

□ **Approximately how large is this lesion in relation to what is seen on this radiograph?**

Seltzer and Bender 1961, Experimental Lesions in Bone.

A. Visualizing Bone Loss & Apical Periodontitis – (Seltzer & Bender, 1961 Experimental Lesions in Bone, Part 1 & 2) (Bender, 1982) several!

- Lesions in Cancellous bone can not be detected by x-ray.
- Lesions in Cortical bone CAN be detected by x-ray ONLY if there is perforation of the bone cortex, erosion from the inner surface of the bone cortex or extensive erosion or destruction from the outer surface.
- Inflammatory lesions CAN be seen on X-ray if the lesions erode the junction of the cortex and cancellous bone or perforate the cortex
- Early stages of bone disease cannot be detected.
- NO correlation between size of rarefied area on x-ray with the amount of tissue destruction.

In this case, accurate size m to d,

□ **What evidence is there in the literature to support the use of direct digital radiography in diagnosis of apical pathosis? LAMYO**

- a. Film vs. digital – NSD in determination of length using Schick digital measurement tool and electronic digital caliper measurement off a film, Both within 1 mm of true instrument length in vitro – ([Lamus, 2001 Evaluation of a digital measurement tool to estimate working length in endodontics](#))
- b. Film vs. digital – Subjective clarity compared with respect to length and homogeneity of obturation, Enhanced digital was superior to original digital and E and F film. ([Akdeniz, 2005 An ex vivo comparison of conventional and digital radiography for perceived image quality in root fillings](#))
- c. Film vs. digital – NSD between Digital and film in detecting artificial periapical bone lesions. ([Mistak, 1998 Interpretation of periapical lesions comparing conventional , direct digital, and telephonically transmitted radiographic images](#))
- d. Film vs. digital – NSD in detecting artificial periapical lesions in cortical bone. RVG superior in detecting lesions involving lamina dura

and medullary bone – ([Yokota & Newton 1994](#) –[Interpretation of periapical lesions using RVG](#))

- e. Film vs. Digital – NSD in length determination, in vivo comparison – ([Ong & Pitt Ford, 1995](#) [Comparison of Radiovisiography with radiographic film in root length determination](#))
- f. 80 – 90% radiation reduction

□ **What diagnostic tests would you perform?**

Clinical tests: percussion, palpation. periodontal probings, mobility. Rule out Non-odontogenic pain, CO2 thermal tests to rule out adjacent teeth.

Diagnostic tests donot give us a definitive diagnosis. Most tests do not actually access the vitality (blood circulation) of the pulp and most do not give much in any indication about the presence or severity of inflammation in the pulp. The Main reason for doing pulpal tests are to reproduce symptoms, to localize the symptoms and to access the severity of symptoms.

There is a poor correlation between clinical symptoms and pulpal histopathology. And likely inaccurate!

Responses are Subjective and can be under or overstated ([Eli, 1993](#) [Dental anxiety: A cause for possible misdiagnosis of tooth vitality](#))

Responses are subjective and likely overstated **ST**

- [Seltzer & Bender, 1963](#) [The Dynamics of Pulp Inflammation: Correlations between diagnostic data and actual histologic findings in the pulp.](#)
- [Tyldesley & Mumford, 1970](#) ([Dental pain and the histologic condition of the pulp](#)) **Classic:** Examined 142 teeth with pain. No correlation between histology and clinical symptoms.
- [Schindler](#), Heat test – used on refractory cases to identify missed canals or late stage of an irreversible pulpitis
- [Garfunkel, 1973](#) [Dental Pulp pathosis: Clinicopathologic correlations based on 109 cases.](#)

[Senia, Cunningham, 1985](#) [The diagnostic dilemma of barodontaliga. Report of two cases.](#) Barodontalgia – sensitivity or pain caused by exposure to a pressure gradient. Fliers & Divers

Thermal tests

These tests are thought to work by hydrodynamic forces in the dentin initiating generator potentials in the nerve endings of displaced surface membranes. By this theory, fluid movement in the tubules (due to thermal stimulation) is responsible for activation of sensory receptor units in the pulp. (**Brannstrom 1972** [The Hydrodynamics of Dentine ;it's possible relationship to dentinal pain](#)).

Cold Tests FSP

The most effective cold tests are those with CO₂ (-78°C) and DDM (difluorochloromethane) (-50°C) (**Fuss, Trowbridge 1986** [Assessment of reliability of electrical and thermal pulp testing agents](#)). Older techniques using refrigerator ice or ethyl Chloride (-4°C) are less reliable. (**Fuss, Trowbridge 1986** [Assessment of reliability of electrical and thermal pulp testing agents](#))

Potential for extreme cold to cause crack in dentin or irreversibly damage the pulp have been shown to be unfounded ([Ingram, 1983 Evaluation of the effects of carbon dioxide used as a pulp test. Part 2. In vivo effect on canine enamel and pulp tissues](#)) and ([Rickoff, Trowbridge, 1988 Effects of thermal vitality tests on human pulp](#))

Abnormal but positive responses are equally distributed among pulps of teeth in all diagnostic categories. (**Seltzer & Bender, 1963** [The Dynamics of Pulp inflammation: Correlation between diagnostic data and actual histologic findings in the pulp](#)). **A positive response is an indication that the pulp is vital but does NOT indicate if the inflammation is irreversible. A negative response is highly indicative of necrosis.** **Seltzer & Bender, 1963** [The Dynamics of Pulp inflammation: Correlation between diagnostic data and actual histologic findings in the pulp](#)).

CO2 has advantage over other sensitivity tests in that it can be used with metallic and porcelain restorations, ortho bands, metallic splints, temporary and permanent crowns,

It is the MOST effective vitality test for immature teeth. (**Fuss, Trowbridge 1986** [Assessment of reliability of electrical and thermal pulp testing agents](#)), and ([Fulling, Andreason, 1976 Influence of maturation status and tooth type of permanent teeth upon EPT and Thermal pulp testing procedures](#)) and ([Ehrman 1977 Pulp testers and pulp testing with particular reference to dry ice](#)).

Accuracy of Cold tests (**Petersson,1999** [Evaluation of the ability of thermal and electrical test to register pulp vitality](#))

90% accurate!

Probability of negative test being necrotic pulp: **89%** cold test, 88% EPT and 48% hot test

Probability of positive test being vital pulp: **90% cold** test, 84% EPT and 83% hot test

□ **Trace the sensory fibers that innervate the mandibular first molar as they progress toward the central nervous system.**

Activation of A-delta and C fibers in the dental pulp causes transmission of nociceptive signals via one of the 3 branches of the 5th cranial nerve (CN V). are branches from the **Trigeminal Ganglion**. From there they enter the **Spinal Trigeminal Nuclear Complex** located in the medulla. The trigeminal spinal nuclear tract includes, the **nucleus oralis, nucleus interpolaris and nucleus caudalis (dorsal medullary horn)**. The nucleus caudalis is an important site for processing Orofacial pain. Also innervated by the trigeminal sensory neurons is the **cervical dorsal spinal cord, reticular formation and the solitary tract nucleus**. From the spinal cord the nerves enter the **Trigeminal Thalamic Tract** and then into **Thalamus** of the brain.

Trace the sensory fibers that innervate each tooth in the arch as they progress toward the CNS?

Upper Anteriors and Canines - *Anterior Superior Alveolar nerve* of *Maxillary branch* of *Trigeminal nerve C-V*

Sphenopalatine nerve - Nasopalatine branch supplies the **palatal structures** around the **upper central and lateral incisors** (the upper front four teeth).

Upper Bicuspid and the MB root of upper 1st molar - *Middle Superior Alveolar nerve* of *Maxillary branch* of the *Trigeminal Nerve C-V*

Upper Molars – *Posterior Superior Alveolar Nerve* of *Maxillary branch* of the *Trigeminal nerve C-V*

All Lower Teeth *Inferior Alveolar nerve* The IAN supplies the **lower molar and premolar teeth** and **gingiva**. Its larger terminal branch emerges from the mental foramen as the **mental nerve** to innervate the skin of the chin and the lower lip, while the smaller ***incisive branch*** supplies the **canine and incisor teeth**.

- If this patient has referred pain from this tooth, where might it occur?

(Robertson S., 1947 - The teeth as a source of headache and other pain). The authors produced toothaches in their own teeth using electricity (10.0 Volts). After 10 minutes, referred pain occurred over the entire distribution of the involved division of the nerve. They mapped and described the reference pain for a number of teeth.

No pain across the midline!

- Upper Canine ► Maxillary 1st or 2nd bicuspid and/or 1st and 2nd Molars, as well as mandibular 1st & 2nd bicuspid
 - #6 ► 2, 3, 4, 5, 20 & 21
 - #11 ► 12,13,14,15, 28 & 29
- Upper 1st and 2nd Bicuspid ► Mandibular 1st and 2nd bicuspid.
 - #4 and #5 ► 28 & 29
 - #12 and #13 ► 20 & 21
- Lower 1st and 2nd bicuspid. ► Maxillary 1st and 2nd Bicuspid
 - #20 and #21 ► 12 & 13
 - #28 and #29 ► 4 & 5
- Lower incisors, canine and 1st bicuspid ► Mental area
 - #21, #22, #23, #24 ► Mental area
 - #25, #26, #27, #28 ► Mental area
- Lower 2nd bicuspid ► mental and mid-ramus area
 - #20 ► mental and mid-ramus area
 - #29 ► mental and mid-ramus area
- Lower 1st and 2nd bicuspid ► All Maxillary molars
 - #20 and #21 ► All Maxillary Molars
 - #28 and #29 ► All Maxillary Molars
- Lower molars ► Lower 1st and 2nd bicuspid
 - #17, #18 and #19 ► #20 & #21
 - #30, #31 and #32 ► #28 & #29

Robertson's referred pain patterns: tooth to remote structures

- Upper Incisors ▶ Frontal area
 - #7, #8, #9, #10 ▶ Frontal Area
- Upper Canine & 1st Bicuspid ▶ Nasolabial area and Orbit
 - #6 and #5 ▶ Nasolabial area and Orbit
 - #11 and #12 ▶ Nasolabial area and Orbit
- Upper 2nd bicuspid and 1st Molar ▶ Maxilla and temporal region
 - #3 and #4 ▶ Maxilla and temporal region
 - #13 and #14 ▶ Maxilla and temporal region
- Upper 2nd & 3rd Molars ▶ Mandibular molar area and ear
 - #1 and #2 ▶ Mandibular molar area and ear
 - #15 and #16 ▶ Mandibular molar area and ear
- Lower 1st and 2nd molars ▶ ear and angle of mandible
 - #18 and #19 ▶ ear and angle of mandible
 - #30 and #31 ▶ ear and angle of mandible
- Lower 3rd molars ▶ Ear and the Superior Laryngeal area (area by upper neck under the angle of mandible)
 - #17 ▶ Ear and the Superior Laryngeal area (area of upper neck under the angle of mandible)
 - #32 ▶ Ear and the Superior Laryngeal area (area of upper neck under the angle of mandible)

What is the probable source of infection? Coronal leakage Bacteria in root from initial tx or outside in PA area. **Tronstad and Trope**

□ **Compare and contrast the literature on the microbiology (etiology) of odontogenic infections from the sixties to today.** Research techniques have given us greater knowledge. Much more info with PCR, polymicrobial, colonies, classifications have increased. Also spores, fungi, & viruses have been found.

□ **Based on the literature, describe the organisms that might be present in this case.**

- ▶ Untreated case **FEPPPPLAVSTT** GRAM NEGATIVE ANEROBES
- ▶ Treated case **FEEPPPLASSC** GRAM POSITIVE ANEROBES

Sundqvist & Figdor 2004

□ **What facial spaces are involved? What are the anatomic boundaries of these spaces?** Body of mandible or buccal vestibule

4 regions for facial infections:

Mandible and below **BBMSSS**
Lateral face and cheek **BBST**
Parapharyngeal and cervical **PPC**
Midface **PBCP**

□ **Is it more difficult to obtain anesthesia in the presence of infection? YES.**
ACID pKa increase changes disassociation curve

□ **The patient indicates that she has a temperature of 101°F. What role does fever play in the host's response to infection?** Increased temperature kills temperature sensitive bacteria

□ **What are the considerations regarding the choice of local anesthetic? What route of administration would you use?** lido or carbocaine depending on if pt has any medical conditions which make her sensitive to epinephrine, IAN, PDL AND INTRAPULPAL.

□ **Describe the technique for administration of the Gow-Gates block and the nerves anesthetized.** 10 mm higher than IAN and toward tragus of ear. Gets long buccal, lingual and IAN.

□ **The general dentist treating this patient indicates that a Sargenti paste was used as a sealer. What evidence is there to refute the use of this material?**
Cytotoxic and leaves fixed antigenic material.

Newton 1980 cytotoxicity

Spangberg 1974 neurotoxic

- **How should this case be treated?** Initiate NSRCT with I and D clindamycin, advil and Vicodin. Per Baumgartner; Clindamycin 98% effective, Augmentin 100% and Penicillin 85%
- **What evidence is there in the literature regarding the use of CaOH as an intracanal medication?** Lots, bactericidal and effective in 2 appointments but you can get same bacterial reduction in 1 visit with NaOCL. CAO H could against Endotoxin. Should be used in 2 visits not in one. No difference in healing rates. [Waltimo 2005](#), [Peters 2004](#), studies say there is no difference in healing

Is chloroform safe for use in retreatment procedures? Justify your answer using the literature. **KMM** (KIM)

1. [Kaminski 1998 JOE](#) – No health risk to the patient, amount expelled thru the apex (0.32mg) is several orders of magnitude below the permissible toxic dose (49mg/m)
2. [McDonald 1992 JOE](#) – Chloroform is safe for the dentist and staff. Air vapor levels were well below the OSHA mandated levels.
3. [Margelos, 1996](#) - Chloroform uptake by gutta-percha and assessment of its concentration in air during the chloroform-dip technique. Concentration levels of chloroform evaporated during the practice of chloroform dip within a dental office do not exceed the safety limits.

CHLOROFORM CONE FIT **MV NK** (MINK)

[Moyer, 1995](#) - Evaluation of a solvent-softened gutta-percha obturation technique in curved canals. A significant difference in favor of the solvent-softened techniques was found over untreated lateral condensation.

[Van Zyl, 2005](#) - Effect of customization of master gutta-percha cone on apical control of root filling using different techniques: an ex vivo study. Root filling extrusion was significantly influenced by 'operator' and was reduced by cold lateral compaction and customization of the master cone. **Customization of master cone was the only factor that reduced voids apically**.

[Narracott, 1989](#) - An in vitro comparison of the single cone and lateral condensation techniques using 'friction-fitted' and 'solvent dip-fitted' primary gutta-percha cones. The single cone and lateral condensation techniques which utilized chloroform dip-fitted cones ranked first and second with respect to frequency of no dye penetration

[Keane & Harrington \(1984\)](#) - The use of a chloroform-softened gutta-percha master cone and its effect of the apical seal. Described technique. Primary cone is 1–2 sizes larger

than the apical preparation and selected to bind at 1-mm short of the working length. The apical 2 mm of the GP cone was dipped in chloroform for 1 second and the softened GP cone was gently placed into a slightly moist canal, noting the orientation of the cone. The GP cone was pushed to the canal terminus in a pumping motion and this was continued for another 10 s to allow the GP to become firm without engaging undercuts

During treatment the patient loses consciousness. What are possible etiologies? How would you manage this situation? Syncope, MI, Stroke, acute adrenal insufficiency, diabetic coma or insulin shock, seizure epileptic or LA OD

Basic ABC oxygen, reassess, 911, sugar, CPR

The patient calls the next day and reports that her lip is still numb. What would you do? Monitor and reassure. Likely irritation to IAN, could also be pressure anesthesia from abscess.

During retreatment a nickel-titanium file separates in the mesial lingual canal. What methods are advocated to retrieve the instrument? Scope, ultrasonics. **Spili 2005** NSD in healing. Sabeti/Simon 2006 PA lesions healed without obturation. NSD fill or empty, so obturation may be overrated. A broken instrument may of no consequence, if you've adequately instrumented and disinfected.

This patient has a history of malignant hyperthermia. Would you alter your treatment in any way? No, this is a concern with general anesthesia only

What anesthetic / analgesic / antibiotic would you prescribe? Clindamycin 96% effective and not allergenic, ibuprofen 400 mg q6h 2 days, Vicodin prn pain

What recall sequence? ONE YEAR **RRO** Reit, Rud & Orstavik

- **Reit (1987):** Decision strategies in endodontics: on the design of a recall program. Best recall is at one year. Also rec recalls annually for minimum of 4 years (esp in questionable cases)
- **Rud & Andreasen (1972):** A follow-up study of 1,000 cases treated by endodontic surgery. If PARL healed at 1 year, then ok
- **Orstavik (1996):** Time-course and risk analyses of the development and healing of chronic apical periodontitis in man. ~76% of apical periodontitis lesions developing post-tx are seen within 1 year. Therefore, 1yr follow-up predicts long-term success.

I do 6 months but lit suggests 1 yr is optimum for healing or appearance of PAR.

Based on the literature discuss the success rates for retreatment procedures and compare these to the success rates for initial root canal treatment.

Outcome Studies

Initial treatment – NS RCT

Author	% Healed	# Cases	Follow-up period	Date
Strindberg	87	529	4 years	1956
Seltzer	80	2921	0.5 years	1963
Grossman	86	432	1-5 years	1964
Ingle	92	1229	2 years	1965
Kerekes	91	501	3-5 years	1979
Swartz	88	1007	1 years	1983
Sjogren	91	356	8-10 years	1990
Smith	84	821	5 years	1993
Molven	86	265	20 years	2002

Re-treatment

Author	% Healed	# Cases	Follow-up period	Date
Allen	73	1300	0.5 years	1989
Sundqvist	74	54	5 years	1998
Sjogren	98 without AP 62 with AP	356	8 years	1990

Surgical Root Canal Treatment

Author	% Healed	# Cases	Follow-up period	Date
Dorn	95	488	6mos-10years	1990
Friedman	44	136	6mos-8 years	1991
Frank	58	104	15 years	1992
August	63	39	10 years	1996
Testori	85	302	6 years	1999
Rubinstein	92	59	5 years	2002

The Toronto Studies – Outcomes

Initial treatment – confirmation that preexisting apical periodontitis and treatment technique were the main predictors of outcome in initial treatments.

- a. overall healed rate for Phase I & II was 85%
- b. if based on only radiographic measure it would be 95%

- i. therefore, it should be noted that the absence of symptoms is insufficient as a measure of healing.
- c. W/out preop AP healing rate reached 94%
- d. With preop AP healing rate 79%
 - i. 45% showed reduced size from original
- e. 10% higher healing rate noted for those cases treated with flared canal preparations and vertical compaction of warm gutta-percha than step-back preparation and lateral compaction of gutta-percha
- f. Other factors were noted but not statistically significant – tooth location, preop symptoms, perio condition, flare-ups, final restoration.

Orthograde Retreatment – This study suggests that apical periodontitis, although a strong predictor, was secondary to preoperative perforation and root filling quality, and to postoperative restoration, in predicting the outcome of retreatment.

- a. overall healed rate was 81%
- b. 93% were asymptomatic and fully functional at the 4-6 yr f/u (radiographically not healed)
- c. w/out preop AP healing rate 97% (elective procedure)
- d. overall with preop AP healing rate 78%
- e. with preop AP & w/out perf healing rate 86%
- f. with preop AP & with perf healing rate 36%*
- g. with preop AP & shorter than 2 mm fill 82%
 - i. able to renegotiate short treatment in 74% of cases
- h. with preop AP & adequate fill healing rate 67%
 - i. these cases may be treatment resistant cases

*Trope suggests that 3 factors effect outcome of perf treatment

- 1. size, 2. location 3. time since perforation

Surgical Retreatment – This study suggests that preoperative lesion size and root-filling length were significant predictors of outcome of apical surgery.

- a. overall healing rate was 74%
- b. 91% of the teeth were asymptomatic and functional
 - i. despite radiographic findings
- c. 60% demonstrated reduction of lesion size, & asymptomatic
- d. if reduced lesion size were included in healing overall = 87%
- e. healing rate for long or short fills = 86%*
- f. healing rate for adequate fills = 68%
- g. healing rate for lesion < 5mm = 86%
- h. healing rate for lesion > 5 mm = 65%
- i. healing rate w/ orthograde retx = 84% (NSD)**
- j. Retrograde retreatment healing rate 94%
- k.

*Lustmann suggests etiology removed therefore healing

** Zuolo et al – 90% success for surgical cases previously retreated

Based on the literature what are the anatomic and morphologic variations of this tooth group? 8 types per Vertucci 2 or 3 roots, mesial root 1, 2, 1/2 2/1 2/1/2, 1/2/1

- Discuss the pros and cons of culturing this case. What would you do in your practice?** Antibiotics sensitivity test delays initiation of therapy. Rx. Clindamycin 98% effective per Baumgartner against endodontic micro-organisms. She's allergic to Penicillin which is 85% effective, so can't take Augmentin (Amoxicillin with Clauvulanic Acid) which is 100% effective.

- What is your diagnosis for this patient?** Acute Periradicular abscess