

Shaping of the Root Canal System: hand and rotary instrumentation techniques



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Based on **Mahmoud Torabinejad, Richard E. Walton,**
ENDODONTICS: PRINCIPLES AND PRACTICE 4th edition

Cleaning and Shaping

(Chemomechanical preparation)



ENDODONTICS

PRINCIPLES AND PRACTICE

4th Edition



Mahmoud Torabinejad
Richard E. Walton



Videos and Chapter Review Questions



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CHAPTER 15

Cleaning and Shaping

▲ William T. Johnson and W. Craig Noblett

LEARNING OBJECTIVES

After reading this chapter, the student should be able to:

1. State reasons and describe situations for enlarging the cervical portion of the canal before performing straight-line access.
2. Define how to determine the appropriate size of the master apical file.
3. Describe objectives for both cleaning and shaping and explain how to determine when these have been achieved.
4. Diagram "perfect" shapes of flared (step-back) and standardized preparations and draw these both in longitudinal and cross-sectional diagrams.
5. Diagram probable actual shapes of flared (step-back) and standardized preparations in curved canals.
6. Describe techniques for shaping canals that have irregular shapes such as round, oval, hourglass, bowling pin, kidney bean, or ribbon.
7. Describe techniques (step-back or crown-down) for standardized and flaring preparations.
8. Distinguish between apical stop, apical seat, and open apex and discuss how to manage obturation in each.
9. Describe the technique of removing the pulp.
10. Characterize the difficulties of preparation in the presence of anatomic aberrations that make complete débridement difficult.
11. List properties of the "ideal" irrigant and identify which irrigant meets most of these criteria.
12. Describe the needles and techniques that provide the maximal irrigant effect.
13. Discuss the properties and role of chelating and decalcifying agents.
14. Explain how to minimize preparation errors in small curved canals.
15. Describe techniques for negotiating severely curved, "blocked," or constricted canals.
16. Describe in general the principles of application of ultrasonic devices for cleaning and shaping.
17. Evaluate in general alternative means of cleaning and shaping and list advantages and disadvantages of each.
18. Discuss nickel-titanium hand and rotary instruments and how the physical properties of this metal affect cleaning and shaping.
19. Discuss the properties and role of intracanal, interappointment medicaments.
20. List the principal temporary filling materials and describe techniques for their placement and removal.
21. Describe temporization of extensively damaged teeth.
22. Outline techniques and materials used for long-term temporization.

CHAPTER OUTLINE

PRINCIPLES OF CLEANING

PRINCIPLES OF SHAPING

APICAL CANAL PREPARATION

- Termination of Cleaning and Shaping
- Degree of Apical Enlargement
- Elimination of Etiology
- Apical Patency

PRETREATMENT EVALUATION

PRINCIPLES OF CLEANING AND

SHAPING TECHNIQUES

IRRIGANTS

- Sodium Hypochlorite
- Chlorhexidine

LUBRICANTS

SMEAR LAYER

DECALCIFYING AGENTS

- EDTA
- MTAD

TECHNIQUES OF PREPARATION

- Watch Winding
- Reaming
- Filing
- Circumferential Filing
- Standardized Preparation
- Step-Back Technique
- Step-Down Technique
- Passive Step-Back Technique
- Anticurvature Filing
- Balanced Force Technique
- Nickel-Titanium Rotary Preparation
- Final Apical Enlargement and Apical Clearing

Recapitulation

- Combination Technique
- General Considerations: A Review

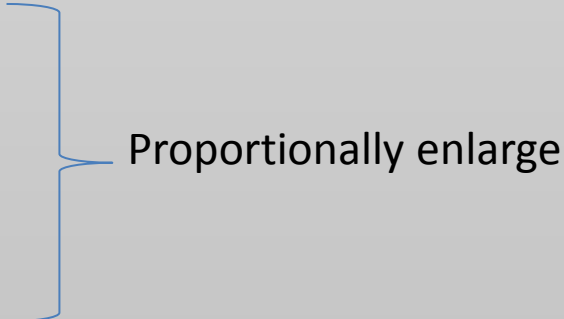
CRITERIA FOR EVALUATING CLEANING AND SHAPING

- INTRACANAL MEDICAMENTS
- Phenols and Aldehydes
- Calcium Hydroxide
- Corticosteroids
- Chlorhexidine

TEMPORARY RESTORATIONS

- Objectives of Temporization
- Routine Access Cavities
- Extensive Coronal Breakdown
- Provisional Post Crowns
- Long-Term Temporary Restorations

The criteria of canal preparation

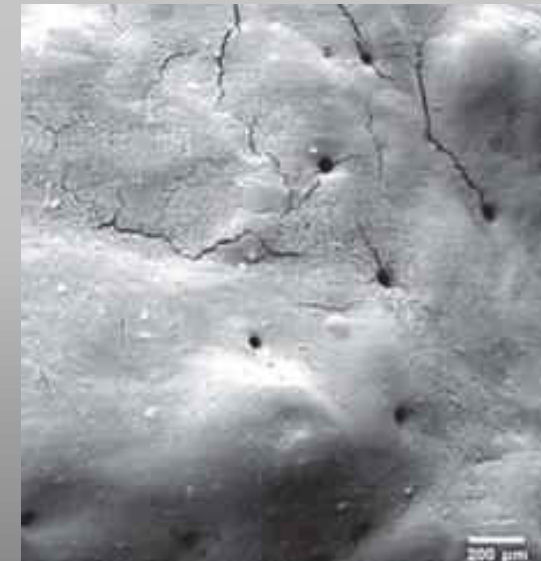
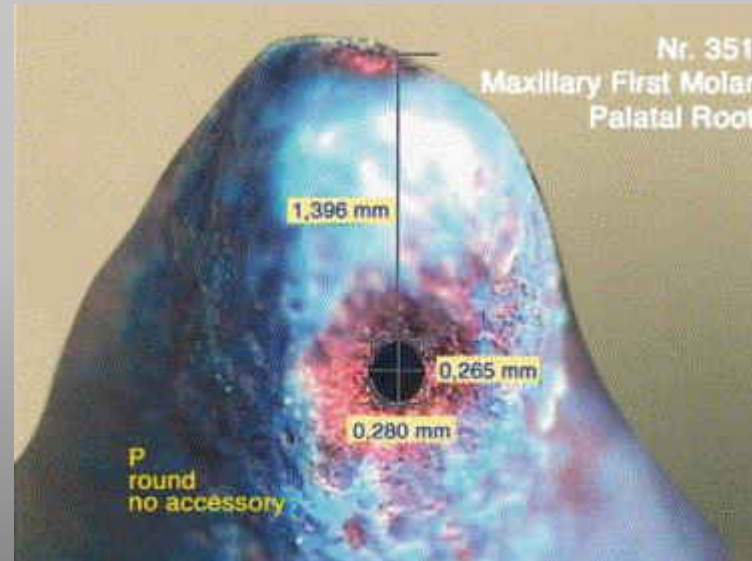
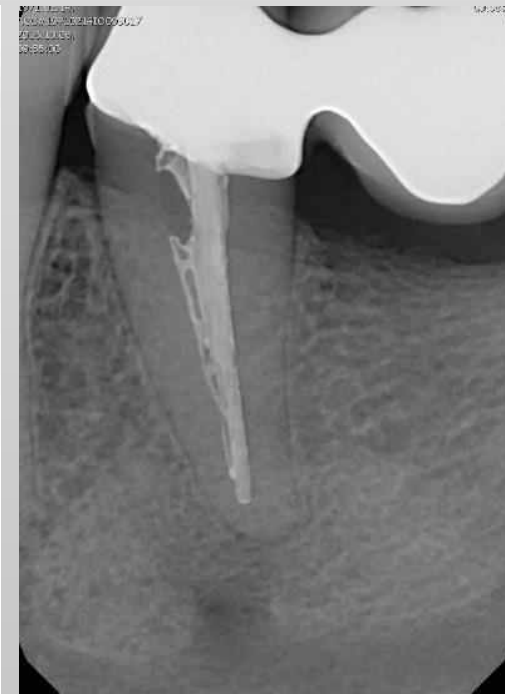
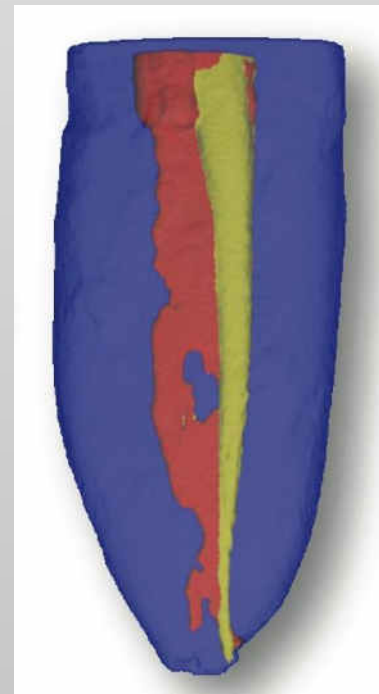
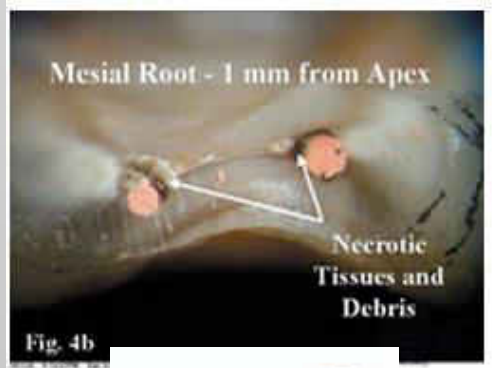
- developing a continuously **tapered** tunnel
 - maintaining the **original shape** of the canal
 - maintaining the apical foramen in its **original position**
 - keeping the apical opening **as small as** possible (prevention of reinfection, apical stop for obturation)
 - developing glassy **smooth** walls
- 
- Proportionally enlarge

Is there any perfect shaping technique?

Not yet available (95% success rate is possible)

(biological and technical issues)

Untouchables



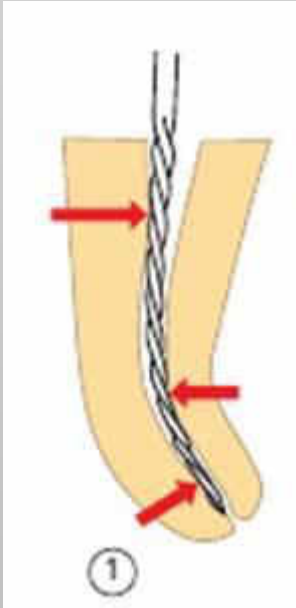
Procedural Errors

- loss of working length:
 - Inadequate reference point
 - Apical block
 - Ledge formation
- apical transportation (zipping) → apical perforation
- stripping perforations
- Instrument fracture

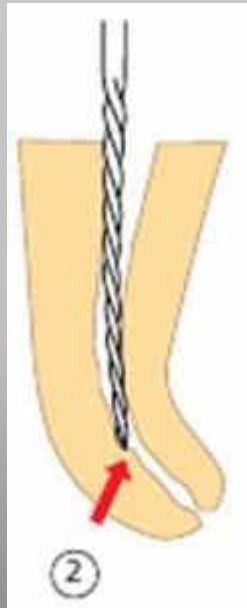


Reasons of procedural errors:

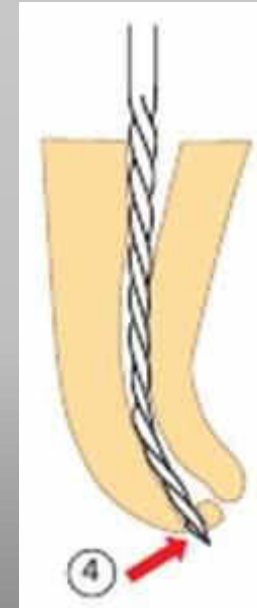
Restoring force (stiffness) in curved canal (Standard technique – stainless steel file)



Ledge formation –
loss of working length

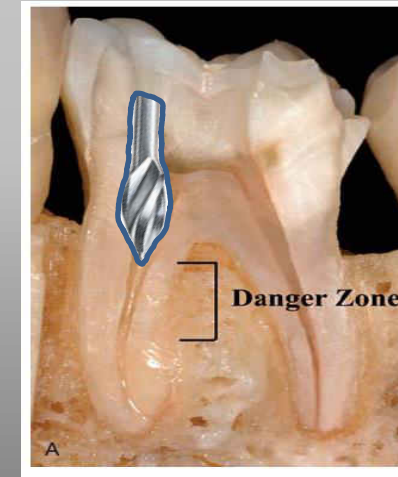
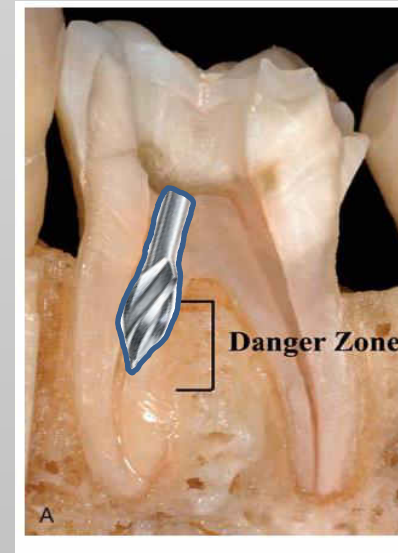
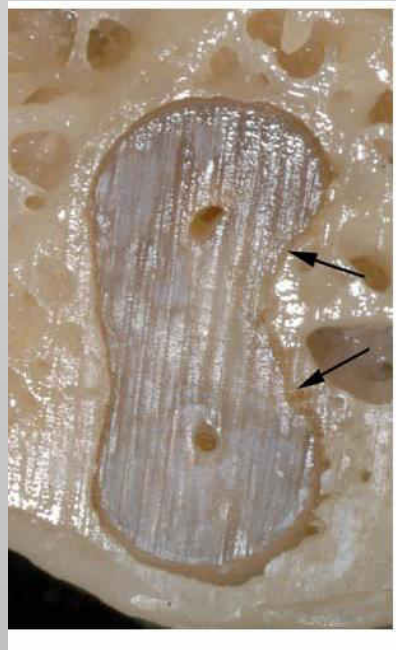
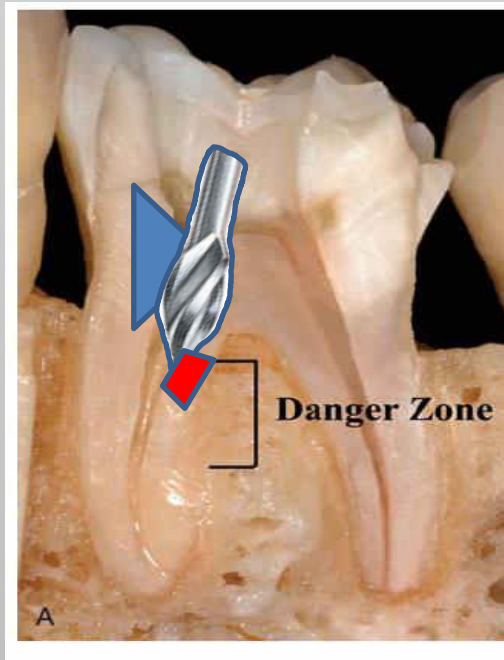


apical transportation (zipping) → apical perforation

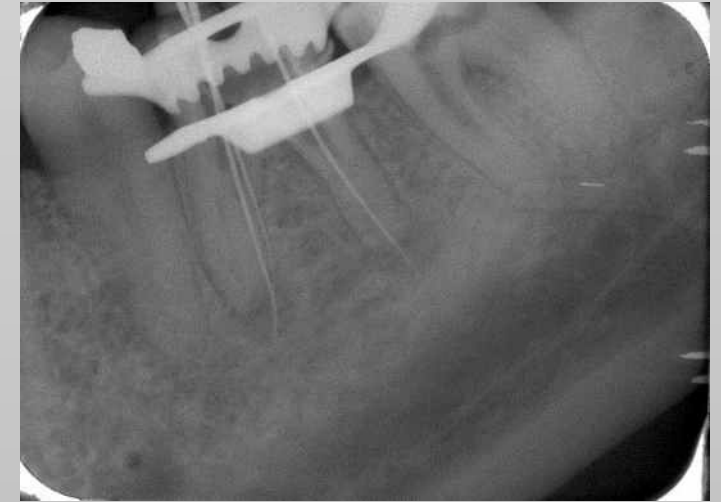


Reasons of procedural errors

Stripping perforation due to **asymmetrical over preparation**



Perforation



The right position

Nickel Titanium versus stainless steel files

NiTi

- Shape memory
- High flexibility
- Cyclic and torsional fatigue
- Expensive

Stainless Steel

- Recording curves
- Rigidity
- More resistant to fatigue
- Cheap

Reasons of procedural Errors

File Stress



1. Cyclic Fatigue



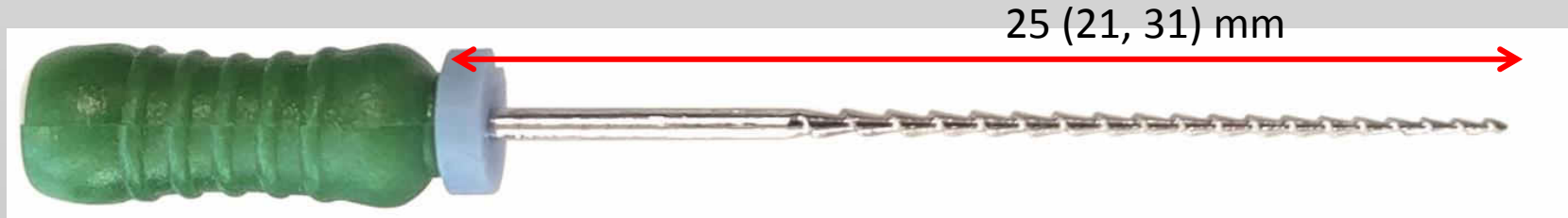
2. Torsional Fatigue



3. Cyclic and Torsional Fatigue

Prevention of procedural errors

inspection of the file



stretching



A



D

tip is missing

bend



B



E

stretching

cutting edge
change



C

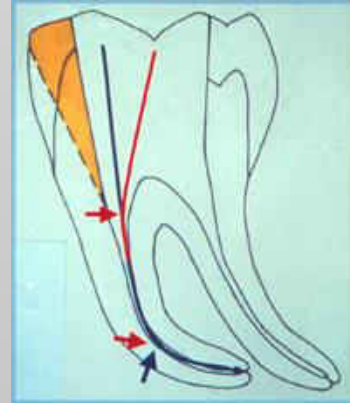


F

reverse twist

Prevention of procedural errors

- Minimal force on file
- Straight-line access
- Rotary:
 - cyclic axial motion
 - file manufacturer recommends:
 - speed (in revolutions per minute [rpm])
 - torque control
 - Pre-flaring the canal (crown-down)
 - Clean the file regularly
 - Single use



Mtwo® TORQUE VALUES

Mtwo®	gcm	Ncm	Mtwo®	gcm	Ncm
10/.04	120	1.2	25/.07	200	2.0
15/.05	130	1.3	30/.06	120	1.2
20/.06	210	2.1	35/.06	100	1.0
25/.06	230	2.3	40/.06	170	1.7
30/.05	120	1.2			
35/.04	120	1.2	Retreatment instruments		
40/.04	160	1.6	R15/.05	30	0.3
45/.04	160	1.6	R25/.05	120	1.2
50/.04	200	2.0			
60/.04	300	3.0			
All sizes: 280 rpm					

Files can be operated between 250-350 rpm. The VDW torque values are recommended for safety and efficiency.
100 gcm are equivalent to 0.981 Ncm.



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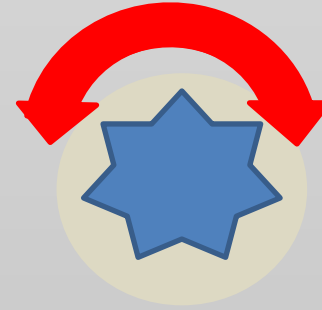


Preparation technique

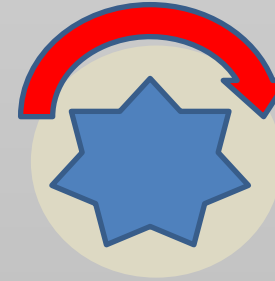
- Step-Back Technique
- Step-Down Technique
 - Crown-down Technique
- Anticurvature Filing
- Balanced Force Technique
- Nickel-Titanium Rotary Preparation
- Final Apical Enlargement and Apical Clearing
- Recapitulation
- Combination Technique

Movements for preparations

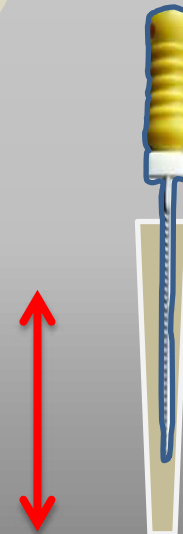
- Watch winding (clockwise/counterclockwise rotation, reciprocating)



- Reaming (clockwise cutting rotation)



- Filing (scraping), Circumferential filing



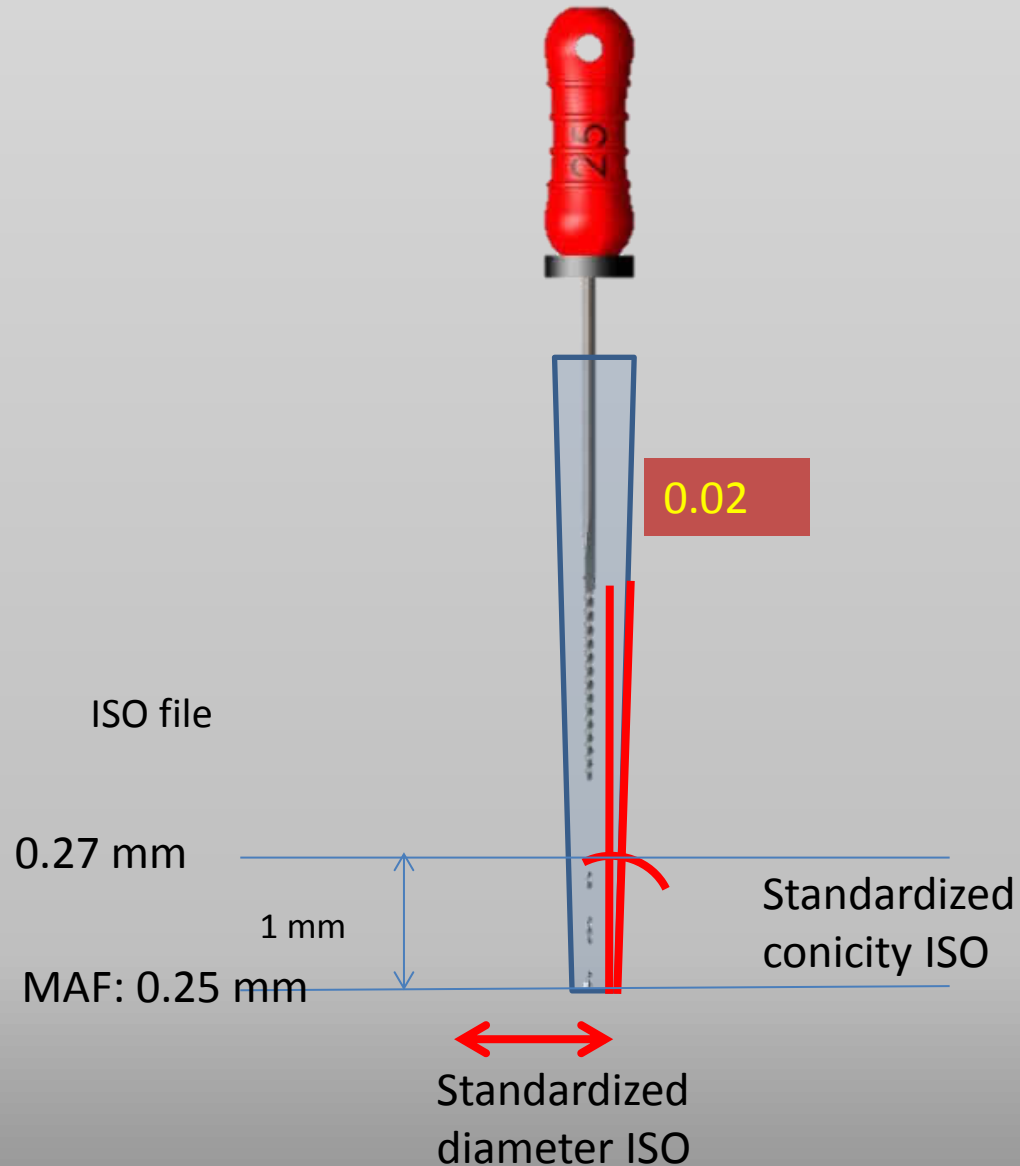
Watch-winding



Standardized technique

Aim: standardized uniform tapered canal

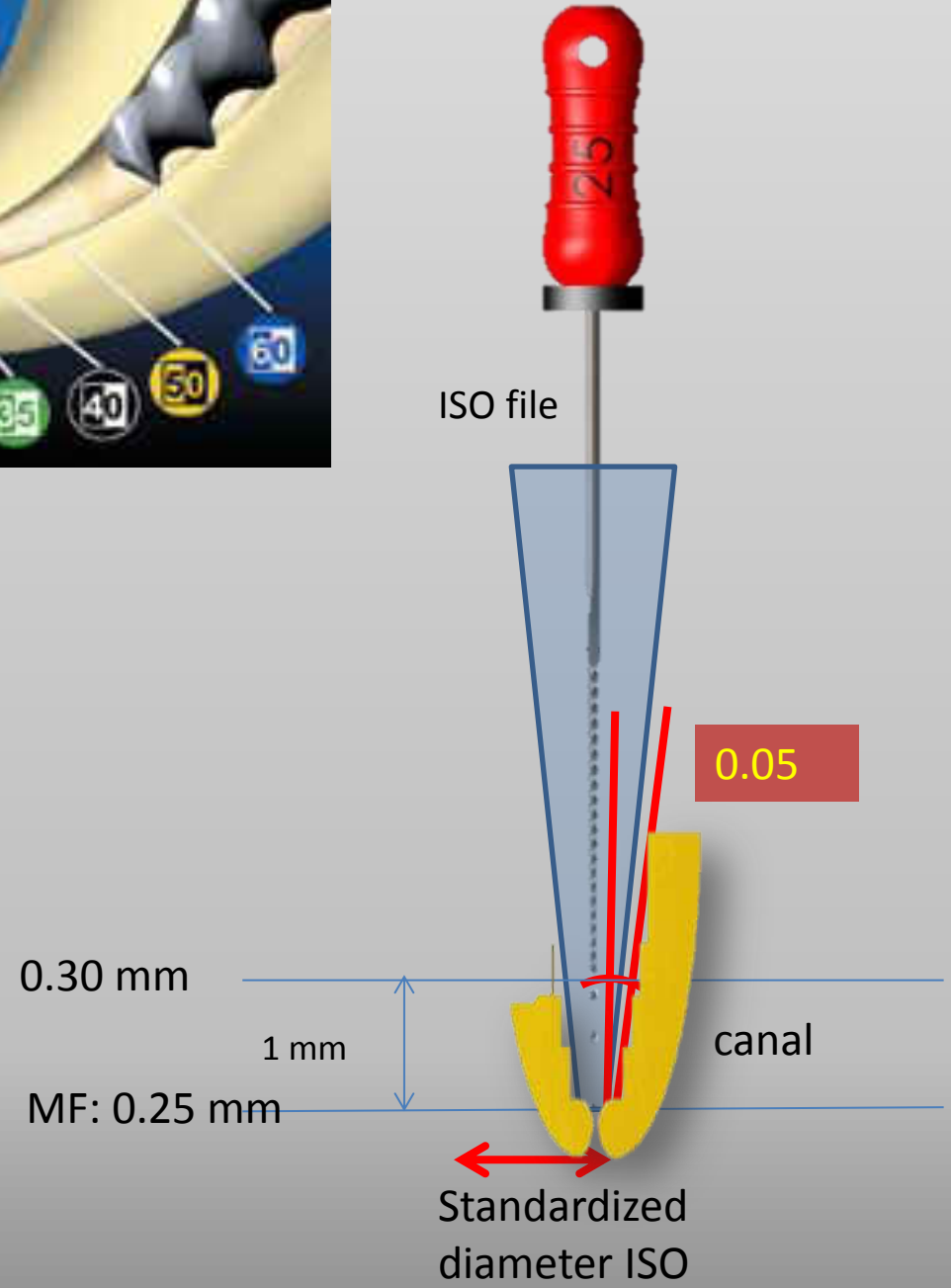
1. Watch-winding (reamer, K-files)
2. all instruments introduced into a root canal to the entire working length, gradually larger and larger
3. MAF = the size of the last file used
4. Filling: single-cone technique
5. Cons: curved canals **will be wider** than the last used instrument, exacerbated by the pulling portion of the hand movement. Adequate **compaction** of guttapercha in such a small taper (0.02) is difficult or impossible.





Step-back technique

Aim: increase the diameter without procedural error

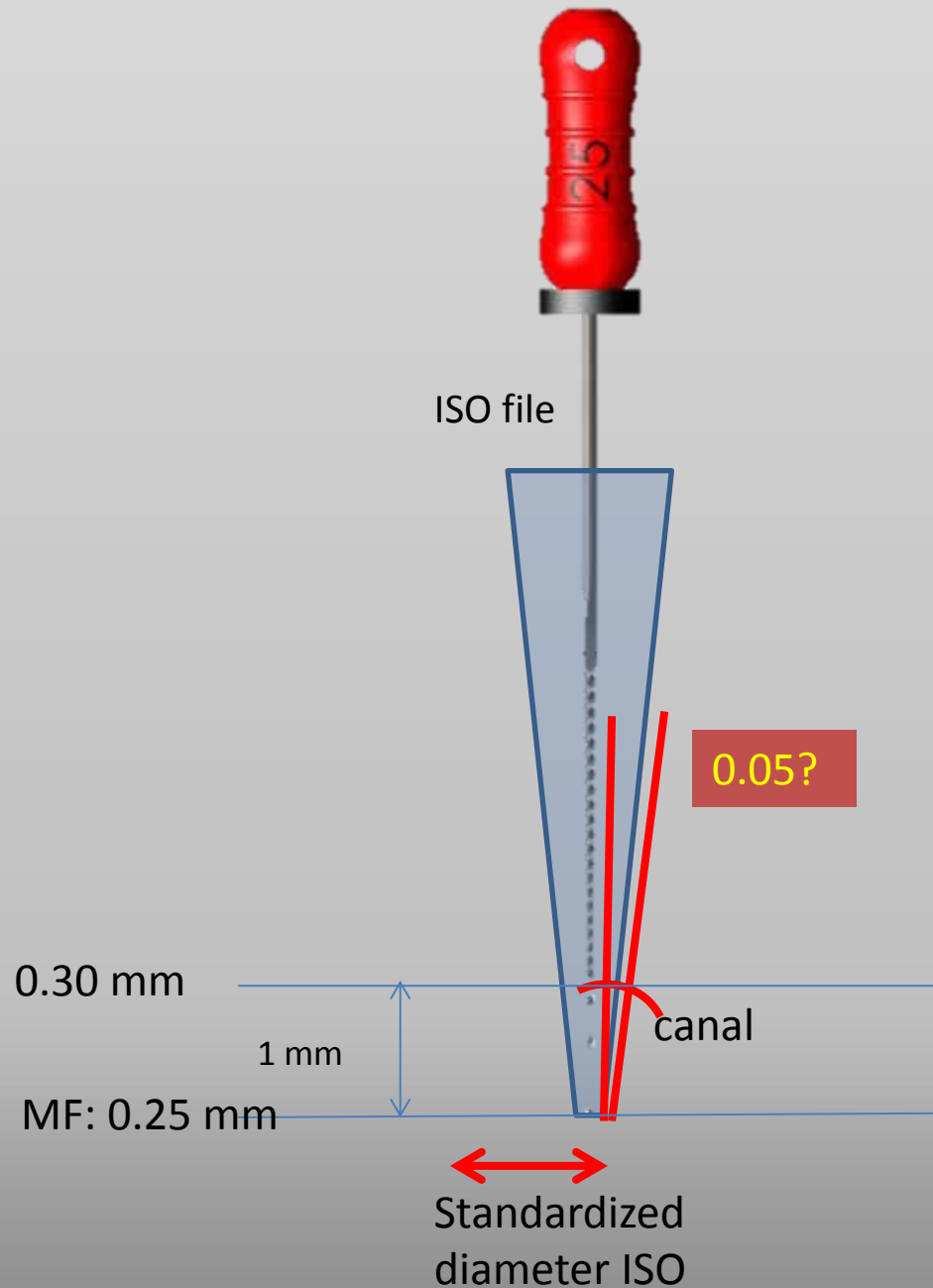


1. Filing (+apical last mm: rotation)
2. Incrementally reducing the working length when using larger and stiffer instruments
3. More tapering: Avoid procedural error, easier rinsing, compactable filling, better copying the non-rounded cross-section
4. Cons: procedural error still occur, apical dentin plug

Step-down technique

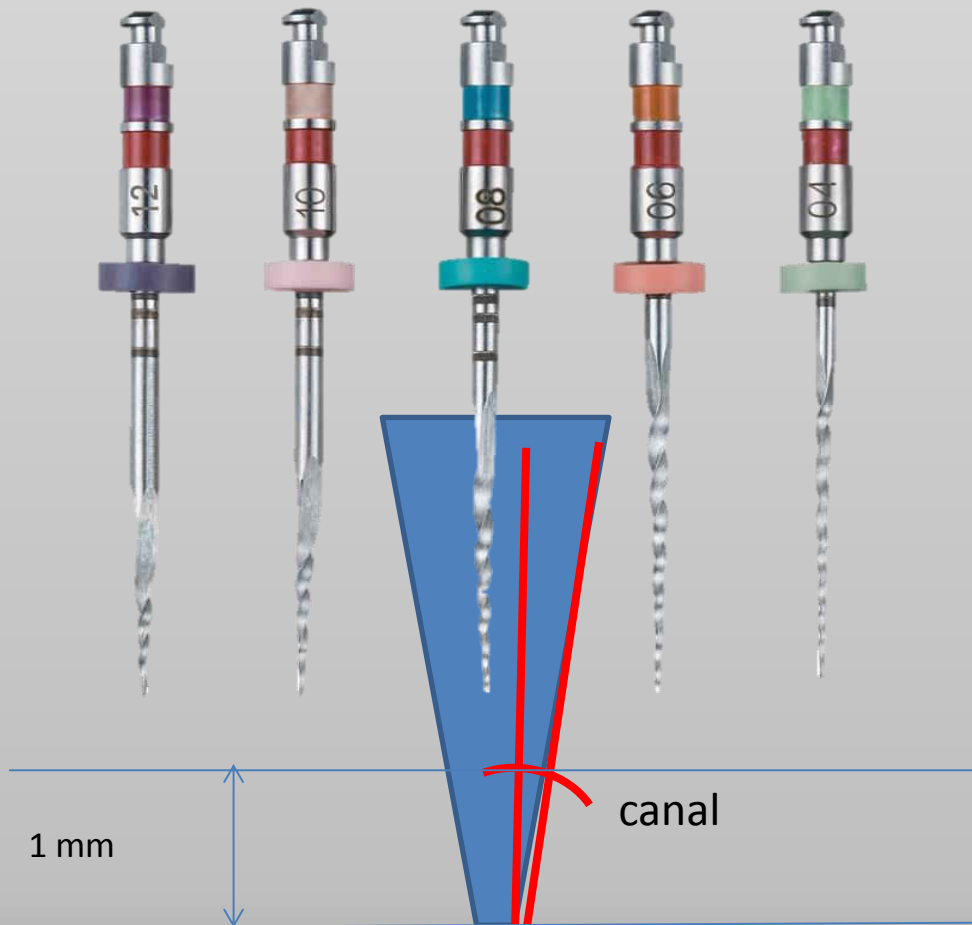
Aim: the most infected coronal debris is removed first

1. Rotation motion (watchwinding or reaming)
2. Gradually move deeper with smaller file
3. More tapered canal: less error, easier rinse, compactable filling, less dentin plug
4. Cons: in narrow canal ledge formation may occur



Crown-down technique (modification of the step-down technique)

Aim: even more aggressive coronal flaring to avoid intrusion of the debris and better determination of the apical size

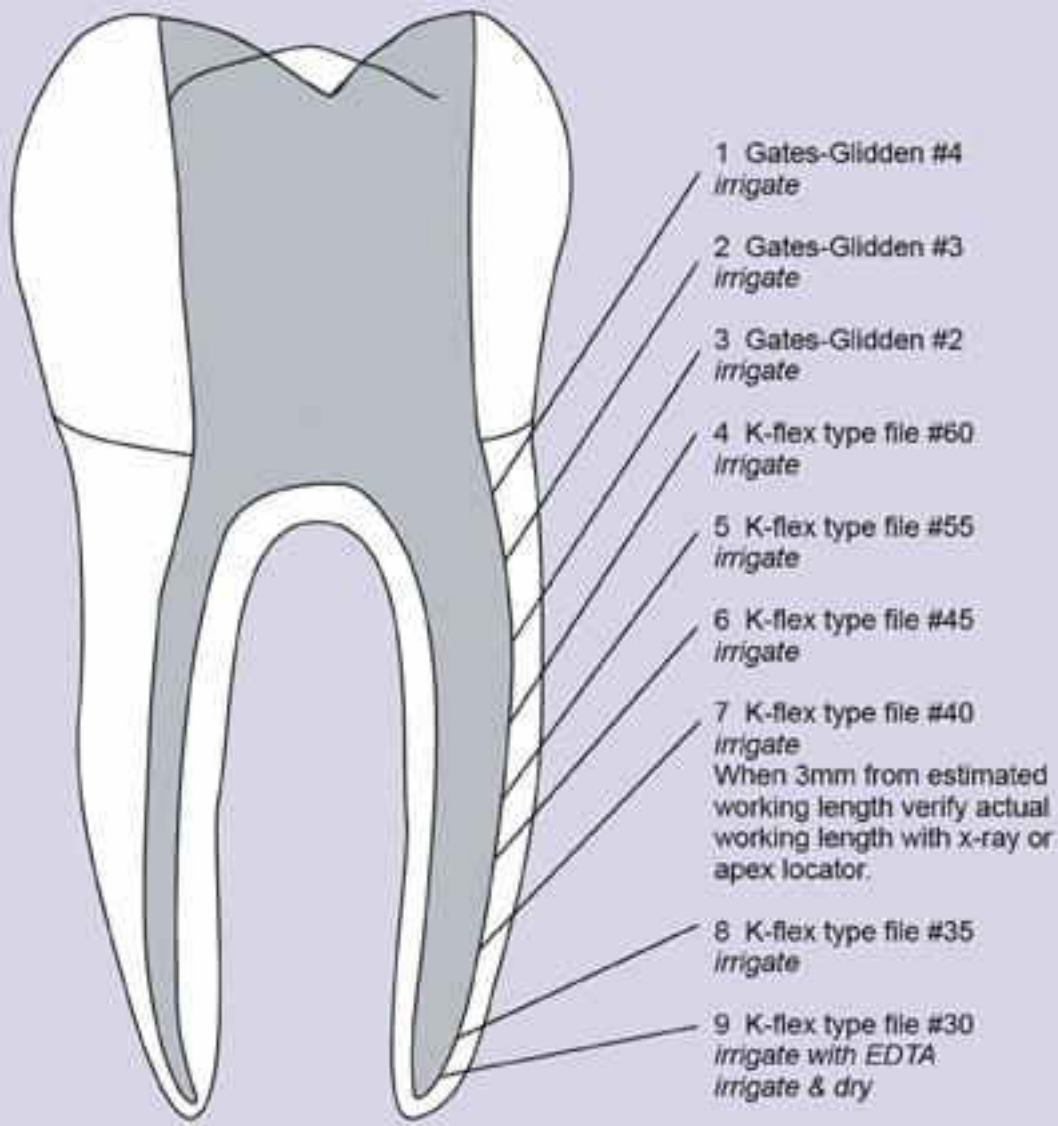


Standardized
diameter ISO

0.04, 0.05, 0.06, 0.07,
0.08,

1. Nowadays: preferable with engine driven instrument with rotary movement
2. The determination of the WL done after the coronal preparation

An example of crown-down technique



Coronal flare (orifice shaper)

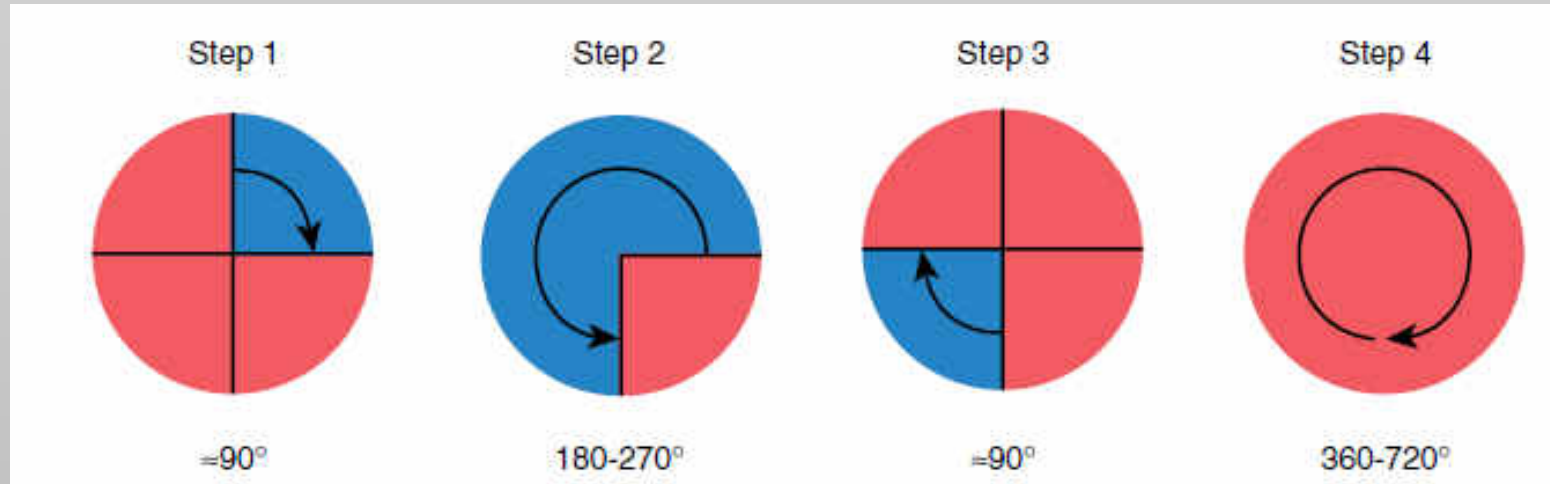
WL determination

Apical shaping

Balanced-force technique

Aim: To reduce procedural error significantly in case of K-file

This technique keeps the file centrally in the canal



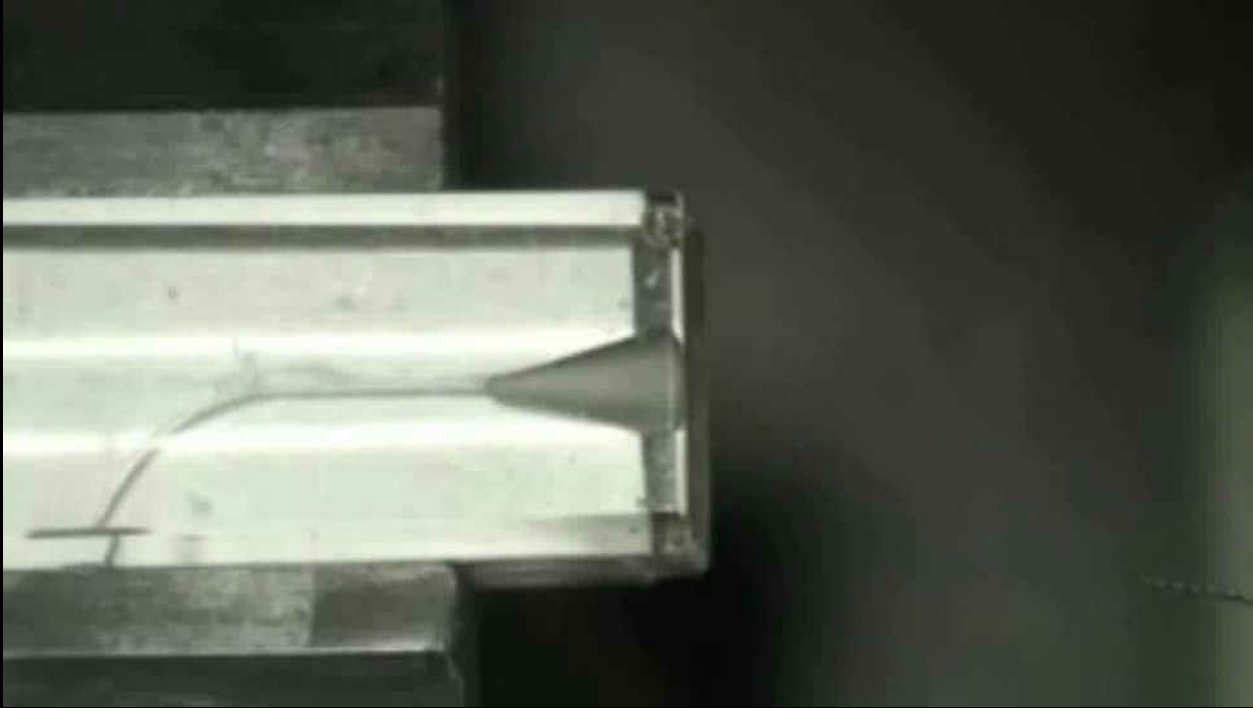
Passive introduction

Light apical pressure

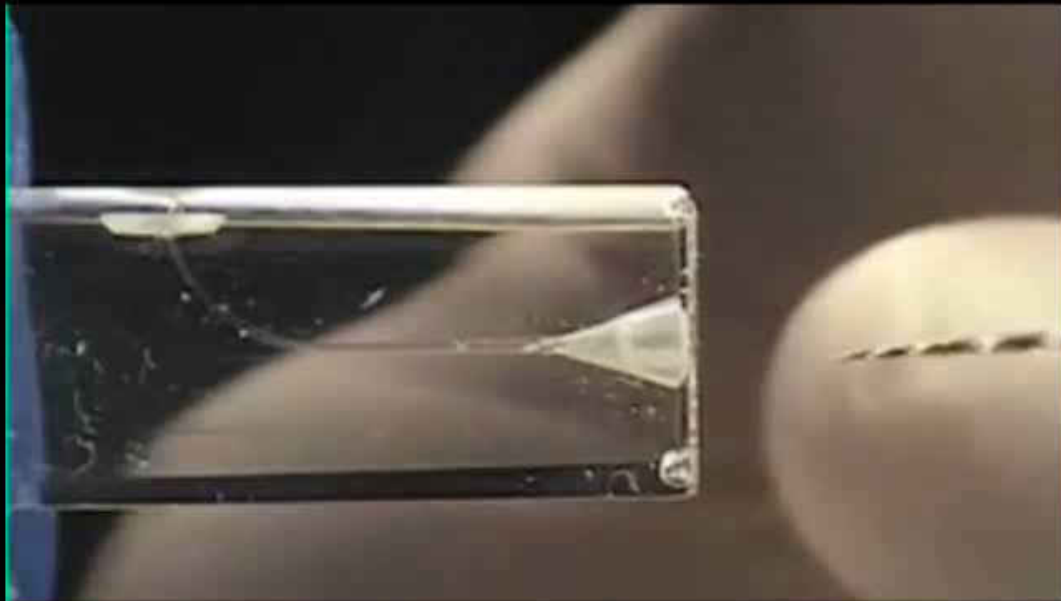
sufficient apical pressure to keep the file in constant length

Advance of the instrument apically

File removing for cleaning

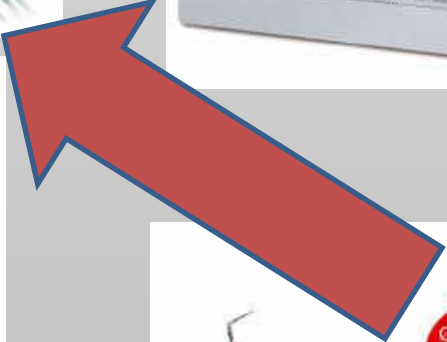


Balanced-force
technique
HAND FILE



Reciprocation





Endo motor

- Length control
- Speed control
- Torque control



Endodontic Intracanal Lubricants

simple to use



Simply put some FileCare® EDTA from a dappen dish or similar...



...onto an endodontic instrument (e.g. FlexMaster® or hand-file)...



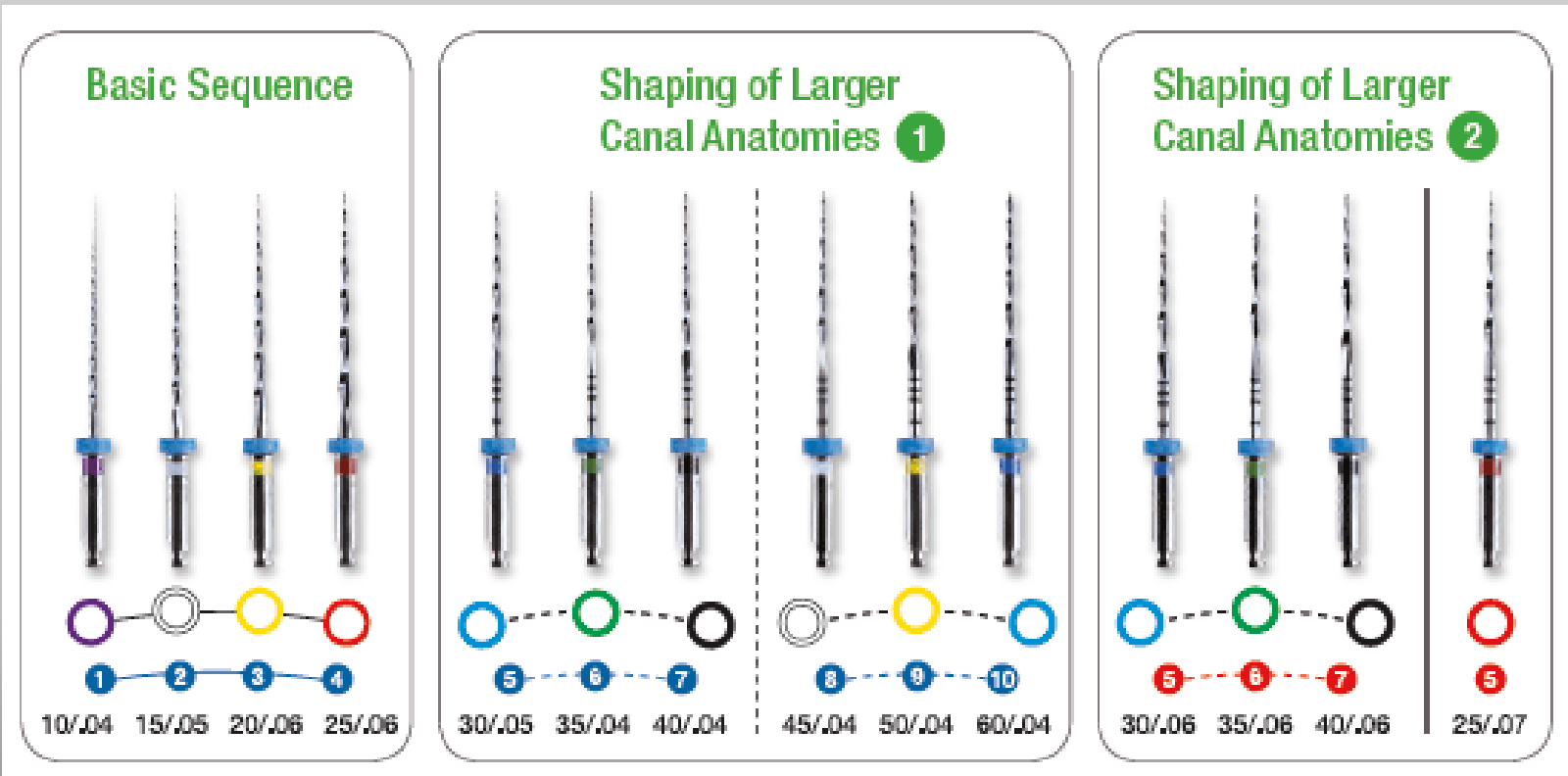
...and introduce it into the canal.



Hand versus engine driven rotary instruments

- NiTi rotary instruments:
 - **Less debris and irritants** enter the periapical tissue (Madhusudhana et al. Contemp Clin Dent. 2010 Oct-Dec; 1(4): 234–236.), causing less inflammation and complaints (Siqueira Int Endod J. 2003 Jul;36(7):453), except the reciproc (Bürklein and Schäfer, J Endod. 2012 Jun;38(6):850-2.)
 - **Less preparation error** (Esposito and Cunningham CJ. J Endod 1995;21:173-176., Sonntag et al. Int Endod J 2003;36:715-723.)
 - Convenient
 - Faster:
 - Very narrow canal
 - Standardized, smooth, equally tapered canal is easier to fill in
- Hand instruments:
 - Better adapt to the individual canal morphology
 - Elliptic, figure-8 cross-section
 - Big curvature: precurved stainless steel hand file
 - Less file separation?

MTWO system



Mtwo® TORQUE VALUES

Mtwo®	gcm	Ncm	Mtwo®	gcm	Ncm
10/.04	120	1.2	25/.07	200	2.0
15/.05	130	1.3	30/.06	120	1.2
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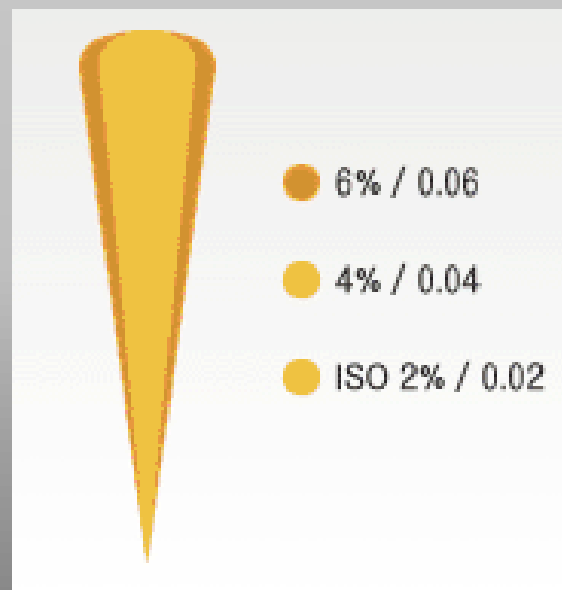
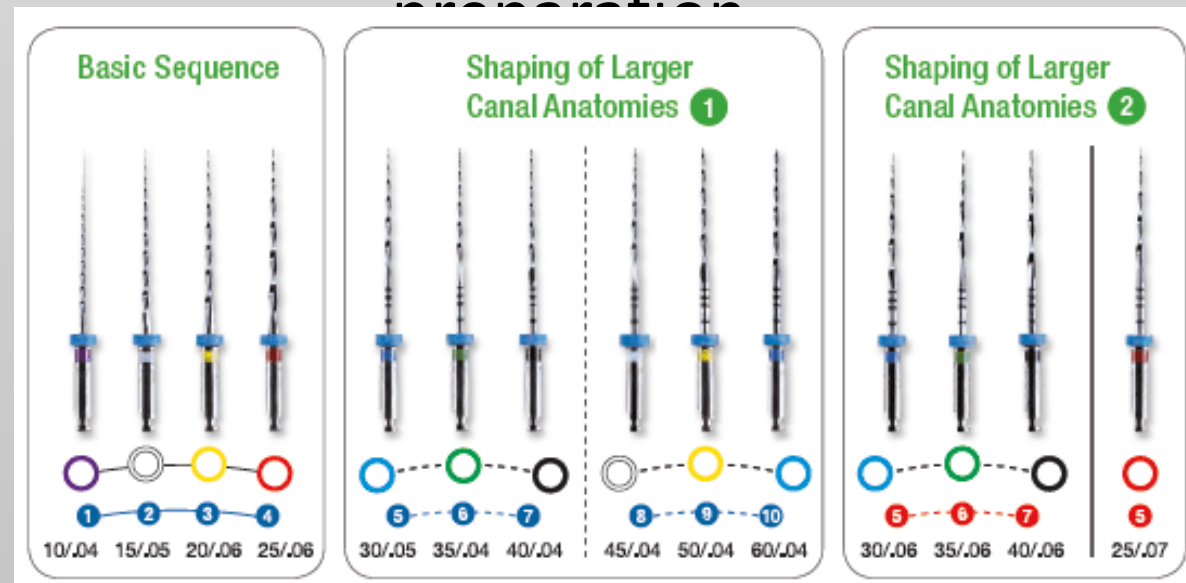


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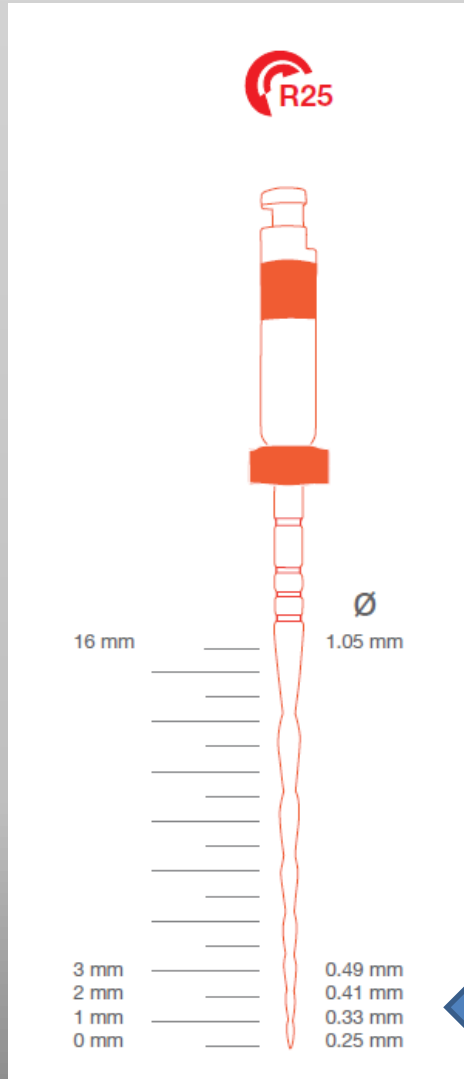


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Synchronized technique: Tapering of the guttapercha points should match the canal morphology after preparation



Reciproc system



$0.33 - 0.25 = 0.08$

RECIPROC® Instruments

Single sizes

STERILE

Blister of 6 Instruments		21 mm	25 mm	31 mm
R25	●	0212 021 025	0212 025 025	0212 031 025
R40	●	0212 021 040	0212 025 040	0212 031 040
R50	●	0212 021 050	0212 025 050	0212 031 050
Blister of 4 Instruments		21 mm	25 mm	31 mm
R25	●	0212 021 025	0212 025 025	0212 031 025



RECIPROC® Gutta-Percha

Box of 60 pieces

Size		28 mm
R25	●	0214 028 025
R40	●	0214 028 040
R50	●	0214 028 050
40 x R25, 10 x R40, 10 x R50		0214 028 237



RECIPROC® Paper Points

Box of 144 pieces

Size		29 mm
R25	●	0216 029 025
R40	●	0216 029 040
R50	●	0216 029 050
96 x R25, 24 x R40, 24 x R50		0216 029 237

STERILE



Köszönöm a figyelmet