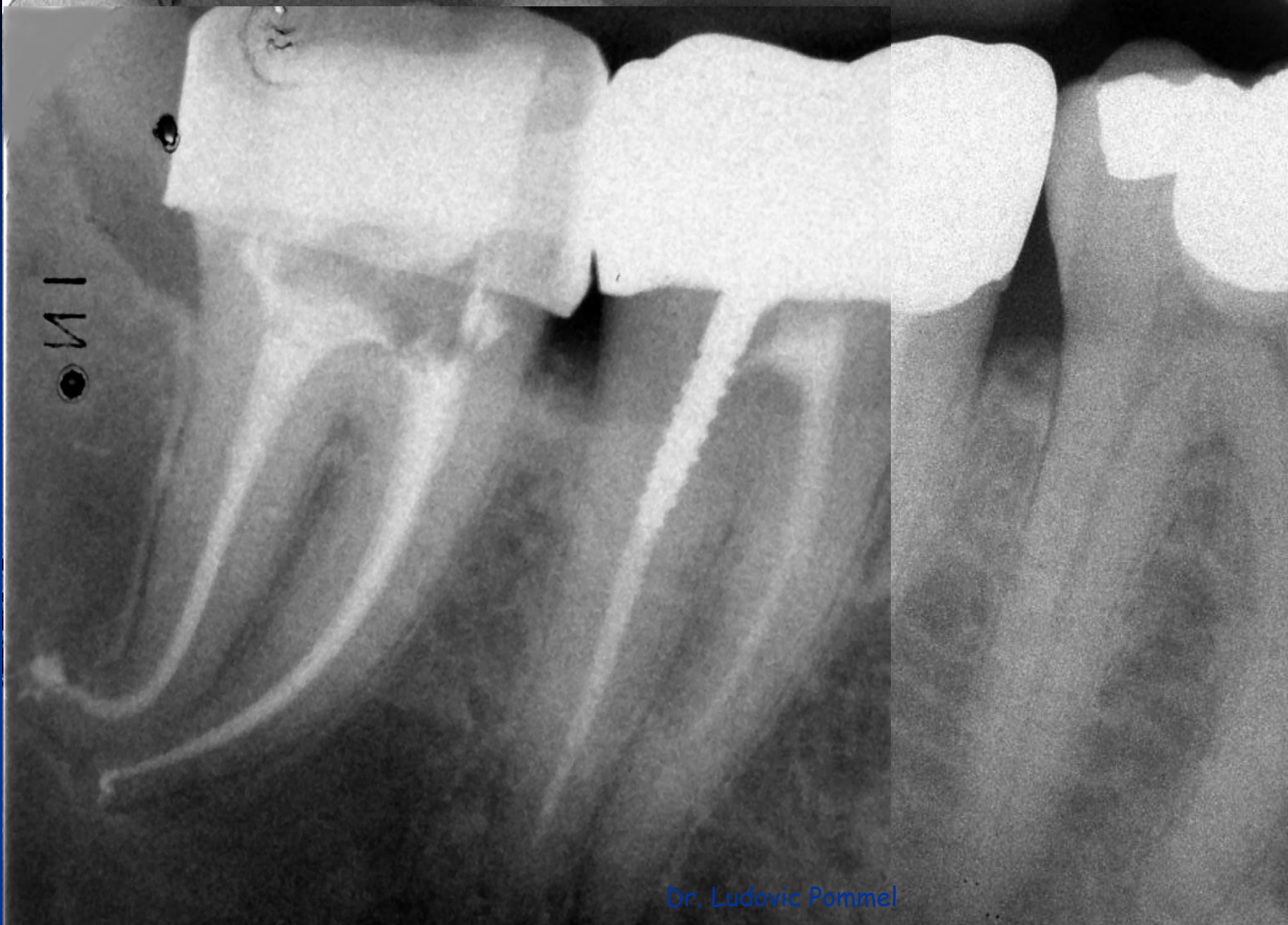
M-wire

Rotary Always combination with hand





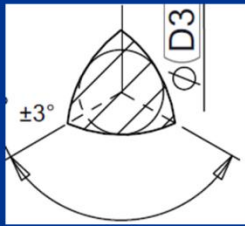




MI

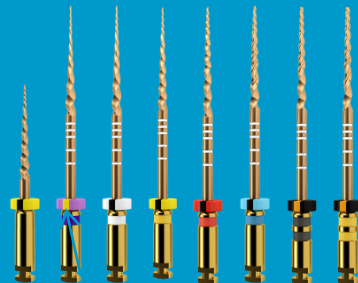
Dr. Ludovic Pommel

# Gold instruments – upgrade



Convex Triangular shaped  
cross-section

**PROTAPER•GOLD™**



# ProTaper Ultimate Slider

Sterilní NiTi nástroj

- Flexibilní nástroj, který si zachovává účinnost řezání díky NiTi materiálu M-WIRE



# ProTaper Ultimate Shaper

- Sterilní NiTi nástroj
- Metalurgicky ošetřeno tepelným zpracováním GOLD
- Větší účinnost řezání



# ProTaper Ultimate Finishers

- Sterilní NiTi nástroje
- Metalurgicky ošetřeno tepelným zpracováním GOLD, poskytuje větší flexibilitu a vyšší odolnost vůči cyklické únavě



# ProTaper Ultimate Finishers

Sterilní NiTi nástroje

Metalurgicky ošetřeno tepelným zpracováním  
BLUE

Speciální sekvence pro široké a rovné kanály



# Basic rules of power driven endodontics - rotary

Initial flaring

Controlled rotation

Following sequences

Abundant irrigation

No pressure

Movement up and down

10-15s work in one phase, cleaning and checking the instrument

Recapitulation

Touch apical constriction and going back

Check apical size after the preparation



# One file endodontics

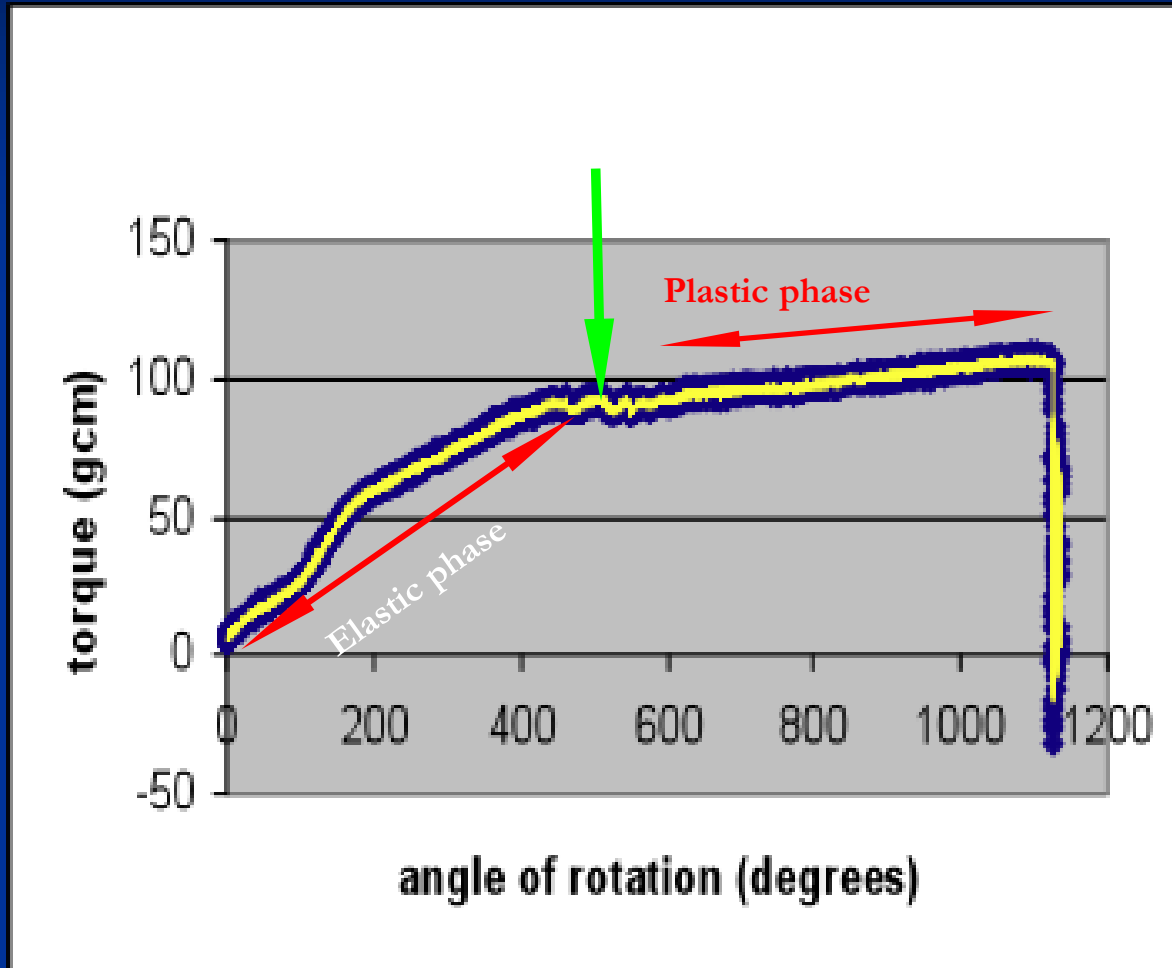


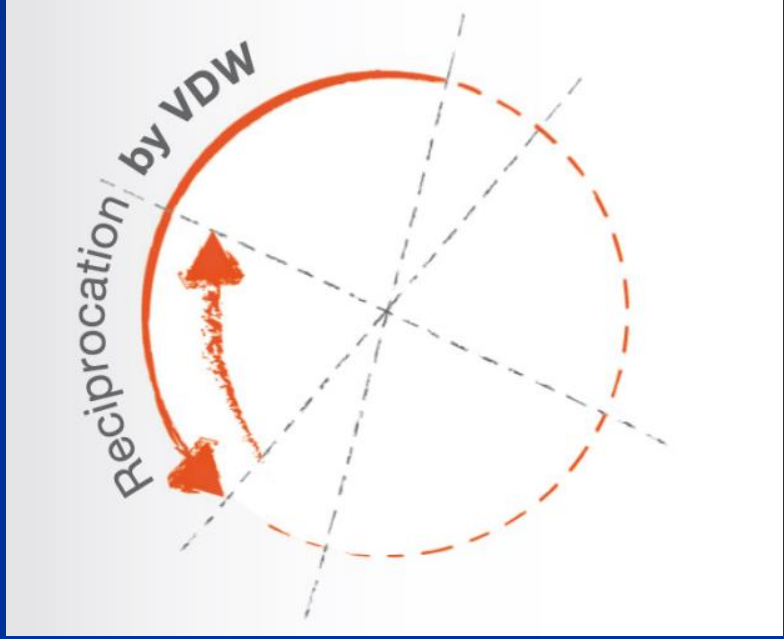
Wave one....



The instrument releases within the elastic phase

# Reciprocation - benefits





# Reciprocation - benefits

## ■ **Simplicity**

- Ony one instrument for one tooth
- Sterile – single use

## ■ **Safety**

- Minimized risk of fracture
- No risk of contamination
- Users friendly

# Wave One

- Regressive taper

# Wave ONE GOLD

M - wire (Dentsply Tulsa Dental)

Před broušením tepelné ošetření

- **Výhody:**
  - **Vysoká flexibilita**
  - **Menší riziko cyklické fraktury**

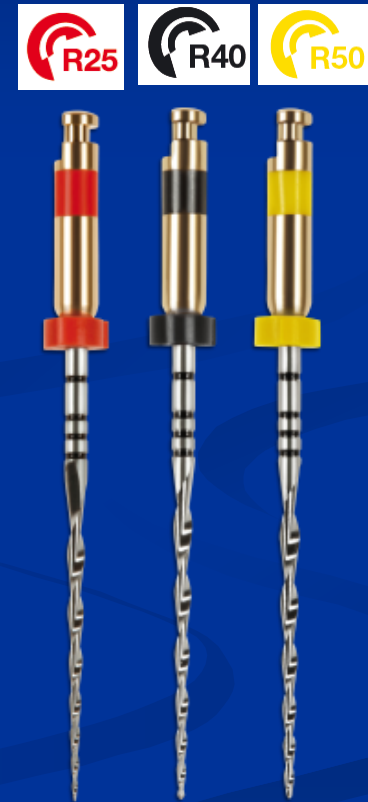




# RECIPROC

Příkladem je Reciproc,  
Reciproc Blue:

3 velikosti nástrojů



# RECIPROC®



Ø  
1,05 mm

0,49 mm  
0,41 mm  
0,33 mm  
0,25 mm



Ø  
1,10 mm

0,58 mm  
0,52 mm  
0,46 mm  
0,40 mm



Ø  
1,17 mm

0,65 mm  
0,60 mm  
0,55 mm  
0,50 mm

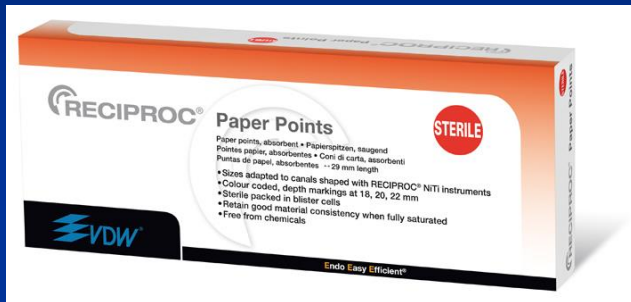
# RECIPROC®

VDW.SILVER® RECIPROC® motorC

- Endo motor
  - Reciprokační systémy
    - RECIPROC®, WaveOne™
  - Rotační systémy
    - Mtwo®, FlexMaster®, ProTaper®, K3™, Gates, Dr.`s Choice



# Compatibility – paper and gutta cones



- Sterile
- For single use
- No autoclaveable



# Remnants of tissue after cleaning and sterilisation



Abb. 4 ▲ Nickel-Titan-Instrument mit Rückständen nach klinischer Anwendung trotz Durchführung eines Reinigungsprotokolls zur Prionendekontamination

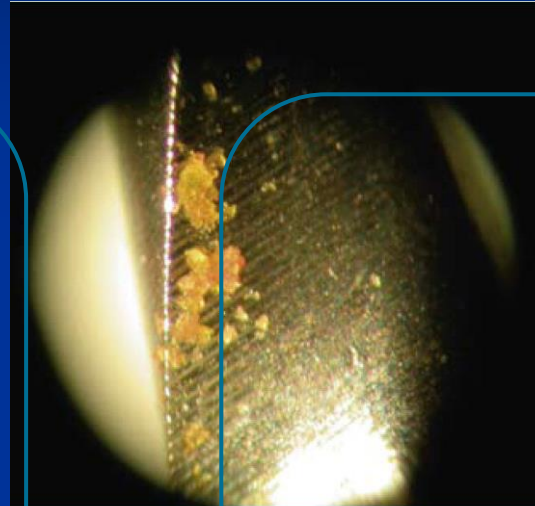


Abb. 5 ▲ Organische Rückstände auf einem Edelstahl-Handinstrument nach Sterilisationsprozess

## Basic Research—Technology

### Effect of Prion Decontamination Protocols on Nickel-Titanium Rotary Surfaces

David Sonntag, DMD,\* and Ove A. Peters, PD, DMD, MS, FICD<sup>†</sup>

#### Abstract

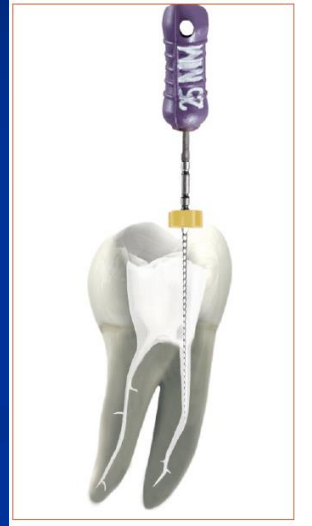
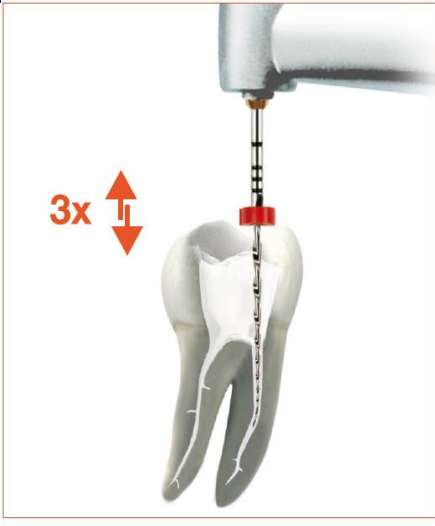
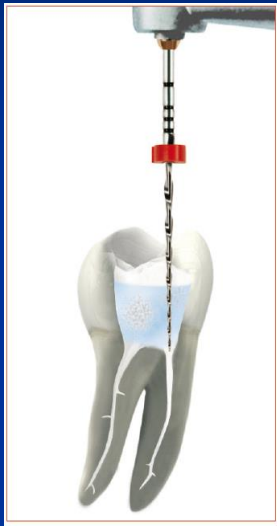
Decontamination of instruments is a prerequisite for their potential reuse but may affect surface integrity. Hence, the effect of prion removal protocols on 7 brands of nickel-titanium files was investigated. Baseline debris scores were determined under magnification

Prions are proteins that have been linked to fatal neurodegenerative diseases commonly called transmissible spongiform encephalopathies. The term *prion* (PrP) was coined by Prusiner (1) in 1982, when he described a protein with a nonpathogenic isoform PrP<sup>C</sup> and the infectious agent PrP<sup>Sc</sup> as a cause of scrapie, a veterinary disease. Similar agents may infect humans with Creutzfeldt Jacob Disease (CJD), which in fact

# Choice of the instrument

- Hand instrument ISO 30: 50
- Hand instrument ISO 20: R40
- Hand instrument ISO 10: 20, 25
  
- The hand instrument must reach the WL without any bending





# Basic rules of power driven endodontics - reciprocation

- Movement in amplitudes: up/down 3 mm
- Cleansing of instruments each 3 amplitudes
- Reach the apical constriction and go out !





# Rotary instruments for glide path

## ■ Pathfile



## ■ Proglider file



progressive taper 2% - 8%

„glide path“

M-wire

Controlled rotation

| D0 | D4 | D8 | D12 | D16 |
|----|----|----|-----|-----|
| 10 | 18 | 26 | 34  | 42  |
| 15 | 23 | 31 | 39  | 47  |
| 16 | 24 | 36 | 55  | 82  |

10  
15  
16

endorusdfe.com

Always combination with hand instruments

# Reciprocating instrument for glide path

- Gold Glider File

Progressive taper 2°-6°

Gold wire

Reciprokační pohyb





# Twisted adaptive files (Kerr)

- Grinding twisting, electrogalvanic treatment
- Rotation – reciprokation according to the loading
- Sequences for various root canals

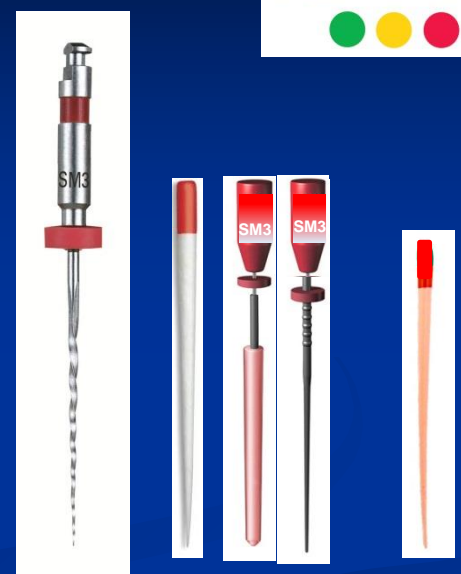
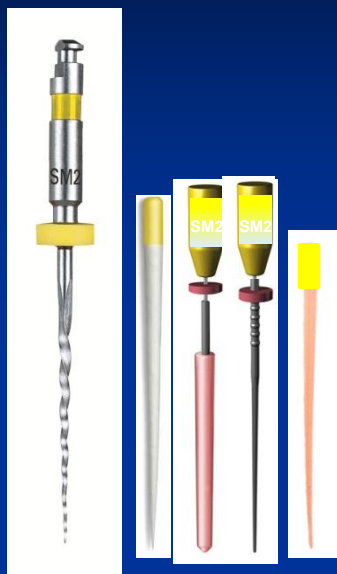




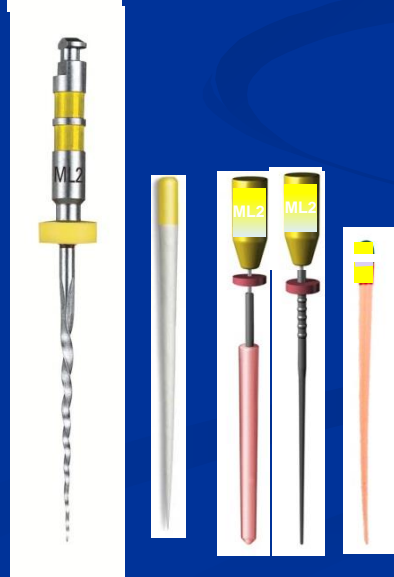
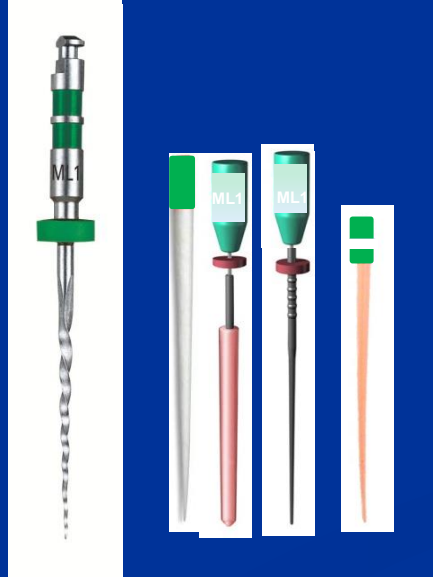
# Kompletní systém



Malé  
1 barevný pruh



Střední / Velké  
2 barevné pruhy

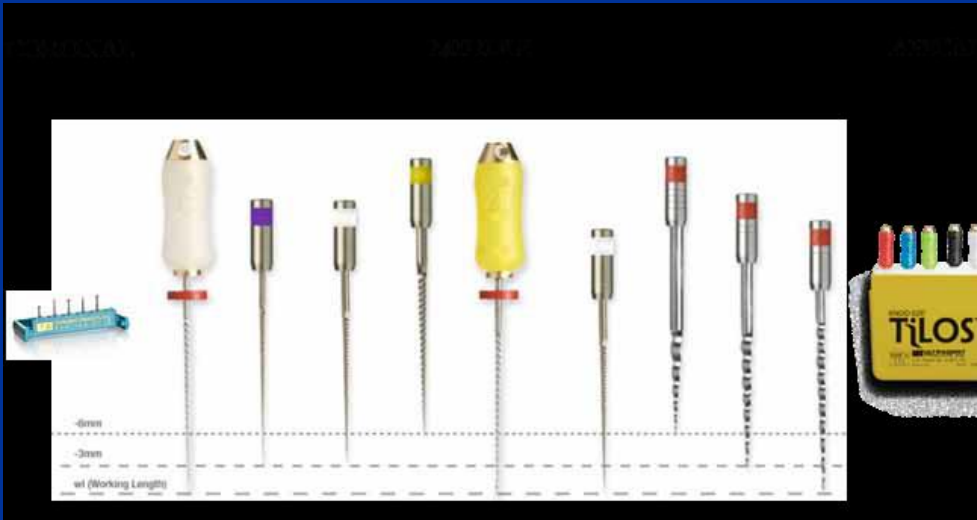




ADAPTIVE MOTION  
TECHNOLOGY

# Oscillating instruments – AET technique

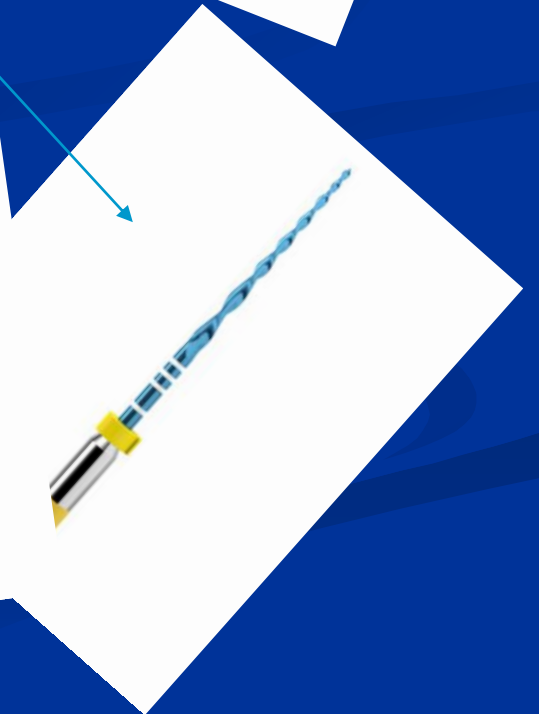
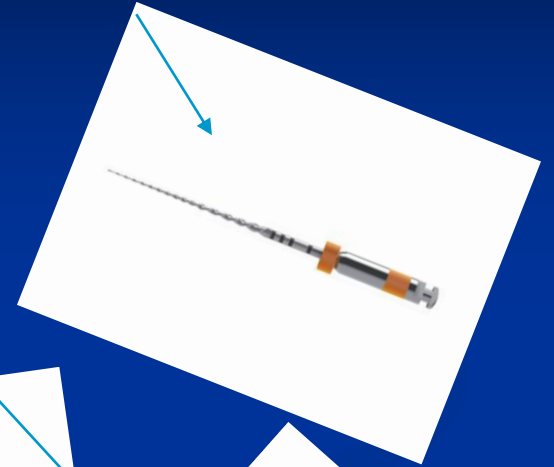
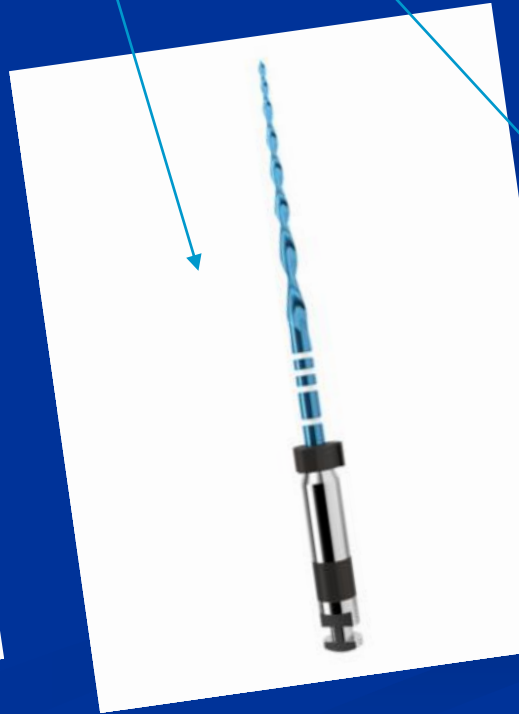
- Tilos
- Special handpiece



# Basic rules for all systems

- No pressure
- Short periods
- Checking the instrument
- Recapitulation
- Do not shape too much the apical constriction
- Measure the apical size at the end
- Abundant irrigation

# Reciproc Blue R Pilot



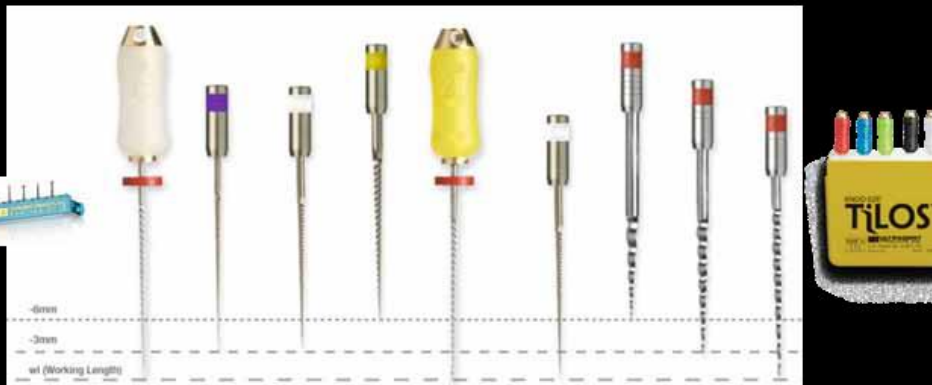
# Unicone Plus



  
UNICONE  
PLUS

# AET (anatomic endodontic technique)

- Tilos
- Special handpiece





# AET

- Oscillation 30°
- Combination with hand preparation – glide path, recapitulation and the shaping of apical part
- The middle part is shaped using oscillating instruments
- Combination of stainless steel and NiTi



# Instruments for reendo

- Special design – variable taper – regressive
- Active tip

# Good selection and lege artis work

