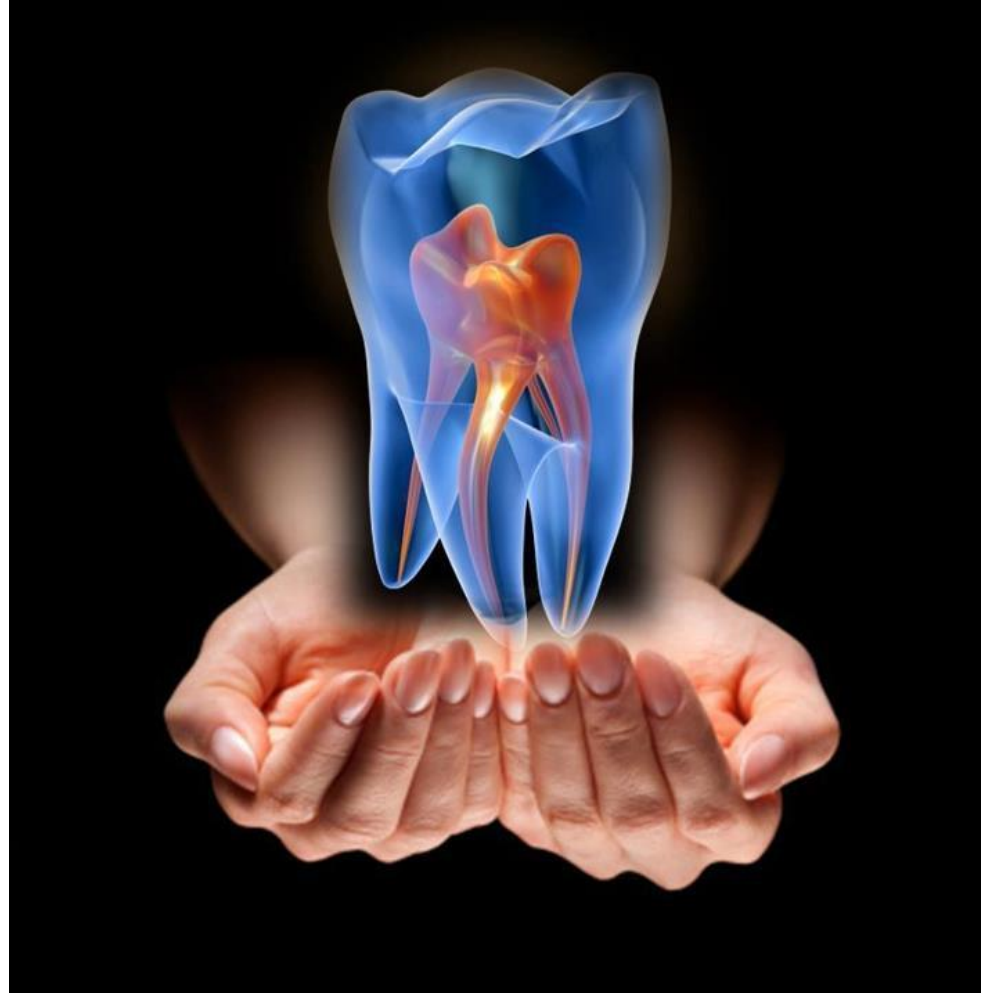


به نام خدا



Rotary endodontics instruments



Root canal shaping

Biologic objectives

- Mechanical removal of vital and/or necrotic tissues from the root canal system
- Allowing the creation of an adequate space for the chemical disinfection

Mechanical objectives

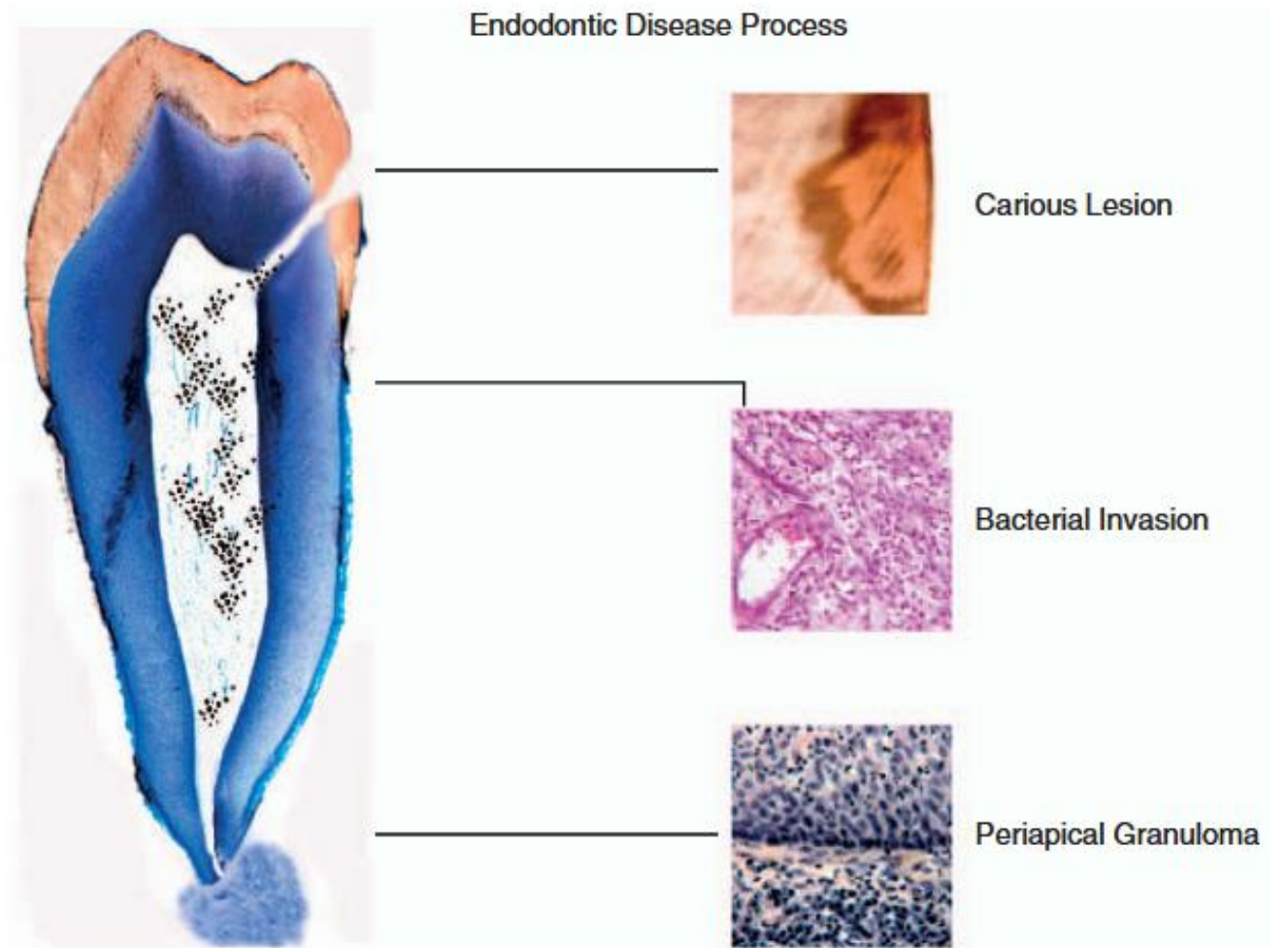
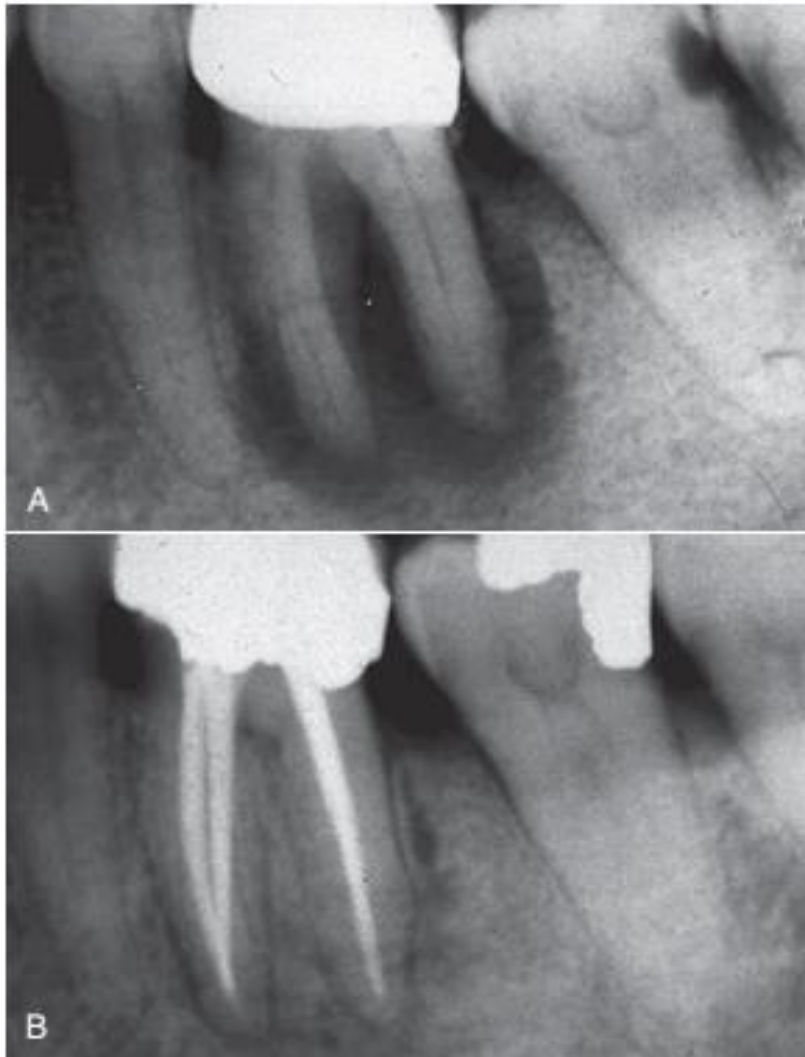
- Complete and centered incorporation of the original canals into the prepared shape
- Retain as much cervical and radicular dentin as possible (not to weaken the root structure)

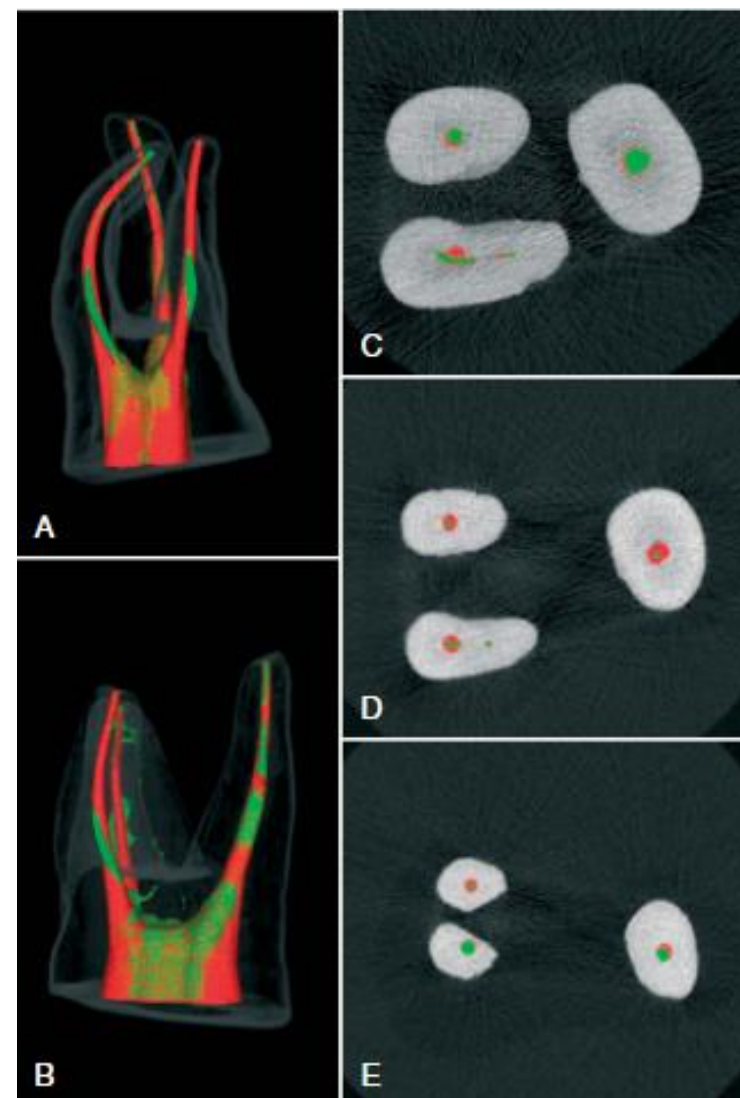
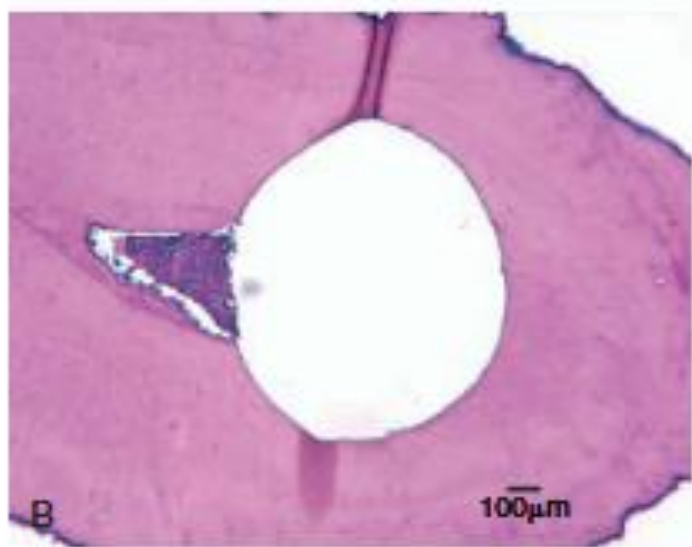
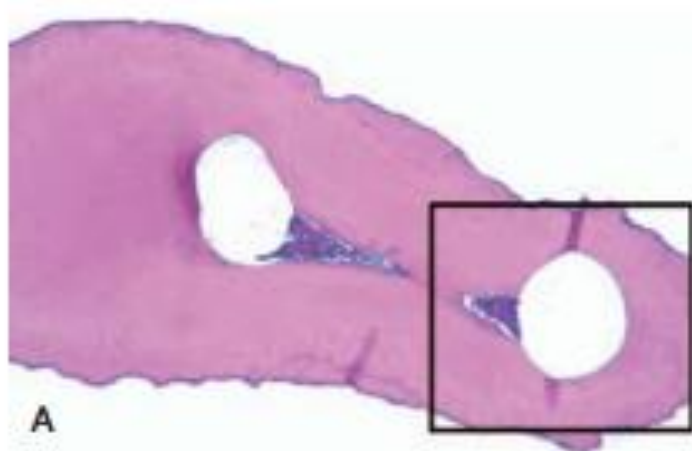
Mechanical Objectives

- Prepare a sound anatomical matrix
- Create a continuously tapering funnel shaped preparation
- Avoid overzealous instrumentation
- Precurve files when necessary
- Remove all residues from the canal
- Maintain patency through the apical foramen

Biologic Objectives

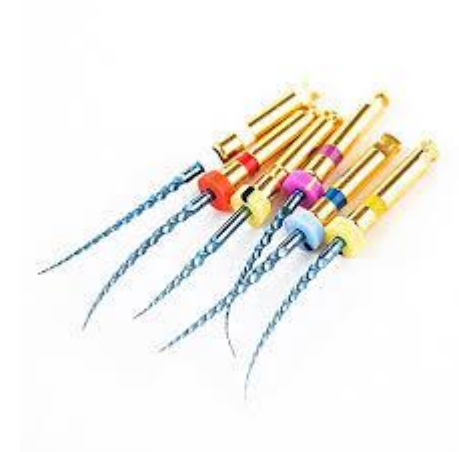
- Establish an exact working length
- Confine instrumentation to canal
- Remove all irritants from the canal
- Avoid pushing debris past the apical constriction
- Create a significant width in the coronal half of the canal to allow for copious irrigation



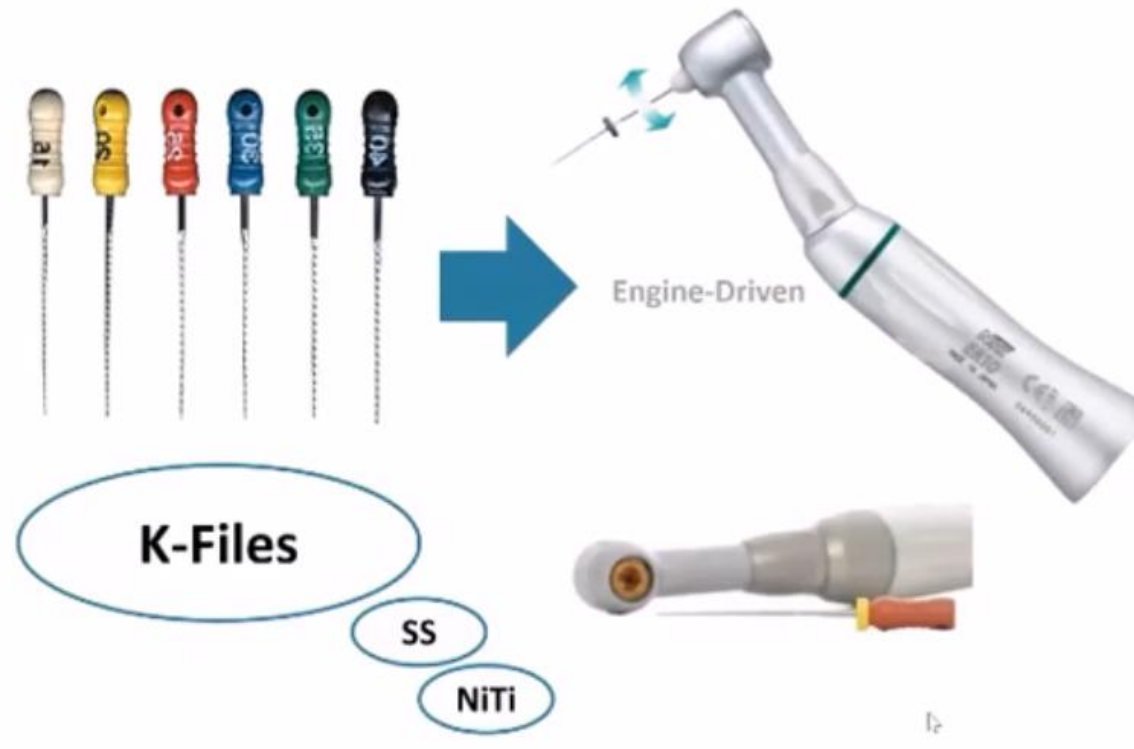


Instruments for canal preparation

- Hand instruments
- Engine-driven instrument



Manually operated instruments for canal preparation



Low-speed instruments with a latch-type attachment



Engine-driven nickel-titanium rotary instruments

- They consist of a rotating blade that can safely be operated in, and **adapt itself to, curved root** canals. Most engine-driven instruments available today belong to this group.
- With the advent of **NiTi rotaries**, the much more **flexible alloy** allowed continuous rotation and reduced canal preparation error.

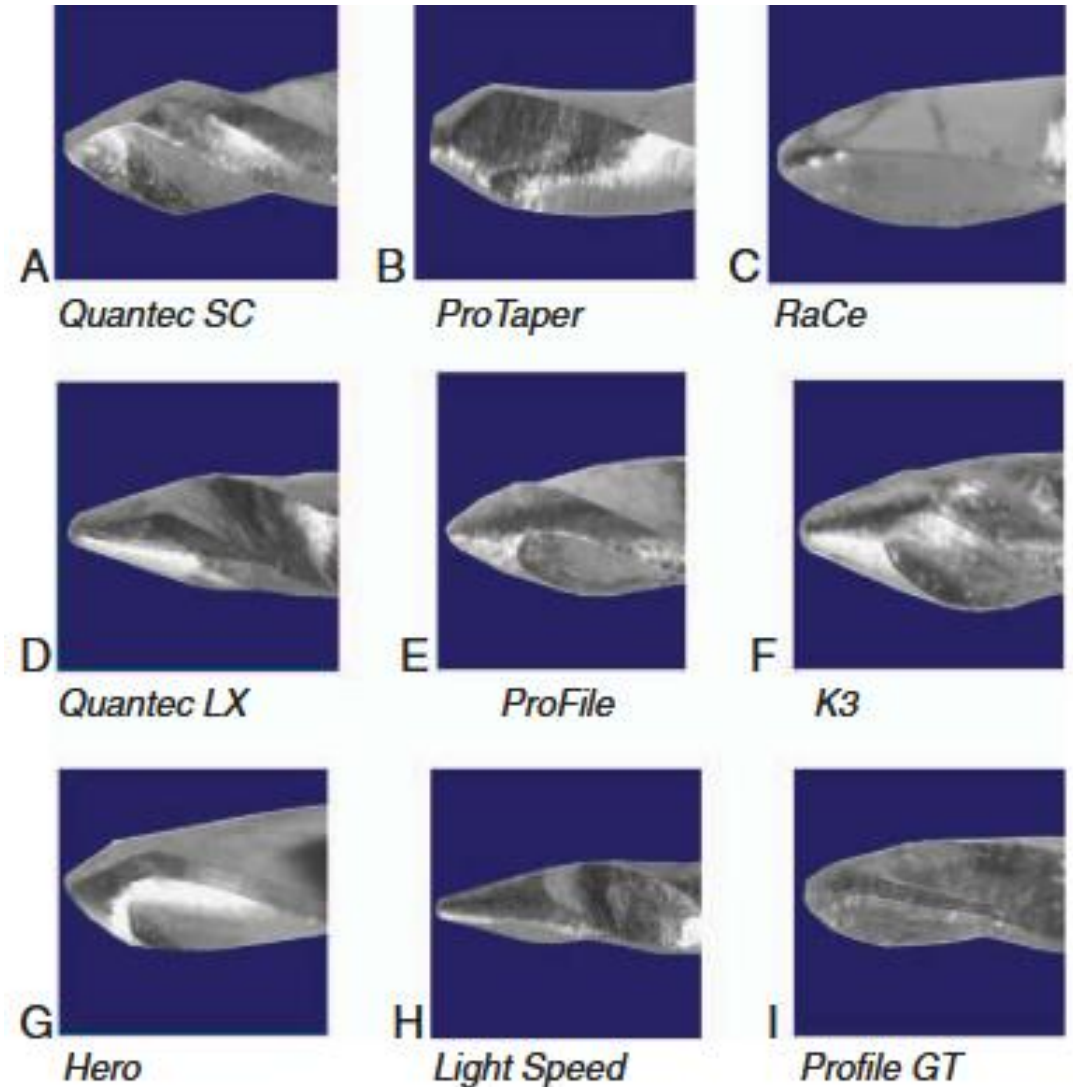


Advantages in using NiTi rotary instruments

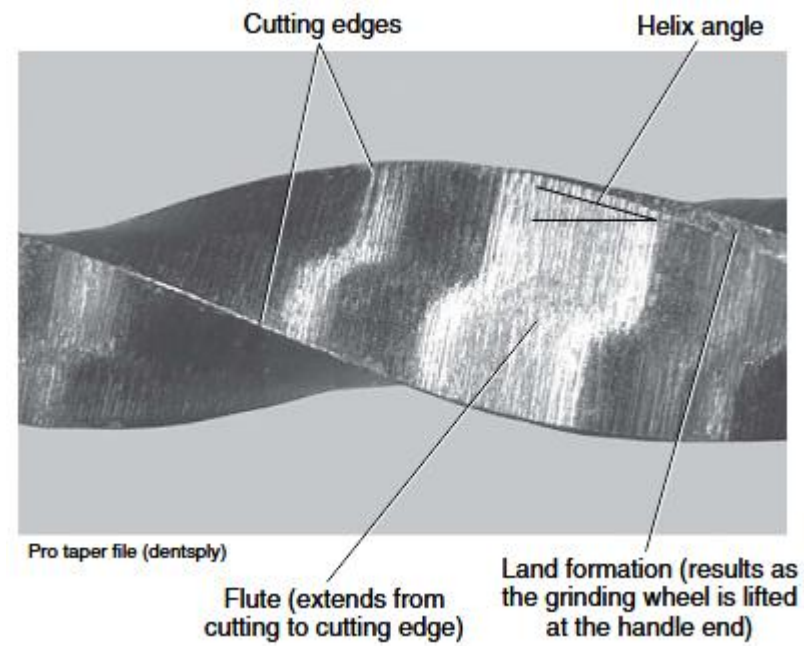
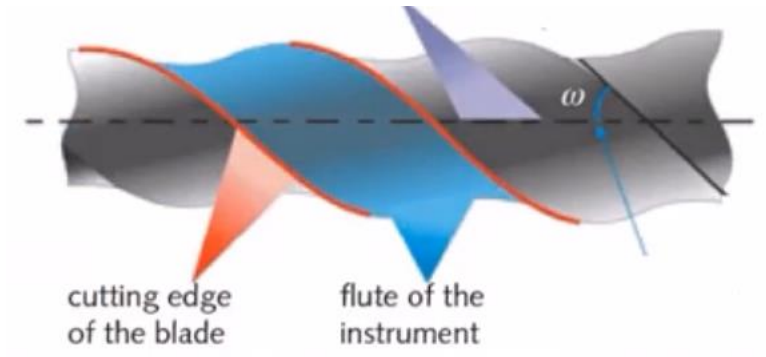
- Reduction in **time** of endodontic treatments
- **Simplification** of instrumentation procedures
- Increase of predictability and **effectiveness** of endodontic treatments

Design characteristics of NiTi rotary instruments

- Tip design
- Cutting tip
- Non-cutting tip (batt tip)



flute



size

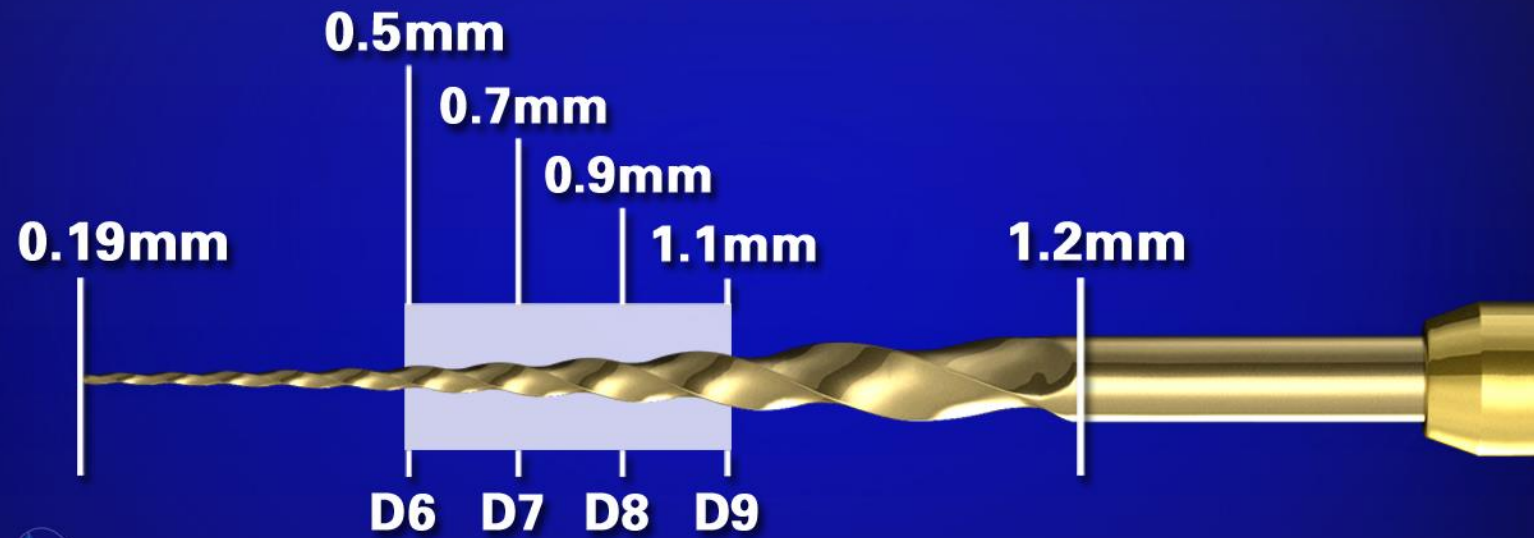
Ø ISO													
													
10	15	20	25	30	35	40	45	50	55	60	70	80	

MODEL	SX	S1	S2	F1	F2	F3
Taper	3.5-19	02-11	04-11.5	07	08	09
Diameter	#19	#17	#20	#20	#25	#30

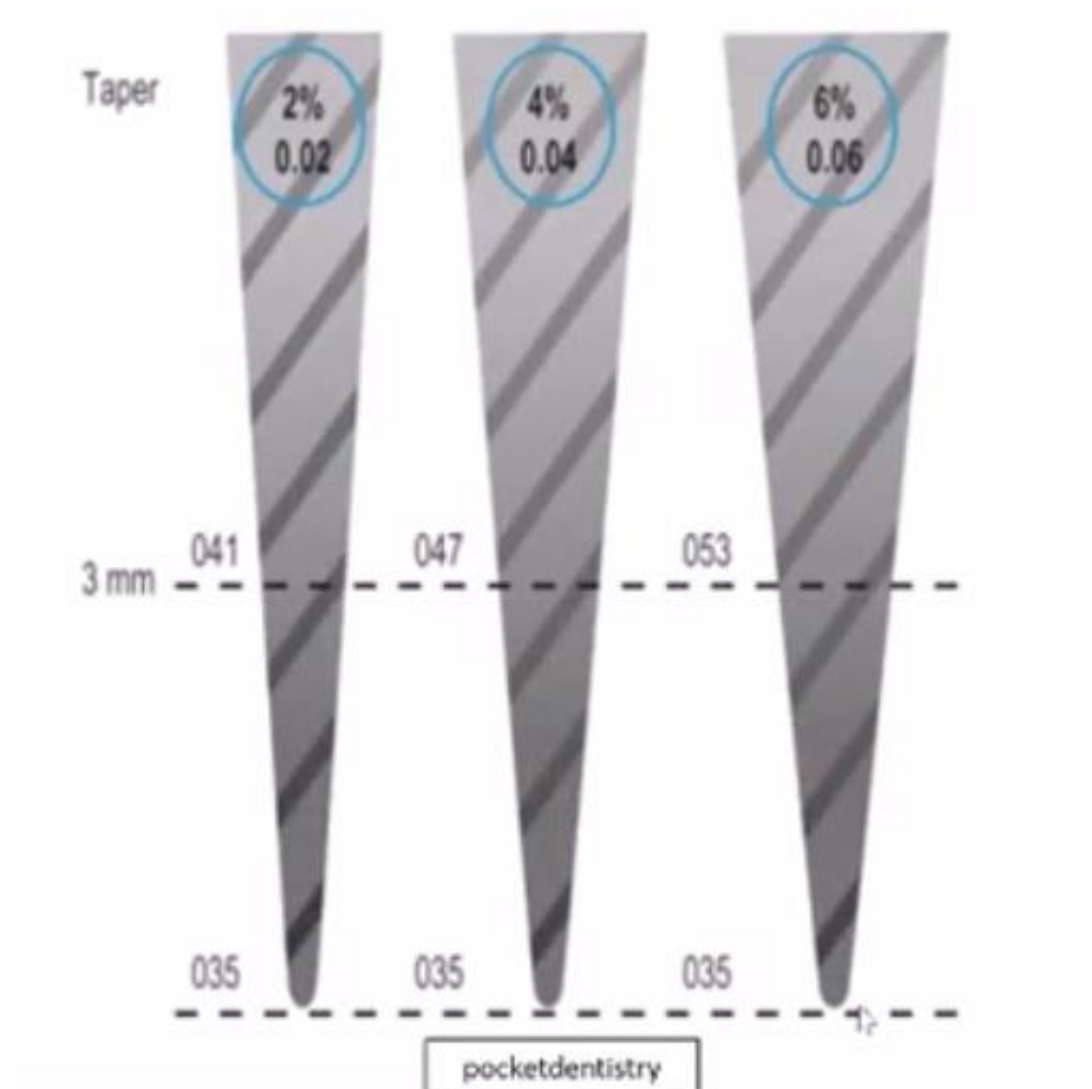
17.06 (N1)		PURPLE
17.04 (N2)		WHITE
20.06 (C1)		YELLOW
25.06 (C2)		RED
30.06 (C3)		BLUE
40.06 (C4)		BLACK



AUXILIARY SHAPING FILE (SX)

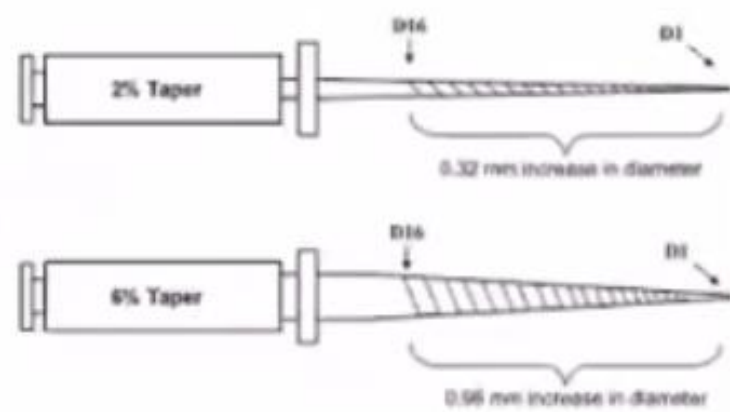


taper





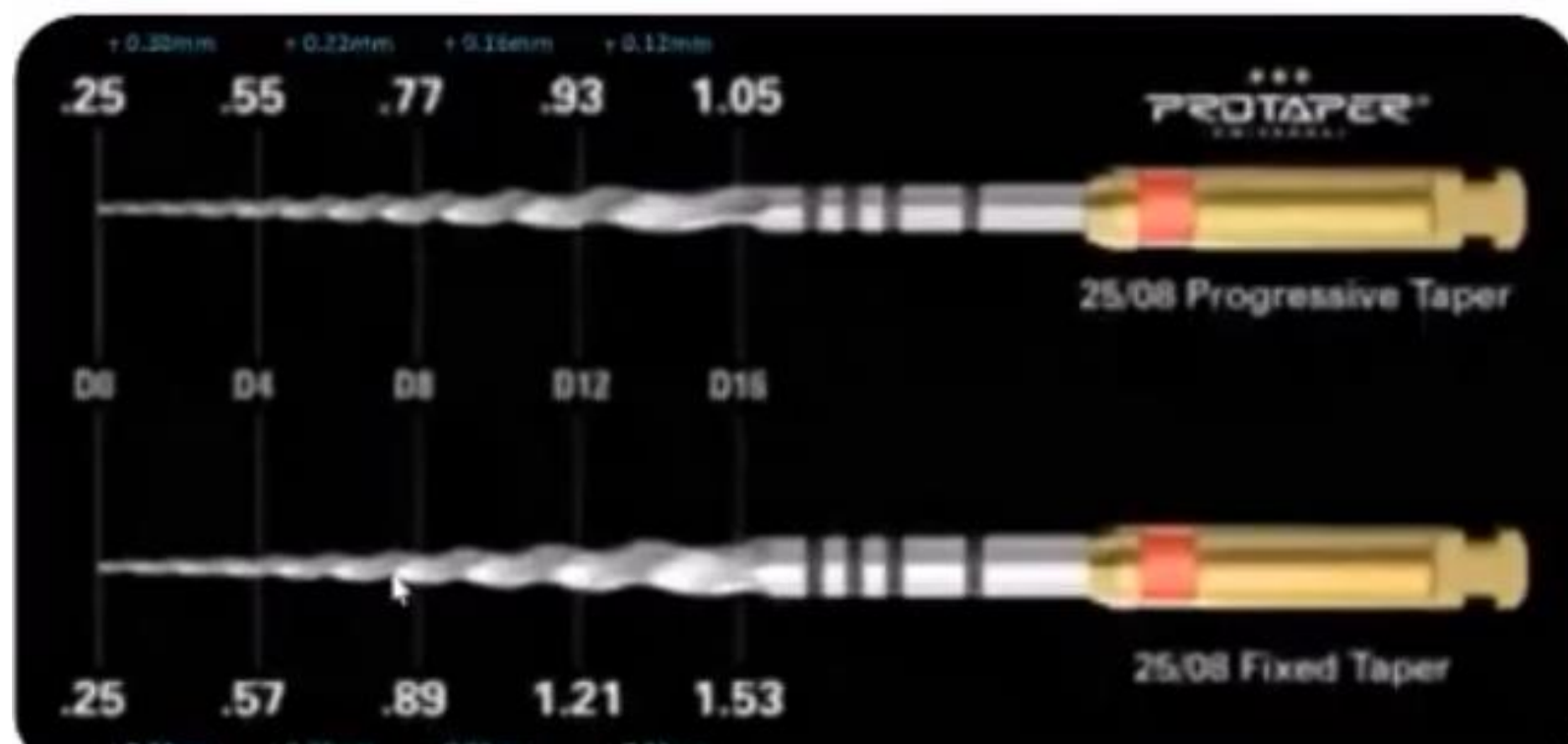
Constant Taper



Variable Taper

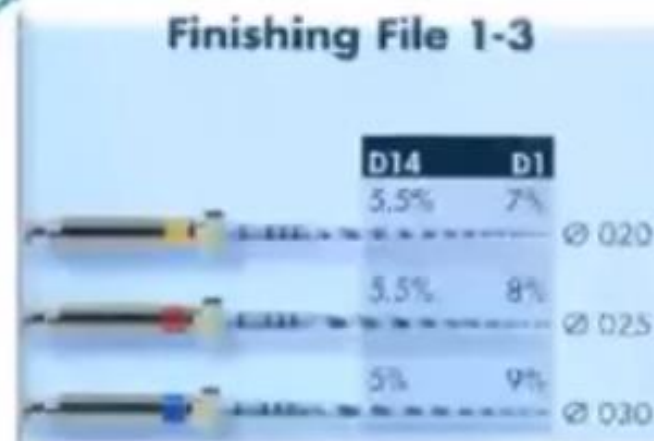
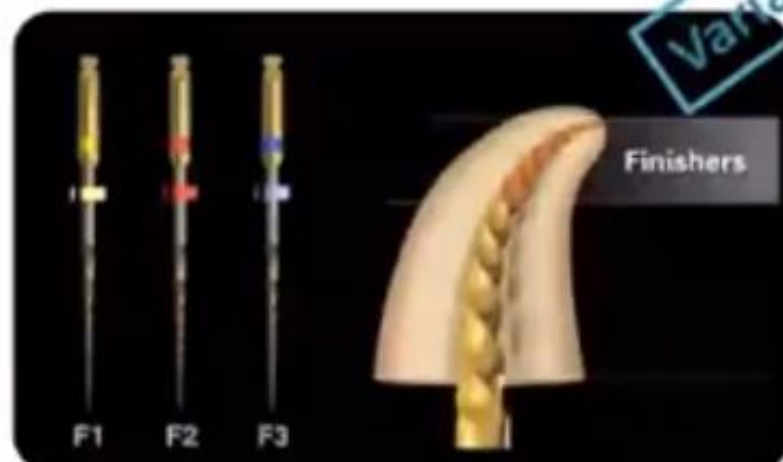
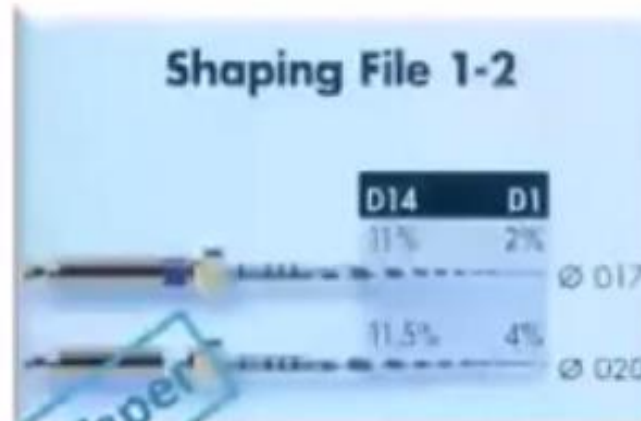
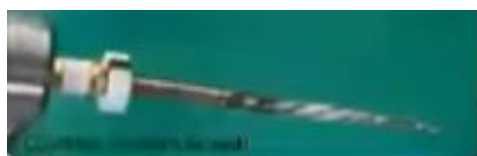
Progressive Taper

Regressive Taper



Variable Taper

Constant Taper



Variable Taper

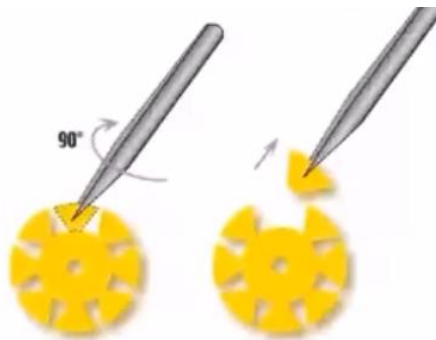
length

- 31
- 25
- 21
- 19



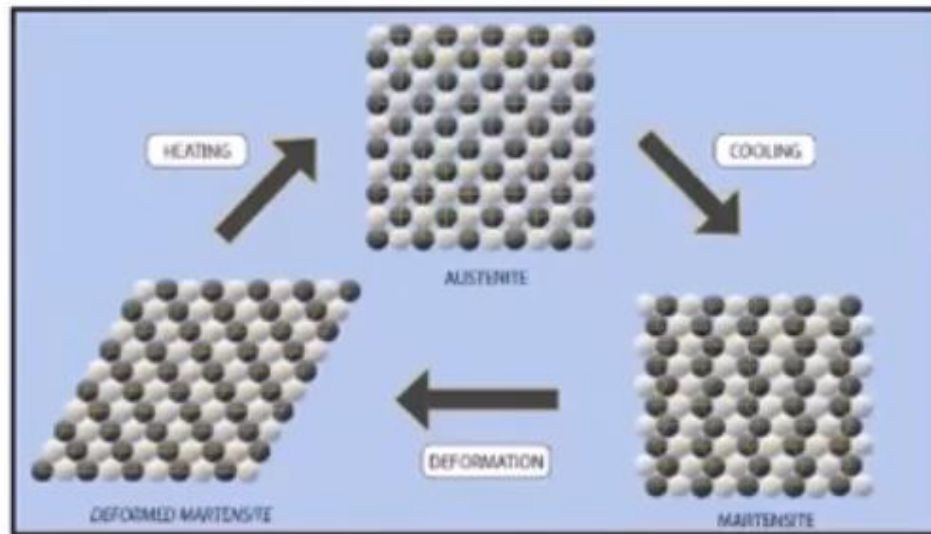
Safety memo disk (SMD)

- One petal corresponds to simple cases(S), i.e., straight, slightly curved or wide canals.
- two petals corresponds to moderately complex cases(M), i.e., more curved or narrow canals.
- four petals corresponds to difficult cases(D), i.e., canal that are, s-shaped, very narrow, calcified or with extreme curvature.

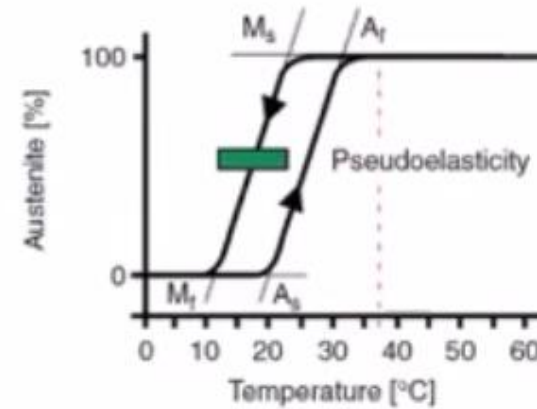


Alloy

Nickel-Titanium (NiTi) Alloy

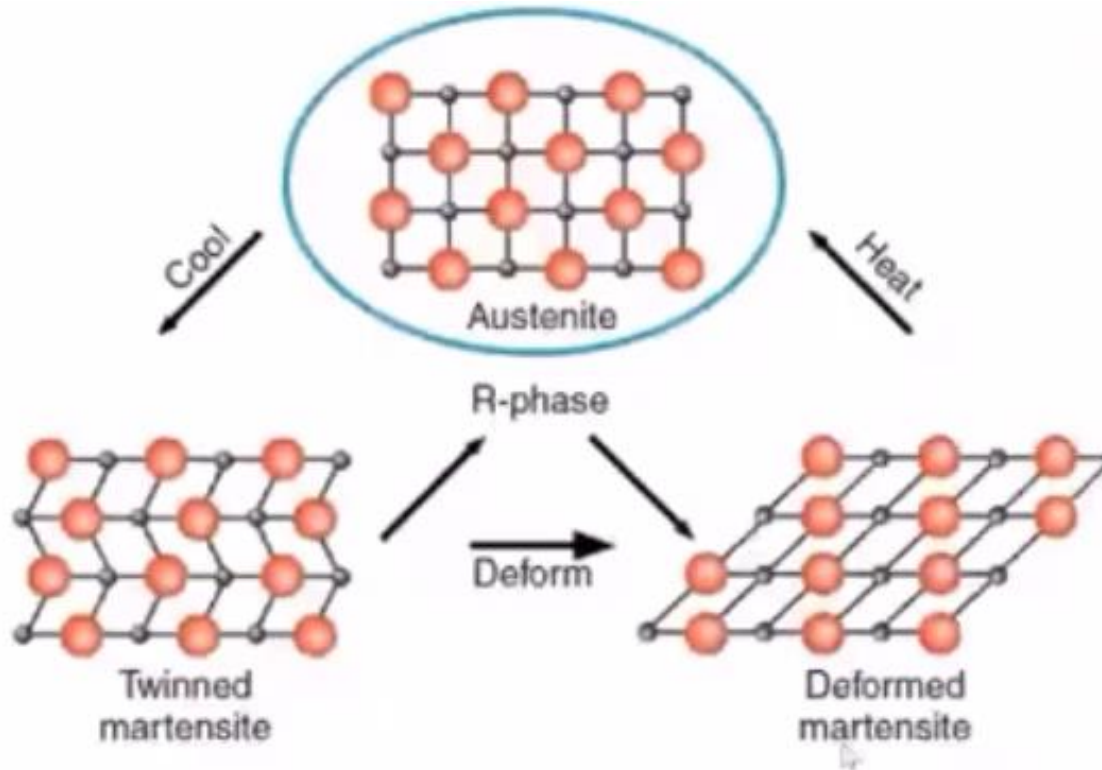


Nickel: 56% wt
Titanium: 44% wt



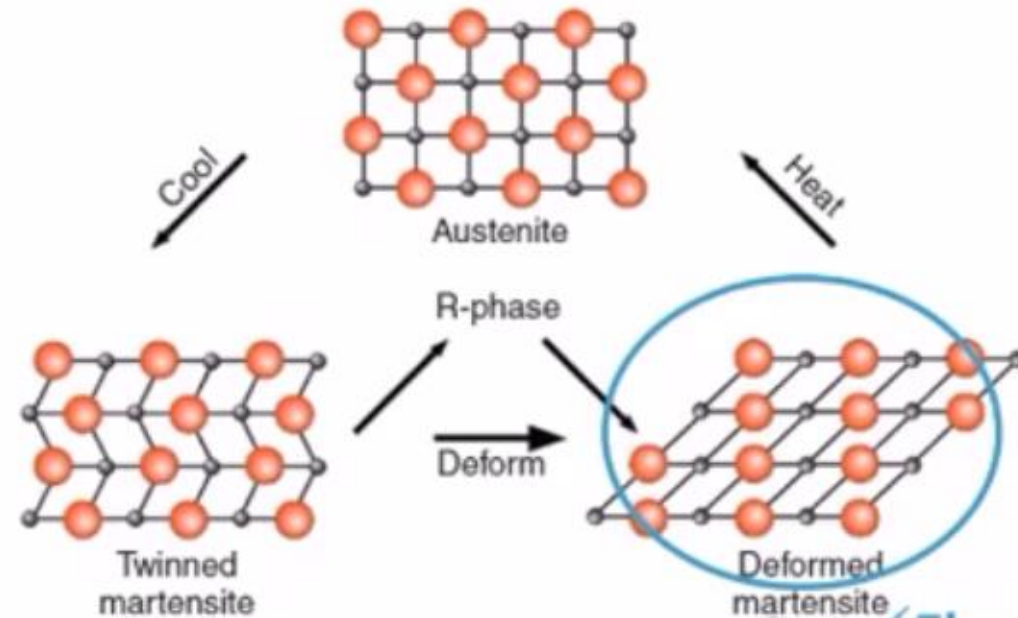
Austenitic phase

- Rigidity
- Super elasticity



Martensitic phase

- Flexibility
- Cyclic fatigue resistance



Conventional NiTi

- Race
- Oneshpe
- Mtow
- Protaper universal

Austenitic
(Room / Body Temperature)



Alloy treatment

- **Thermal treatment**
- **Mechanical treatment**
- **Electropolishing**
- **Electric discharge machining (EDM)**

Heat treatment has several potential benefits:
Removes precipitants within the structure of the metal
Remove internal stress within metal
Decrease hardness and increase ductility
Creates an alloy in the martensitic



- **Third generation NiTi** systems present modifications in the composition of the alloys that are thermally pretreatment, making the files more flexible.
- The NiTi alloys used for manufacturing of the endodontic instruments contain approximately 56%(wt) of nickel and 44%(wt) of titanium. However, even a **0.1% change in the composition of these alloys** can result in a 10 C change in the transformation temperature, which can subsequently affect the mechanical characteristics of these alloys.
- The appearance of proprietary **thermal treatment of NiTi alloys** with different series of heating and cooling treatments has led to the enhancement of the mechanical properties of contemporary rotary instruments by optimizing the microstructural characteristics of the alloy. The **higher flexibility and cyclic fatigue resistance** of these new instruments provides better clinical behavior.

Files with the **austenite** phase have super elastic properties and are recommended to be used in **straight or mildly curved canals**



➤ **Austenitic** NiTi files

cannot be bent at room temperature



Shape memory effect

Martensitic NiTi files

can be bent at room temperature

Files composed of the **martensite** phase possess high flexibility along with increased resistance to cyclic fatigue and are recommended to be used while **preparing canals with complex curvatures**

M-Wire

- **Protaper next** , **Reciproc** made of M-Wire
- **Austenitic** with small amounts of **R-phase** and **Martensite**
- **Superelastic**
- **Flexibility** more than conventional NiTi
- **Cyclic fatigue** resistance more than conventional NiTi

CM-Wire (T-Wire, C-Wire, Fire-Wire, AF-R wire)

- **Martensite** with varying amounts of **Austenite** and **R-phase**
- **Doesn't have superelasticity** (doesn't fully straighten when used to prepare a curved canal and respect curved canal anatomy well with minimal straightening.)
- **Flexibility** more than **conventional NiTi**
- **Cyclic fatigue** resistance more than **conventional NiTi**

Electric Micromotor and Handpiece

- Speed
- torque



Glide Path

- **Early exploration** of the root canal system to be prepared
- **Assessment** of canal width, content, curvatures, and ledges
- **Reduction of friction** of small NiTi instruments thereby lowering the risk of instrument separation.



Hand and rotary instruments recommended for preparation of **Glide path**

Manual instruments

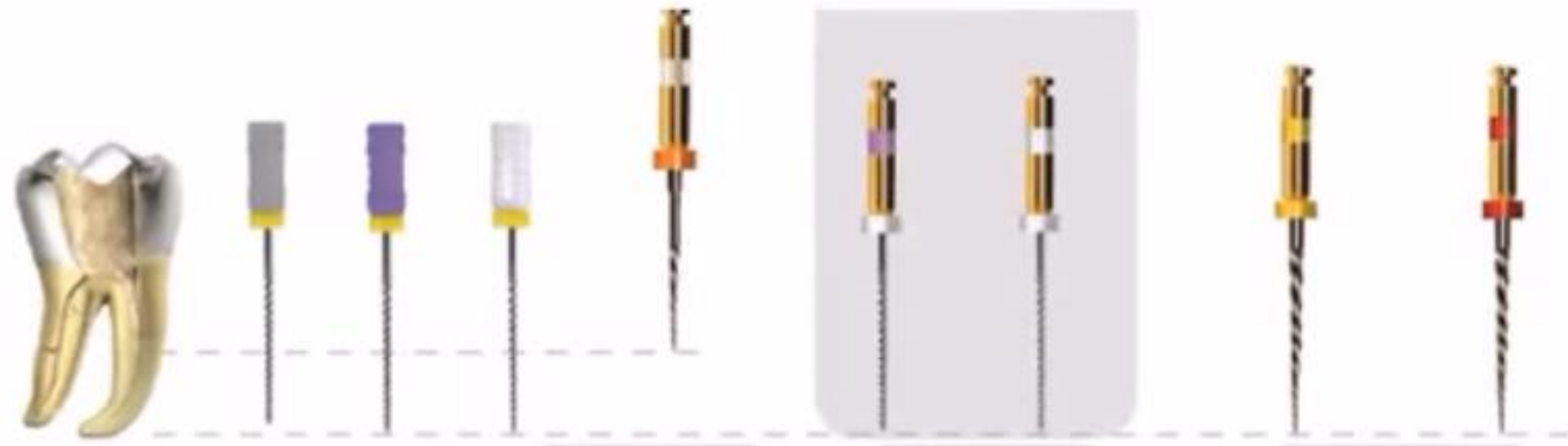
K-files (ISO-sizes 06, 08, 10, 15, 20)
C+ files (Dentisply/Maillefer)
C-Pilot Files (VDW)

Rotary instruments

Scout race (FKG)
Pro glider (Dentisply/Maillefer)
C-path (SP1)
M3 Path (M3)

G-files (microMega)
One-G (microMega)
GPS (Neolix)
WayFinder (IMD)





- | | | | | | | | |
|-----------|----------------|-----------|-----------------------|-----------|------------|-----------|------------------|
| | | | | | | | |
| DiaDent | Race | IMD | M3 | Neolix | Denco | ProTaper | MicroMega |
| DX | preRace | DX | Orifice opener | C1 | SX | SX | EndoFlare |
| 16 4% | 30 6% | 18 4% | 17 8% | 25 12% | 19 3.5-19% | 19 4-...% | 25 12% |
| | 35 8% | | 17 12% | | | | |
| | 40 10% | | 30 8% | | | | |
| | | | | | | | OneFlare |
| | | | | | | | 25 9% |

25 9%

Rotary endodontic systems

Full sequence rotary systems

crown-down techniques

single length techniques



Single file systems

Full clockwise rotary motion

Reciprocating motion



Full sequence rotary systems

Fixed taper instruments

Race, Hero, Sp1 AF, M3 Pro Gold, M-pro
(IMD)

Various taper instruments

Pro taper, Denco, Edge taper, Sp1 v-Taper,
DiaDent, M-Taper (IMD)

Full sequence rotary systems

Fixed taper instruments

- These instruments can be used in any sequences according to the **practitioner s needs**.
- Clinician can choose **crown-down or single length** techniques.
- Depending on the case, the clinician can select 4-5 files from the wide range of files with various diameters and tapers.
- Sizes 10, 15, 20, are very efficient for narrow or curved canals.
- The suggestion for **finishing** the apical preparation is **taper of .04** .
- Instruments with taper of .06 are used for shaping of coronal 2/3 of canal and overall shaping of the canal.

Race

Race

	10	15	20	25	30	35	40	45	50	55	60	70	80
BT2	•	•	•	•	•	•	•	•	•	•	•		
.04	•	•	•	•	•	•	•	•	•	•	•		
.06	•	•	•	•	•	•	•	•	•	•	•		

BT-Race sequence

- 10/08 BT1
- 35/00 BT2
- 35/04 BT3

iRace sequence

- 15/06 R1
- 25/04 R2
- 30/04 R3

BioRace sequence

D-Race sequence (for retreatment)

FKG Swiss

Conventional NiTi Al

DR1 - Access

- ISO 030/0.10 - L 15/8 mm
- active tip

DR2 - Full path




- ISO 025/0.04 - L 25/16 mm
- safety tip

SP1
China



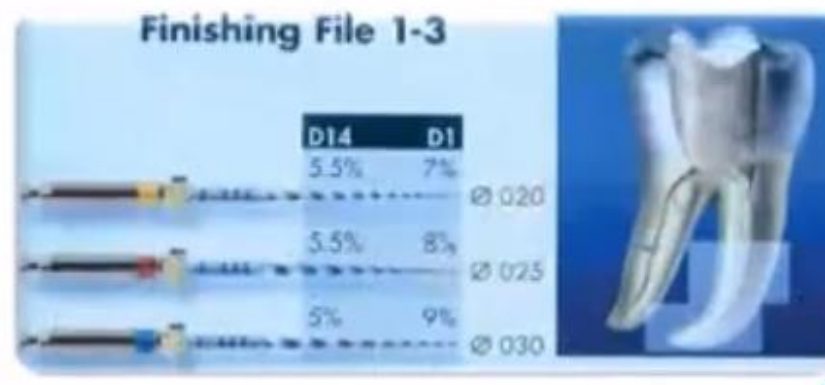
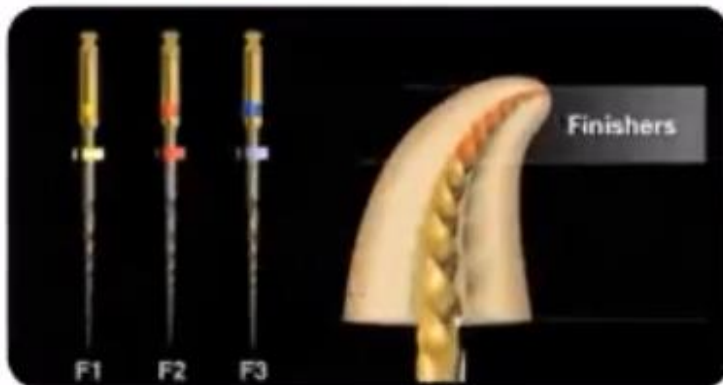
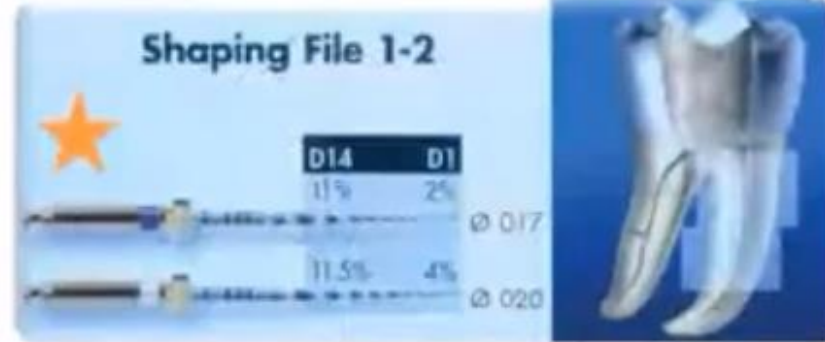
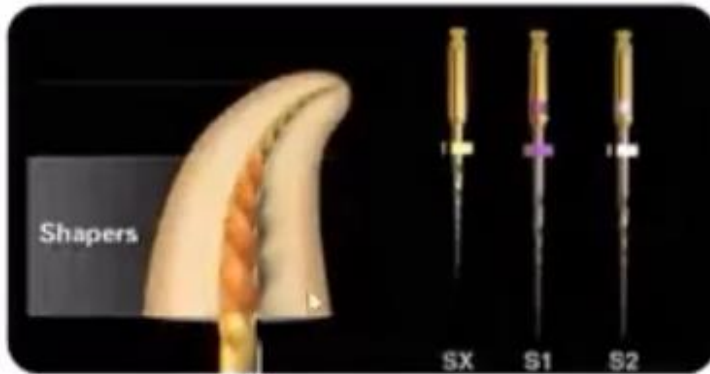
M3
China



	10	15	20	25	30	35	40	45	50	55	60	70	80
.02 	●	●	●	●	●	●	●	●	●	●	●		
.04 	●	●	●	●	●	●	●		●				
.06 	●	●	●	●	●	●	●						

Full sequence rotary systems

Various taper instruments (ProTaper technique)



Protaper

- Universal

Conventional NiTi Alloy

•Gold

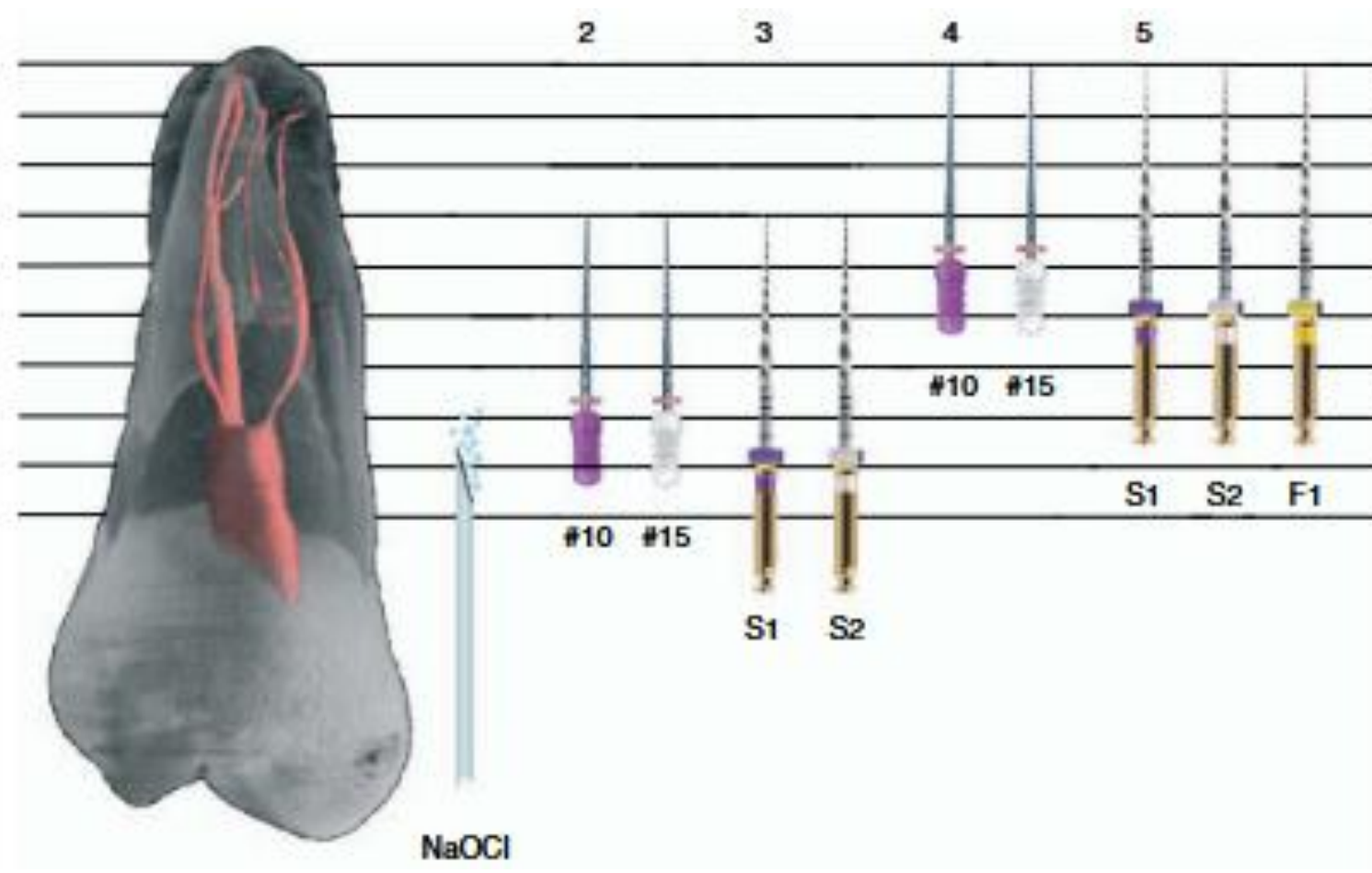
Gold heat-treated Alloy

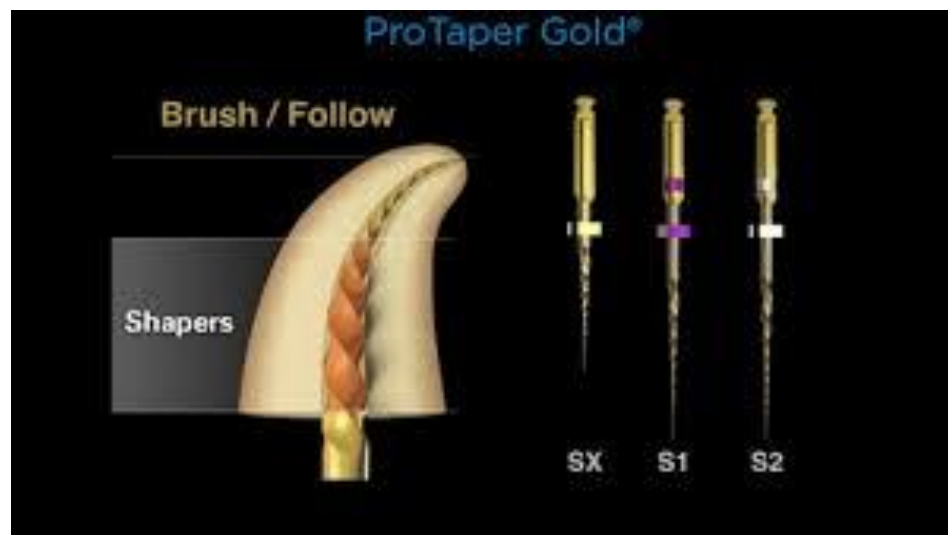


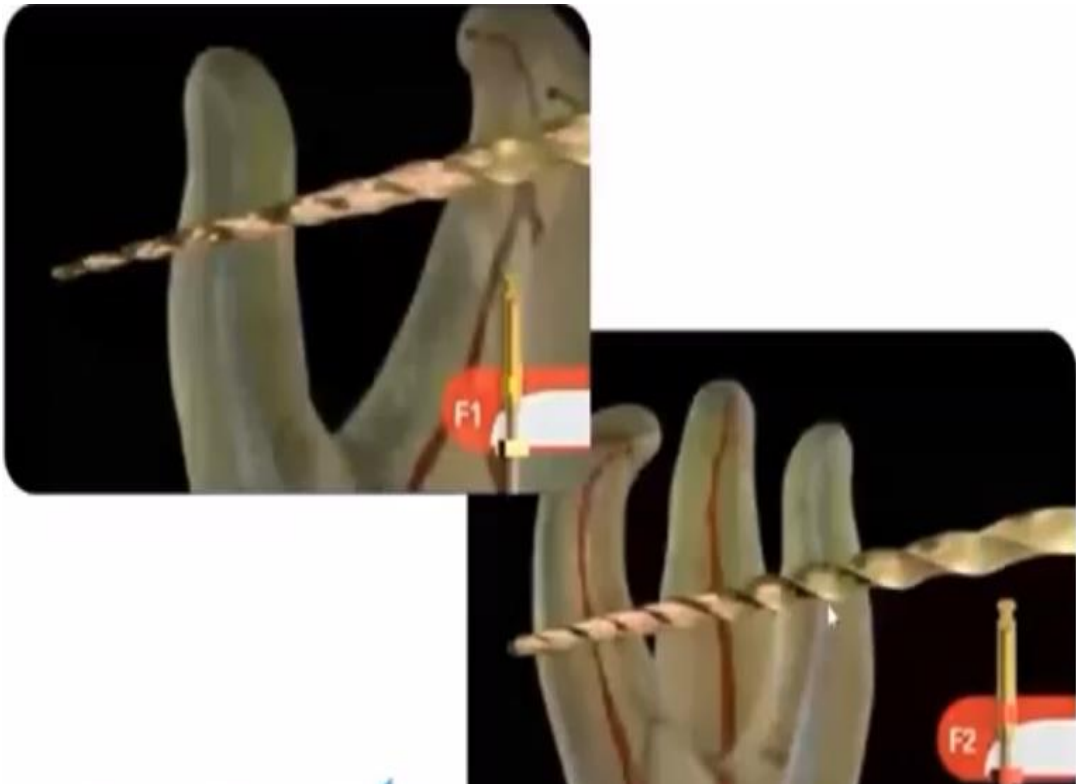
- Next

M-Wire









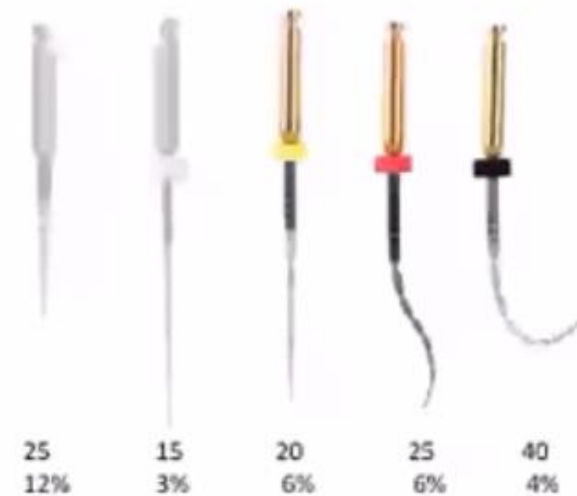
Single file systems

- Single-file systems maintain well the **original canal curvature**, even of severely curved canals, and are safe to use.
- Single-file systems are **faster** than full-sequence rotary NiTi instruments. It can be decreased by up to 60% when using the single-file systems.
- Due to the faster preparation time with single-file systems, special measure to improve canal **cleanliness** and **disinfection** (e.g. passive ultrasonic activation of irrigants, longer contact time) may be required.
- Dentinal **micro-cracks** on canal walls.

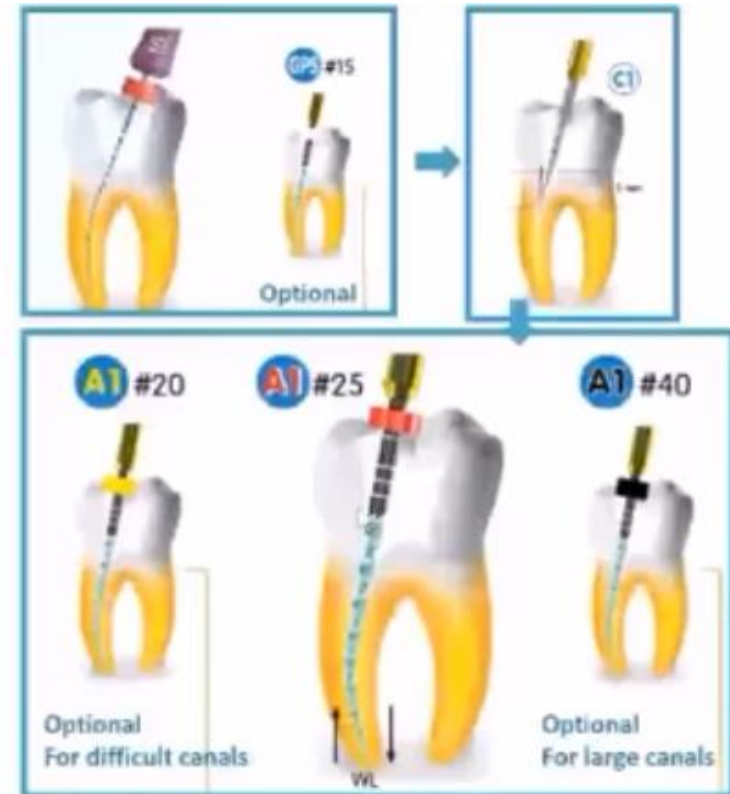
Single file systems

Full clockwise rotary motion

Neolix



NeoNiTi
France



Single file systems

Reciprocating motion



Waveone



M3

M3
China



Rotary & Reciprocating Motion





Thank you