Endodontic Therapy

There is a lot more to it than just doing root canals!!!
Housekeeping
Dr. Herb Ray, Endodontist
Chairman Dept Endodontics & Director of Residency Program, University of Pittsburgh

Dr. Ray received his DMD in 1988 and then completed his residency in endodontics at Temple University School of Dentistry in 1990, where he received the Louis I Grossman study club resident award for academic and clinical excellence. He has been a Diplomate of the American Board of Endodontics since 1995. Dr. Ray maintained a private practice with his sister Dr. Heidi Ray limited to endodontics for 20 years. In 2010 Dr. Ray moved to a full time academic position as the Director of the Endodontic residency program, and Chair, of the Department of Endodontics at the University Of Pittsburgh School Of Dental Medicine. Dr. Ray is a member of the Center for Craniofacial Regeneration, and holds an appointment at the McGowan Institute for Regenerative Medicine. Research interests are in pulpal regeneration and microcomputer tomography studies of the root canal system. Dr. Ray has authored several articles related to endodontic research, and lectures extensively on the all aspects of clinical endodontic therapy.
Conflict of Interest

Dr. Ray will receive an honorarium and expense reimbursement from KaVo Kerr for today’s lecture.
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Center for Craniofacial Regeneration
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Apical Periodontitis
(a microbial disease)
Apical Periodontitis

- **Cause:** Microorganisms

Kakehashi et al, 1965
Korzen et al, 1974
Sundqvist, 1976
DIAGNOSIS
Why Do You Need A Diagnosis?

• Necessary to formulate a treatment plan
• Can’t treat the patient without a clear understanding of their problem and its etiology
• As the treating dentist, YOU are LIABLE for your treatment.
ALWAYS examine the patient and come up with your OWN diagnosis!!!
Patient Interview

• Medical History
• Dental History
• Chief Complaint
  • In patient’s own words
• History of Present Illness
  • Open ended questions
Clinical Exam

• Should be done **PRIOR** to looking at the radiograph
• Keeps testing objective
• Prevents “Endo Vision”
Clinical Observations

• Extra-oral exam
  • Facial asymmetry
  • Lymphadenopathy

• Intra-oral exam
  • Swelling, sinus tracts
  • Description of tissue color and consistency
    • Fluctuant
    • Indurated
Parts of the Diagnosis

• Two parts of the endodontic diagnosis
  • Pulpal Diagnosis
  • Apical Diagnosis

• These correlate with the different anatomical structures and different symptoms
Endodontic Testing
Three Main Parts

• Pulpal
  • Thermal (cold and heat)
  • Electric pulp testing (EPT)

• Apical
  • Percussion
  • Palpation

• Periodontal
  • Probing
  • Mobility
Testing Procedure

• Start with a baseline response
• Test suspected tooth last
• Start with the easiest and least painful test

The **GOAL** is to **REPLICATE** the patient’s chief complaint.
Pulpal Testing

Cold Testing

- Cotton roll isolation
- Dry the tooth
- Utilize a #2 cotton pellet with cotton pliers
- Endolce
- Apply to the buccal surface of multiple teeth
Pulpal Testing

Crowns do not affect thermal testing.

-Miller, 2004
Apical Testing

**Percussion**

- Percuss with the blunt end of a mouth mirror
- Do not use fingers to eliminate variability
- Percuss in two planes
  - Occlusal
  - Buccal
Pulpal Testing

**Electric Pulp Testing**

- Utilize a conducting medium such as toothpaste or petroleum jelly
- Does not indicate pulpal health.
- Can only discern pulpal necrosis or vitality.
Pulpal Testing

Heat Testing

• Only to done if it is in the patient’s chief complaint
  • Apply petroleum jelly on the tooth. Use a flame heated gutta percha to apply heat.
  • Heat testing attachment of heating elements (Calamus, System B, etc.)
  • Isolate the tooth with a rubber dam and apply hot water.
Apical Testing

**Palpation**

- Palpate with the goal of approximating the root apices
- Test buccal and lingual areas
Periodontal Evaluation

Probing and Mobility should also be assessed.
Adjunctive Tests

• Bite Stick
  • Cracked tooth syndrome

• Transillumination
  • Locate fractures

• Check occlusion
  • Recent restorations

• Selective anesthesia
  • Localize quadrants

• Test cavity
  • Confirm pulpal necrosis
Pain
Pulpal Nerve Fibers

- A-delta
- A-beta
- C-fibers
A-delta Fibers

• 25-50% of fibers in the pulp
• Small
• Myelinated – fast conducting
• Sharp pain sensation – cold test
A-beta Fibers

- Medium size
- Myelinated fibers in pulp horn
- Primary fibers of hydrodynamic theory (mechanical stimulation)
C Fibers

- Majority of pulpal nerve fibers
- Unmyelinated – slow conducting
- Deep, aching pain
Apical Pain

• Nociceptive fibers in the PDL and adjacent tissue
Altered Pain States

- **Hyperalgesia** – increase in the perceived magnitude of a painful stimulus
  - Extra painful response to cold with pulpitis

- **Allodynia** – a reduction in pain threshold so that previously non-noxious stimuli are perceived as painful.
  - Percussion sensitivity
## Current AAE terminology

### AAE Consensus Conference Recommended Diagnostic Terminology

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neutropulpa</td>
<td>A clinical diagnosis category in which the pulp is asymptomatic and normally responsive to pulp testing.</td>
</tr>
<tr>
<td>Inflammatory pulpa</td>
<td>A clinical diagnosis based on subjective and objective findings indicating that the inflammation should be treated and that pulp return to normal.</td>
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<tr>
<td>Symptomatic irreversible pulpa</td>
<td>A clinical diagnosis based on subjective and objective findings indicating that the pulp is irreversibly inflamed with irreversible pulpal inflammation associated with severe pain, swelling, and fever.</td>
</tr>
<tr>
<td>Asymptomatic reversible pulpa</td>
<td>A clinical diagnosis based on subjective and objective findings indicating that the inflammatory process is reversible with proper endodontic therapy and appropriate antibiotic therapy.</td>
</tr>
<tr>
<td>Polytrabekular</td>
<td>A clinical diagnosis category indicating death of the dental pulp. The pulp is usually irreversibly pulpateted.</td>
</tr>
<tr>
<td>Freshly treated</td>
<td>A clinical diagnosis category indicating that the tooth has been endodontically treated and the root canal is obturated with various filling materials other than infrared.</td>
</tr>
<tr>
<td>Previously treated</td>
<td>A clinical diagnosis category indicating that the tooth has been previously treated by partial endodontics (e.g., step-by-step retreatment).</td>
</tr>
<tr>
<td>Apical</td>
<td>Normal apical issues are those with normal periapical issues that are not reactive to periradicular testing and do not result in further injury, and are usually not associated with an apical radicular fenestration.</td>
</tr>
<tr>
<td>Apical pathological</td>
<td>Pathological changes at the apex of the tooth, including defects in the tooth structure, microlesions, or other biologic or chemical alterations.</td>
</tr>
<tr>
<td>Acute apical abscess</td>
<td>An inflammatory reaction to a periradicular abscess that is characterized by rapid onset, increased periapical inflammation, and intense pain that is not relieved by antibiotic therapy.</td>
</tr>
<tr>
<td>Chronic apical abscess</td>
<td>An inflammatory reaction to a periradicular abscess that is characterized by gradual onset, less intense inflammation, and a more gradual progression of symptoms.</td>
</tr>
<tr>
<td>Containing source</td>
<td>Diffuse inflammatory response to a localized periapical abscess that is characterized by slow onset, localized inflammation, and eventual resolution of symptoms.</td>
</tr>
</tbody>
</table>
Pulpal Diagnosis
Pulpal Diagnosis

• Normal pulp
• Reversible Pulpitis
• Irreversible Pulpitis
  • Symptomatic
  • Asymptomatic
• Pulp Necrosis
• Previously Initiated Therapy
• Previously Treated
Normal Pulp

• Pulp is symptom free
• Normally responsive to pulp testing
Reversible Pulpitis

• Indicates that the inflammation in the pulp should resolve and the pulp return to normal

• The pulp is inflamed, but it has the capacity to return to normal if the etiology is addressed.

• Etiology
  • Cracks
  • Caries
  • Restorative
  • Periodontal Procedures
  • Trauma
Reversible Pulpitis

• The patient’s chief complaint is usually an exaggerated response to thermal stimuli that quickly returns to normal.

• Pulp testing will elicit this same response.

• This patient will NOT have SPONTANEOUS pain.
Symptomatic – Irreversible Pulpitis

• The vital inflamed pulp is incapable of healing.

• The pulp is irreversibly inflamed and will become necrotic if left untreated.

• Additional descriptions include lingering thermal pain, spontaneous pain, and referred pain.
Symptomatic – Irreversible Pulpitis

• The patient may have a history of **spontaneous pain** and/or exaggerated, lingering response to hot or cold

• Cold test will produce an **intense, lingering** response.

• Often wakes the patient up at night.
Asymptomatic Irreversible Pulpitis

• Indicates that the vital inflamed pulp is incapable of healing. However, there are no clinical symptoms except for inflammation produced by caries, caries excavation, and trauma.

• Etiology
  • Carious pulpal exposure
  • Traumatic exposure
  • Pulp polyp
  • Internal resorption

• Pulpal tests are normal and patient is symptom free
Pulp Necrosis

- Pulp is usually nonresponsive to pulp testing
- Denotes **pulpal death**
- **No response** to vitality tests
- The end state of Irreversible Pulpitis
Previously Initiated Therapy

• The tooth has been treated by Partial Endodontic Therapy
  • Pulpotomy
  • Pulpectomy

• Take a new radiograph prior to starting treatment
Previously Treated

- The tooth has been endodontically treated and the canals are obturated with various filling materials other than intracanal medicament
Apical Diagnosis
Apical Diagnosis

- Normal Apical Tissues
- Symptomatic Apical Periodontitis
- Asymptomatic Apical Periodontitis
- Acute Apical Abscess
- Chronic Apical Abscess
- Condensing Osteitis
Normal Apical Tissues

• Normal periradicular tissues that are not sensitive to percussion or palpation testing.
• The lamina dura surrounding the root is intact, and the periodontal ligament space is uniform.
• The periradicular tissue is healthy.
Normal Apical Tissues

Radiographically

- Lamina dura intact
- PDL space is uniform
Symptomatic Apical Periodontitis

• Inflammation of the apical periodontium producing clinical symptoms such as a painful response to biting and/or percussion or palpation.

• May or may not be associated with an apical radiolucent area.

• Etiology
  • Pulpal – pulpitis or necrosis
  • Occlusal trauma – primary or secondary

• CHECK OCCLUSION!!!
Asymptomatic Apical Periodontitis

• Inflammation and destruction of apical periodontium that is of pulpal origin.

• An apical radiolucent area is present but there are no clinical symptoms.

• Etiology
  • Pulp
  • Previous history of treatment

• NO CLINICAL SYMPTOMS!!!
Acute Apical Abscess

• Inflammatory reaction to pulpal infection and necrosis
• Characterized by rapid onset, spontaneous pain, tenderness to pressure, pus formation, and swelling of associated tissues
• Associated with a necrotic or previously treated tooth – no cold response
• Patient’s can present with systemic symptoms like fever and malaise
• NO SINUS TRACT
Acute Apical Abscess

Radiographic Findings
• May or may not have apical radiolucency

Clinical Findings
• Facial swelling
• No response to cold
Chronic Apical Abscess

• Inflammatory reaction to pulpal infection and necrosis
• Characterized by gradual onset, little or no discomfort, and the intermittent discharge of pus through an associated sinus tract
• ALWAYS TRACE THE SINUS TRACT AND TAKE A RADIOGRAPH
Chronic Apical Abscess

**Radiographic Findings**
- Associated radiolucency

**Clinical Findings**
- Sinus tract present
- Necrotic or previously treated tooth
- No response to cold
Chronic Apical Abscess
Condensing Osteitis

• Diffuse radiopaque lesion representing a localized bony reaction to a low-grade inflammatory stimulus, usually seen at the apex of the tooth
• Should have identifiable etiology
• Diagnosis dependent on radiographic appearance
• Pulpal and periapical symptoms can vary

85% of these resolve after RCT.

-Eliasson, 1984
Condensing Osteitis

**Radiographic Findings**
- Diffuse radiopaque lesion at apex of the tooth

**Clinical Findings**
- Pulpal and periapical symptoms
Emergency Care
Palliative Endodontic Treatments

- Pulpotomy
- Pulpectomy
- Gross Pulpal Debridement
- Occlusal Adjustment

All endodontic treatment **MUST** be done with a rubber dam. If you can’t isolate it, **EXTRACT**.
Pulpectomy

• Removal of inflamed **CORONAL** pulp tissue **ONLY**
• Placement of eugenol pellet (antimicrobial, sedative)
• Only done on multi-rooted teeth
What are our options?

• Rebel (1922) “an exposed pulp is a doomed organ”

• Is it Really???

• Seltzer, Bender, OOO,63
Histologically pulp inflammation tends to be localized, with surrounding tissues remaining normal. Radicular pulp is rarely inflamed.
Pulpectomy = Cleaning & Shaping

• Files should only be taken down a canal if you plan on cleaning and shaping to completion
• Pick the most inflamed canal in multi-rooted teeth
• Eugenol pellet if vital tissue remains
Gross Pulpal Debridement

• Treatment for a symptomatic necrotic tooth
• Goal: Change bacterial flora in canal system that is causing **APICAL INFLAMMATION**
• Copious irrigation with NaOCl and non-iatrogenic instrumentation of canals
Occlusal Adjustment

• Occlusion can be reduced to decrease periapical symptoms
Pain Does Not Equal Antibiotics

• Antibiotics should only be given if patient presents with systemic symptoms
• The four previously discussed treatments will address all non-systemic symptoms
Rubber Dam Isolation for Endodontic Treatment
Of these 524 PIs:

- 44% used a rubber dam for all RCTs,
- 24% used it for 51-99% of RCTs,
- 17% used it for 1-50% of RCTs,
- 15% never used it during RCT.
Rubber Dam Use during Post Placement Influences the Success of Root Canal-treated Teeth

Ishana Goldstein, DDS* | Chad Spiker, DDS | Matthew Friedman, PhD | and Robert Affrunti, DDS

Abstract

Background: Saliva leakage after root canal therapy is of great concern and can lead to failure of the endodontic therapy. The aim of this study was to investigate whether the use of rubber dam (RD) during post placement improves the success of root canal-treated teeth. Methods: A total of 1,100 patients with an average age of 2.7 years were assessed for the incidence of a new periapical lesion (periapical index score >2) after root canal therapy and post placement. The patients were divided into 2 groups based on the presence or absence of an RD clamp in the verification radiograph during post placement. Results: Twenty-six patients (30 teeth) had a post placed with the use of an RD, and 159 patients (174 teeth) had post placed without an RD. In the non-RD group, 128 (73.6%) teeth were considered successful at follow-up, while in the RD group, 28 (93.3%) teeth were considered successful at follow-up. Based on the bivariate GEE model, the difference in success between these 2 groups was statistically significant (p = 0.035). Conclusions: The use of an RD during prefabricated post placement provides a significantly higher success rate of root canal–treated teeth. Using an RD is already considered a standard of care for nonsurgical root canal therapy; in addition, using an RD during restorative procedures that involve open teeth should also become a standard of care.

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One-Step Placement
One Step Application
One-Step Application
One-Step Application
One Step Application
Marginal leakage
Cavit as Seal
Caulk for Marginal Leakage
Use of Marginal Sealer
Use of Marginal Sealer
Use of Marginal Sealer
Use of Marginal Sealer