Fundamentals of Endodontics

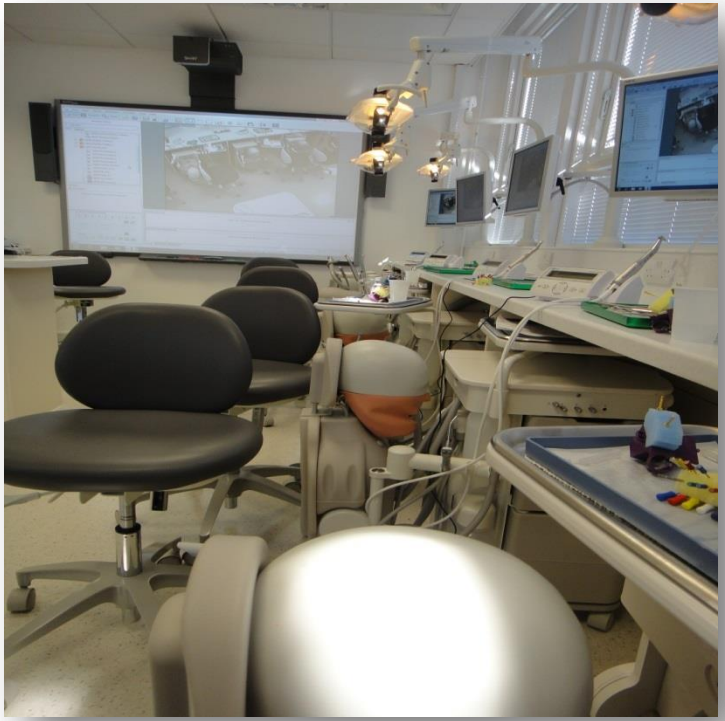
Nalin, Ahmed Farooq, Trish Moore (QED) and I

Practical Hands-on Course

Pan SL DFY2 / CDP

LonDEC 24th July 2014

Dental simulation is important

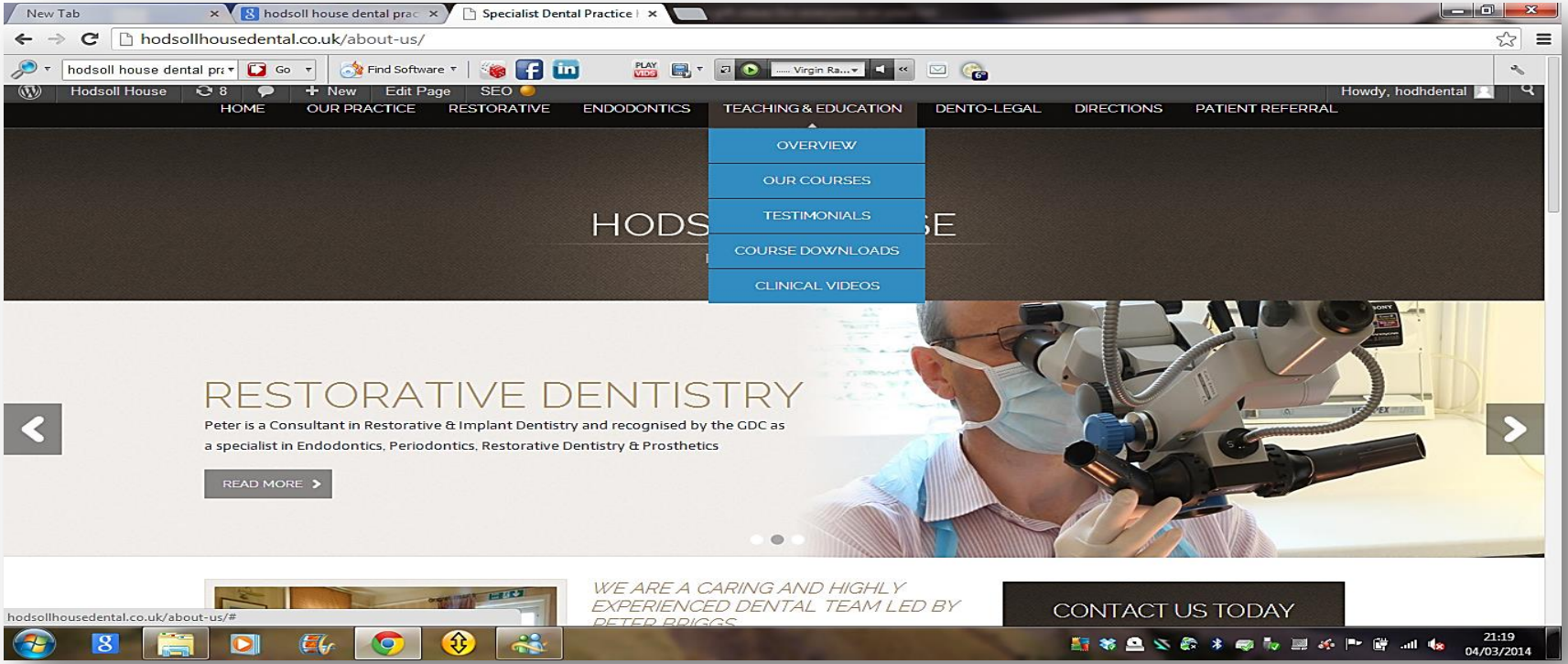


Today

- Take the opportunity to enjoy the facilities
- Remember that endodontics is a team sport – it is difficult to do on our own
- As a profession we need to be looking at ways of improving clinical outcome
- We need to break down our goals into important small do-able tasks

Handouts (PDFs) can be found at

www.hodsollhousedental.co.uk

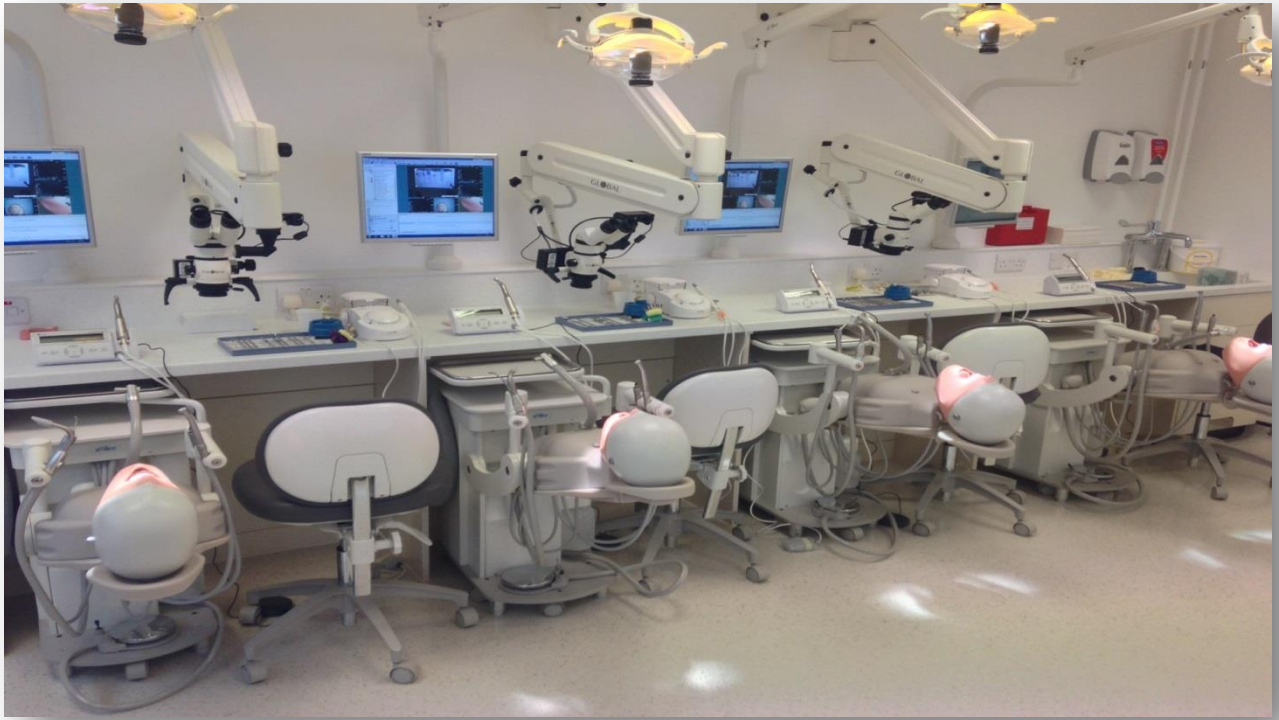



PDFs found at;
www.hodsollhousedental.co.uk

Small things that we need to do better

- **Access**
- **Canal(s) location**
- **Small Scout Files (#08 / #10)** to confirm presence and patency of root canal(s) – very important for re-treatments – must learn ‘watch-winder’ action
- **Preparation** – Coronal, Mid and Apical thirds
- **Obturation**
- **Coronal Restoration**

Why do we need to do these well?



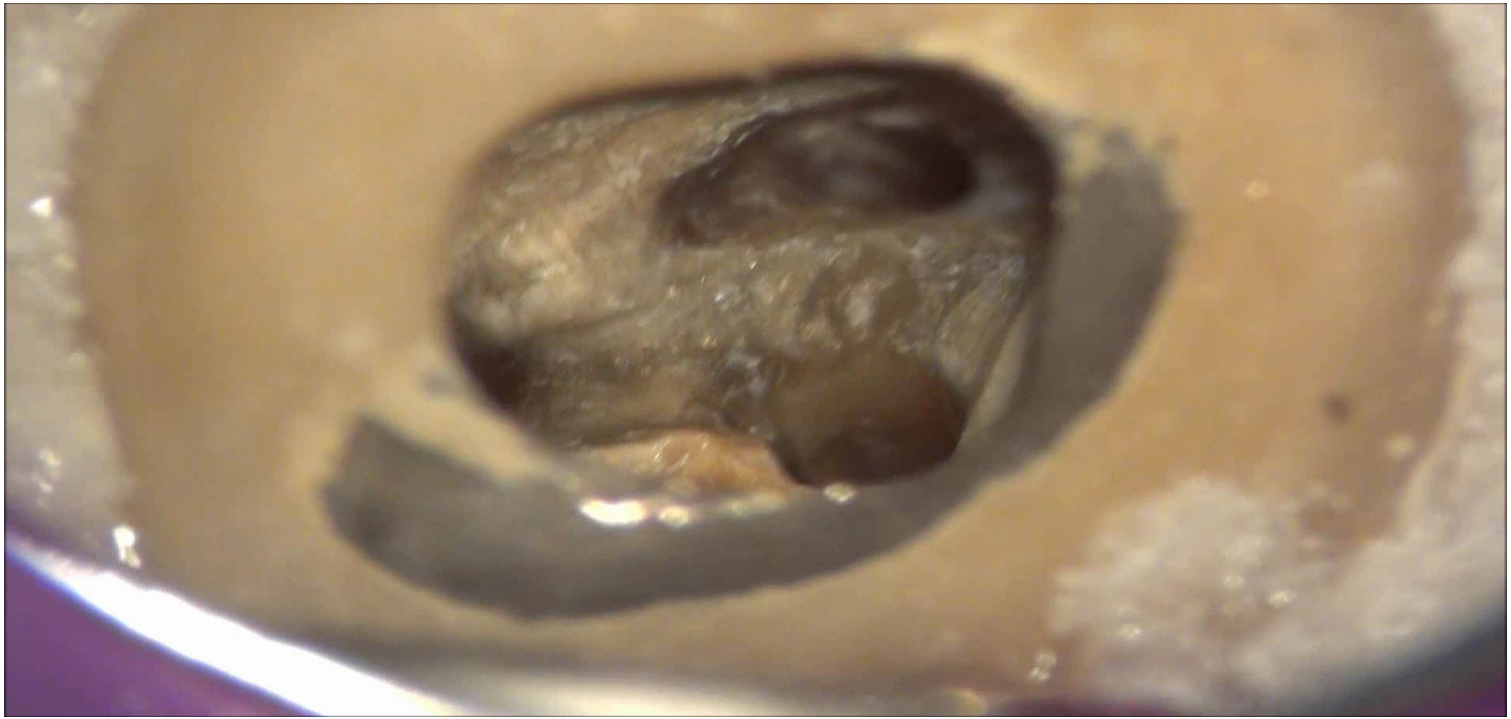
Dummer (1997a & b)


The patient will be equally happy (or unhappy) with either form of fixed restoration
www.hodsollhousedental.co.uk

What endodontic skills are we going to need throughout the life of our patients?

- We all need to know and understand the important factors that influence Endodontic outcome

What factors have been proven to make a difference to endodontic outcome?

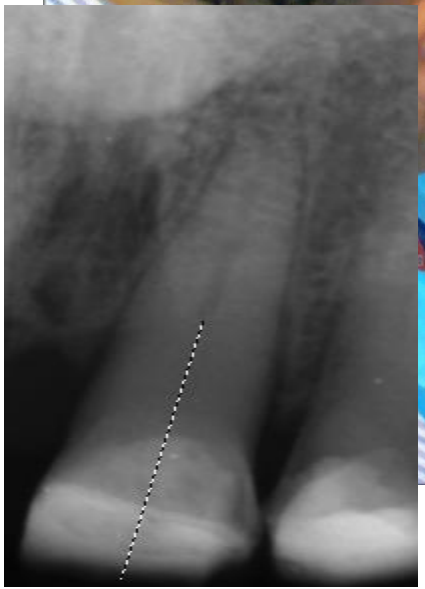


We all should all have read this critical review on Endodontics Ng et al. (2008 a & b) Int Endod J 41: 6-31

- **Pre-operative apical area**
- **Root filling ending within 2 mm of radiographic apex (instrumentation and obturation)**
- **Voids within the root-filling (obturation quality)**
- **Satisfactory restoration coronal seal (post-Rx Rest Dent)**

Electronic Pulp Tester - a great tool

Get the patient to hold the pulp tester and let go when they feel something



Presence of pre-operative area

- Why do you think this is important?
- How long will it take to heal after treatment?

If no sign of healing or radiographic improvement at 24 months then likely not to have worked

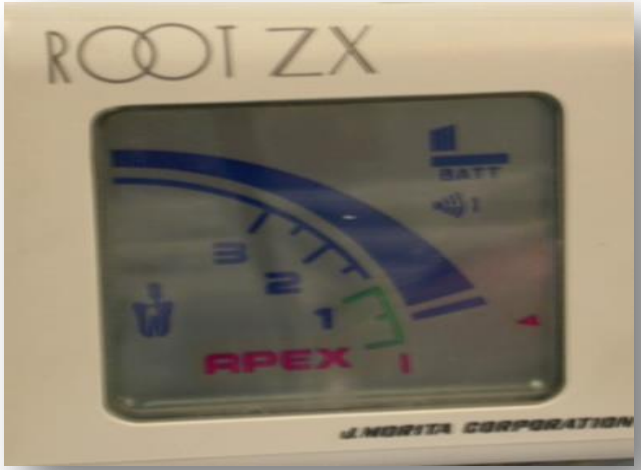
Should see an improvement or resolution by 24 months

Root filling ending within 2 mm of radiographic apex (instrumentation and obturation domains)

Electronic Apex Locators

always use the tip (not the clip) - your nurse can put hold it on the head of the hand-piece it doesn't need to be on the file

Gauging & diagnostic radiographs in a digital age



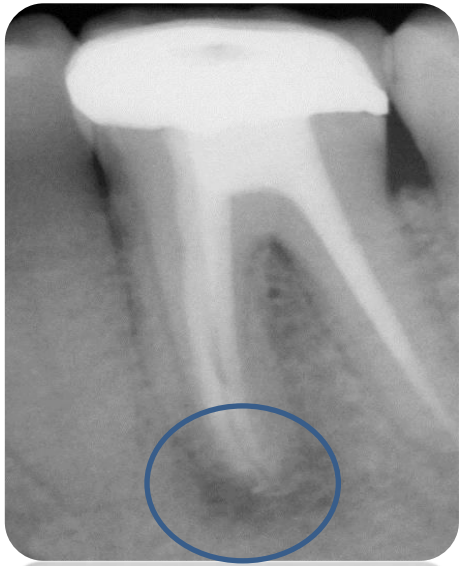
- Learn to use and trust an EAL – it's right as long you can get predictable Zero readings and it's not 'jumping'
- Prepare the root canals with tip of EAL placed on the hand piece as you work
- Always know where you are with reference to the Zero reading
- Use the 'Wand' not the 'Clip'

We must understand how to verify the apical size of our chosen master GP point. We will use either a plastic Maillefer ruler (cut flush with scalpel blade at chosen size gives a apically ‘gauged’ master GP point) or the Gutta Cutter.

Remember GP points vary massively

This gives us control and helps us to obturate confidently and keep our RCT within the root canal

Teeth with apical areas you will get an approximate 12% drop-off in outcome per mm short of ideal length



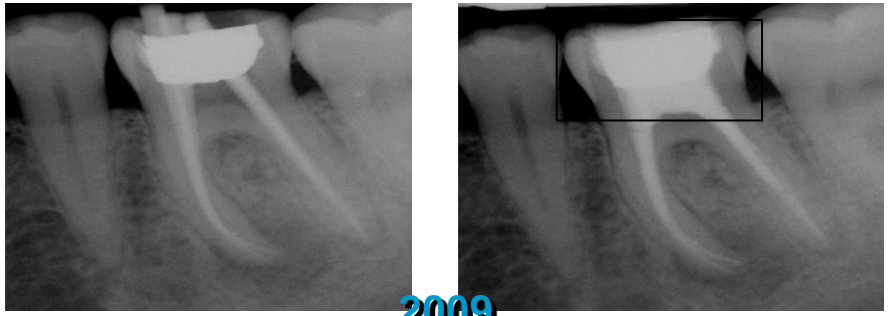
‘Golden Rules’

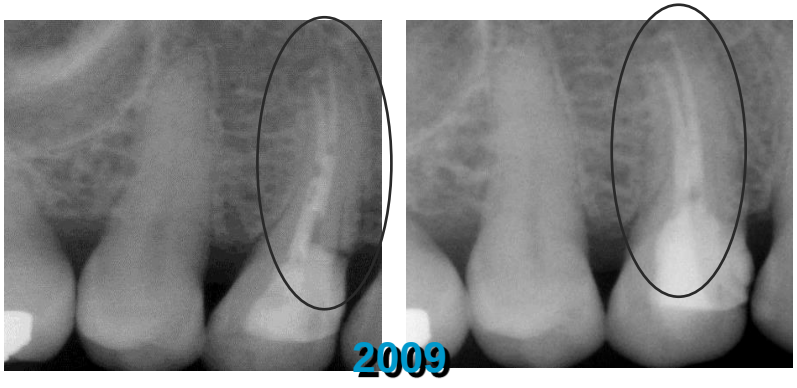
- Never put an unmeasured endodontic instrument into a root canal
- Use your pre-operative radiographs to help provide a guide on likely working length(s)
- Share measuring responsibilities – nurse with measuring block responsible for clearly instructed measurement of all files, syringe needles etc
- Careful gauging and pre-cementation radiographs please

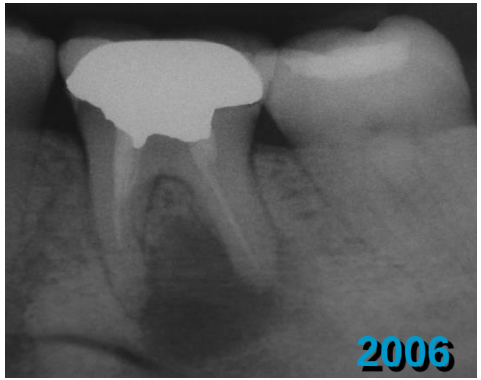
Ng et al. (2008 a & b) Int Endod J 41: 6-31

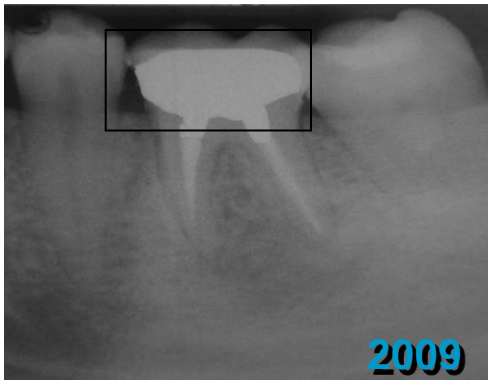
- **We are now probably as good as we can get *“ARE WE THERE YET?”***
- **The older techniques hold up well**
- **Irrigation and ‘bug-killing’ are extremely important when apical periodontitis is present**
- **We must all ‘crack’ a predictable obturation technique**

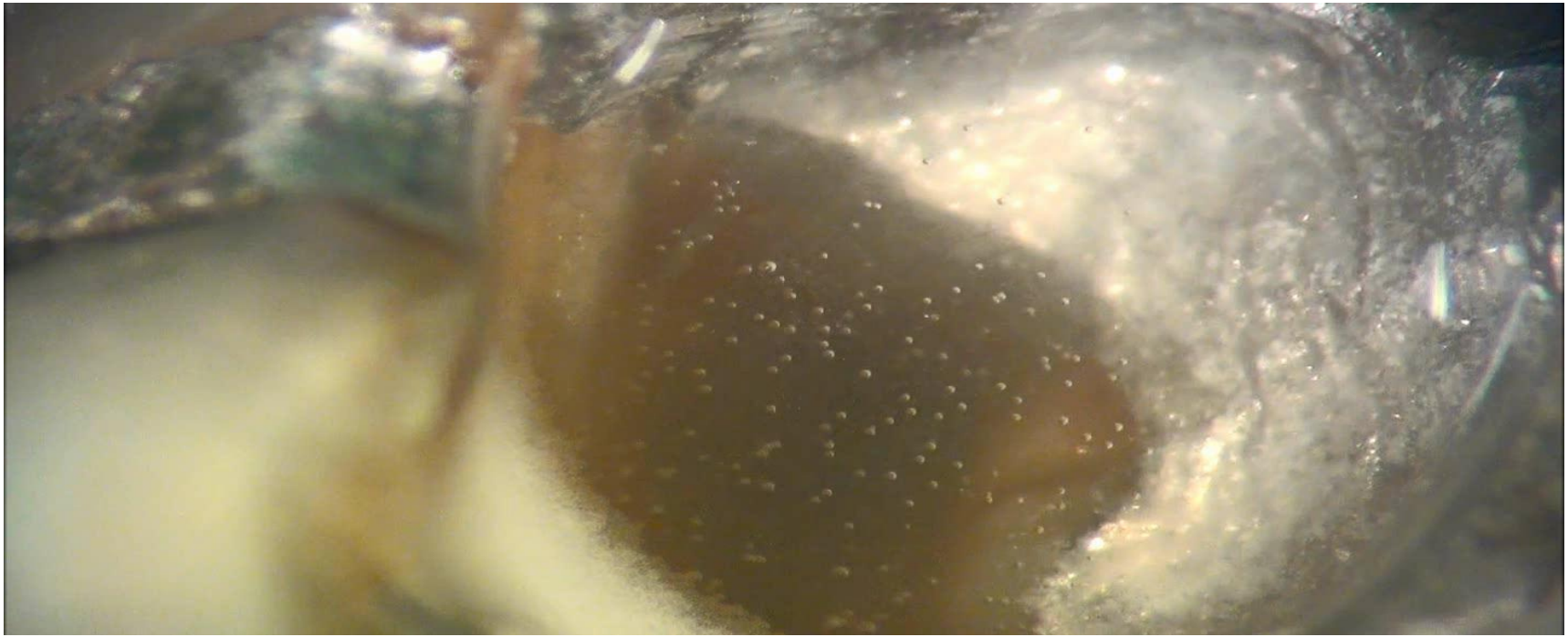
Ng et al. (2008) Int Endod J 41: 6-31









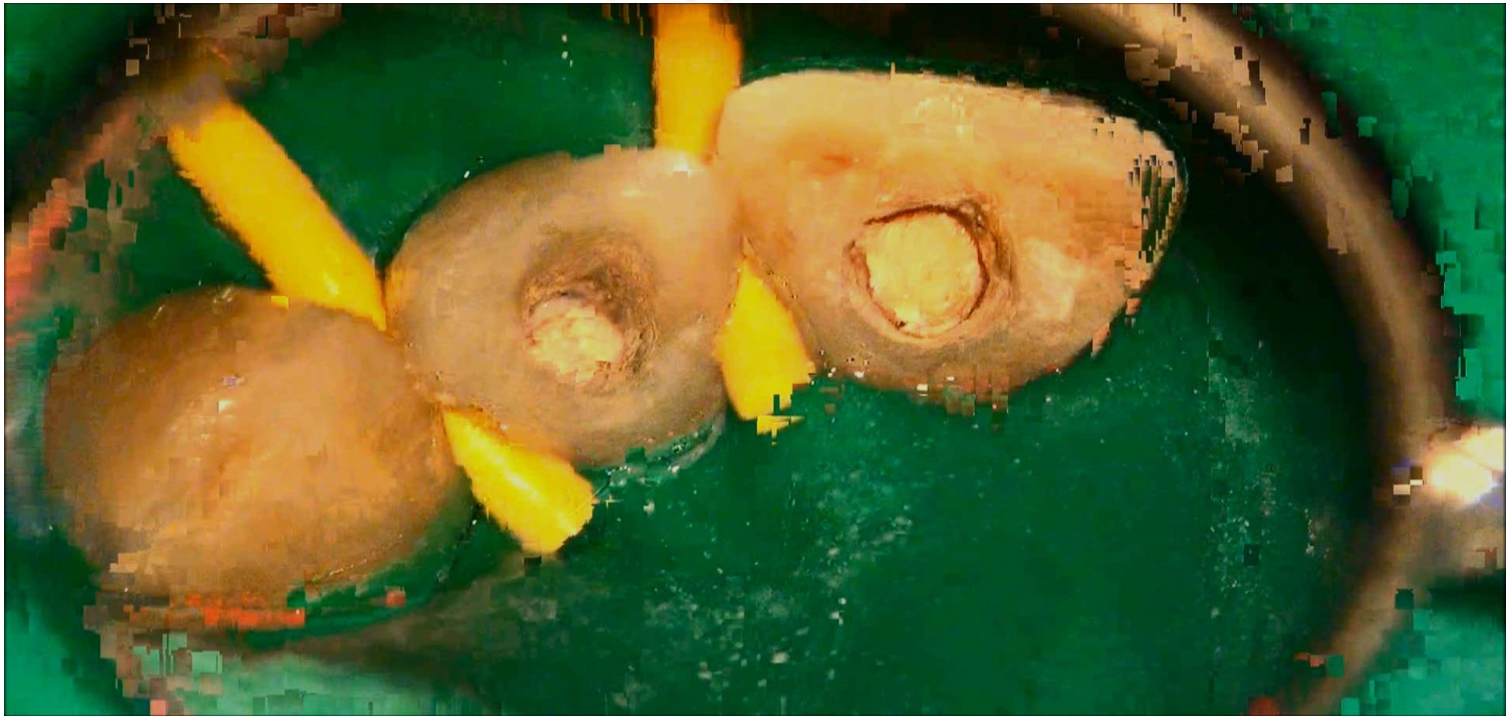


Irrigation & Cleaning is the key

- Ultrasound – 1 minute per canal using and ultrasonic needle and 15ml of 6% hypochlorite.
- Addition of U/S gave a **sevenfold increase** in the chance of a negative culture could be obtained at the end of the procedure.
- U/S significantly reduced colony forming units (CFUs)

Carver K, et al. In vivo antibacterial efficacy of ultrasound after hand and rotary instrumentation in human mandibular molars. J Endod (2007) 33:1038-1043

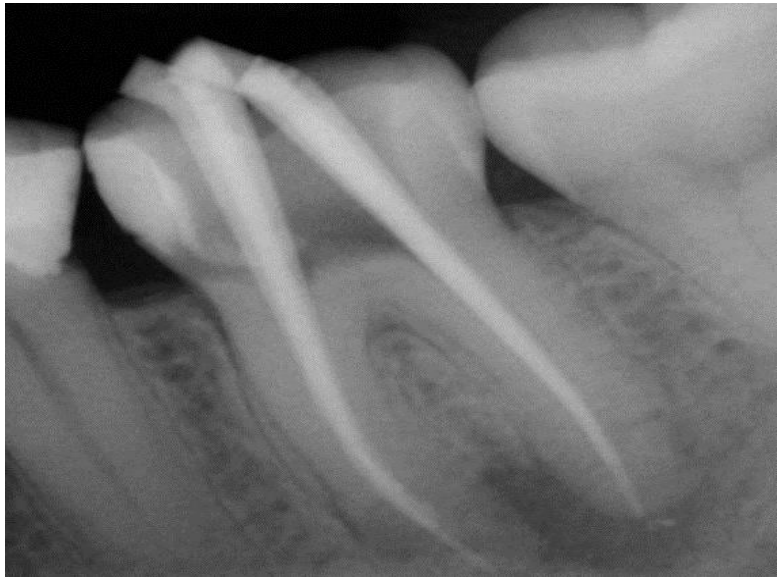
Eliyas S, Briggs PF, Porter RW. Antimicrobial irrigants in endodontic therapy: 1. Root canal disinfection. Dent Update. 2010; 37(6):390-2, 395-7.



Increasing ‘bug-killing’ with hypochlorite

- Warm - 1% at 40 degrees is as effective as 5.25% at room temp
- ‘Pump’ with final GP – 30 seconds per canal with EDTA then 30 seconds with hypochlorite immediately prior to obturation
- This has been shown to make a big difference to outcome for both de-novo and revisions (EDH / USA)

Failure & Revision



Re-treatments – you want to get down to the working length ASAP

International Endodontic Journal (1994) 27, 75–81

Retreatment or radiographic monitoring in endodontics

J.-P. VAN NIEUWENHUYSEN, M. AOUAR & W. D'HOORE*

*Department of Dental Medicine and Stomatology, and *Department of Hospital Administration, Catholic University of Louvain, Belgium*

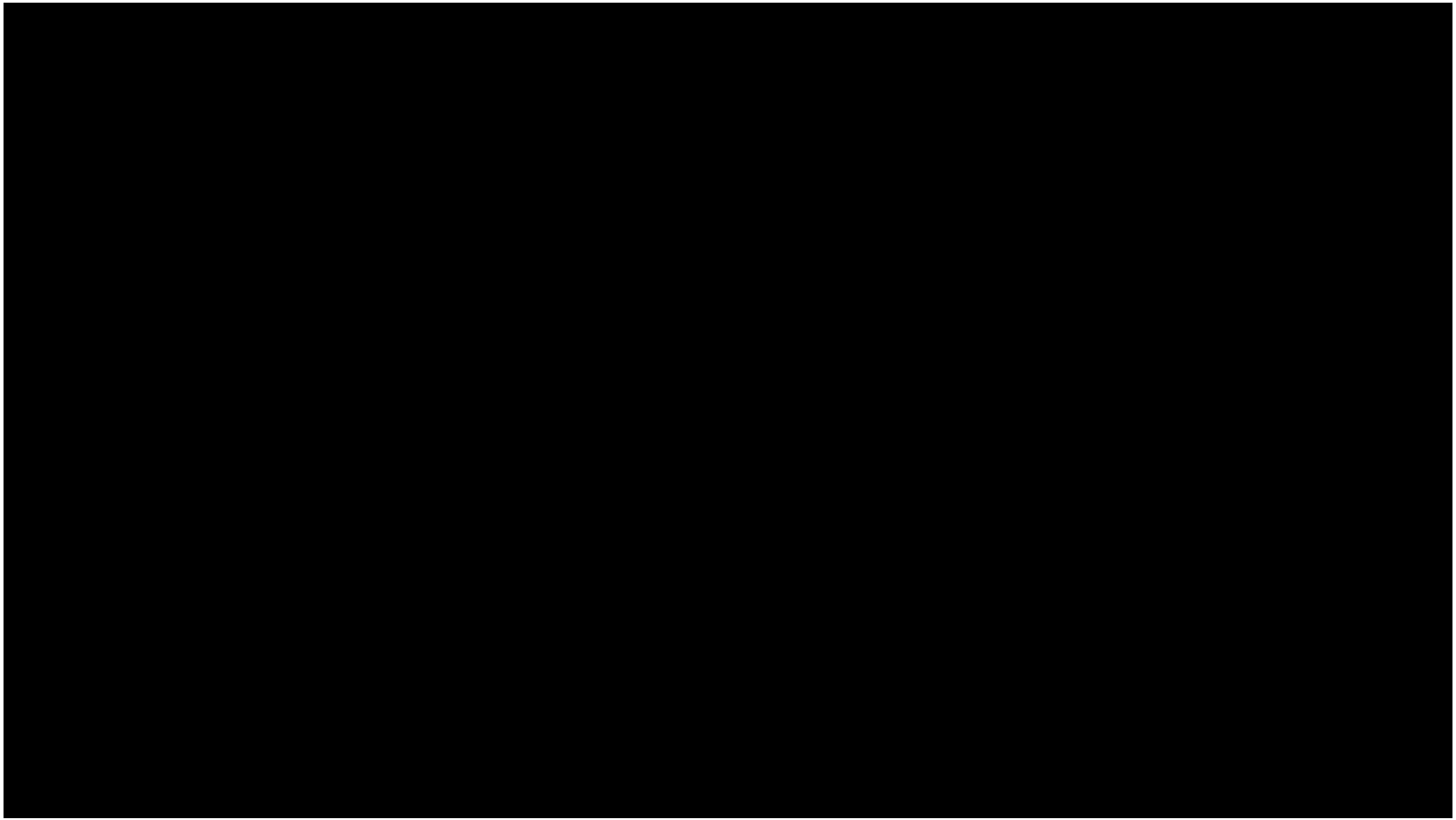
Summary

The aim of this clinical study was to assess 1032 endodontically treated roots in relation to: (i) the success rate of retreatment (612 roots)—only cases that had recall examinations of 6 months or longer

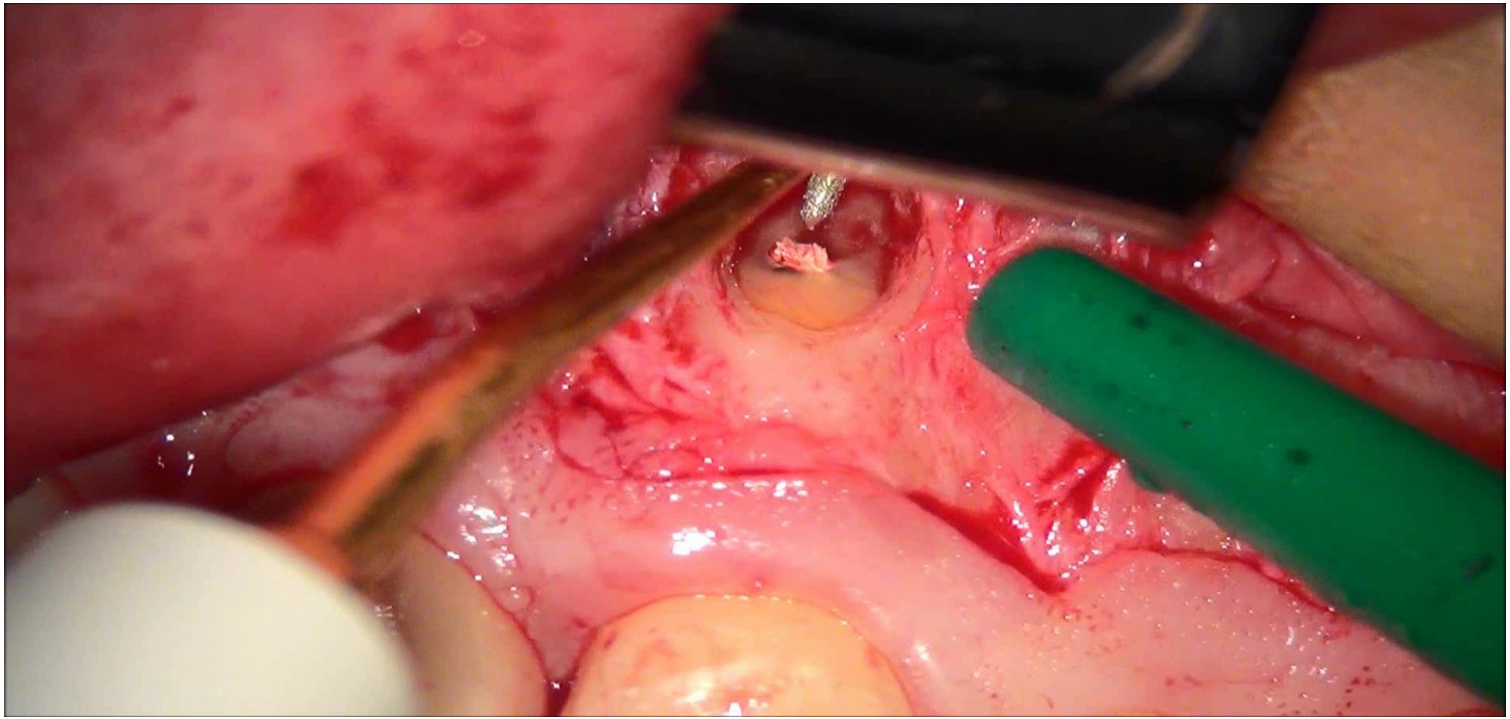
Introduction

Studies have shown that success rates of root canal therapy generally approach 90% (Lewis & Block 1988). When treatment fails, retreatment rather than extraction is usually indicated (Allen *et al.* 1989), but the

Re-Treatment usually means removing a GP - do not be scared of the stuff it will not bite!



Sometimes we will need to carry out apical surgery – we must do it properly



Success rates

- 31-96% based on ‘strict’ criteria
  - Complete resolution of periapical lesion
- 60-100% based on ‘loose’ criteria
  - Reduction in size of existing periapical lesion

80-82%

Ng et al, International Endodontic Journal (2007)

Ng, Mann & Gulabivala; International Endodontic Journal, 2011

Strip down to assess Restorability and reason(s) for endodontic failure – good provisional seal

Can we predict if our Endo is going to work?

Pre-operative:

- Presence of periapical lesion (49% lower)
- Size of periapical lesion (14% lower for every 1mm)
- Presence of sinus (48% lower)
- Presence of root perforation (56% lower)

Ng, Mann & Gulabivala; International Endodontic Journal, 2011

Predictive Discussions with the patient

- CAP with exudation - presence of sinus (48% lower)

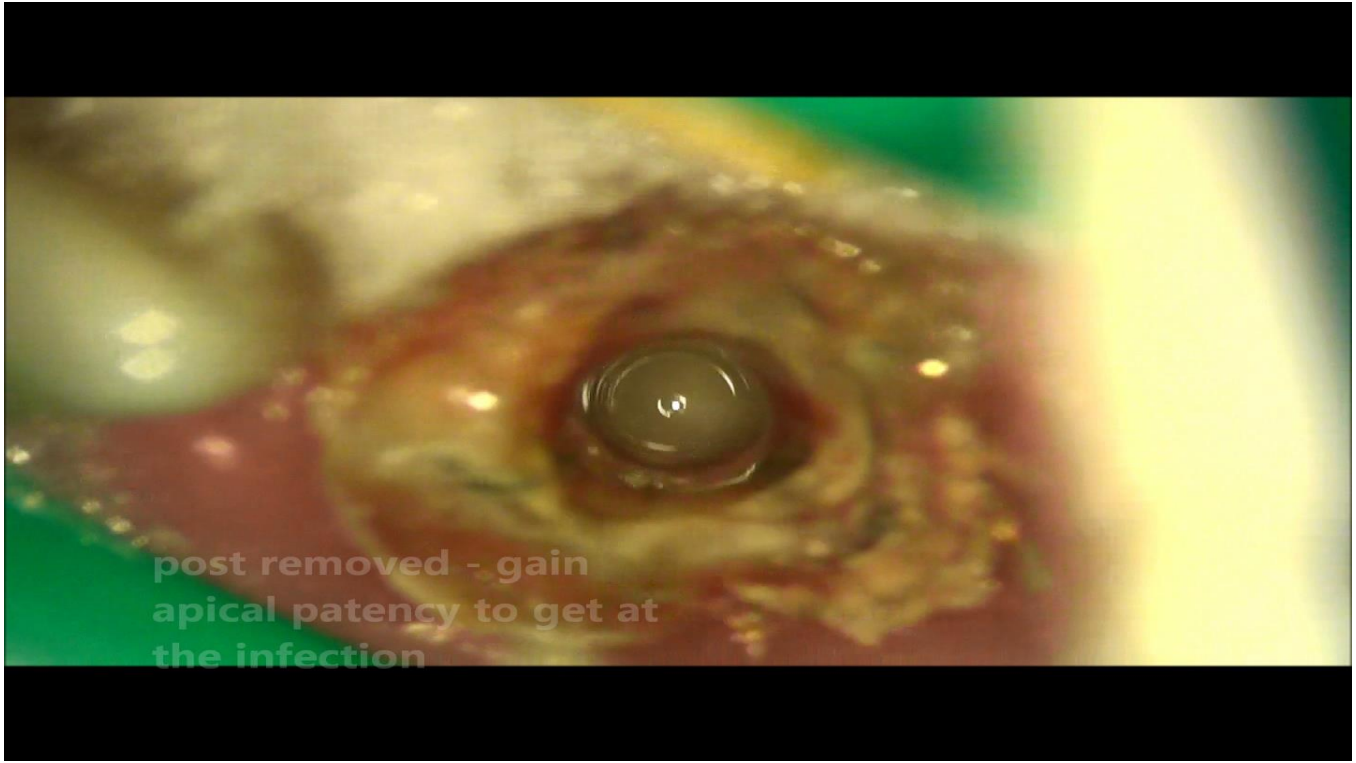
Is our Endo going to work?

Intra-operative:

- Achieving patency (Two-fold increase)
- Canal prepared short of terminus (12% lower for every 1mm short)
- Long root filling (62% lower odds of success)
- Using Chlorhexidine as irrigant (53% lower)
- Using EDTA (Re-RCTx) (Two-fold increase)
- Inter-appointment swelling/pain (47% lower)

Ng, Mann & Gulabivala; International Endodontic Journal, 2011

Early patency and drainage is very important with teeth with CAP



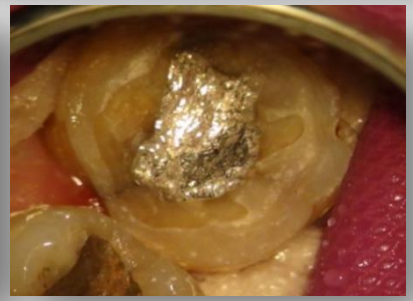
Is our Endo going to work?

Post-operative:

- Good coronal restoration (**Eleven-fold** increase in odds of success)

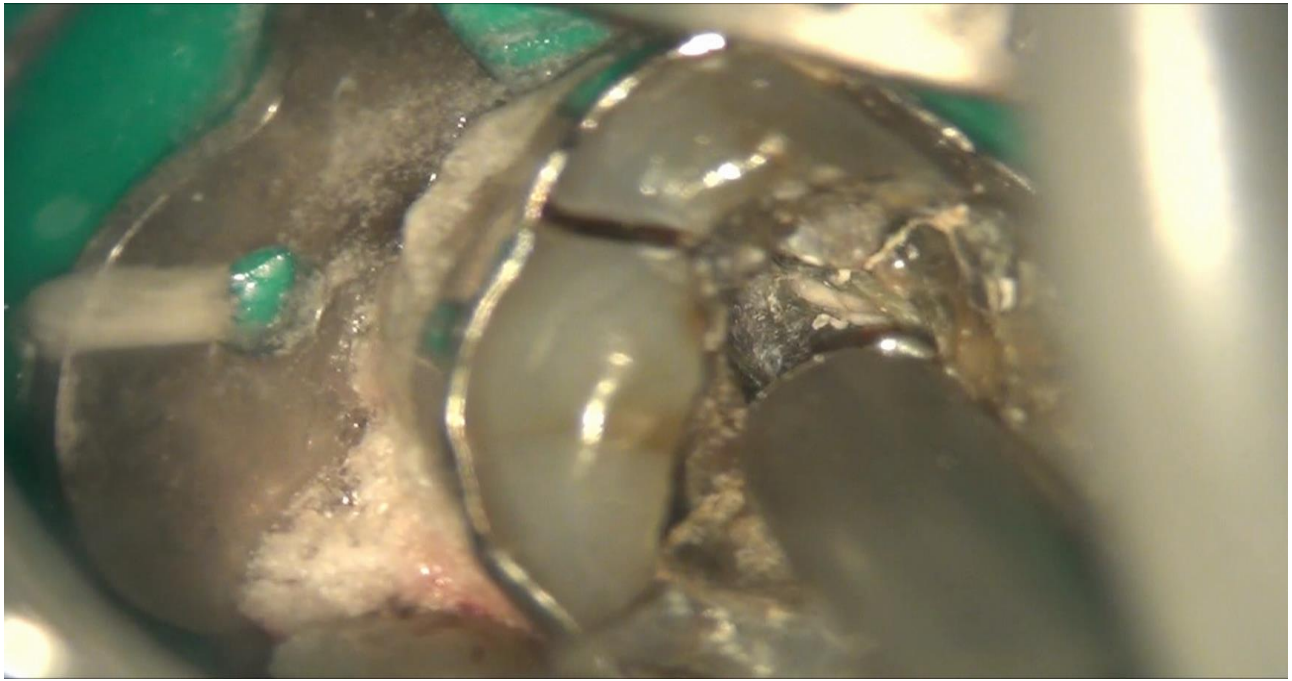
Ng, Mann & Gulabivala; International Endodontic Journal, 2011

We must protect the investment



Satisfactory Restoration

cracked tooth - coronal seal (post-Rx Rest Dent) – orthodontic band and amalgam core UR6 prior to casting



Endodontic Rx tooth survival

Survival at **eight to ten years was 87%**

They were able to place the influential factors in order of signifi

1. **A full coverage coronal restoration after root canal treatment**
2. **Tooth has both mesial and distal proximal contacts**
3. **Tooth not acting as abutment for either a removab fixed prosthesis**
4. **Tooth type, specifically non-molar teeth.**

Ng Y L, Mann V, Gulabivala K. Tooth survival following non-surgical root canal treatment systematic review of the literature. *Int Endod J* 2010; **43:** 171–189. Their findings are from 14 studies.

-tooth implants to 196 root-canal-treated

Although markedly **fewer (5.6%)** noteworthy and included root car

Endodontic Tooth Survival

After four years the cumulative tooth **survival rate was 95.4% for primary treatment and 95.3% for secondary treatment**.

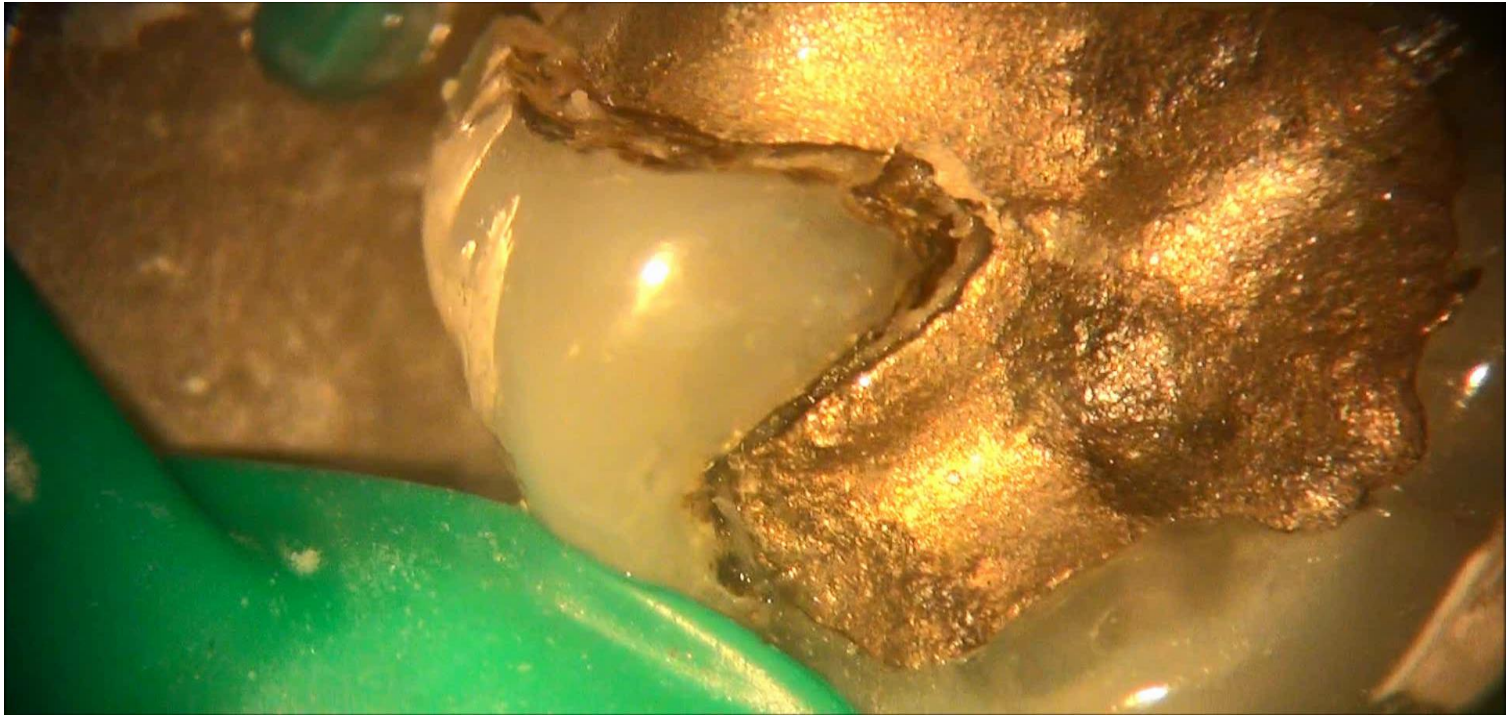
Post-operative factors relevant to survival of root filled teeth were:

- The presence of a cast restoration coronally (positive)
- Two proximal contacts (positive)
- Cast post and core (negative)
- Terminal tooth (negative)

Ng Y, Mann V, GulabivalaK. A prospective study of the factors affecting outcomes of non-surgical root canaltreatment: Part 2: Tooth survival. *Int Endod J* 2011; **44:** 610–625.

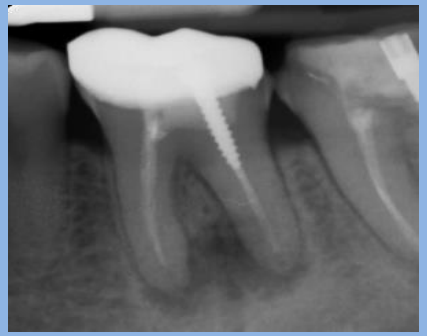
Post Endodontic Restoration and Cuspal Protection
Non-vital posterior teeth # unfavourably

Vital teeth fracture more favourably (supra-gingival) and thus are usually restorable



Survival rates in NHS

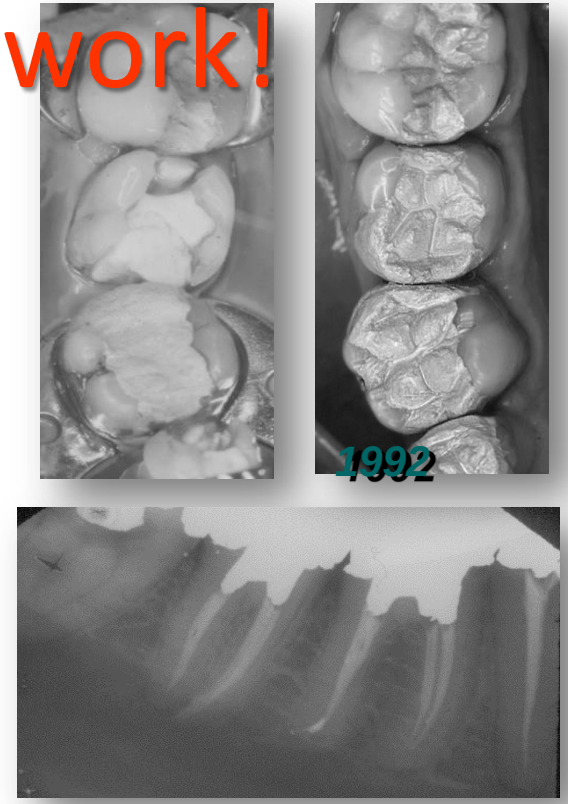
- Tooth still in mouth and asymptomatic
- RCT of 174 lower 6s
- 12 NHS practices
- Salford (NW England)
- 90% retained at 5 years
- Most failures in first year
- 10% failure: 15 extracted, 1 retreated
- Statistically significant difference if tooth crowned



Tickle et al, British Dental Journal (2008)

Protect your hard work!

- Reduce the risk of coronal leakage by cutting back GP - so the whole pulpal chamber can be filled.



Saunders & Saunders Coronal leakage as a cause of failure in root canal therapy: a review' Endod Dent Traumatol (1994)

Skills we need you to all display today

- **Think about preparation – with Rotary (Protaper) and Reciprocation (Reciproc)**
- **Break up into coronal / mid / apical (Hand / Protaper and Reciproc)**
- **Achieve apical patency / Apical gauging**
- **Irrigation – dynamic pumping / EDTA / Hypochorite**
- **Obturation – vertical warm and cold lateral condensation**

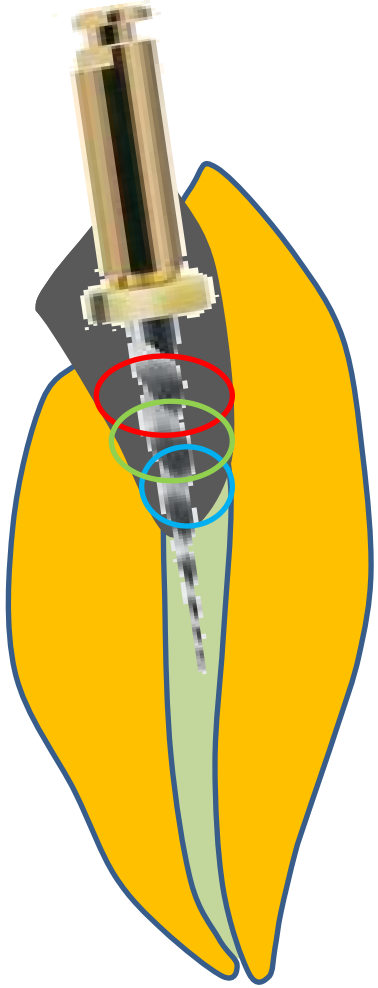
Lets get going with practical stuff please

Dental Simulation
(Rotary Preparation)

Practical Endodontics Thursday
24th July 2014

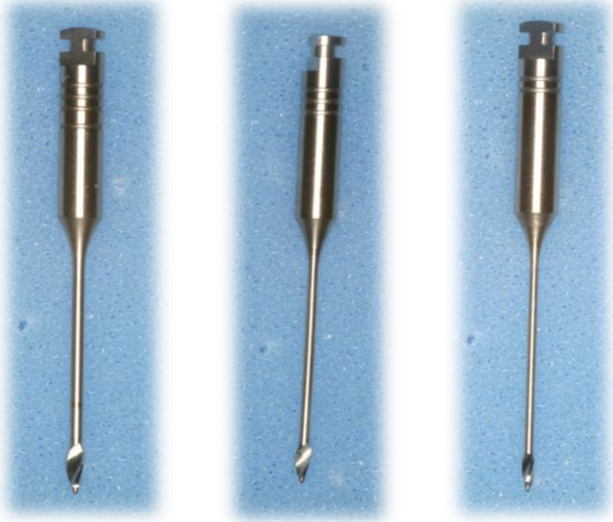
We are after a continuous tapered shape

allows early flow of sodium hypochlorite to apex and makes obturation more effective



Coronal Third

Choice for Orifice/lip shaping



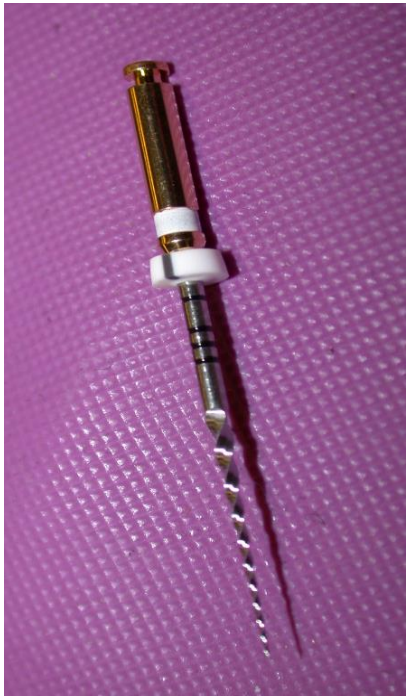
SX G4 G3 G2

Protaper Shapers:

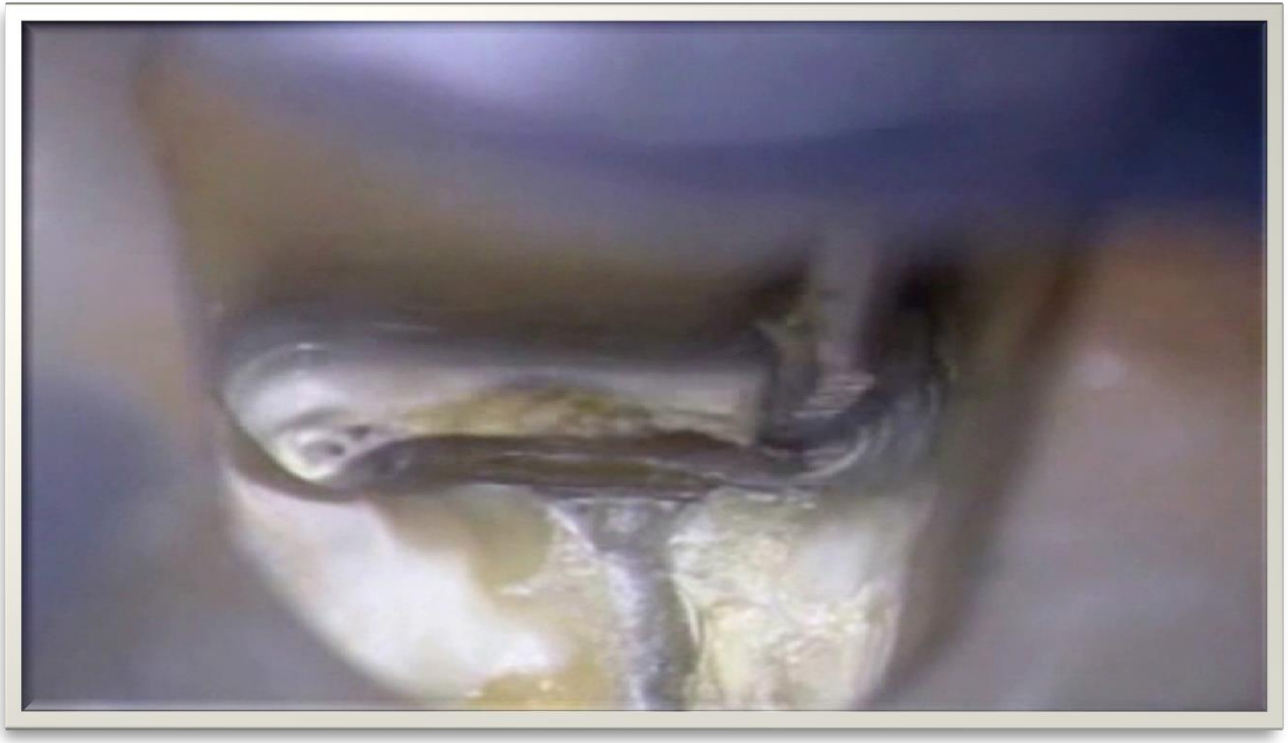
SX

S1

S2

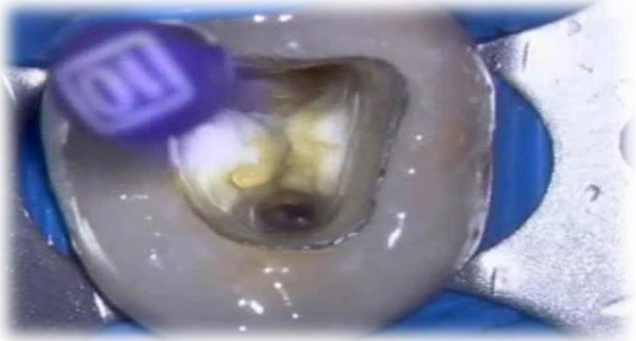


Gates Gliddens - brush on the upstroke



SX equivalent to GG 1-4 in One instrument

Correct access and radicular preparation will allow passive placement of scout file and the early taking of the W/L



Why do I use use ProTaper & ProFiles?

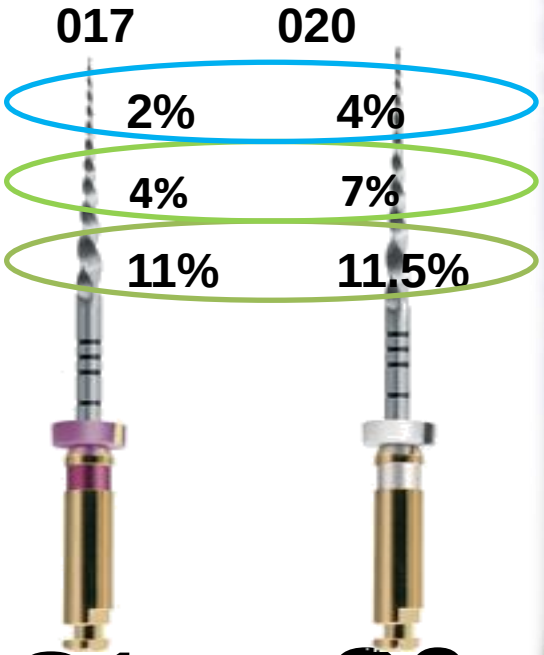
- Super elastic
- Efficient debris removal
- ‘Brushing action’ (ProTaper) allows straight line access to be established quickly
- Can use best of both systems
- **ProTaper** offers variable taper
- **ProTaper** alone can establish basic shape in a straight/minimally curved canal with 3 instruments
- **Protaper** excellent for coronal 2/3rds of canals
- **Profile** less aggressive and less tapered at apex – therefore more suitable for apical finishing
- **ProFile** offers continuous fixed taper and is less aggressive in the apical third than the **Protaper** finishing files

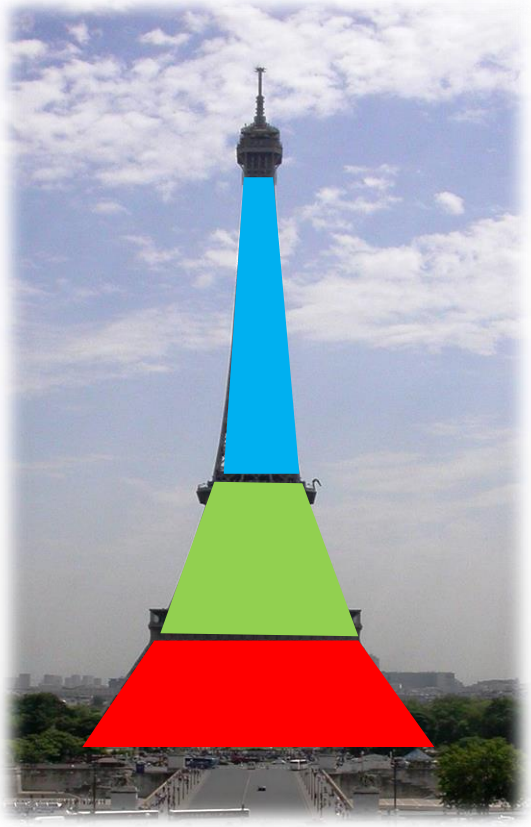
ProTaper Next – Improves the apical part of the system

- **L**ess aggressive and less tapered at apex
- **L**ess rigid finishing files than previously

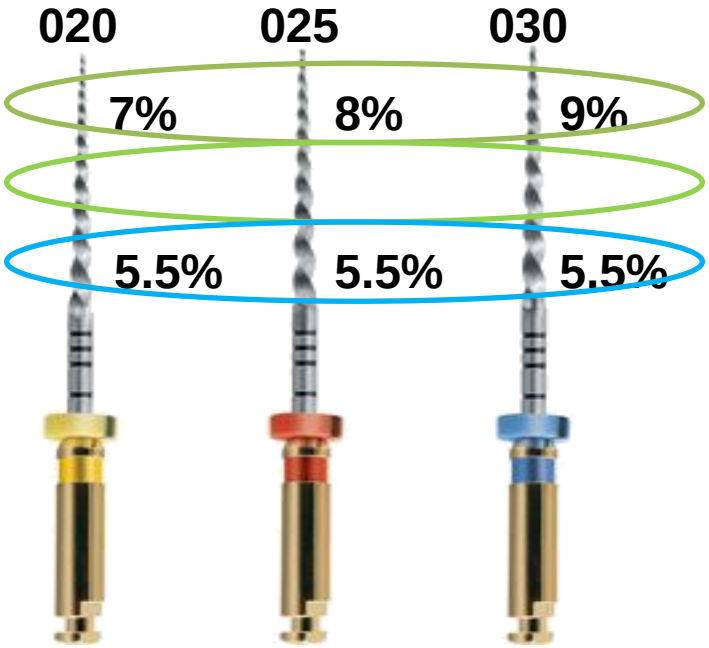
Coronal S1 & Mid Third S2

Canal shaping



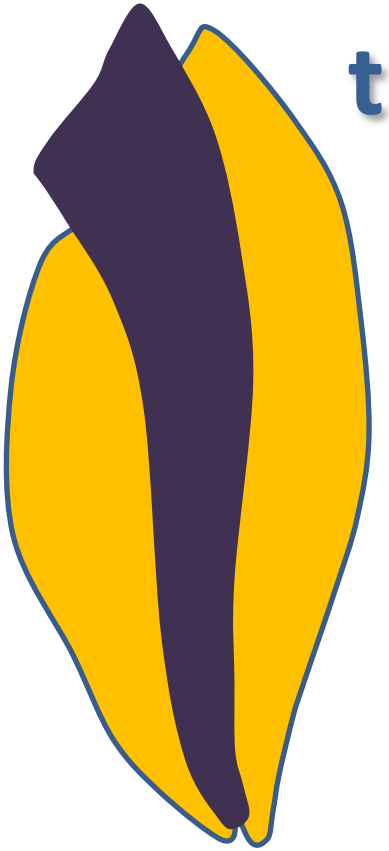


Apical third - Protaper options - Canal finishing – I am happy for you all to get F1 (red) to length and then stop



F1 F2 F3

Overall canal shape at this point (F1 to length)



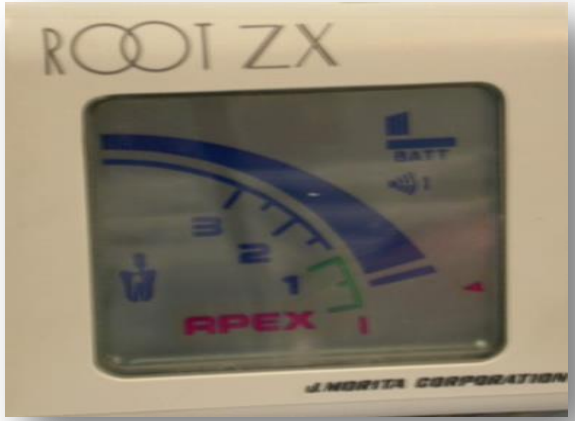
- Coronal flare
- Continuous taper
- No deviation/transportation from the original canal shape
- No ledging or zipping
- Apical stop 0.5-2mm from anatomical apex

Summary of ProTaper Preparation (for straightforward canals)

- Access / GGs / SX
- Ensure that a small scout #08/#10 **K files** can be passed to the apex of the canal(s) – WL estimation with EAL / or X-ray with at least a size #15 file in situ
- **Protaper** S1 (purple) or S2 (white) to full working length
- **Protaper** F1 (yellow) to full length
- Gauge apex with hand **K file**
- Use appropriate sized **ProTaper** F1, F2 or F3 depending on apical gauge
- Pre-cementation radiograph with verified Profit GP point(s) in situ
- Dynamic pumping – followed by Obturation

Apical Third of Canal

Gauging & Diagnostic radiographs in a digital age

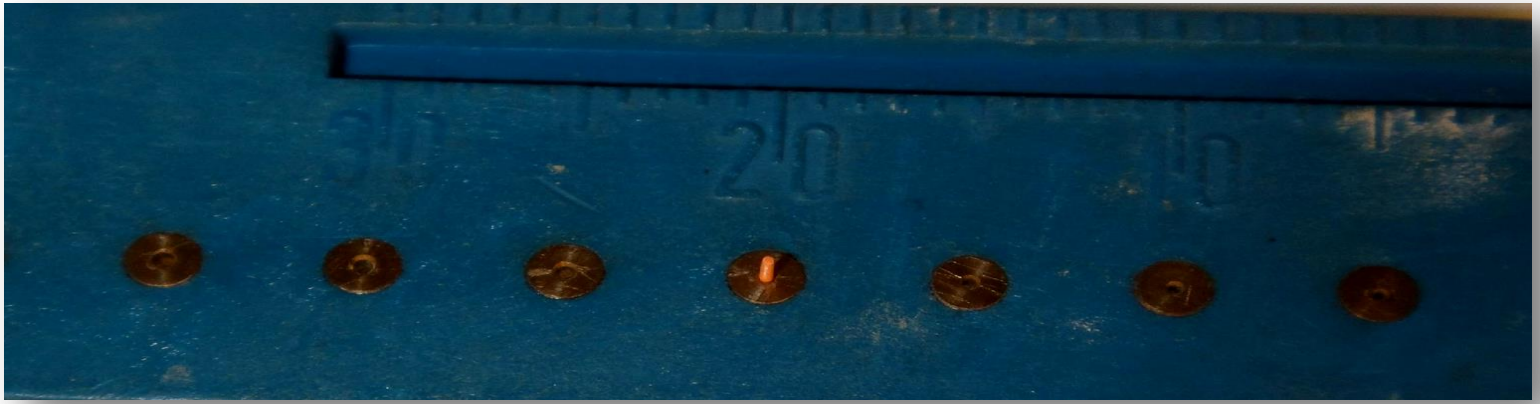


- Learn to use and trust an EAL – it's right as long you can get predictable Zero readings and it's not 'jumping / zipping'
- Prepare the root canals with tip of EAL placed on the hand piece as you work

Apical Third - Apex

- Apical gauging of your GP point with a Gutta Cutter or a plastic Maillefer ruler
- Check that #20 if F1; #25 if F2 or #30 if F3 binds solid at WL and doesn’t pass through the apex
- Check that higher sized hand files step back from apex

Verify apical size of master GP point with plastic Maillefer ruler to apical gauge - GP points vary massively – cut flush with scalpel blade then you have an apically ‘gauged’ master GP point that can be seated within the root canal – Gauge canal apex without other factors higher up the canal affecting ‘the seat’ of the file



Summary of Hybrid Preparation (for difficult canals)

- Access / GGs / SX
- Ensure that a small scout #08/#10 **K files** can be passed to the apex of the canal(s) – WL estimation with EAL / or X-ray with at least a size #15 file in situ
- **Protaper** S1 (purple) or S2 (white) to full working length
- **Protaper** F1 (yellow) to full length
- Gauge apex with hand **K file**
- Use appropriate sized double-striped **Profile** (06 taper) to apex
- Pre-cementation radiograph with verified GP point(s) in situ
- Dynamic pumping – followed by Obturation

Getting the best out of conventional Hand K filing

1. Thread the file down the root canal with a gentle clockwise rotation – no more than a ¼ turn
2. On apical resistance, keep apical pressure on and de-rotate the file as it moves coronally
3. Keep repeating the process until the file is loose at the required length.
4. Then move up a size

Reciprocation

Single file systems

- Reciprocation technology
- Single file systems
- A defined back and forth movement as oppose to continuous rotation
- Most popular systems are *Wave One (DENTSPLY) and Reciproc (VDW)*

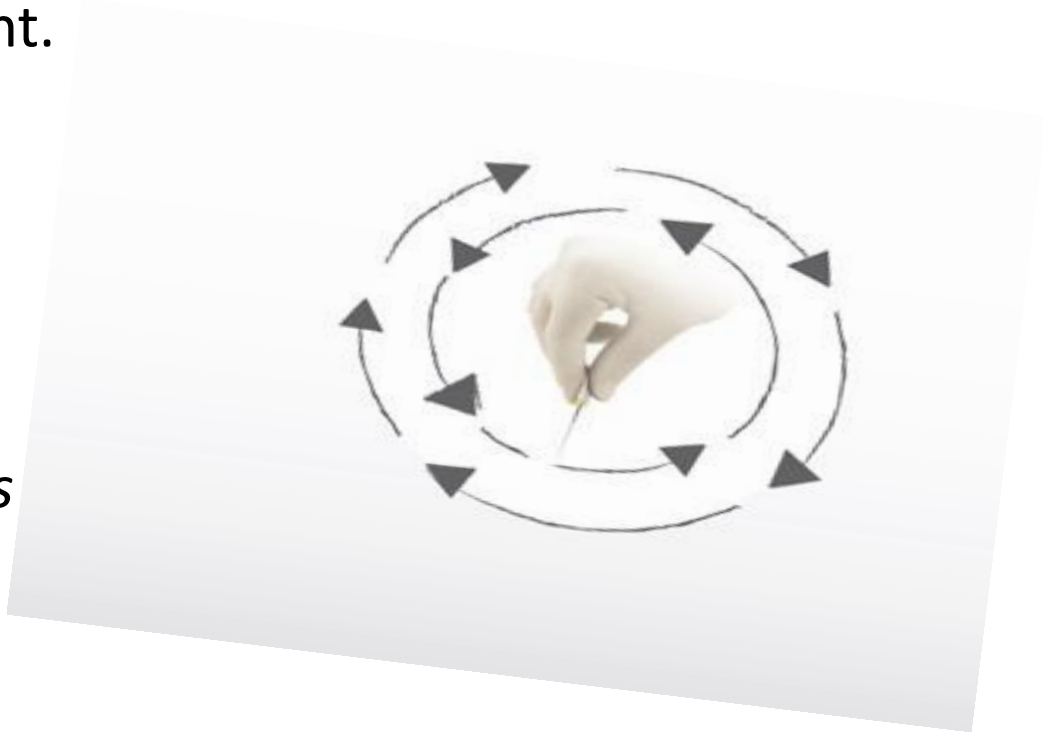
WaveOne

- 3 files
- 21/0.06 – smaller diameter, longer and more curved canals
- 25/0.08 – majority of root canal configurations regardless of length, diameter of shape
- 40/0.08 – larger diameter and straighter canals

Reciproc

- 3 files
- R25 ,25/0.08 – narrow canals, partially or completely invisible on radiograph
- R40, 40/0.06 – medium canals, completely visible on radiograph
- R50, 50/0/06 – wide canals

Reciprocation – a alternating back-and-forth movement.



CW and CCW movements determine amplitude of reciprocation

- Instrument is first driven in a cutting direction and then reverses to release the instrument.

- Several reciprocating movements complete one 360 degree rotation.

-The angle in the cutting direction is greater than the angle in the reverse direction.

-- Angles set in the motors

RECIPROC
Instrument Design

- Non-cutting tip
- M-Wire NiTi
- Thermal treatment process
- Regressive taper
- S-shaped cross section

m-wire®
nickel titanium

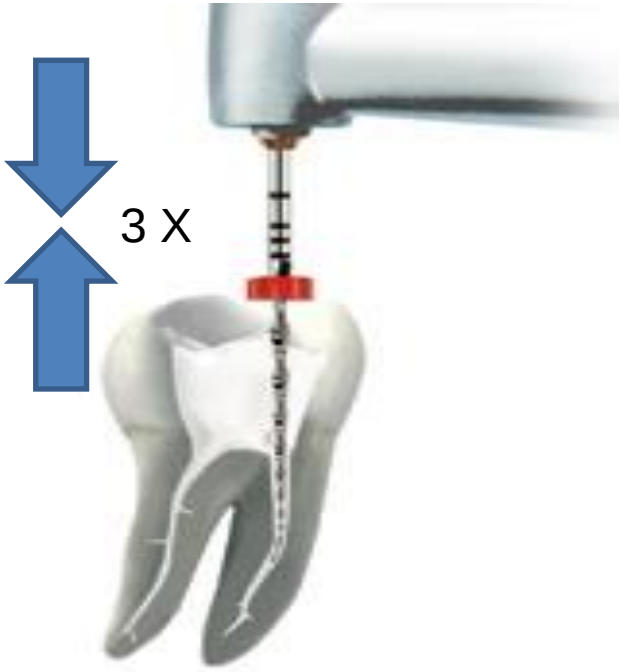
R25

R25 R40 R50

Reciproc Technique

- Access cavity/ straight-line access
- EWL from rad
- Irrigate access cavity
- Select instrument R25, R40 or R50

- Introduce instrument into orifice
- Press foot pedal when instrument at orifice



- Slow in-and-out pecks
- 3mm movements
- “3-pecks and out!”
- 1 in-and-movement = 1 peck

- Remove instrument and clean/ inspect

Reciproc Technique

- Re-irrigate

- Insert ISO size 10 C-PILOT file or K-file
- Make sure canal is free 3mm beyond prepared length / determine WL with AL
- Continue with Reciproc instrument until full WL is reached
- Withdraw instrument as soon as WL is reached

Glide path management

1. Initial hand filing to create a Glide Path

- Current teaching standard to prevent a rotary instrument from binding in the root canal

2. Without Glide Path

- Goes against current teaching standard
- CW and CCW angles set in the motor are lower than the angles at which these instruments fracture.
- When these files bind in the canal, it will not fracture because they will not rotate past its specific angle of fracture

Rotary Instrument Advantages / Disadvantages

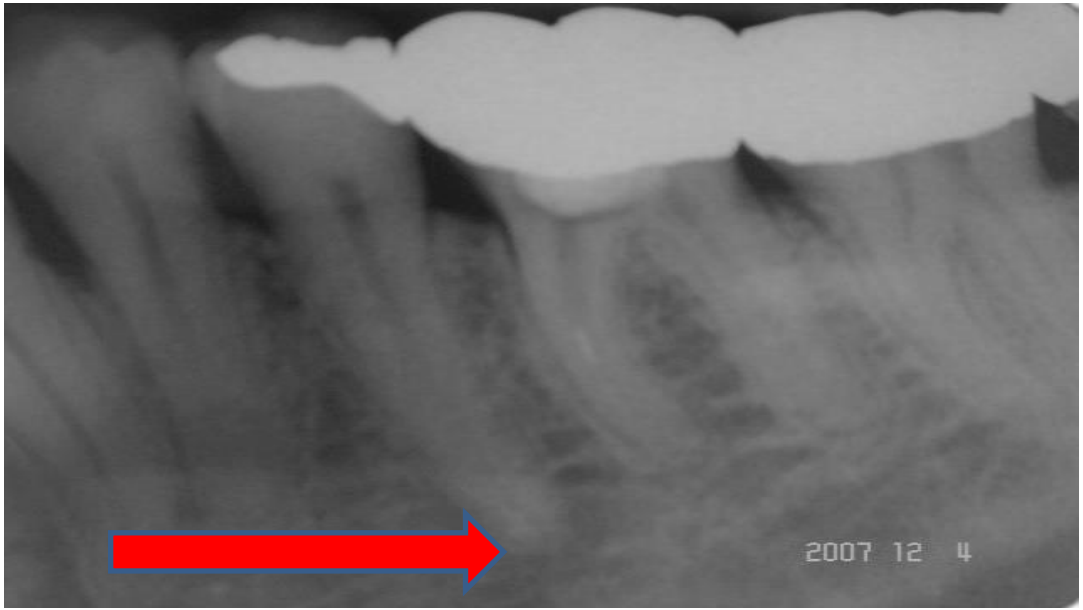
-Safety

-Shorter working time

-Instruments cantering ability

-Greater taper shapes for effective disinfection

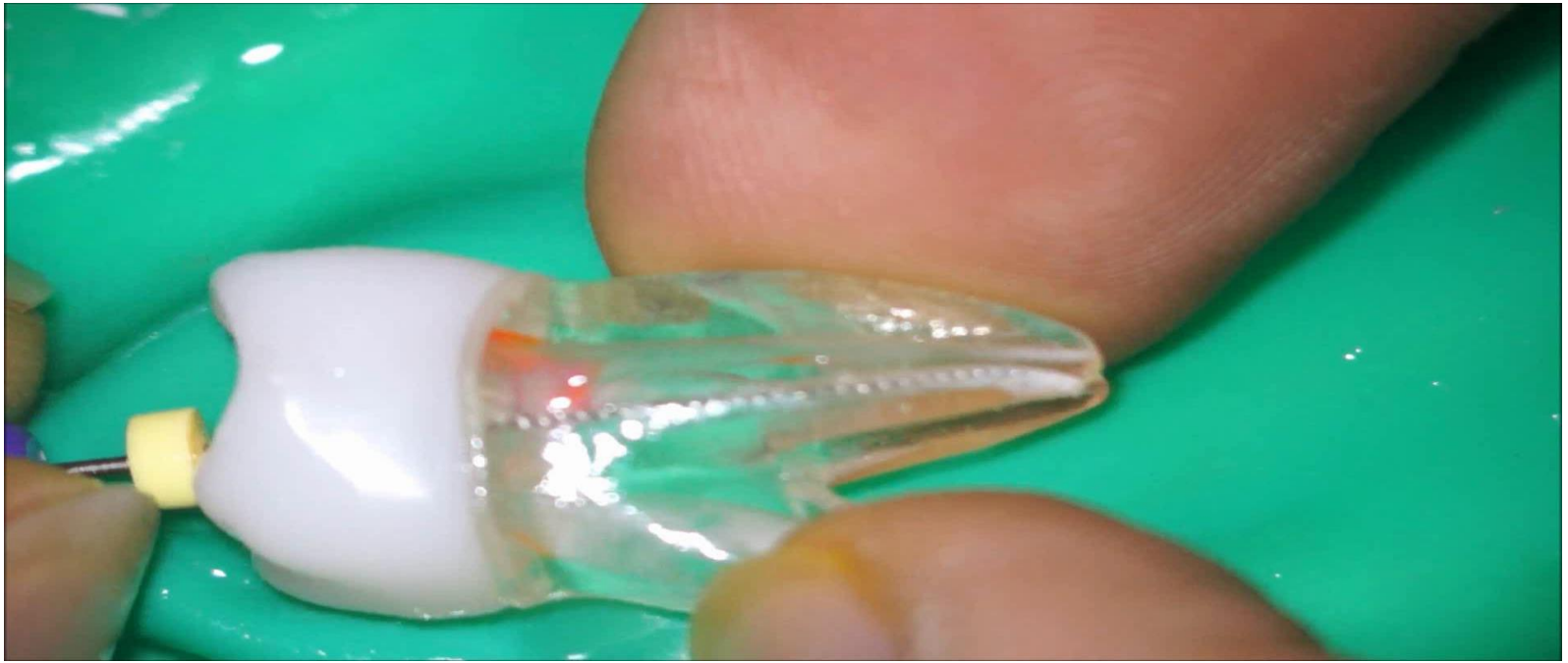
-Less number of instruments required



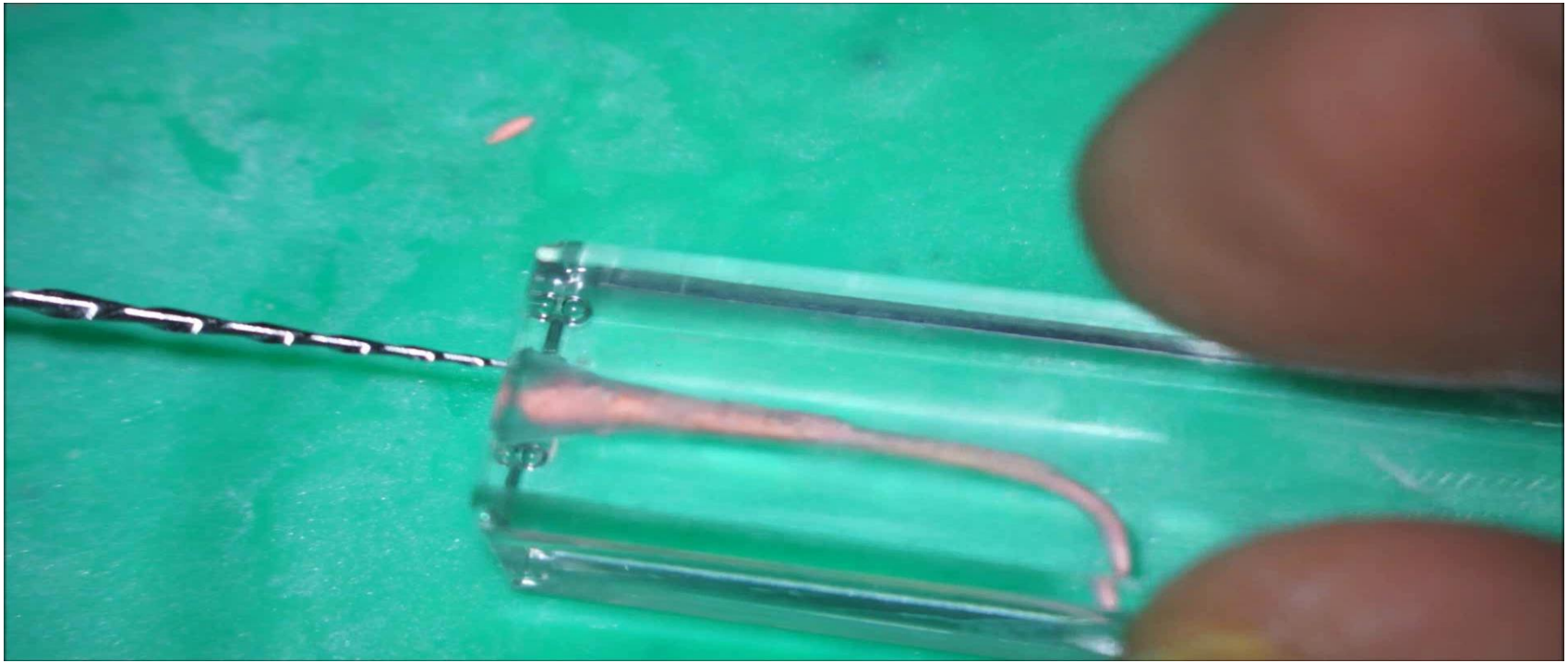
Endodontics has got easier and much quicker (reciprocation and MB2)

Endodontics has got easier and much quicker (reciprocation and MB2)

This gives much more time to get the irrigation right – we need it at the apex



Re-treatment has just got quicker too



Endodontic Warm Vertical Obturation

Peter F. A. Briggs

Consultant in Restorative Dentistry

St George's Hospital

5th March 2014

Endodontic Warm Vertical Obturation

(two components: apical down-pack followed by warm backfill – goal is a the creation of a ‘void less’ root-filling ending within 2mm of radiographic apex (Ng et al 2008))

Use the correct GP points for the correct system you are using

Obturation Unit

Ensure that your tapered GP points fit well within the root canals and have been apically gauged – the process can only work predictably if you have

Apical Obturation

- Confirm that heating tip and a Buchanan plugger can reach to within 5mm of WL
- Mark this length (WL minus 5mm) with a silicone stopper
- Coat the master cone apically with a thin layer of sealer and insert to WL
- Set heating tip to 200^0C to burn off excess GP from orifice

Select a correct ‘sized’ and ‘tapered’ GP point
Work out which plugger can get down to within 4mm from apex

Apical obturation

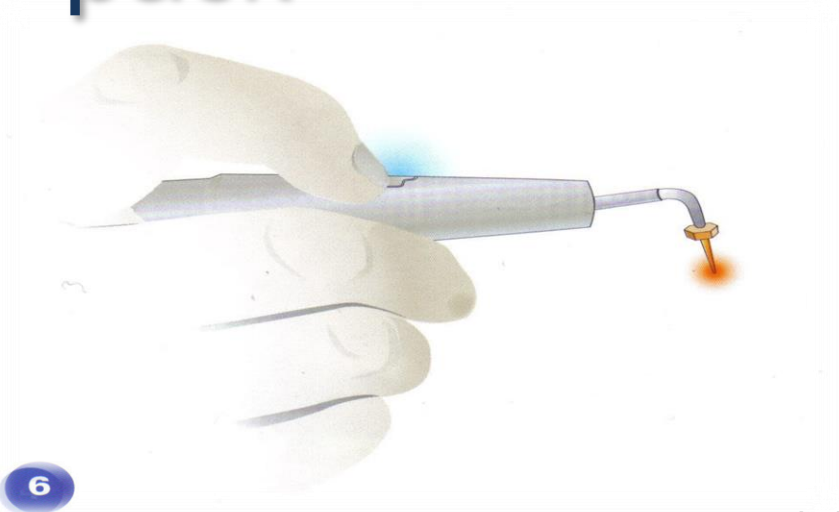
- Activate heating tip to release plugger shearing off the apical portion
- Vertically condense the GP with cold Buchanan plugger to pack the apical portion
- A radiograph can be taken to check

The Vertical Heated Down-pack and warm back-fill

- Activate heating tip to release plugger shearing off the apical portion
- Vertically condense the GP with cold Buchanan plugger to pack the apical portion
- A radiograph can be taken to check density

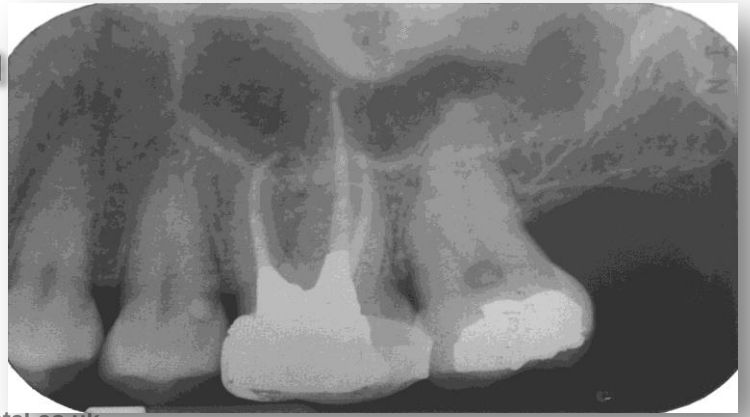


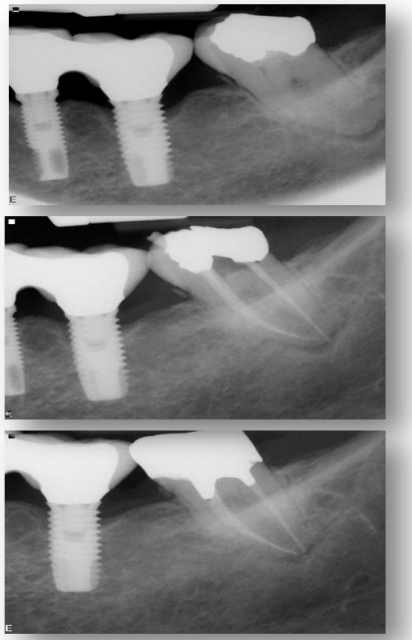
The Vertical Heated Down-pack



Coronal backfill obturation

- Set the GP backfill extruder to 200^{0}C.
- Insert the needle to length, hold for 3 seconds and then express molten GP into the canal in increments of 3mm.
- Condense the GP with the cold Buchanan pluggers
- rt of ca





Coronal backfill obturation

- Set the GP extruder to 200^0C.
- Insert the needle to length, hold for 3 seconds and then express molten GP into the canal in increments of 3mm.
- Condense the GP with the cold Buchanan pluggers
- Repeat until 3mm short of canal orifice

Problem with the plastic blocks and teeth

- They melt
- Use lots of glide
- Accept you will melt the blocks
- Accept that you will leave GP core behind- we will show you how to retrieve / remove it

Now please go and do it