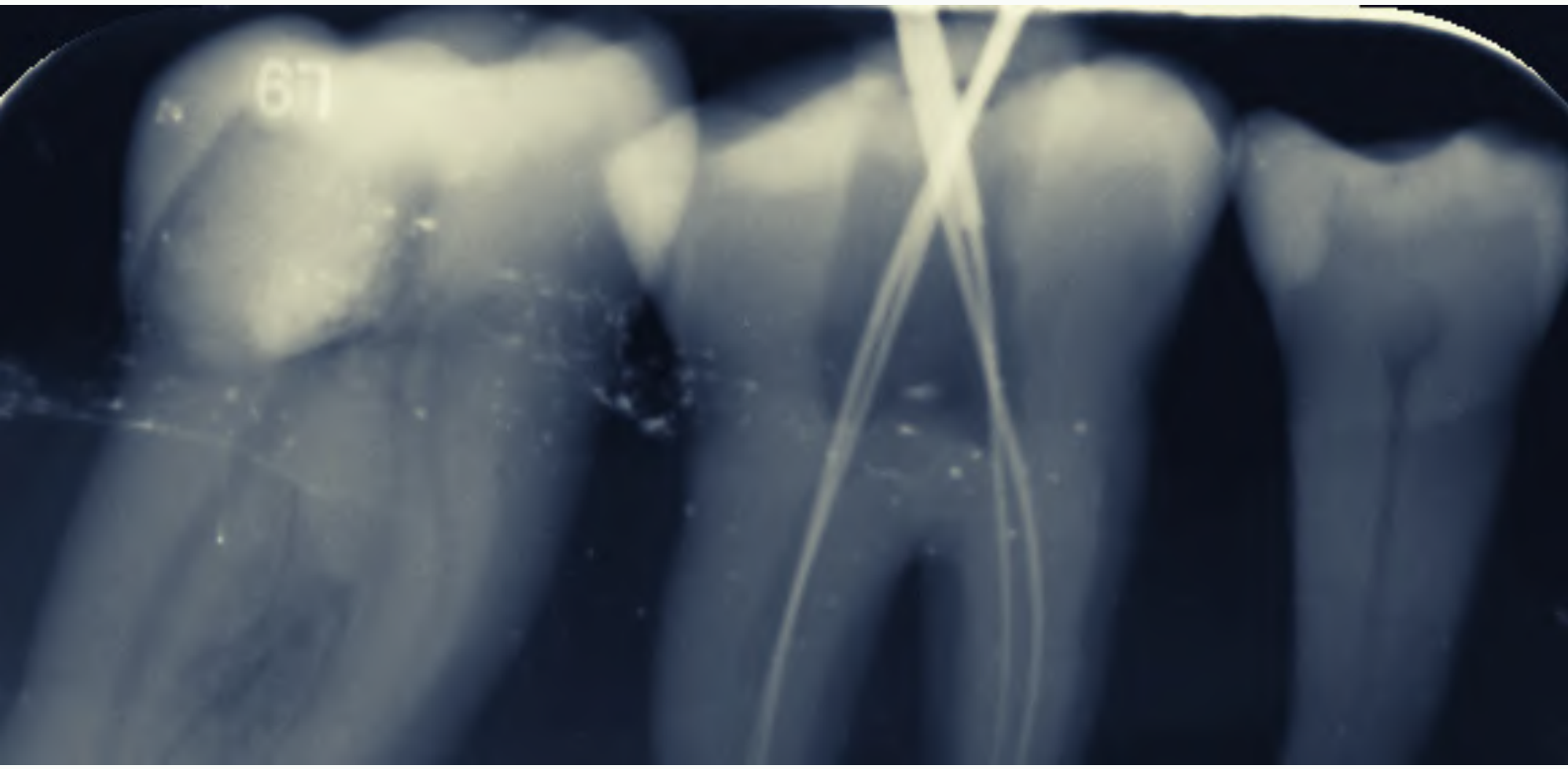
THE AUDSS ARTICULATING PAPER:
THE ENDO FILES



A Word From the Editor

BY YANNII POUFERIS

In the March edition of the Articulating Paper we focus on one of the topics which I always found to be one of the more daunting ones as I was going through 3rd and 4th year. Endodontics is an information dense topic that can seem a little overwhelming at first, but one day, eventually, you too will experience the “zen” that comes from filing 4 canals on an upper 6. Let this guide (and printable running sheet) set you on the path to endodontic enlightenment – get a handle on the basics of endodontic diagnosis, case selection and treatment Full disclaimer, this is in no way meant to replace your lectures and I strongly advise that you read and/or watch all your lecture content! Honestly though, that disclaimer is only for the one student that will attempt to do that. You know who you are.

In this issue we also have A 'Real' Guide to Endodontics by Tarek Abasseri – which is in no way meant to be taken seriously. I didn’t think it was possible to pack so much misinformation into a single hilarious article, but again Tarek shows that if you put your mind to it, no goal is unattainable. We also have The Basics of Learning by Haran Ragupathy, which I strongly recommend you read. Though the section on procrastination was particularly difficult to get through, and didn’t stop the Netflix binge moments later, it is absolutely essential that you be guilted into action in the lead up to exams.

Best of luck!

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PUBLICATIONS TEAM

Editor Yannii Pouferis

Content Writer Tarek Abasseri

Content Writer Haran Ragupathy

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Need to Know! The Endodontic Lexicon

Normal Pulp
Pulp response to sensibility testing is in line with adjacent and contralateral teeth (Usually 1-2 seconds) (Must account for large restorative Tx & age of the patient).

Reversible Pulpitis
Discomfort when exposed to stimuli (cold, sweet), but pain is non-spontaneous, non-lingering and can most likely be managed by simple restorative Tx. At this stage there are no significant radiographic changes apically. Must rule out dentinal hypersensitivity when making this diagnosis.

Symptomatic Irreversible Pulpitis
Sharp, lingering pain when exposed to stimuli (cold, hot). The patient may also experience spontaneous pain and/or referred pain. May be associated with deep caries, deep restorations or fractures.

Asymptomatic Irreversible Pulpitis
May respond normally to pulp testing, but likely requires endodontic treatment due to deep caries or trauma.

Pulp Necrosis
Pulp is dead and therefore non-responsive to stimuli / testing. Must discount lack of response due to canal calcification, trauma, age etc. prior to making this diagnosis.

Partial Pulp Necrosis -
Presence of both inflamed and necrotic pulpal tissue. More difficult to diagnose - the patient may experience a continuous dull ache, mixed results with sensibility testing, may or may not have tenderness to percussion or palpation, may or may not have an associated apical radiolucency.

Normal Apical Tissues
No sensitivity to percussion or palpation. Radiographically the lamina dura appears intact, with a uniform PDL space.

Symptomatic Apical Periodontitis
Inflammation of the apical periodontium which may present as pain to percussion, palpation or biting. There may or may not be an apical radiolucency present depending on the progression of the disease.

Asymptomatic Apical Periodontitis
Inflammation of the apical periodontium which may appear as an apical radiolucency. Does not present with traditional symptoms such as pain to percussion, palpation or biting.

Chronic Apical Abscess
Inflammation of the apical periodontium resulting from pulpal infection and necrosis. Presents as an intermittent purulent discharge through an associated sinus tract, which can be traced to its source using a gutta percha cone & radiograph. Abscess is usually associated with radiographic changes (periapical radiolucency).

Acute Apical Abscess
Inflammation of the apical periodontium resulting from pulpal infection and necrosis. Presents as spontaneous pain (rapid onset), extreme tenderness to pressure, purulent discharge & soft tissue swelling. There may not be radiographic signs of the abscess. Patients may also present with malaise, fever & lymphadenopathy.

Condensing Osteitis
Radiopaque lesion at the apex of a tooth, due to a low-grade inflammatory reaction.

Previously Treated / Previously Initiated Therapy
Self explanatory. Pulp will not respond with the former category, may respond in the latter if only partially treated (pulpotomy).

Endodontic Diagnosis

Before you start thinking about endodontic treatment you need to be able to identify the cause of the patient's pain, and in the case of pain of odontogenic origin, diagnose both the pulpal and periapical tissues of the tooth. Additionally, you must also factor in the indications for and against endodontic treatment in this specific circumstance, but that will be discussed in case selection!

Chief Concern:

- For how long has the patient been experiencing symptoms?
- What are the symptoms?
  - Duration?
  - Location?
  - Onset?
  - Stimuli?
  - Are they taking pain relief?
- Do not assume the pain is of odontogenic origin! And don't take the patients word for it! Patients can be unreliable in their descriptions of pain, always corroborate patient **symptoms** with clinical **signs**.

MHx / DHx:

- Are there any medications or conditions that contraindicate extraction?
  - Poorly controlled diabetes
  - Radio/chemotherapy
  - Bisphosphonates
  - Blood thinning medication or conditions
- Could the symptoms be related to other conditions?
  - Maxillary sinusitis
  - Fibromyalgia
  - Chronic pain syndromes

Extraoral Exam:

- Facial symmetry (may help identify extra-oral swelling)
- Soft tissues (palpate & check for swelling)

Intraoral Exam:

- Visual assessment:
  - Caries?
  - Restorations (defective? newly placed?)
- Pulp Testing:
  - Cold test – Stimulates A-delta fibres & determines whether the nerve of the tooth is healthy or at the stage of reversible or irreversible pulpitis
  - Difficult to get results for older patients w/ sclerosed teeth in addition to crowned teeth
  - Electric pulp test – Also stimulates A-delta fibres
- Periapical Testing:
  - Percussion – assists in identifying periapical signs of infection.
  - Palpation – Helps identify periapical swellings.
  - Biting (tooth sloth / frac finder) – apply to individual cusps to identify fractures (patient will experience pain on release, not initial bite).
  - Presence / absence of a sinus tract – if present, trace tract w/ GP point under LA to identify source.
- Perio Testing:
  - Perio probing – can help determine if there is a crack (isolated deep pocket).
  - Mobility – is the tooth perio compromised?

Radiographs:

- Periapical radiographs are a must for endo.
- Check for apical radiolucencies suggestive of symptomatic apical periodontitis.
- Check for J shaped radiolucency suggestive of a vertical root fracture, which is usually associated with an isolated, deep periodontal pocket.

Others - to be used if signs & symptoms cannot be localised to a specific tooth

- Transillumination – identifies cracks and/or fractures.
- LA test – if correct tooth is anaesthetised, you may see elimination of primary pain and referred pain to other sites.
- Removal of restorations & test cavity – Absolute last resort! Done without LA into dentine, if the pulp is still vital you will definitely know about it…

NOTE: Pulpal pain never crosses the midline!

The Fundamentals of Case Selection

This is one of the most important things to consider before starting endodontic Tx for a patient. It's all well and good in sim clinic to carry on with endo on an absolutely hopeless tooth, but in the real world you need to be very cautious with what you choose to take on clinically. You need to ask yourself the following questions:

1. **Is RCT indicated in this scenario? Would extraction be more appropriate?**
2. **Is RCT feasible? What is the likelihood of success?**
3. **Is it within my scope?**

Use of the AAE Case Difficulty Form is strongly recommended in order to determine where on the spectrum of difficulty your case may be. For those starting out, stick to easier RCTs – straight canals from 5-5. Leave the molars for later in 4th year or during 5th year, and get as much use out of those sim clinic sessions in the meantime.

Indications for RCT

1. Irreversible pulpitis
2. Necrotic pulp
3. Symptomatic apical periodontitis
4. Asymptomatic apical periodontitis
5. Symptomatic apical abscess
6. Asymptomatic apical abscess
7. Resorption

Patient Considerations

- Is the patient compliant and able to proceed with treatment financially?
- Is there severe pain or swelling? May be more appropriate for the patient to go the hospital, *particularly* if they present with Ludwig's Angina.
- Are there any medical factors that complicate diagnosis or make extraction the preferred choice of treatment?
- Bisphosphonates – can induce MRONJ if appropriate precautions are not taken.
- Radiotherapy – Can induce osteoradionecrosis if appropriate precautions are not taken.
- Uncontrolled diabetes can result in abscesses that are not of dental origin.
- Sickle cell anemia can cause bone pain similar to that of odontogenic pain, in addition to bone loss which may be mistaken for periapical radiolucencies.
- Odontogenic pain can also be mimicked by trigeminal neuralgia, multiple sclerosis, referred pain from cardiac angina & acute sinusitis.

Tooth Factors

- Tooth structure remaining – is it restorable? Can it be isolated appropriately? If not the pt may be more suitable for an extraction.
- Periodontal status – if the tooth is periodontally compromised, again the tooth may be more suitable for extraction.
- Canals – instrumentation is going to be a nightmare if they are sclerosed or have unusual / difficult morphology.
- Has there been a history of trauma? This will likely change treatment and recall.
- What is the tooth's strategic value? Is it the abutment tooth of a denture or bridge?

The EPI tool

While the AAE Case Difficulty Form will help determine what is within your scope to treat, the EPI tool (which can be accessed through the SADS intranet) will assess whether the tooth can be treated through the public system. A good rule of thumb is that 7s and 8s are not treated through SADS unless they are of strategic importance (denture abutment tooth). 1s to 6s are fair game provided the tooth is restorable and within your scope to treat.

Success & Consent

SUCCESS OF ENDODONTIC TX OVERALL APPROX. 61%

APICAL RADIOLUCENCY*

- NOT PRESENT 89-96%
- PRESENT 68-86%

CULTURE**

- GRAM NEGATIVE 89-94%
- GRAM POSITIVE 68-83%

RE-TREATMENT VS SURGERY***

RE-TREATMENT
- LONG TERM SUCCESS 83%
- INITIAL SUCCESS 70.9%

SURGERY
- INITIAL SUCCESS 77.8%
- LONG TERM SUCCESS 71.8%

SJOGREN ET AL 1990

- Vital pulp - 96% Success
- Re-treatment due to technical inadequacy - 98% success
- Pulp necrosis & PA lesion - 86% success
- Previously root filled, PA lesion - 62% success

GORNI AND GAGLIANI 2004

- Overall success - 69%
- Root canal morphology respected - 86.8% success
- Root canal morphology altered - 69% success

CONSENT

One of the most important – prior to commencing endodontic Tx. The last thing you want is for one of your patients to complain about a lack of communication regarding time, cost or treatment outcomes. Lower your patient's expectations, discuss and document everything.

1. Discuss the Options:

- Do nothing.
- Extraction +/- prosthodontic replacement of teeth.
- Endodontic Tx +/- fixed pros.

2. Discuss the Tx Process (multiple long appointments):

- Appointment 1: Remove the decay and open up the tooth, remove the nerve, locate and clean the canals, place medication in the canals & a temporary filling in the tooth.
- Appointment 2: Instrument further if required, place medication in the canals & a temporary filling in the tooth.
- Appointment 3: Place a filling material in the roots and a permanent restoration on the tooth.

3. Discuss the Cost:

- Plan out your sessions on titanium so that you know ahead of time what is being done in that session & the estimated cost.
- Be sure to include the cost of the extirpation, instrumentation, PA radiographs, obturation & final restoration (including any fixed prosthodontics).

4. Discuss the Risks:

- Post-op tenderness.
- Failure of instrumentation or obturation including but not limited to:
  - Broken file/s, perforation, ledging, zipping, transportation, etc.
- Reinfection.

* (Strindberg 1956, Seltzer et al 1963, Kerekes & Tronstad 1979, Sjogren et al 1990)
** (Engstrom et al 1964, Zeldkow & Ingle 1963, Oliet & Sorin 1969, Sjogren et al 1997)
*** (Torabinejad et al 2009)

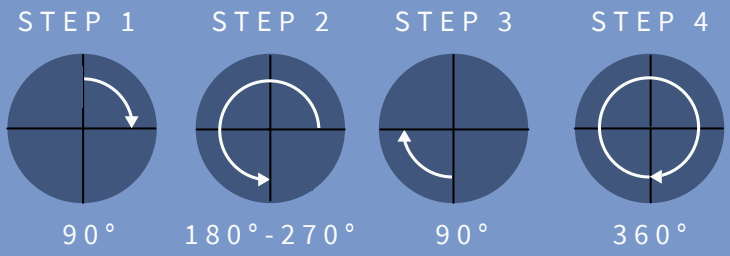
The Instruments & the Irrigants

Hand Filing Instruments:

- K files – Your mainstay. Stainless steel blanks with a square or triangular cross-section.
  - Increases by 0.02mm every mm from the tip.
  - Comes in 21mm, 25mm, 28mm & 31mm.
- H Files – Stainless steel blanks with a round cross-section. More flexible, with increased cutting efficiency, but more likely to fracture.
- Barb Broach – removes pulp tissue.

K files are used with the balance forces / watch winding technique:

1. Insertion of file without pressure, then rotate 90° clockwise with light apical pressure.
2. Maintaining constant pressure so as to keep the file at the same depth, rotate anticlockwise 180°-270°.
3. Repeat steps 1 & 2, which will insert the file apically.
4. After 2-3 repeats, remove the file from the canal, clean the flutes and irrigate the canal.



Sodium Hypochlorite (0.5-6%)

- Antimicrobial, kills on contact by irreversibly inactivating bacterial enzymes.
- Oxidises, hydrolyses and osmotically draws out fluids from tissues.
- Dissolves & removes the organic components of the smear layer (vital & non vital pulpal tissue).
- Can cause significant harm (severe pain & swelling) if introduced beyond the apex of the tooth - always evaluate the tooth for immatre apices, root resorption, perforations.

EDTA (17% disodium salt, pH7)

- Chelating agent that assists in removal of the inorganic components of dentine.
- Exposes dentinal tubules, softens dentine & increases dentine permeability.
- Increases the effectiveness of medicament & cement adhesion.

Irrigation Technique:

- Bend needle tip at 45-90 degrees and measure.
- Loosely insert the needle into the canal.
- Minimal pressure to deliver the irrigant.
- Irrigate copiously with suction:
  - During access
  - During/after ·initial canal exploration
  - After each file
  - During final flush
- Dry with paper points.

Instrumentation & Irrigation

INSTRUMENTATION

The Goals of Instrumentation:

- Remove all of the vital and necrotic tissue from the root canal.
- Create sufficient space for irrigation and placement of medicament.
- Preserve apical root canal anatomy.
- Create convenience form to facilitate obturation.
- Additionally, to avoid iatrogenic damage, prevent irritation / reinfection of periradicular tissues & preserve root dentine.

IRRIGATION

The Goals of Irrigation:

- Remove bacteria from the canal.
- Remove organic & inorganic debris from the canal.
- Improve filing efficiency.
- Lubrication of the canal.
- Non-irritant to healthy tissue.

THE PROCESS

1 Find the Apex:

- First estimate the working length using the radiograph-measuring tool, so that you have a rough idea of the file length needed to reach the radiographic apex.
- After removal of the pulp with a barb broach, negotiate a size 10 file to the apex using the balance forces / watch winding technique.
- Use of an apex locator is recommended for identifying the apex, but with practice you should be able to identify the feeling of apical constriction.
- The goal at this stage is to identify the location of the apical constriction (which marks the point which you will prepare to) which is spproximately 0.5mm from the apex of the tooth.
- Note: the true apex of the tooth may be 0-3mm from the radiographic apex of the tooth.

2 Crown Down:

- Improves access to canals & minimises the risk of apical blockage due to infected dentine in the coronal portion of the canal. Also reduces the risk of file fracture.
- Use a size 2 and 3 gates glidden burs (away from the furcation in molars) in a brushing motion.
- Don't force the burs down the canals and irrigate extensively.
- At this point I take a radiograph to confirm working length.

3 Apical Preparation

- Using the watch winding technique, enlarge the canal to the master apical file (MAF).
  - Ensure files are pre-bent prior to insertion & irrigate after each file.
  - Ensure file is relatively loose in canal prior to increasing the size & check patency regularly.
  - MAF is the file size 3x larger than the first file to bind apically in the canal.

4 Step back

- Results in a coronal taper which allows for easier irrigation and obturation.
- Step back involves increasing the file size being used & decreasing the length of instrumentation by 1mm - Step back 2-3 file sizes.

The Medicaments

CACLIUM HYDROXIDE

Mechanism of action:
- pH 12.2 – release of OH-

Pros:
- Bactericidal
- Localised cell necrosis
- Activates alkaline phosphatase
- Promotes periapical healing
- Dissolves necrotic tissue
- Inactivates endotoxins (e.g. LPS)
- Does not cause discolouration

Cons:
- Some microorganisms have shown resistance to CaOH (most prominently E. faecalis)

Indication for use:
- Gold standard
- RCT in cases where pt is not experiencing pain

ODONTOPASTE

Mechanism of action:
- Contains Clindamycin Hydrochloride AB (5%) + triamcinolone acetonide (1%) corticosteroid + calcium hydroxide (1-2%)

Pros:
- Greater post-op pain relief than just calcium hydroxide
- Does not cause discolouration

Cons:
- E. faecalis is resistant to Odontopaste

Indications for use:
- Luxation injury
- ROP

LEDERMIX

Mechanism of action:
- Contains tetracycline AB – democlocycline (3.2%) + triamcinolone acetonide (1%) corticosteroid + polyethylene glycol base

Pros:
- Bacteriostatic
- Greater post op pain relief than caclium hydroxide
- Better results than calcium hydroxide in avulsed teeth

Cons:
- AB ineffective againsts yeasts & limited effectiveness against endo pathogens
- AB conc. not high enough to inactivate bacteria
- AB related grey/brown discolouration – worse for immature teeth

Indication for use:
- ROP

CHLORHEXIDINE

Mechanism of action:
- Binds to (negatively charged sites) & disrupts the bacterial cell walls and cellular membranes

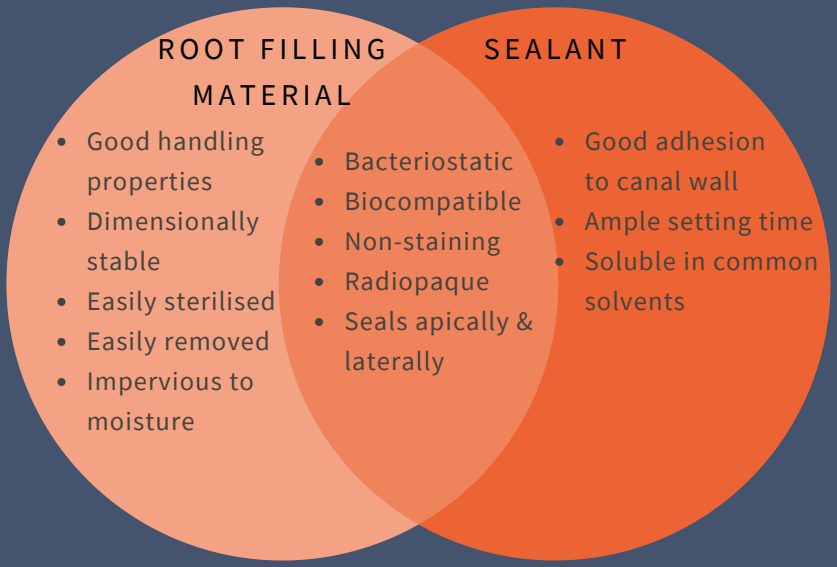
Pros:
- Antimicrobial for at least 12 weeks
- Optimal antimicrobial action at neutral pH

Cons:
- Lacks tissue dissolving capacity
- Less effective against gram –ve than gram +ve bacteria
- Reduced effectiveness in the presence of dentine albumin
- Not readily available (in an appropriate formulation) for endodontic use

Indication for use:
- Retreatment

Sealants & Gutta Percha

IDEAL PROPERTIES



SEALANTS

AH/26 Sealant:

- Epoxy resin based sealant composed of Epoxy-Bis-phenol resin.
- Powder: 80 % Bismuth Trioxide & 20 % Methenamine
- Liquid: Bis-phenol -A-D Glycidyl Ether

AH/26 Properties:

- Good working time
- Good flow
- Good setting time
  - Setting time: 9 - 15 hours at 37 C
  - Have it mixed early in the appointment in order to save time
- Low toxicity
  - compared to other sealers
- Well tolerated by P/A tissues - generally absorbed by tissues (so don't stress if you have sealer extruding beyond the apex).
- Though there is some evidence of (mostly) reversible parasthesia in cases of overfills.

AH Plus

- Reduced formaldehyde release during setting reaction.
- Reduced discolouration.

GUTTA PERCHA

Gutta Percha is a naturally occurring polymer (beta isomer)

Composition:

- 20% Gutta-Percha - increases yield strength
- 60-75% ZnO (filler) - increases hardness
- 1-17% Heavy metal sulphate (radio-opaque)
- 3% Waxes & Resins - increases plasticity/ Lubricant

GP Properties:

- Good handling properties
- Dimensionally stable
- Radiopaque
- Does not stain tooth
- Biocompatible – no inflammation of periapical tissues
- Easily sterilised
- Easily removed from canal if required
- NOT impervious to moisture, bacteriostatic & does not provide apical and lateral seal alone.

ALTERNATIVE ROOT FILLING MATERIALS / SEALANTS

Alternative Root Filling Materials:

- Silver points - historical, not especially popular in modern dentistry.
- MTA - biocompatible, good sealing properties, shown to cause calcification over MTA.
- Resilon - biocompatible, good sealing properties, requires more research.

Alternative Sealants:

- Zinc Oxide Eugenol
- Salicylate
- Zinc Oxide - fatty acid
- Glass Ionomer
- Silicone
- Tricalcium silicate (MTA/Bioceramic)
- Methacrylate Resin

Temporisation & Obturation

TEMPORISATION

Interim Restorations:
Ideally, the interim restoration should be easily identifiable, require minimal preparation and be easy to remove, in addition to the usual slew of ideal properties (easy to use, cost effective, good physical properties, etc.). While the whole range of restorative materials is available to you, I find that a well-placed GIC (Fuji Pink) works well in most cases, with a double seal over the access cavity (Cavit & GIC). Keep in mind that you can also use stainless steel bands in order to reduce cusp flexure (in teeth with one or more cusps missing).

Key Points:

- When temporising after the initial extirpation ensure that caries has been fully removed from the tooth - One of the most important features of endodontics is bacterial control.
- After having removed all the caries, re-assess your initial determination as to the tooth's long term prognosis.
- Temporising using a double seal:
  - Deliver medicament into the canal/s using a clean file, then place a medicament laden cotton pellet into the pulp chamber.
  - Place Cavit – A zinc oxide temporary restorative material:
    - Sets with moisture (I like using a wet ball burnisher to ensure adaptation to the sides of the cavity, but you can also use a wet cotton pellet).
    - Cures quickly and expands slightly which ensures a good seal.
  - Final GIC layer – Fuji VII Pink.

On Permanent Restorations:
Endodontically treated teeth can be used for fixed prosthodontics! Particularly posterior teeth, which benefit greatly from cuspal coverage.

OBTURATION

The goal of obturation is to prevent reinfection & periapical inflammation through the use of an inert, dimensionally stable and biocompatible filling material. Obturation also entombs remaining bacteria, prevents coronal leakage of bacteria and strengthens the root. Obturation extends to the apical constriction and relies on a sound coronal seal in order to prevent reinfection.

THE OBTURATION PROCESS

Prior to Obturation:

- Must have an asymptomatic tooth! No tenderness to percussion or palpation.
- Absence of a draining sinus.
- +/- a reduction in periapical radiolucency
  - 50% heal within 12 months.
  - 80% show signs of healing at 12 months.

Obturation Technique:

- Access canals through temporary restoration.
- Confirm patency & that your Master Apical File can reach the correct working length (MAF = MGP).
  - Irrigate during this process.
- Insert your MGP to length and confirm with a PA.
  - GP too long? Try a larger GP point OR measure the excess on the radiograph and cut it off.
  - GP too short? Consider using a smaller GP point OR enlarge the canal. Check you are using the right GP size & for the presence of ledges / blockages within the canal.
- Dry canals with paper points the same size as your MAF
- Insert the sealer using a lentulo spiral (<200rpm) OR an appropriately sized file.
  - Lentulo spirals can break if they engage the canal walls & can be quite difficult to remove.
- Laterally condense the MGP to allow room for accessory points (size 15).
- Sear off the GP and remove the excess sealer
  - I like to use an ultrasonic scaler for this.
- Take a post-op PA to assess obturation.

ENDO DIAGNOSIS

1. **C/C:** Pt symptoms
2. **MHx:** New / update
   DHx: Past and present dental Tx,
3. **Hx of C/C:**
   - I. **Q&A:** What is the C/C?
   - II. **Location:** Where the pain is coming from?
   - III. **Intensity:** Does it disrupt day-to-day life?
   - IV. **Duration:** Short & sharp or lingering pain?
   - V. **Stimulus:** Cold? Hot? Sweet? Biting?
   - VI. **Relief:** Does medication help? Cold packs?
   - VII. **Spontaneity:** Pain without stimulus?
4. **EXAM:**
   - I. **Extraoral:** Appearance, tone, asymmetry, redness, sinus tract (~S30 file), lymph nodes, TMJ
   - II. **Soft tissue:** Discolouration, inflammation, ulceration, swelling, sinus tract, etc.
   - III. **Dentition:** Discolouration, fracture, abrasion, erosion, caries, large restorations, discolouration, etc.
   - IV. **Clinical tests:** Always have control (061)
     - i. Percussion: +ve / -ve
     - ii. Palpation: +ve / -ve
     - iii. Cold Test: +ve / -ve, S / L
     - iv. Heat Test: +ve / -ve, S / L
     - v. Perio: MB__ B__ DB__
       ML__ L__ DL__
5. **RADIOGRAPHIC EXAM:**
   - I. Periradicular
     - i. Loss of lamina dura?
     - ii. Apex radiolucency?
   - II. Pulpal
     - i. Internal resorption?
     - ii. Calcification?
     - iii. Canal obliteration?
6. **SPECIAL TESTS:**
   - I. Caries removal: Pulp affected?
   - II. Selective anaesthesia: ID location
   - III. Trans-illumination: ID fractures
   - IV. Test cavity
7. **DIAGNOSIS:**
   - I. Pulpal _____
   - II. Periapical_____

Tx: Restorable? Strategically important? MHx considerations? Cost? Likelihood of success?

---------- **EPI TESTING TO BE DONE HERE** ----------

ACCESS, EXTIRPATION (419) & TEMPORISATION

1. **ACCESS**: 838, EndoZ
   - I. **HOT PULP - SKIP TO STEP 9 (MEDICAMENT)**
2. **CANAL TO APEX**: Barb broach / S10 to remove pulp. Confirm with apex locater + PA (with S15 file/s minimum [For radiographic visibility])
3. **CROWN DOWN**: Gates-Glidden (S2, S3) away from furcation - must irrigate during crown down
4. **MASTER APICAL FILE (MAF)**:
   - I. Pre-bend files
   - II. First file to bind + 3 file sizes
   - III. Irrigate after every file
5. **PATENCY**: Recapitulate after every file - S10 through apex of tooth to prevent blockages
6. **STEP BACK**: 2-3 file sizes to increase taper & facilitate irrigation & obturation (415, 416)
7. **FINAL IRRIGATION**: Irrigate using EDTA solution then final irrigation with NaOCl solution
8. **DRY**: Use appropriate paper points to dry canal
9. **MEDICAMENT:**
   Gold Standard → $Ca(OH)_2$
   Retreatment → CHX
   Luxation → Odontopaste + $Ca(OH)_2$
   ROP → Odontopaste
10. **TEMPORISATION**:
    - I. Insert cotton pellet
    - II. Single seal: Cavit or GIC (Fuji VII)
    - III. Double seal: Cavit then GIC (Fuji VII)
11. **RECALL:** 3 months
    If extirpated (+ medicament placed) check there is a reduction in symptoms +/- radiographic evidence of healing prior to obturating.

OBTURATION (417, 418 for each additional canal)

1. Access though GIC / temporary restoration
2. Confirm patency & that MAF can be taken to length (ensure canal/s are irrigated during this)
3. Dry canal/s using correctly sized paper points
4. Insert sealant using lentulo spiral (<200rpm)
5. Measure Master Gutta Percha (MGP = MAF) prior to insertion to ensure length is reached and insert
6. Lateral condensation & insertion of additional GP points (size 15)
7. Sear off GP & remove excess sealant w/ U/S scaler
8. Take post op PA to assess obturation

*__Irrigants__: NaOCl (0.5-6%) → dissolves organic material,
EDTA (17% disodium salt, pH 7) → chelating agent (removes inorganic material)

**__Odontopaste__: Clindamycin Hydrochloride (5%), Triamcinolone Acetonide (1%), $Ca(OH)_2$ (1-2%)

TREATMENT RECORD:

Case Difficulty: _____

Anticipated Prognosis (circle one):

Good / Fair / Guarded / Poor

If fair, guarded or poor, comment on limiting factor:

_____

_____

Restorative Plan post endodontic treatment:

_____

ESTABLISHING WORKING LENGTH

	Canal 1	Canal 2	Canal 3	Canal 4
Apex Locator				
PA Radiograph				

CROWN DOWN

Canals	Files	Length (mm)
1		
2		
3		
4		

MAF

Canals	Files	Length (mm)
1		
2		
3		
4		

STEP BACK

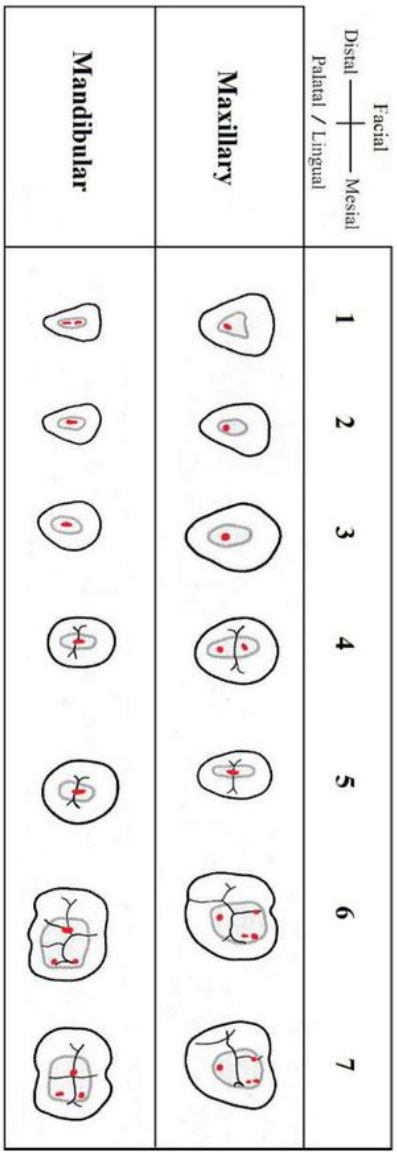
Canals	Files	Length (mm)
1		
2		
3		
4		

CONFIRM MAF

Canals	Files	Length (mm)
1		
2		
3		
4		

PULP CHAMBER LAWS

1. **Centrality** – floor of the pulp chamber is always located in the centre of the tooth at the level of the CEJ
2. **Concentricity** – walls of the pulp chamber are concentric to the external surface of the tooth at the level of the CEJ
3. **CEJ** – consistent landmark for all teeth
4. **Symmetry 1** – Barring Mx molars, orifices of canals are equidistant from an M-D line through pulp chamber floor
5. **Symmetry 2 –** Barring Mx molars, orifices of canals lie on a line perpendicular to a line drawn in an M-D direction across the centre of the pulp chamber floor
6. **Colour change** – pulp chamber floor is darker than dentine of pulp chamber walls
7. **Orifice location 1** – located at the junction of the dentine walls and floor of pulp chamber
8. **Orifice location 2** – located at the angles of the junction of dentine wall to the pulpal floor
9. **Orifice location 3** – orifices of the root canals are located at the terminus of the root developmental fusion lines



A 'REAL' GUIDE TO ENDODONTICS*

Tarek Abasseri

*1000% SARCASM

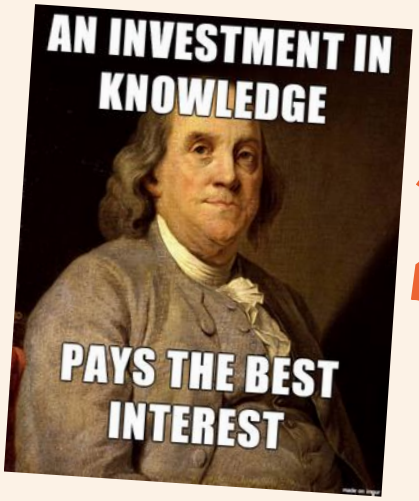
Okay, so you've learnt what you "need to know" from Yannii — the basics, the essentials. The 'textbook guide' to Endo.

Now for some actual learning. Real life, on the job experience.

Contained within are invaluable pointers and life lessons — the nuggets of gold I've come to behold in the quest to conquer the challenges of Endo. I humbly share my knowledge below.

1 Barbed broaches. You thought they're just for removing pulp tissue? Heck no. Use liberally to instrument your canals when finished, because those spikes on the file help cut retentive grooves into the canal dentine, that'll help you retain that amalgam sealer. Thank me later.

I pose you the question: what else can clean a canal better? Seriously.



2 **No, no, no, no, NO!** Cavit is NOT JUST an excellent material for temporising. For the tooth's sake, it is your BEST definitive restorative material choice! Don't be a slave to literary/clinical misinformation. Resins are struggling to keep up in the race, and that etch, prime, bond cult is a total myth.

3

Ahhh, we've all been there. The patient comes in for a 43 buccal GIC filling, but you somehow lose track of your surroundings, and end up rubber dam isolating the healthy 16.

"It's too late now" you think, ***"I've already spent a good 5 minutes setting this dam up"***. Hey, I get it: your integrity is at stake here. ***"NO!"*** you say, as you point to yourself in the handheld mirror instrument, ***"I will not be that student who isolated the wrong tooth. Not today."***

There's nothing for it. You clearly have no other choice but to access, instrument, and obturate the healthy 16 (we affirm single visit endodontics). Don't worry, these mistakes happen to the best of us. Chin up, move on, #990.

4

Spent heaps of time chasing that MB2? Yeh, for good reason. Next time, remember to make a massive MB1...

5

Yes, we've all learnt we need to go up by 1 hand file size each time, when instrumenting. But we can't always have our brains in neutral — think about it, why is the dental products industry so lucrative? Instead of wasting all those precious files (i.e. $$$$, aka. your Endo instrument rep's Porsche repayments), next time, jump straight to main file size. It's a #10 to a #35 for me. Efficiency is an art form.

CONGRATULATIONS. COLLECT 0.5 CPD HRS.

HOPE YOU LEARNT SOMETHING FROM THIS KEEP'N IT REAL GUIDE.

*** THE ABOVE IS STATED IN GOOD HUMOUR, AND IS NEITHER TO BE FOLLOWED IN CLINIC, OR USED AS DEFENCE IN A COURT OF LAW ***

The basics of learning.

BY HARAN RAGUPATHY

Learning and chunks.

- **Learning** is the acquisition of knowledge or skills through study, experience, or being taught.
- An effective way of learning is by *chunking information*.
- **Chunks** are pieces of information, bound together through *use* and *meaning*, that can get bigger and more complex over time.
- Chunking/learning requires (**1**) focused attention → (**2**) understanding → (**3**) practice.
- *Orphan knowledge* (isolated facts) isn't good and is difficult to remember. Instead, slowly build your library of chunks (don't cram).
- **Transfer** is when a chunk you have mastered in one area can often help you much more easily learn other chunks of information in different areas.
  - This is why studying a subject or topic gets easier as you learn more about it.

The rules of learning.

- There is **no one size fits all approach** when it comes to learning.
  - Every person, subject and topic may require a different learning approach.
- **Eliminate information overload** by knowing what you want to learn.
  - Trying to learn everything will only make you less productive and lead to burnout.
  - At some point you will need to make decisions on what is and is not worth spending time to learn.
- **Understand first**, learn the **big picture second**, then **memorise** and **learn the details last**.
  - Memorising all the words in a textbook would be much harder if you don't understand them so do that first.
  - Start from the basics and once you have committed those to memory it will be easier to learn the details as you can connect it to the chunks you just made.
- **Avoid illusions of competence**.
  - This is when you think you know the material but your don't.
  - Use **recall** (retrieving information without looking at it such as by reciting, questions or flashcards) **BEFORE rereading** to check if anything was missed.
  - Balance your studies and focus on the topics you find more difficult (**deliberate practice**).
- **Do the work!**
  - Develop healthy habits, deal with your procrastination/distractions and be productive.
- Get some **sleep**, **exercise**, and **socialise**!
  - Research has shown that all of these things help your brain produce new neurons.

Overcoming procrastination.

The problem:

- Doing something you do not want to do can cause stress and anxiety which activates the area in the brain that is associated with pain.
- Your brain looks for a way to stop that negative feeling by switching your attention to something more pleasant.

The solution:

- The trick is to **just start**. Once you start the work the neuro-discomfort will disappear.
- Remember that the better you get at something, the more enjoyable it will become.

Productivity methods:

1 Eat your frogs first – start your day with your important, intimating, anxiety-inducing tasks first then move on to easier things.
2 Pomodoro – a timer with scheduled study periods and rest breaks.
3 Ivy Lee – at the end of each day, write down the six most important things you need to accomplish tomorrow in order of their importance.

The learning checklist.

A straightforward approach to chunking information.

1. **Survey or scope ⊠**
   - Know the learning outcomes
   - Read the introduction and summary
   - Skim the information
2. **Read and recall ⊠**
   - Read a section
   - What did I just read? (elaborate)
   - What does it mean? (understand)
   - Take basic notes or highlights (bigger picture)
3. **Review ⊠⊠**
   - Use flashcards
   - Test yourself with questions
   - Recite information using headings and subheadings as trigger words
   - Create summary sheets (with sources and connections)
   - Draw concept map or diagrams (complex relations)
   - Use the Feynman technique (teaching)
4. **Master ⊠**
   - Space your repetition
   - Do deliberate practice (practice difficult concepts)
   - Interleave studies

Learning strategies, ranked.

1 Practice testing (flashcards, questions)

self-testing or taking practice tests on to-be-learned material

2 Distributed practice (e.g. spaced repetition)

implementing a schedule of practice that spreads study activities over time

3 Interleaved practice

implementing a schedule of practice that mixes different kinds of problems, or a schedule of study that mixes different kinds of material, within a single study session

4 Elaborative interrogation

generating an explanation for why an explicitly stated fact or concept is true

5 Self-explanation

explaining how information is related to known information, or explaining steps taken during problem solving

6 Rereading

restudying text material again *after an initial reading*

7 Highlighting and underlining

marking potentially portions of to-be-learned materials while reading

8 Summarization

writing summaries (of various lengths) of to-be-learned texts

9 Keyword mnemonic

using keywords and mental imagery to associate verbal materials

10 Imagery for text

attempting to form mental images of text materials while reading or listening

Learning FAQs.

Q: Concept/mind maps are cool, are they good?
A: Research has found that retrieval practice is best and doing both concept maps and retrieval practice produce no added benefit. They may help you understand the bigger picture and where everything fits in.

Q: But retrieval practice/practice testing/recall seems difficult?
A: Exactly! It requires effort and making mistakes but that results in the best learning and retention of information. Even when you don't fully understand a topic doing questions or flashcards will usually fix that or at the very least will start building chunks of knowledge that will be a starting point to build from.

Q: Do I need to space my repetition, why can't I just cram?
A: Distributing or spacing practice allows you to strengthen your memory of information over the long-term. It involves retrieving the information once it has (or has almost) been forgotten (see Ebbinghaus forgetting curve below)

AUDSS PUBLICATIONS