

Not to assume it's impossible  
because you find it hard. But to  
recognize that if it's humanly  
possible, you can do it too

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EDUCATION

Not to assume it's impossible  
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**MARCUS AURELIUS**

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EDUCATION

You just keep pushing. You just  
keep pushing. I made every  
mistake that could be made. But I  
just kept pushing

**RENE DESCARTES**

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Luck is what happens  
when preparation meets  
opportunity

**SENECA**

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We are what we repeatedly  
do. Excellence, therefore,  
is not an act, but a habit

**ARISTOTLE**

**obtr8**  
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If my mind can conceive it  
and my heart can believe  
it, then I can achieve it

**MUHAMMAD ALI**

**obtr8**  
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EDUCATION



### Advanced Endodontics & Retreatment

Dr. David Landwehr



A Company Of More. We Are Heartland Dental.



## Vision

To be a world class company and the leader in dentistry

## MISSION

To support doctors and their teams as they deliver the highest quality dental care and experiences to the communities they serve while providing exceptional careers and creating value for our stakeholders



Achieve



Execute



Honor



Balance



Collaborate



Celebrate

# 15-25 MILLION ROOT CANALS/YEAR IN USA

# 90 % SUCCESS

# 1.5 MILLION

# RETREATMENTS, SURGERIES OR EXTRACTIONS



## Root Canal Treatment Advanced Anatomy & Retreatment

David Landwehr D.D.S., M.S.  
Capital Endodontics  
Madison, Wisconsin



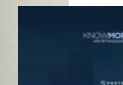
ADVANCING ENDODONTIC EDUCATION

David Landwehr, DDS, MS  
obtr8@yahoo.com • www.obtr8.com  
www.facebook.com/obtr8 @obtr8



### Bringing new technology to an existing medical field.

Surround Medical Systems is a medical device company that develops cutting edge 3D X-ray imaging systems. Utilizing nanotechnology, we are able to create 3D imaging systems with no motion of the X-ray source.



Do as little as needed,  
not as much as possible

HENK KRAAIJENHOF



PLEASE

Be cautious about integrating  
new technology into your  
practice

ADA C·E·R·P®

Continuing Education Recognition Program



EXPERT.....

A person who has made ALL the  
mistakes which can be made, in a  
narrow field

Niels Bohr



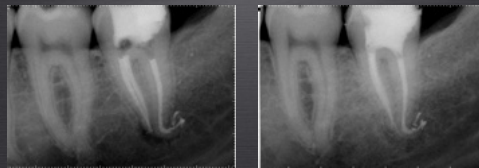
REMEMBER

None of the clinical outcomes have been  
altered in any way



REMEMBER

None of the clinical outcomes have been  
altered in any way



6 month



REMEMBER

This is my story !



## BACTERIA, BACTERIA, BACTERIA...



S Kakehashi, HR Stanley, RJ Fitzgerald. The effects of surgical exposures of dental pulps in germ-free and conventional laboratory rats. Oral Surg Oral Med Oral Pathol 1965; 20:340-49.

G Sundqvist. Bacteriological studies of necrotic dental pulps [odontologic dissertation no.7]. 1976 University of Umea Umea, Sweden

AJ Möller, L Fabricius, G Dahlén, et al. Influence on periapical tissues of indigenous oral bacteria and necrotic pulp tissue in monkeys. Scan J Dent Res 1981; 89:475-84.



## GOALS OF TREATMENT

Prevent / resolve apical periodontitis by:

Removal of all organic substrate from the canal system

Prevention of re-infection

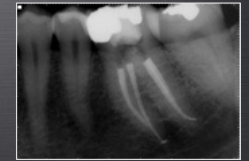


Schilder, Dent Clin Nor Am 1974

## GOALS OF TREATMENT

**Safely** deliver irrigant to within 2-3 mm of the working length

Preserve the natural anatomy of the tooth



## GOALS OF ROOT CANAL TREATMENT



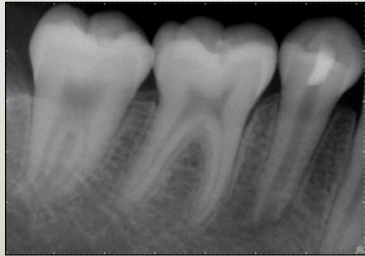
4.21.05



8.29.05



3.1.06



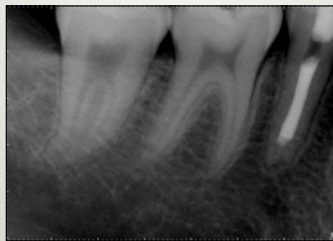
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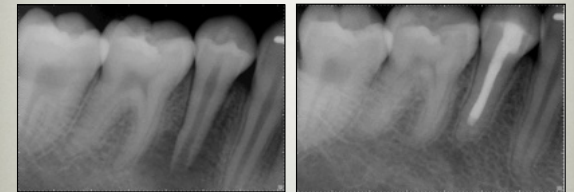
4.30.07



1.14.08



One Year



## APICAL HEALING NO OBTURATION

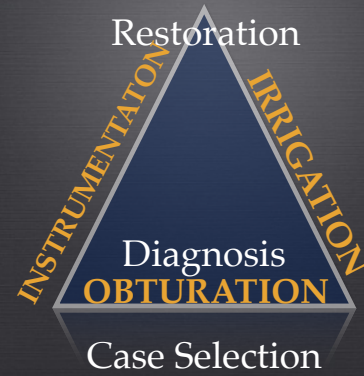


JOE 2006

The success of endodontic treatment depends on the elimination of the microorganism, host response and coronal seal

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## ENDODONTIC SUCCESS



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## CASE SELECTION

- Medical History
- Patient Management
- Anesthesia
- Access/Opening
- Anatomical Variability
- Isolation
- Resorption/Crack
- **Previous Endo**

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Everyone has a plan until they get punched in the mouth

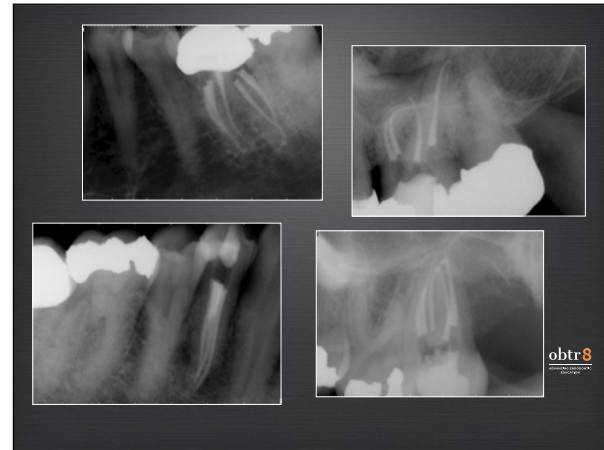
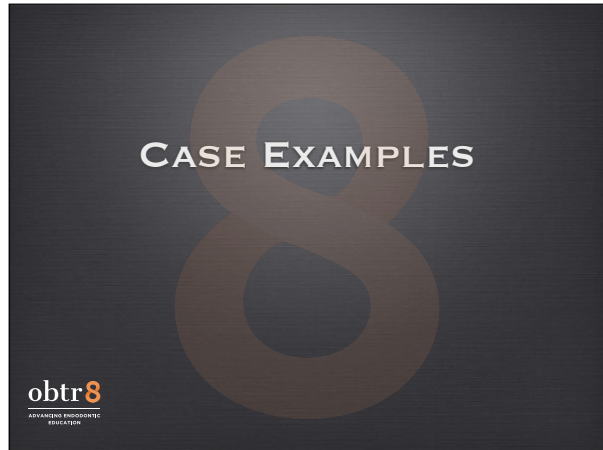
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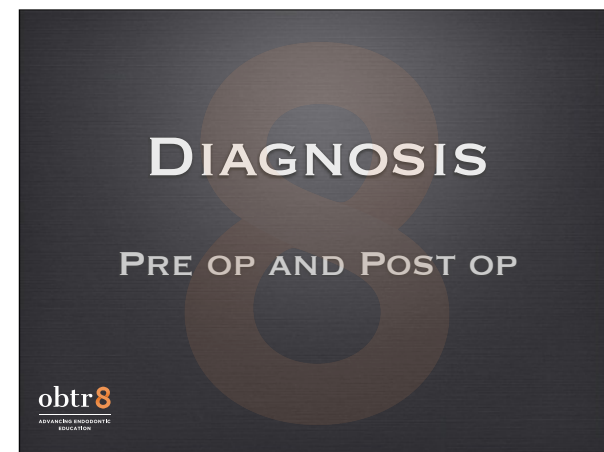
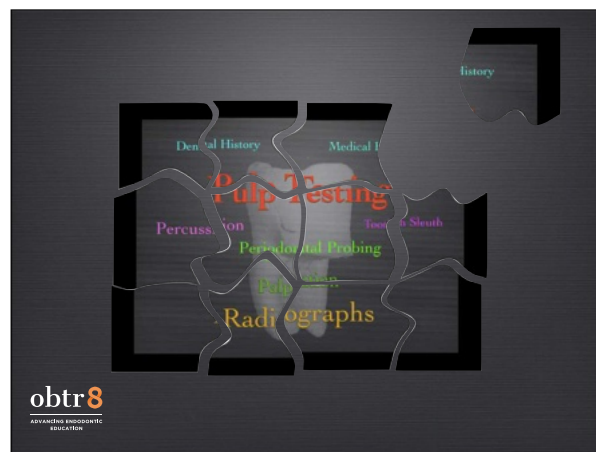
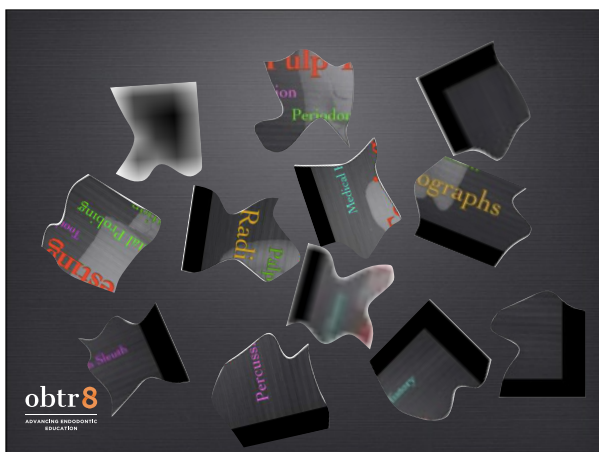
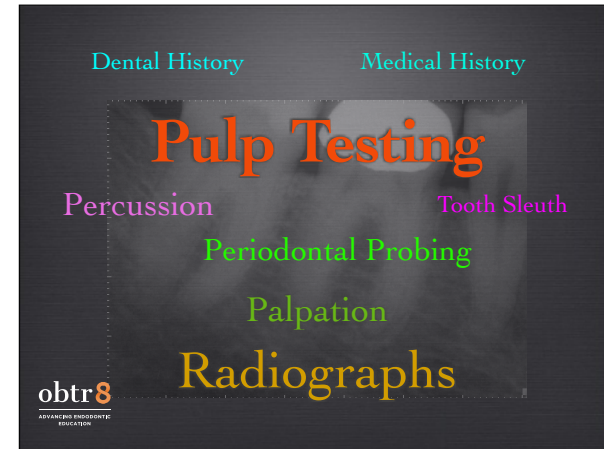


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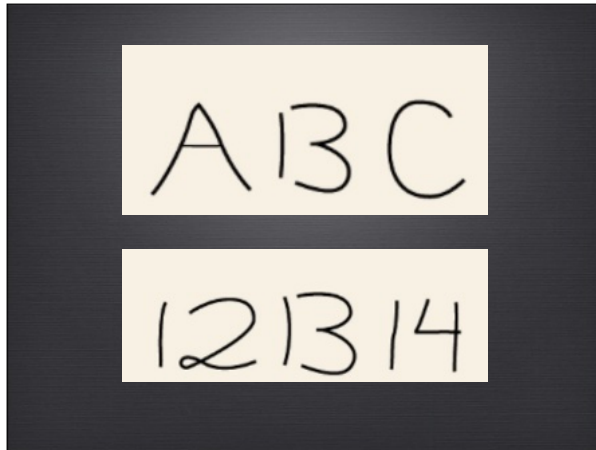
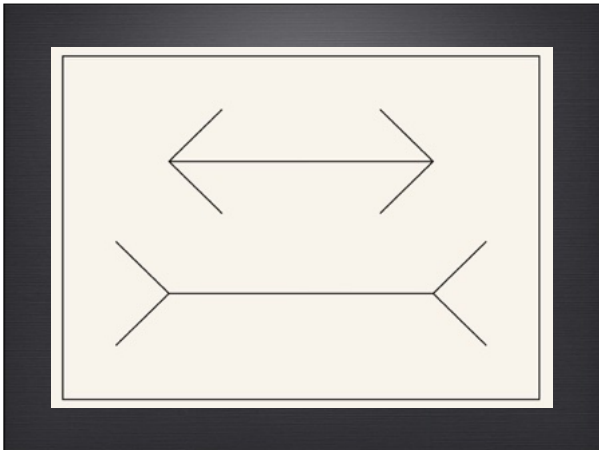


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**IN LESS THAN 10 SECONDS  
ANSWER THE FOLLOWING**

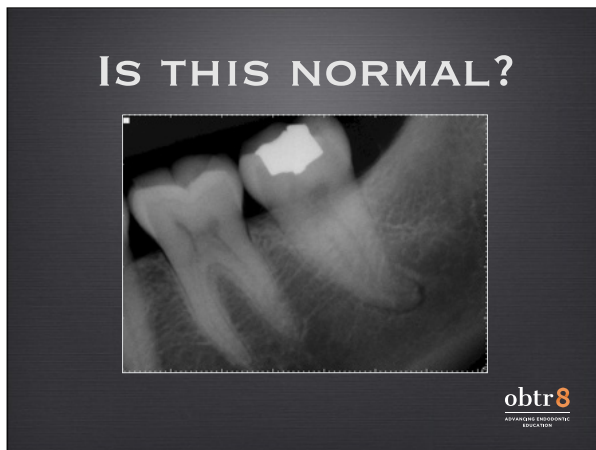

A bat and ball cost \$1.10  
The bat costs one dollar  
more than the ball  
How much does the ball  
cost?



**IN LESS THAN 10 SECONDS  
ANSWER THE FOLLOWING**


A bat and ball cost \$1.10  
The bat costs one dollar more  
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How much does the ball cost?

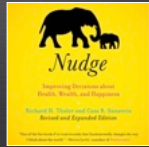
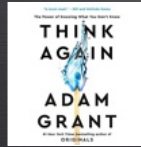
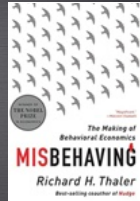
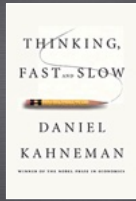
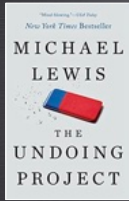
Bat \$1.00	Bat \$1.05
<del>Ball \$0.10</del>	Ball \$0.05



**RADIOLOGY  
LIMITATIONS**

One piece of **Subjective** diagnostic  
information





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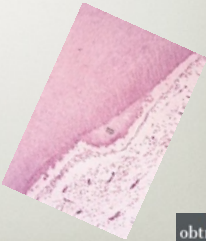


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## PULPAL

- Normal
- Reversible Pulpitis
- Irreversible Pulpitis
  - Symptomatic
  - Asymptomatic
- Necrotic



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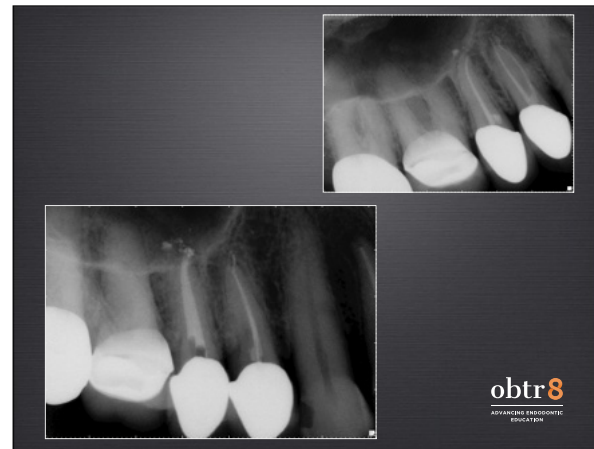
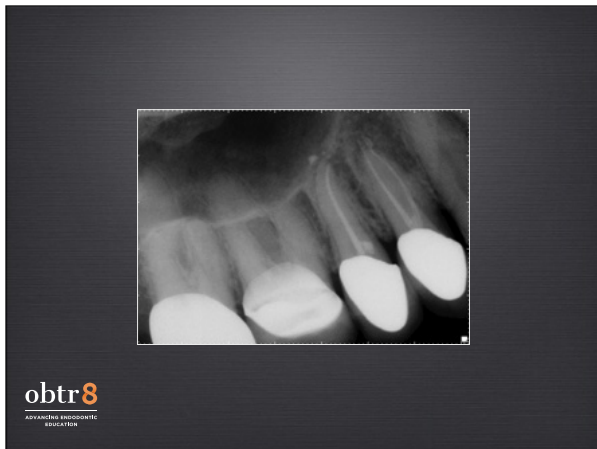
## PREVIOUSLY TREATED

**Has obturating material in canals**

May or may not present with signs or symptoms

Will require additional nonsurgical or surgical endodontic procedures to retain the tooth

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## PERIAPICAL

- Normal
- Asymptomatic Apical Perio
- Symptomatic Apical Perio
- Acute Apical Abscess
- Chronic Apical Abscess



## TESTING GOALS

- Repeatable
- Redundancy
- Chief Complaint

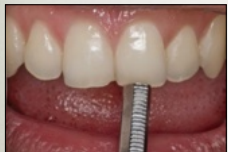


## PULP TESTING

- Thermal
- Electric
  - Laser Doppler Flowmetry (LDF)
  - Pulse Oximetry
  - Test Cavity
  - Selective Anesthesia



## PERIAPICAL TESTING

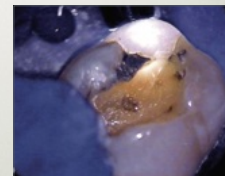


- Percussion
- Palpation
- Bite Stick



## OTHER TESTING

- Periodontal Probing
- Transillumination



## PULP TESTING LIMITATIONS



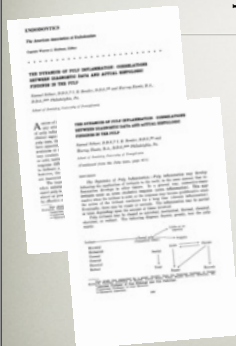
## LIMITATIONS OF PULP TESTING

The vitality of the pulp is determined by the health of the **vascular supply**, not the status of the pulpal nerve fibers

**Sensibility** Testing is not vitality testing



## LIMITATIONS OF PULP TESTING



Oral Sx 1963

-Not a good correlation between the objective clinical signs and symptoms and the pulpal histology

-No proprioception in pulp



## NO PROPRIOCEPTION



JOE 2010

Patients can localize painful tooth 73.3%

89% if periradicular



## LIMITATIONS OF PULP TESTING



Sensitivity is ability of a test to identify teeth that are diseased

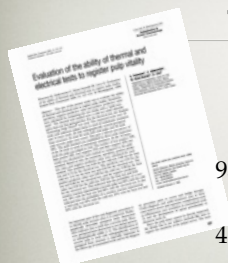
Cold test correctly identified 83% of the teeth that had a necrotic pulp

Heat 86%

Electric pulp tests 72%

T Petersson K, Soderstrom C, Kiani-Anaraki M, Levy G: Evaluation of the ability of thermal and electric tests to register pulp vitality. Endod Dent Traumatol 1999; 15:127. ext

## LIMITATIONS OF PULP TESTING



Specificity is the ability of a test to identify teeth without disease

93% were correctly identified by both cold and EPT

41% of the teeth with healthy pulps were identified correctly by the heat test

T Petersson K, Soderstrom C, Kiani-Anaraki M, Levy G: Evaluation of the ability of thermal and electric tests to register pulp vitality. Endod Dent Traumatol 1999; 15:127. ext

## RADIOLOGY LIMITATIONS



## WHO IS READING THE RADIOGRAPH ?

Interexaminer agreement ~ 50%  
 Intraexaminer agreement ~ 75 - 80 %

Goldman M, Pearson A, Darzenta N. Reliability of radiographic interpretations. Oral Surg 1974; 38(2):340.



## WHO IS READING THE DIGITAL RADIOGRAPH ?

100% agreement < 25%  
 5 agree ~ 50%  
 Intraobserver reliability  
 41 % - 85 %  
 Average 68 %

Tewary S, Luzzo J, Hartwell G. Endodontic radiography: who is reading the digital radiograph? J Endod. 2011 Jul;37(7):919-21.



## RADIOLOGY LIMITATIONS

Bone loss will not be detected if the lesion is only in cancellous bone

PA lesion when bone loss extends to the junction of the cortical and cancellous bone



Bender IB, Seltzer S: Roentgenographic and direct observation of experimental lesions in bone. Part I. J Am Dent Assoc 1961; 62:152.



## RADIOLOGY LIMITATIONS

Certain teeth are more prone to exhibit radiographic changes than others, depending on their anatomic location



Bender IB, Seltzer S: Roentgenographic and direct observation of experimental lesions in bone. Part II. J Am Dent Assoc 1961; 62:708.



## RADIOLOGY LIMITATIONS

Lesions were always larger than the radiographic image, especially in the molar region

Lesions were evident on the radiograph before junctional bone or cortical plate was involved



Shoha RR, Dowson J, Richards AG. Radiographic interpretation of experimentally produced bony lesions. Oral Surg Oral Med Oral Pathol. 1974;38(2):294-303.



## RADIOLOGY LIMITATIONS

7.1% mineral bone loss to produce a radiolucency

Lesions 1-7 mm didn't produce a lesion in cancellous bone



Bender IB. Factors influencing the radiographic appearance of bony lesions. J Endod 1982 Apr;8(4):161-70.



## RADIOLOGY LIMITATIONS



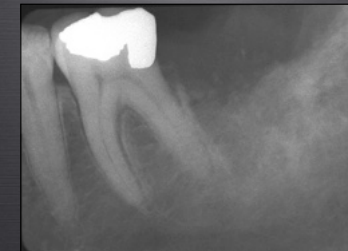
Can have PA radiolucency or PDL changes and inflamed tissue in root canal

Yamasaki M, Kumazawa M, Kohsaka T, Nakamura H, Kameyama Y. Pulpal and periapical tissue reactions after experimental pulpal exposure in rats. J Endod 1994 Jan;20(1):13-7.

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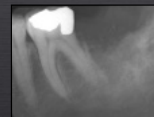
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## Post Operative Diagnosis

Does Treatment Outcome Meet Clinical Expectations?



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## CBCT

CBCT is accurate in detecting apical periodontitis

Estrela C, Bueno MR, Leles CR, Azevedo B, Azevedo JR. Accuracy of cone beam computed tomography and panoramic and periapical radiography for detection of apical periodontitis. J Endod 2008 Mar;34(3):273-9.

De Paula-Silva FW, Wu MK, Leonardo MR, da Silva LA, Wesselink PR. Accuracy of periapical radiography and cone-beam computed tomography scans in diagnosing apical periodontitis using histopathological findings as a gold standard. J Endod 2009 Jul;35(7):1009-12.

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## CBCT



CBCT devices demonstrated **poor** accuracy in detecting simulated lesions smaller than **0.8 mm** in diameter

fair to **good** accuracy when simulated lesion diameter was between **0.8-1.4 mm**

**excellent** accuracy when simulated lesions were larger than **1.4 mm** in diameter

Tsai P, Torabinejad M, Rice D, Azevedo B. Accuracy of cone-beam computed tomography and periapical radiography in detecting small periapical lesions. J Endod 2012 Jul;38(7):965-70.



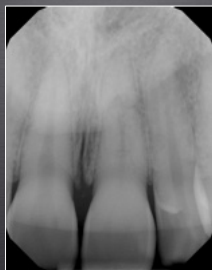
## CBCT SENSITIVITY



## CBCT SENSITIVITY



## CBCT SENSITIVITY



## CBCT SENSITIVITY



## CBCT SENSITIVITY



1.3 - 2.9 incidental findings per CBCT

24 - 93 % of scans had incidental findings

Edwards R, Altalibi M, Flores-Mir C. The frequency and nature of incidental findings in cone-beam computed tomographic scans of the head and neck region: a systematic review. J Am Dent Assoc 2013 Feb;144(2):161-70.





## RADIOLOGY LIMITATIONS



“interpreting the lamina dura continuity, shape and density, and the periodontal ligament width and shape proved to be the best radiographic features”

Kaffe I, Gratt BM. Variations in the radiographic interpretation of the periapical dental region. J Endod 1988 Jul;14(7):330-5.



## CBCT LIMITATIONS

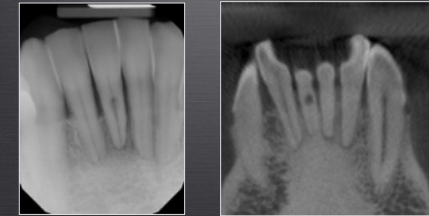


PDL spaces of healthy teeth demonstrated significant variation when examined by CBCT

Pope O, Sathorn C, Parashos P. A comparative investigation of cone-beam computed tomography and periapical radiography in the diagnosis of a healthy periapex. J Endod 2014 Mar;40(3):360-5.



## CBCT LIMITATIONS



## CBCT LIMITATIONS



Clinicians' experience level appears to be correlated with their ability to correctly diagnose **periapical** disease in CBCT volumes

Parker JM, Mol A, Rivera EM, Tawil PZ. Cone-beam Computed Tomography Uses in Clinical Endodontics: Observer Variability in Detecting Periapical Lesions. J Endod 2017 Feb;43(2):184-187.



## RADIOGRAPHIC INTERPRETATION

- Common things occur more often \*\*\*
- Similar clinical presentations but very different treatments and potential outcomes
- Same lesion can have many different presentations



## RADIOGRAPHIC INTERPRETATION

- 90%  $\neq$  100%
- Smaller lesions- unilocular
- Larger lesions- multilocular
- Patient can have more than a single pathology

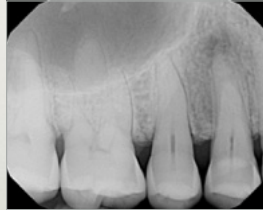


# REMEMBER...

Anything can happen in anyone at anytime



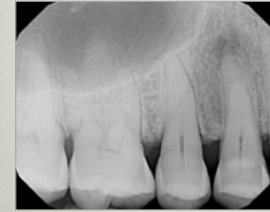
## THOUGHTS?



60 year old female  
Breast cancer - lumpectomy and radiation 5 years ago



## THOUGHTS?

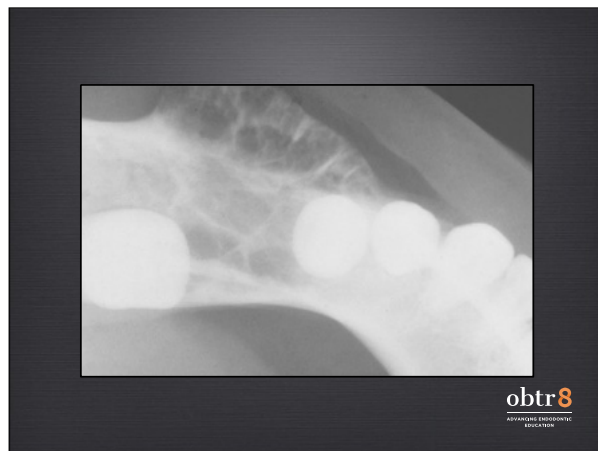
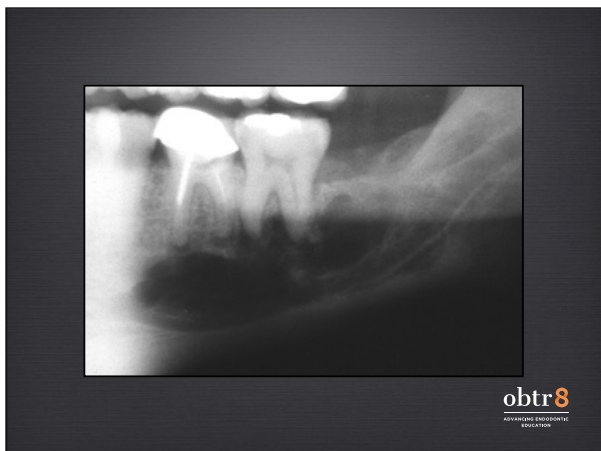


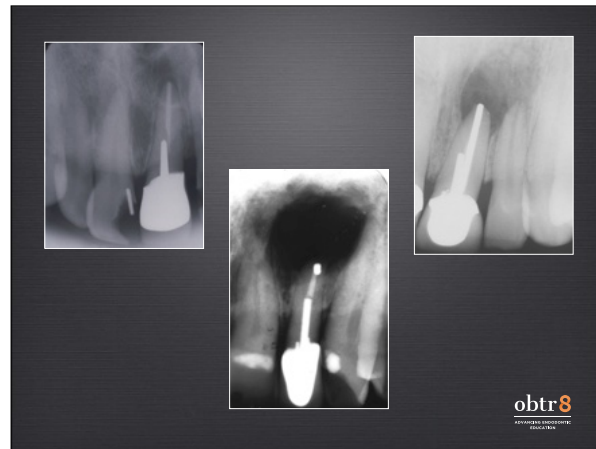
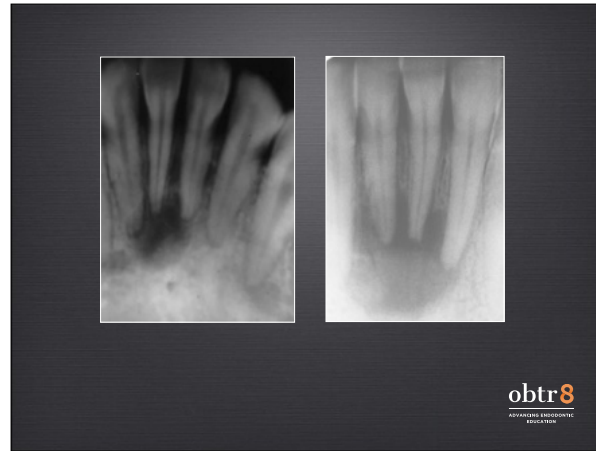
**Tooth 1-4**  
Responds to cold  
Responds to EPT  
+ Percussion  
+ Palpation  
NO CBCT



RECOGNIZE WHAT  
**ISN'T** NORMAL AND  
DO SOMETHING  
ABOUT IT








## DIFFERENTIAL OVERVIEW

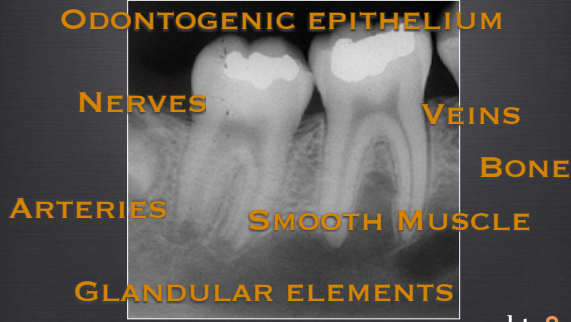
- **M**etabolic
- **I**nfectious
- **N**eoplastic
- **D**evelopmental



The logo 'obtr8' with the tagline 'ADVANCED ORTHODONTIC EDUCATION' is located in the bottom right corner.



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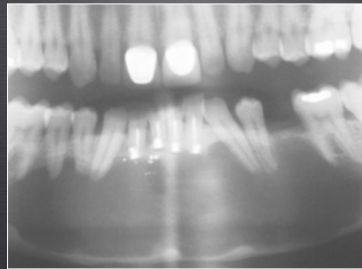
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## SYSTEMATIC DIFFERENTIAL DIAGNOSIS OF PERIAPICAL PATHOLOGY

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UNILOCULAR  
MULTILOCULAR

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## MULTILOCULAR RADIOLUCENCIES

Odontogenic keratocyst\*\*\*  
Ameloblastoma\*\*\*

Central giant cell lesion\*\*

## MULTILOCULAR RADIOLUCENCIES

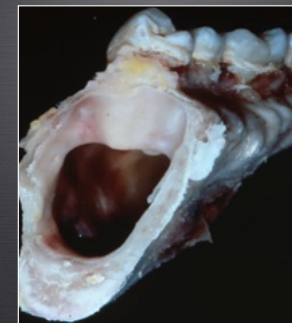
Keratocystic Odontogenic Tumor\*\*\*  
Ameloblastoma\*\*\*

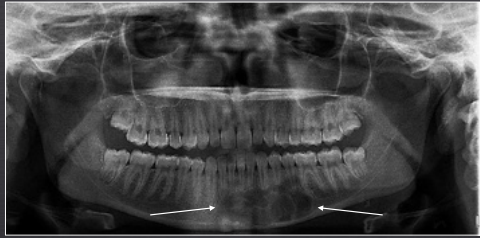
Central giant cell lesion\*\*

## MULTILOCULAR RADIOLUCENCIES

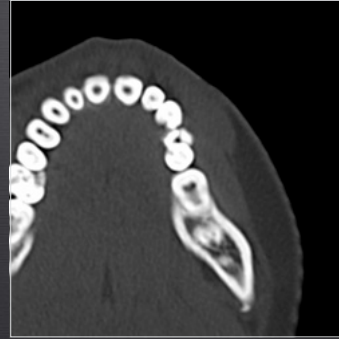
Odontogenic keratocyst\*\*\*  
Ameloblastoma\*\*\*

Central giant cell lesion\*\*





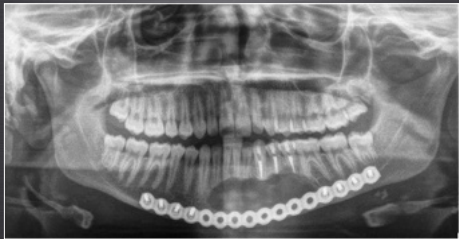
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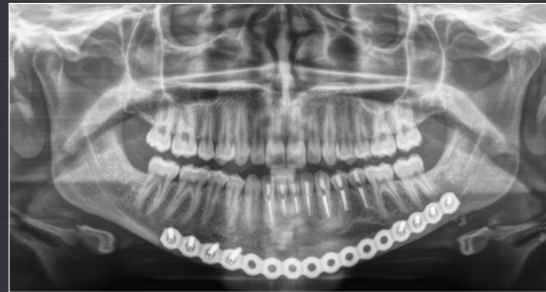
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ADVANCED ENDODONTIC  
EDUCATION



obtr8  
ADVANCED ENDODONTIC  
EDUCATION



obtr8  
ADVANCED ENDODONTIC  
EDUCATION



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EDUCATION

ISOLATED  
8  
MULTIFOCAL

## MULTIFOCAL

Cemento-osseous dysplasia\*\*\*

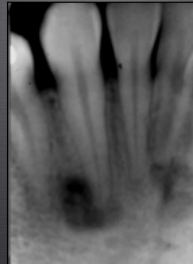
Nevoid basal cell carcinoma syndrome\*\*

Multiple myeloma\*\*

Cherubism\*

Hyperparathyroidism\*

Langerhans cell histiocytosis\*

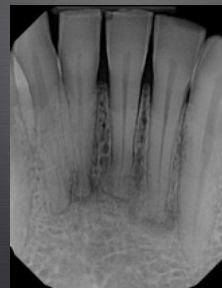


## PERIAPICAL CEMENTO-OSSEOUS DYSPLASIA

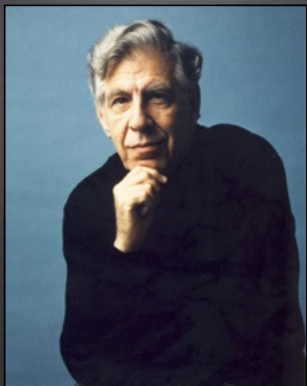
- Early lesions will be radiolucent but with time this will change
- Anterior Mn
- More common multiple, solitary possible

## PERIAPICAL CEMENTO-OSSEOUS DYSPLASIA

- Female (10:1)
- 70% african american-
- Initial Dx between 30-50 years of age (almost never before 20)
- **Vital pulps**
- **Asymptomatic**







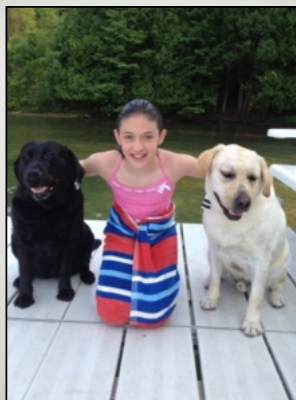
## NEVOID BASAL CELL CARCINOMA SYNDROME

- Jaw Cysts
- Basal Cell Carcinomas
- Intracranial Calcification
- Rib / Vertebral anomalies
- Palmar and Plantar pits
- Variability

1 in 60,000 live births



9 month recall

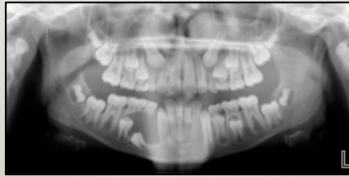


## DIFFERENTIAL DIAGNOSIS

- Dentigerous cyst
- Adenomatoid Odontogenic Tumor
- Ameloblastic Fibroma
- Ameloblastic Fibro-odontoma
- Ameloblastoma
- Odontogenic Keratocyst

## TREATMENT & DIAGNOSIS

Odontogenic Keratocyst



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DENTISTRY

## ISSUES

# Odontogenic Keratocyst

Recurrence

# Syndrome

Inheritance

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DENTISTRY



6 month recall

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ADVANCED PROSTHETIC  
DENTISTRY



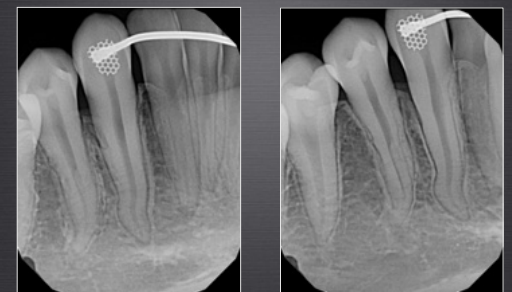
1 year recall

obtr8  
ADVANCED PROSTHETIC  
DENTISTRY



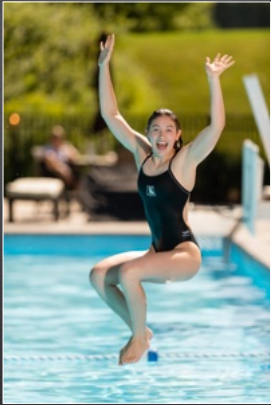
6 year recall

obtr8  
ADVANCED PROSTHETIC  
DENTISTRY



6 year recall

obtr8  
ADVANCED PROSTHETIC  
DENTISTRY



9 year recall

obtr8  
ADVANCED RADIOLOGICAL  
TECHNOLOGY

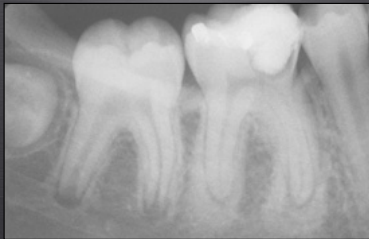
RADIOLUCENT  
MIXED  
RADIOPAQUE

obtr8  
ADVANCED RADIOLOGICAL  
TECHNOLOGY

**RADIOPACITIES:  
WELL-DEMARCATED BORDERS\*\*\***

Torus or exostosis  
Retained root tip  
Condensing osteitis  
Idiopathic osteosclerosis

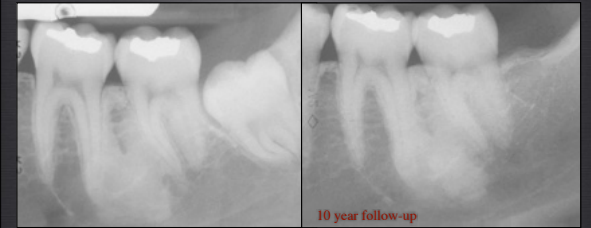
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ADVANCED RADIOLOGICAL  
TECHNOLOGY



obtr8  
ADVANCED RADIOLOGICAL  
TECHNOLOGY

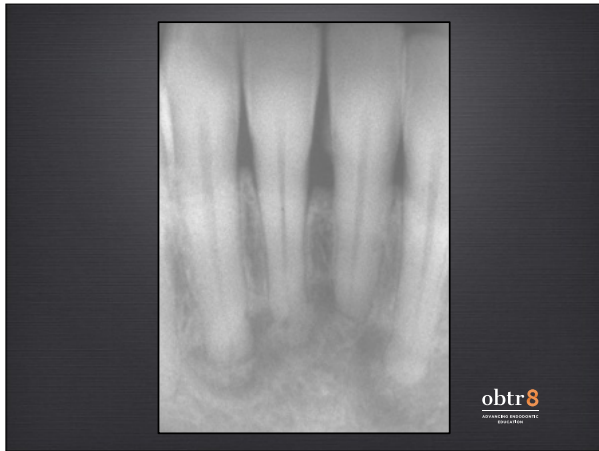


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ADVANCED RADIOLOGICAL  
TECHNOLOGY



10 year follow-up

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TECHNOLOGY



**RADIOLUCENCIES:  
ILL DEFINED**

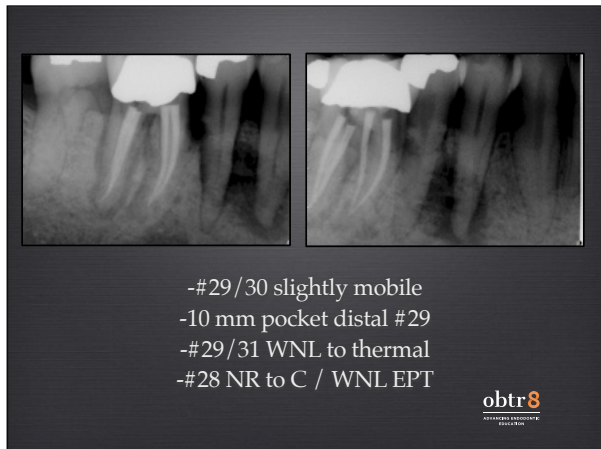
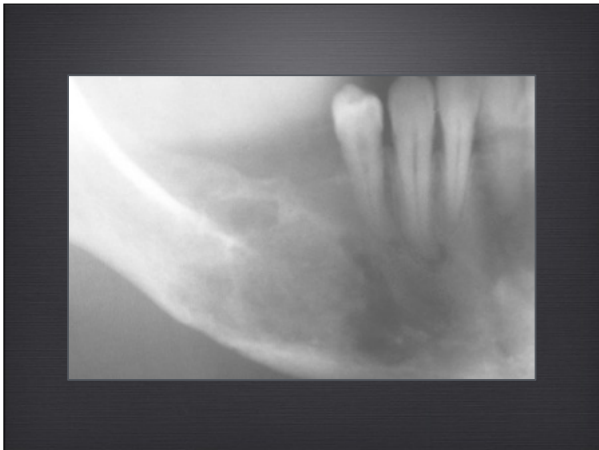
Periapical granuloma or cyst\*\*\*  
Focal osteoporotic marrow defect\*\*\*

Osteomyelitis\*\*  
Medication related osteonecrosis\*\*

obtr8  
ADVANCED RADIOLOGICAL  
TECHNIQUES

This slide features a light beige background with a large, faint number '8' on the left side. The text is centered and lists conditions associated with ill-defined radiolucencies.

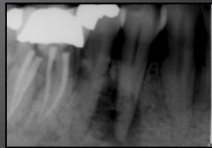




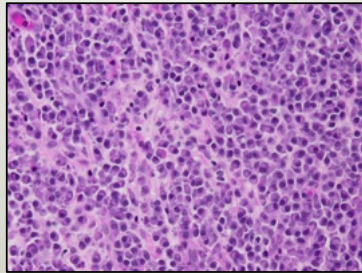
### TREATMENT

- Refer for biopsy and extraction

Differential:  
lymphoma, osteomyelitis, metastatic disease, primary malignancy, MRONJ



The obtr8 logo is visible in the bottom right corner.



High power H&E



2 year follow-up



4 year follow-up



## DRUG RELATED OSTEONECROSIS OF THE JAW

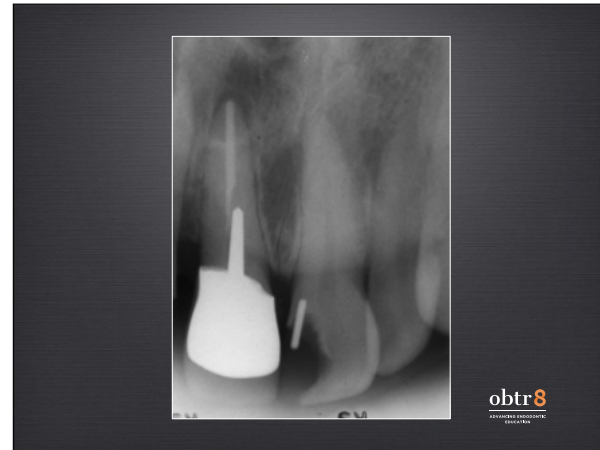
- |              |                 |                 |
|--------------|-----------------|-----------------|
| Sunitinib    |                 |                 |
| Sorafenib    |                 | Bisphosphonates |
| Regorafenib  | Radium 223      | Denosumab       |
| Imatinib     |                 | Bevacizumab     |
| Axitinib     | Raloxifene      | Adalimumab      |
| Pazopanib    |                 | Infliximab      |
| Cabozantinib | Aflibercept     | Rituximab       |
| Dasatinib    |                 | Romosozumab     |
| Everolimus   | Corticosteroids |                 |
| Temsirolimus | Methotrexate    |                 |
| Sirolimus    |                 |                 |



## RADIOLUCENCIES: ILL DEFINED\*

- Osteosarcoma
- Chondrosarcoma
- Ewing's sarcoma
- Other primary bone malignancies:  
fibrosarcoma, lymphoma
- Metastatic tumors
- Multiple myeloma
- Primary intraosseous carcinomas  
odontogenic or salivary





UNILOCULAR  
WELL DEFINED  
ISOLATED  
RADIOLUCENCIES

**UNILOCULAR  
RADIOLUCENCIES:  
PERIAPICAL**

Periapical granuloma\*\*\*  
Periapical cyst\*\*\*

Periapical cemento-osseous dysplasia (early)\*\*

Periapical scar\*  
Dentin dysplasia type I \*

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DENTISTRY



## UNILOCULAR RADIOLOCENCIES: OTHER

Developing tooth bud\*\*\*

Lateral radicular cyst\*\*

Nasopalatine duct cyst\*\*

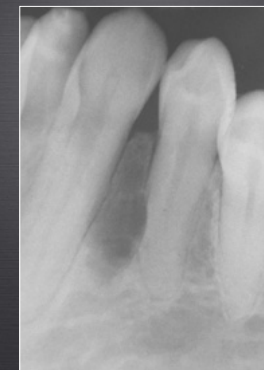
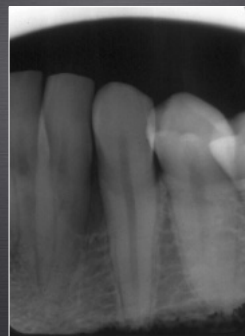
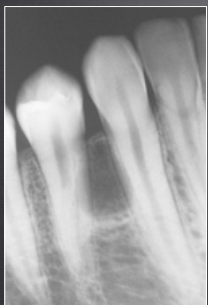
Lateral periodontal cyst\*\*

Residual (periapical) cyst\*\*

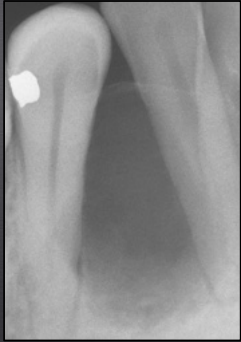
Odontogenic keratocyst\*\*

Central giant cell granuloma\*\*

Stafne bone defect\*\*







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DENTISTRY



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DENTISTRY



Fig. 3-1

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DENTISTRY



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DENTISTRY



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EDUCATION

## CONCLUSIONS



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The prevalence of apical periodontitis continues to increase in general adult worldwide population

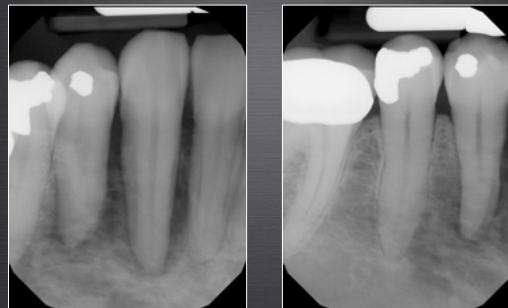
6.3%

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MULTILOCULAR  
MULTIPLE  
RADIOPAQUE  
ILL-DEFINED

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EDUCATION



"I have noticed pressure sensitivity for 6 months and teeth feel loose."

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## RADIOGRAPHIC INTERPRETATION

---

- Most radiolucencies are pulpal in origin
- Correlate findings... med history, dental history, clinical findings and ask???

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## RADIOGRAPHIC INTERPRETATION

## ROOT CANAL OR BIOPSY?

---

60 year old female  
Breast cancer - lumpectomy and radiation 5 years ago

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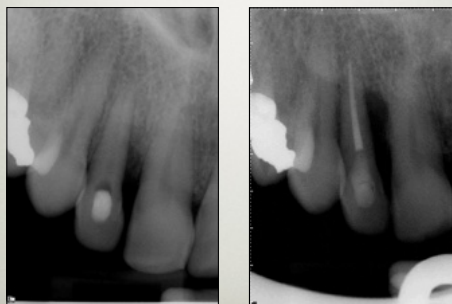
**obtr8**  
ADVANCING ENDODONTIC EDUCATION

**obtr8**  
ADVANCING ENDODONTIC EDUCATION

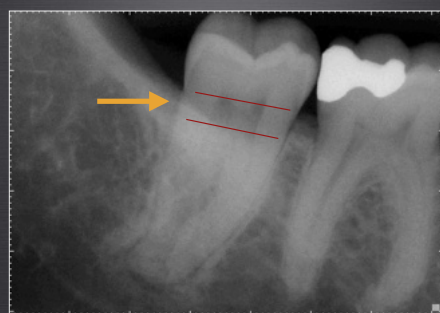
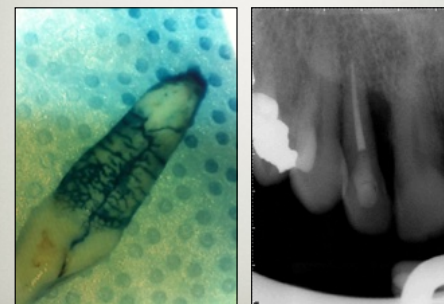
## CRACKS & FRACTURE DIAGNOSIS



## CRACKS & FRACTURE DIAGNOSIS



## CRACKS & FRACTURE DIAGNOSIS



## CRACKS & SPLIT TEETH

### Definition:

Crack that incompletely separates the crown into two parts

Propagation will result into a split tooth

## CRACKS & SPLIT TEETH

### Patient History:

Sharp pain to biting  
Longstanding symptoms  
Difficult to localize  
Pulpitis symptoms

## CRACKS & SPLIT TEETH

### Clinical Findings: (early)

- Variable Restorative History
- Vital Pulp (pulpitis ?)
- Inability To Chew
- Referred Pain
- Radiographs Normal
- Percussion ? / Tooth Sleuth



## CRACKS & SPLIT TEETH

### Clinical Findings: (late)

- Pulp Involvement
- Biting symptoms may decrease with loss of pulp vitality
- Apical Radiolucency



## CRACKS & SPLIT TEETH

### Clinical Findings: (late)

- Extensive Radiolucency
- Narrow Deep Periodontal Pockets (mesial / distal location)



## CRACKS & SPLIT TEETH

### Diagnosis:

- Tooth Sleuth
- Magnification
- Methylene Blue Dye
- Transillumination

**First Symptoms: Pressure or Pulp?**



## CRACKS & FRACTURED CUSPS



Figure 21-2 Pathways of the Pulp



## CRACKS & FRACTURED CUSPS

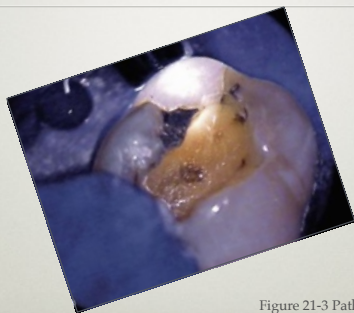


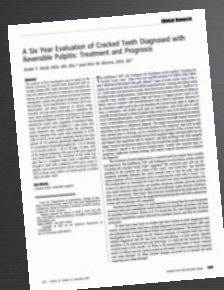
Figure 21-3 Pathways of the Pulp

## CRACKS & SPLIT TEETH

### Treatment Cracked Tooth:

- Goals : Protect tooth and improve function
- Determine Pulp Status
- Temporary Crown

## COMMUNICATION



If a marginal ridge crack is identified early enough in teeth with a diagnosis of RP and a crown is placed, root canal treatment will be necessary in about 20% of these cases within a 6-month period

## CRACKS & SPLIT TEETH

245 restored teeth

23.3% had preop cracks

60% had visible cracks following removal of restoration

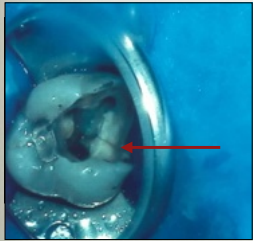
PV Abbott: Assessing restored teeth with pulp and periapical diseases for the presence of cracks, caries and marginal breakdown. Aust Dent J. 49:33 2004

## CRACKS & SPLIT TEETH



### Treatment Split Tooth:

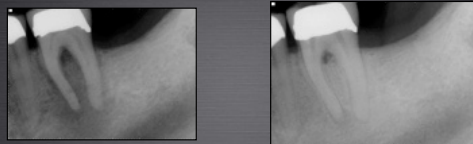
## CRACKS & SPLIT TEETH



Treatment Split Tooth:  
**EXTRACTION**



6 months post  
instrumentation



One year recall



Dr. Scott Doyle

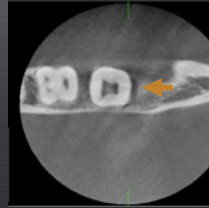
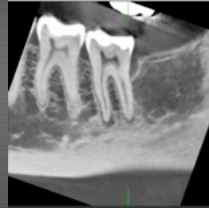


Dr. Scott Doyle

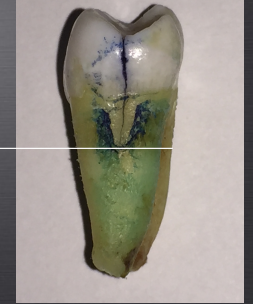




Dr. Scott Doyle



Dr. Scott Doyle



Dr. Scott Doyle

### PREOP



### CALCIUM HYDROXIDE



### OBTURATION

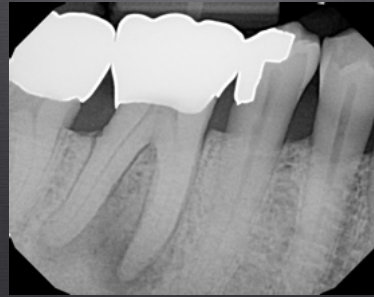




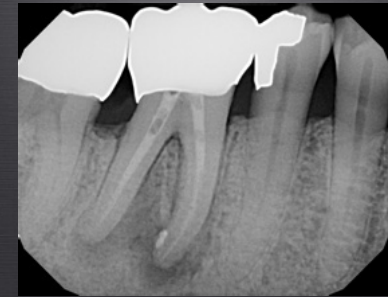
## SIX MONTH RECALL



## PREOP



## CALCIUM HYDROXIDE



## CONCLUSIONS



Dr. Scott Doyle

Difficult to Diagnose

Predict Future

Preserve Maximum  
Tooth Structure

**COMMUNICATE &  
DOCUMENT !**



## ACCESS, ANATOMY & GLIDE PATH MANAGEMENT



## RUBBER DAM



### AAE POSITION STATEMENT

The following statement was prepared by the AAE Clinical Practice Committee. AAE members may photocopy this position statement for distribution to patients or referring dentists.

#### DENTAL DAMS

The American Association of Endodontics is dedicated to excellence in the art and science of endodontics and to the highest standards of patient care. The accumulated clinical knowledge and judgment of the practitioner supported by evidence-based scientific research is the basis for endodontic treatment. Tooth isolation using the dental dam is the standard of care; it is integral and essential for any nonsurgical endodontic treatment.

A dental dam is a latex or nonlatex sheet with a hole punched in the material to allow placement around the tooth during the endodontic procedure. One of the primary objectives of endodontic treatment is disinfection of the root canal system. Only dental dam isolation minimizes the risk of contamination of the root canal system by indigenous oral bacteria. The dental dam also offers other benefits, such as aiding in visualization by providing a clear operating field and preventing ingestion or aspiration of dental materials, irrigants and instruments.





## RUBBER DAM



The use of a rubber dam during RCT could provide a significantly higher survival rate after initial RCT

This result supports that rubber dam usage improves the outcomes of endodontic treatments

J Endod 2014;40:1733-1737



## ISOLATION & VISUALIZATION

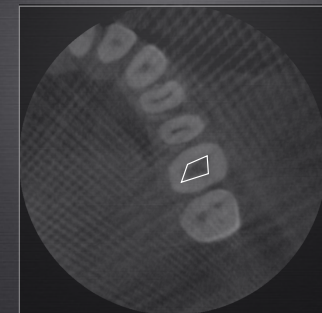


## ISOLATION & VISUALIZATION



## FINDING CANALS

Preoperative Radiograph(s)  
Bite wing angle  
CBCT ?  
CEJ/Perio Probe  
Others....





### ACCESS CONSIDERATIONS

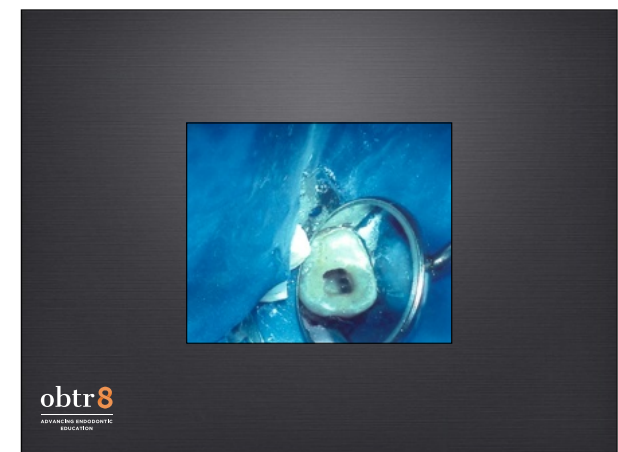
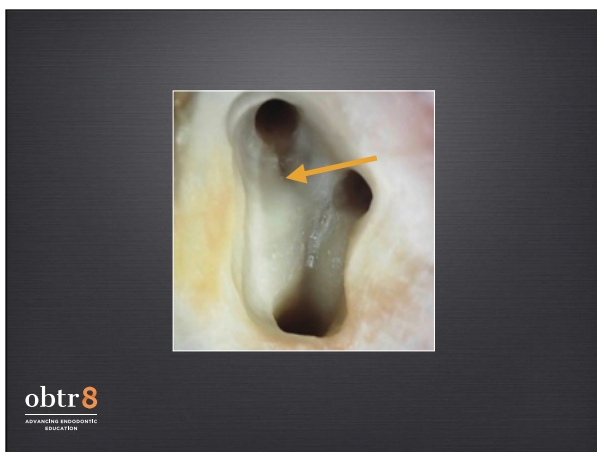
- **Floor** of chamber is in center of tooth at level of CEJ
- Walls of chamber are concentric to external surface of tooth at CEJ
- Distance from external surface of the clinical crown to the wall of the chamber is the same throughout the circumference of the tooth at the CEJ

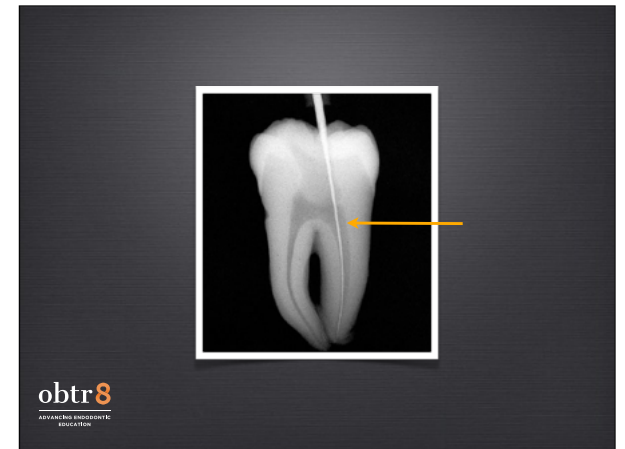
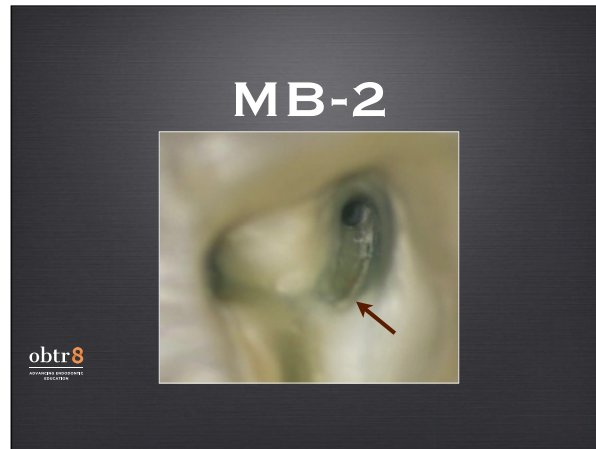
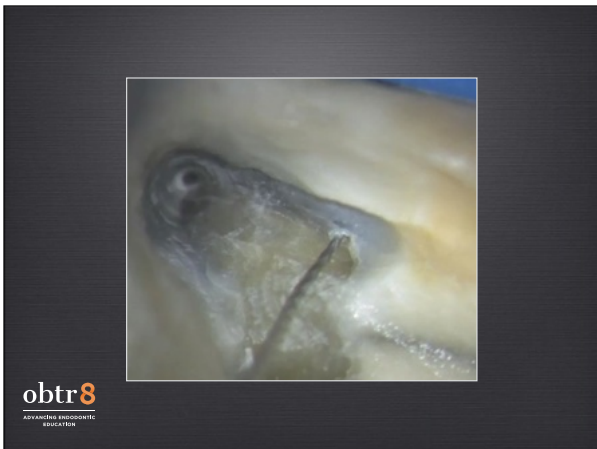
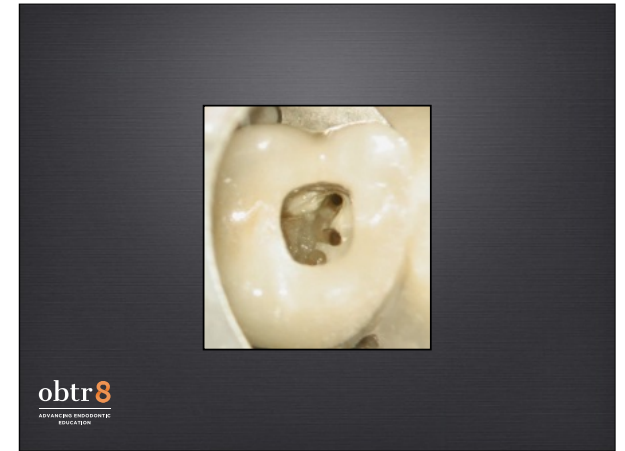
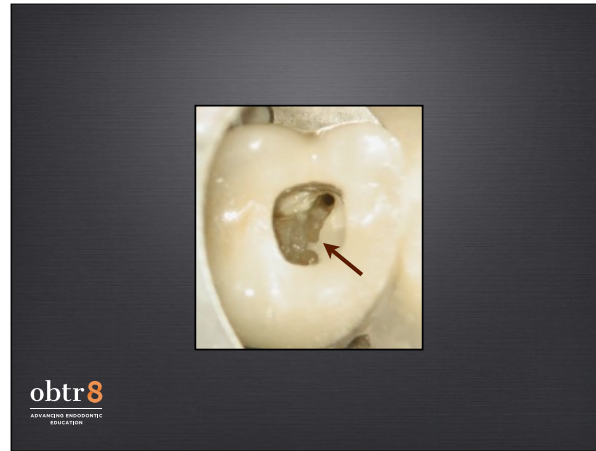
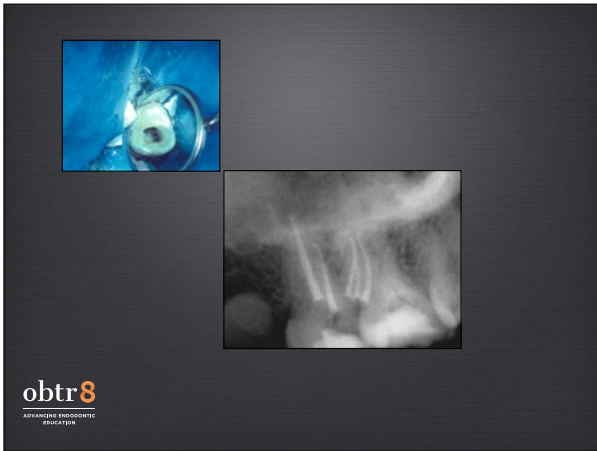
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### ACCESS CONSIDERATIONS

- Canal orifice is equidistant from a line drawn in a MD direction through the center of the pulp (not for Mx molars)
- Chamber floor is darker (different color than wall)
- Orifice is at junction of wall and floor

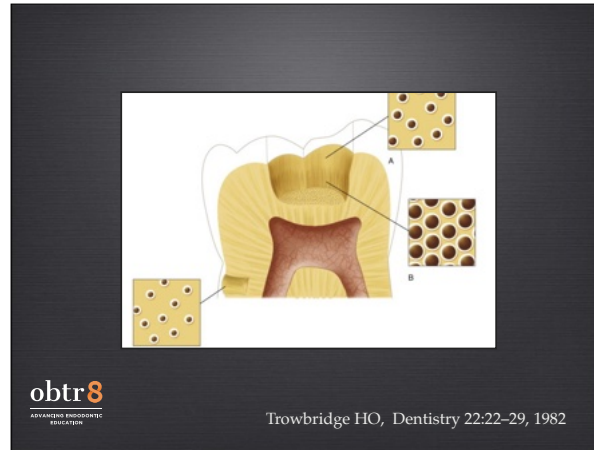
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ADVANCED ENDODONTIC EDUCATION







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ADVANCING ENDODONTIC  
EDUCATION

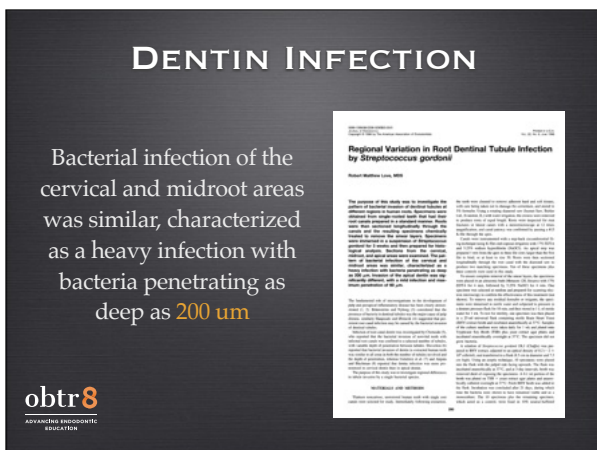


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EDUCATION

Trowbridge HO, Dentistry 22:22-29, 1982



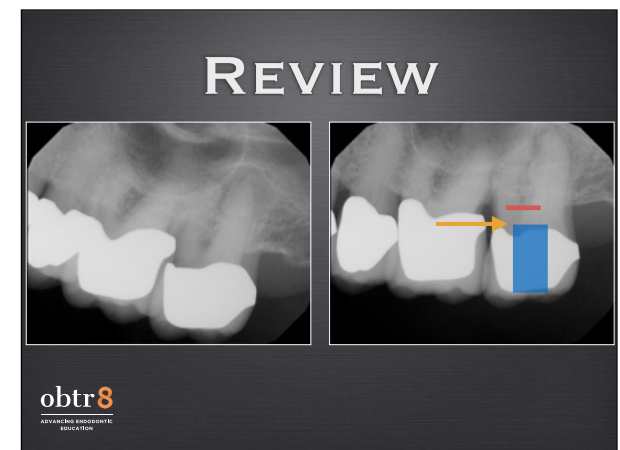
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ADVANCING ENDODONTIC  
EDUCATION



obtr8  
ADVANCING ENDODONTIC  
EDUCATION

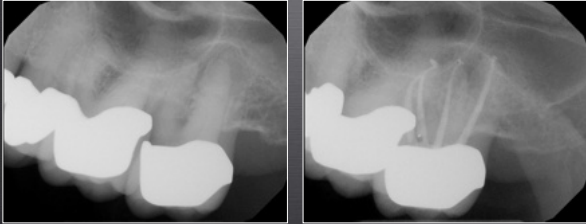


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ADVANCING ENDODONTIC  
EDUCATION



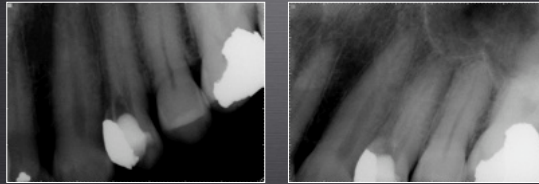
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ADVANCING ENDODONTIC  
EDUCATION

# REVIEW



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ADVANCED ENDODONTIC  
EDUCATION

# OOPS!



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ADVANCED ENDODONTIC  
EDUCATION

# OOPS!



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ADVANCED ENDODONTIC  
EDUCATION

# OOPS!



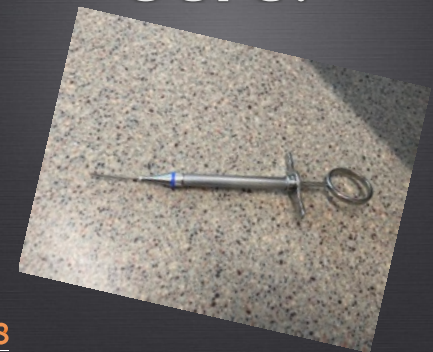
obtr8  
ADVANCED ENDODONTIC  
EDUCATION

# OOPS!



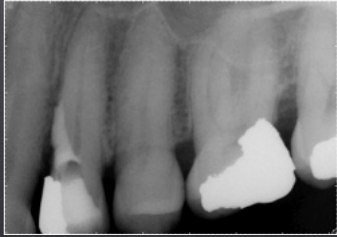
obtr8  
ADVANCED ENDODONTIC  
EDUCATION

# OOPS!



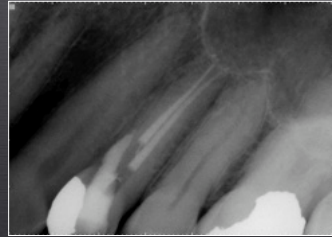
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ADVANCED ENDODONTIC  
EDUCATION

# OOPS!



obtr8  
ADVANCED ENDODONTIC  
EDUCATION

# OOPS!



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ADVANCED ENDODONTIC  
EDUCATION

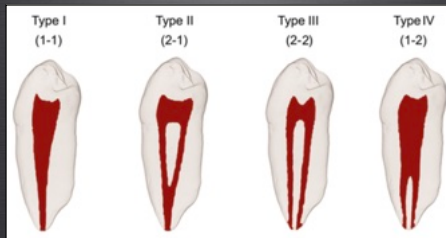
# OOPS!



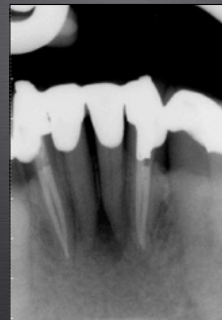
obtr8  
ADVANCED ENDODONTIC  
EDUCATION

1 year follow up

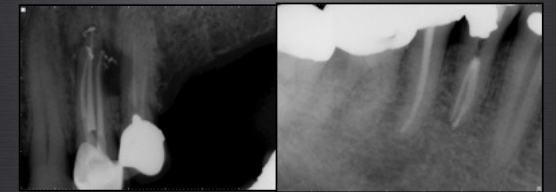
## ANATOMY



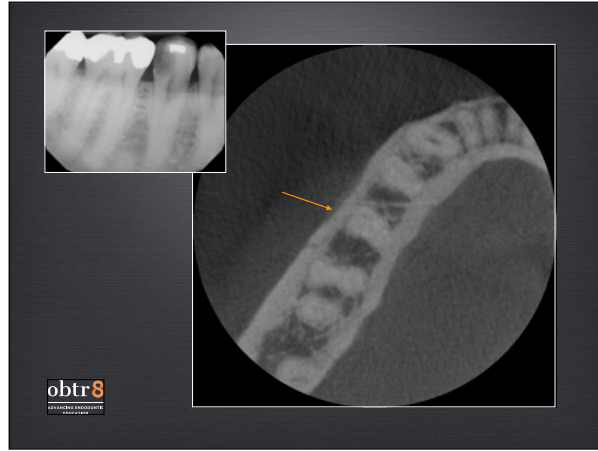
obtr8  
ADVANCED ENDODONTIC  
EDUCATION



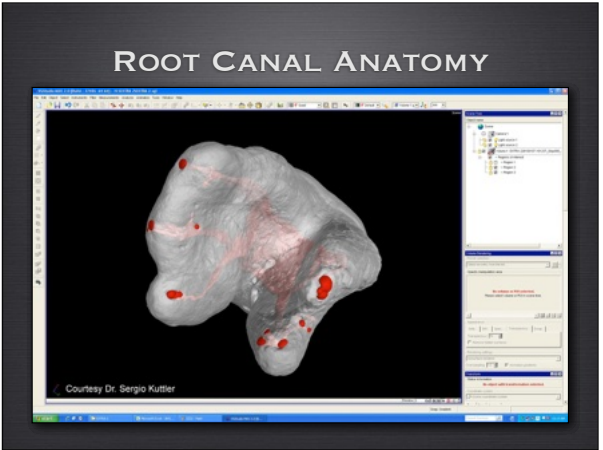
obtr8  
ADVANCED ENDODONTIC  
EDUCATION



obtr8  
ADVANCED ENDODONTIC  
EDUCATION





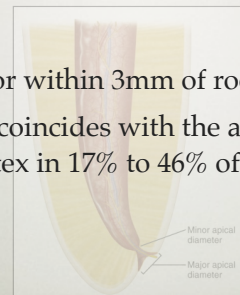


By Dr Marco Versiani



### APICAL LOCATION

- At or within 3mm of root apex
- AF coincides with the apical root vertex in 17% to 46% of cases



### APICAL LOCATION

- At or within 3mm of root apex
  - AF coincides with the apical root vertex in 17% to 46% of cases
- VARIABLE**



## APICAL SIZE

Teeth	Mean (um)
Mx incisors	289.4
Mn incisors	262.5
Mx premolars	210
Mn premolars	268.25
Mx molars	
Palatal	298
Mesiobuccal	235.05
Distobuccal	232.2
Mn Molars	
Mesial	257.5
Distal	392



Morfis et al OOO 1994

## APICAL SIZE

Teeth	Mean (um)
Mx incisors	289.4
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Palatal	298
Mesiobuccal	235.05
Distobuccal	232.2
Mn Molars	
Mesial	257.5
Distal	392



Morfis et al OOO 1994

**VARIABLE**

## APICAL ANATOMY

Close relationship between the anatomic complexity of the root canal system and the persistence of periradicular pathosis



WADA M, TAKASE T, ET AL. CLINICAL STUDY OF REFRACTORY APICAL PERIODONTITIS TREATED BY APICECTOMY PART 1. ROOT CANAL MORPHOLOGY OF RESECTED APEX. INT ENDOD J 1998; 31:53-56.

## APICAL ANATOMY



Approximately 75% of teeth have canal aberrations in the apical 3 mm of the tooth

DE DEUS QD. J ENDOD 1975; 1:361-66.

SELTZER S, SOLTANOFF W, BENDER IB, ZIONTZ M. ORAL SURG ORAL MED ORAL PATHOL 1966; 22:375-85.



## LATERAL



74%

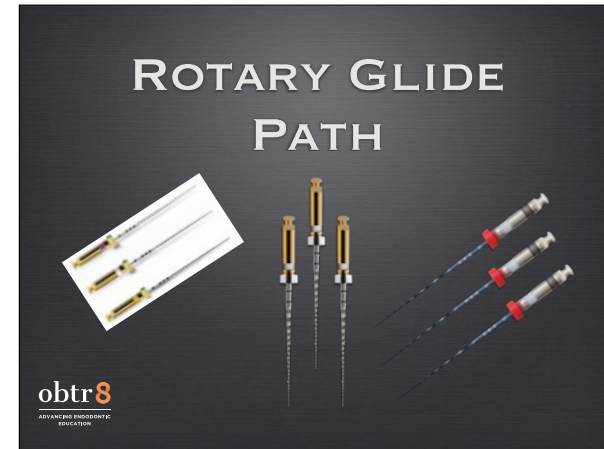
11%  
15%



of the  
rd  
rd

VERTUCCI FJ. ROOT CANAL ANATOMY OF THE HUMAN PERMANENT TEETH. ORAL SURG ORAL MED ORAL PATHOL 1984; 58:589-99.





Glide path preparation:

1. reduces the risk of debris extrusion
2. no influence on the incidence of dental crack formation
3. improves the preservation of the original canal anatomy

Preflaring increases the accuracy of working length determination

J Endod 2020;46:707-729

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ADVANCING ENDOODONTIC EDUCATION

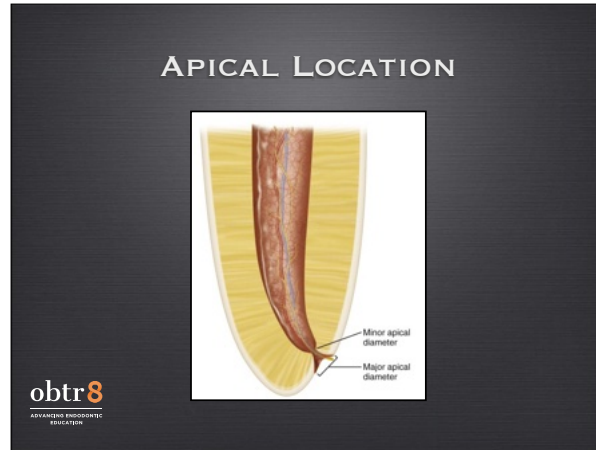
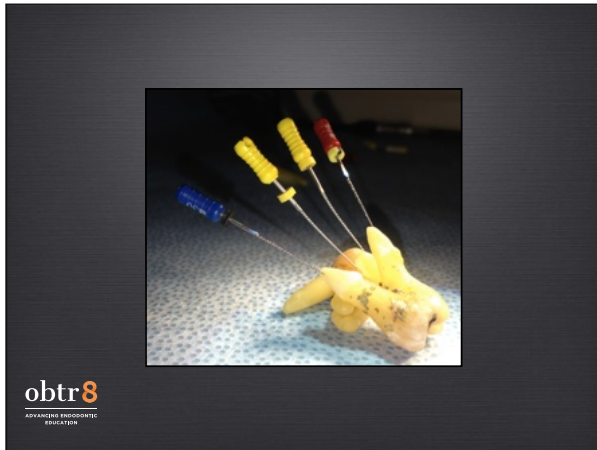
## All Mechanized Instrumentation Begins with a Hand File

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## GLIDE PATH GOAL

10 OR 15 FILE LOOSE AT THE WORKING LENGTH

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### PATENCY

Maintenance of apical patency does not increase the incidence, degree, or duration of post-operative pain

J Endod 2009;35:189-192

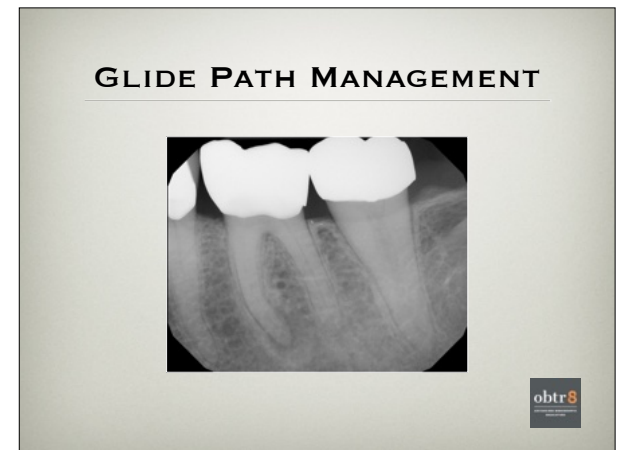
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ADVANCED ENDODONTIC EDUCATION

### FILE ANATOMY

0.02 taper

↑	↑	↑	↑
ISO 10	D-16	D-8	D-0
	0.42	0.26	0.10

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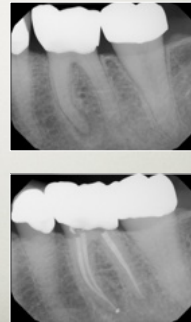


## GLIDE PATH MANAGEMENT



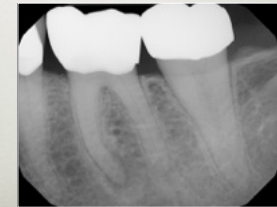
## GLIDE PATH MANAGEMENT

- Estimate working length
- Straight Line Access
- Orifice Opening
- Instrumentation



## TECHNIQUE

Which canal do I treat first ?



## TECHNIQUE

- Access
- Irrigate canal
- Open orifice/canal
  - 10 file
  - Vortex Orifice opener



**DO NOT ALLOW  
FILE TIP TO BIND  
OR HIT CANAL  
WALL**



## VORTEX ORIFICE OPENERS



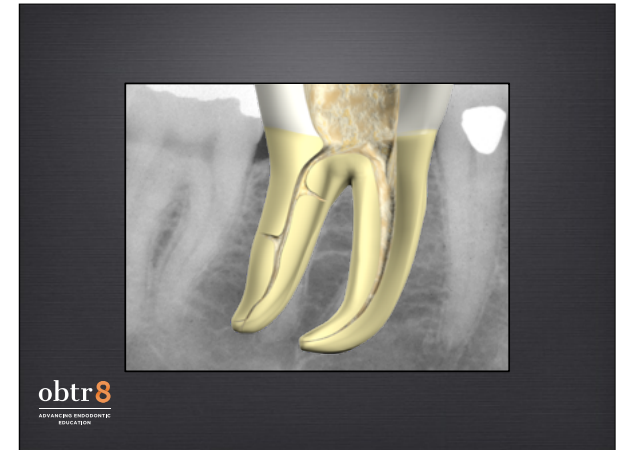
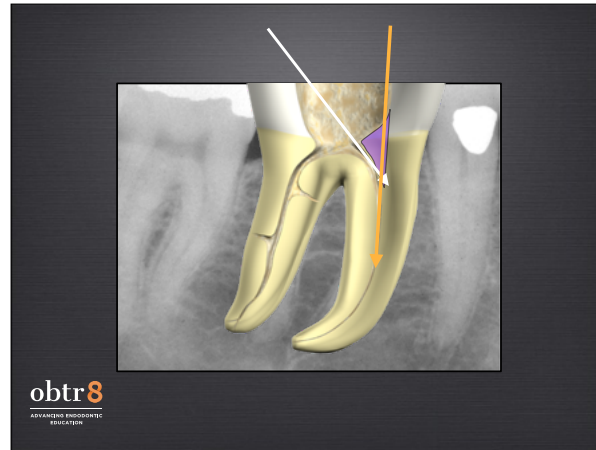
12mm of cutting flutes  
Parallel flutes in the last 3-4 mm  
16 mm 19 mm lengths  
500 rpm



## VORTEX ORIFICE OPENERS


Size (Tip/Taper)	Cutting Length	Tapered Length	Parallel Flutes 00 Taper Length	Maximum Fluted Diameter	Handle Color (Tip Size)	Stopper Color (Taper)	Taper Lines
20/.08	12 mm	9.0 mm	3.0 mm	0.92 mm	Yellow	Blue	4
25/.08	12 mm	9.3 mm	2.7 mm	0.99 mm	Red	Blue	4
25/.10	12 mm	9.4 mm	2.6 mm	1.19 mm	Red	Yellow	5
25/.12	12 mm	7.9 mm	4.1 mm	1.19 mm	Red	Black	6
30/.12	12 mm	8.0 mm	4.0 mm	1.26 mm	Blue	Black	6
40/.10	12 mm	7.9 mm	4.1 mm	1.19 mm	Black	Yellow	5





### TECHNIQUE


- After orifice is opened
- 10 file coronal to any binding
  - roughly 16-17 mm
- WOG Glider 1mm short of 10 file binding



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### WAVEONE GOLDGLIDER

- Reciprocation
- 0.15 mm tip
- Progressive Taper
- 21, 25, 31 mm lengths



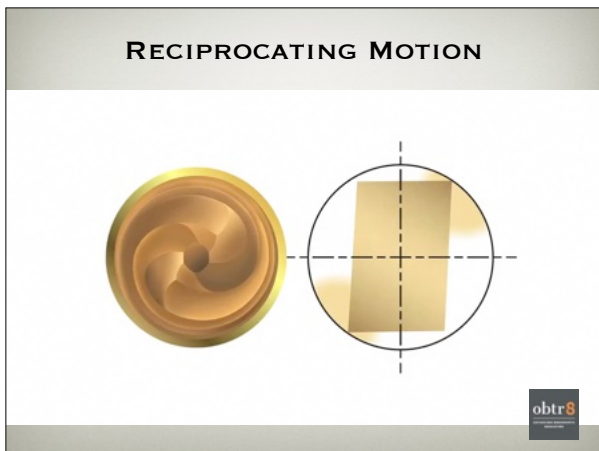
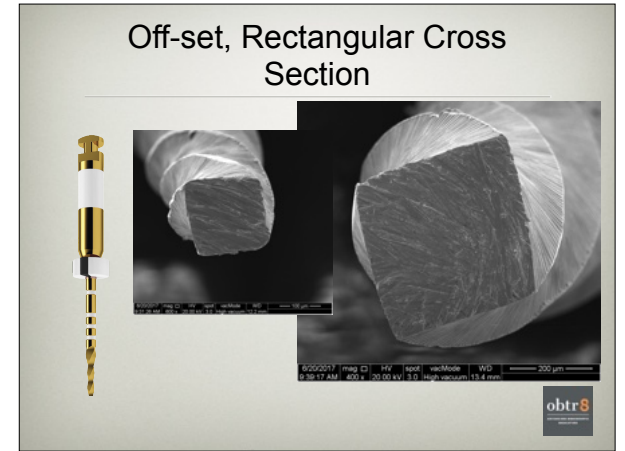
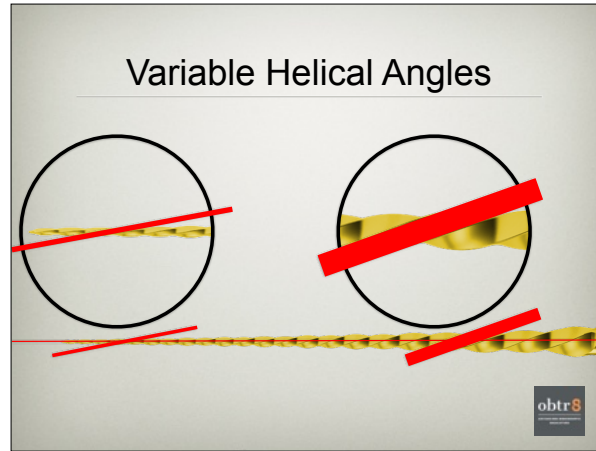
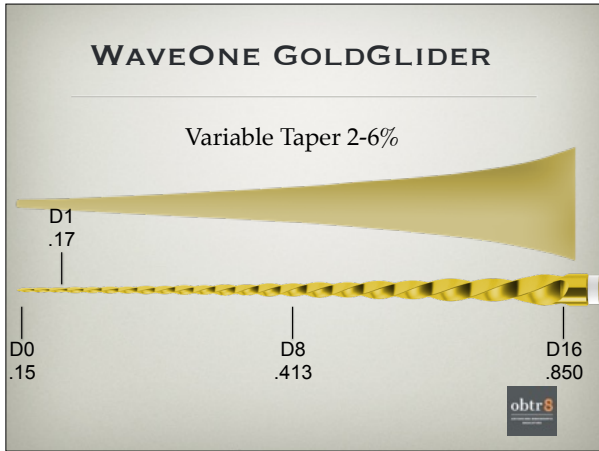
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### WAVEONE GOLDGLIDER

- Prepackaged
- Single use
- Metallurgy



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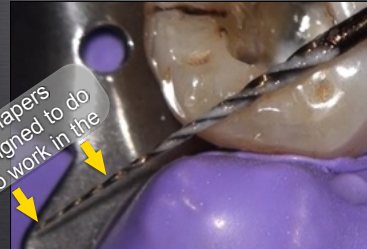


## S1 – DEBRIS PATTERN



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ADVANCING ENDODONTIC  
EDUCATION

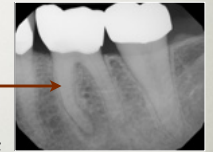
## S1 – DEBRIS PATTERN



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## TECHNIQUE

- After orifice is opened
- 10 file coronal to any binding
- roughly 16-17 mm
- WOG Glider 1mm short of 10 file binding



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EDUCATION

## TECHNIQUE

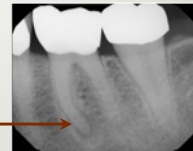
- 10 file coronal to any binding
- roughly 18-19 mm
- WOG Glider 1mm short of 10 file binding



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## TECHNIQUE

- 10 file coronal to any binding
- roughly 20-21mm
- WOG Glider 1mm short of 10 file binding



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EDUCATION

## TECHNIQUE

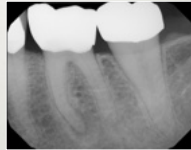
- 10 file apical to est WL (22-23mm)
- Determine WL (EAL +/- or Xray)
- If not at WL continue to work down canal without binding file tip
- WOG Glider @ working length



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## IF 10 FILE NOT ADVANCING

- Open to Final Shape,
  - (.5 mm short of depth of WaveOne Glider )
- Pre-Bend 10 File
- Smaller file ( I don't do this)
- Push 10 File and Engage Tip ( I try to never do this)



## TECHNIQUE REVIEW

- 10 file into canal (past dentin triangle)
- Orifice open (Vortex orifice opener 20/08, 16mm)
- 10 file tap to resistance (or est WL)
- WaveOne Glider @ 1 mm short of 10 file (or at WL)
- If not at estimated WL repeat sequence of 10 file and WaveOne Glider until estimated WL
- Final instrumentation



## WORKING LENGTH



## ELECTRONIC APEX LOCATOR



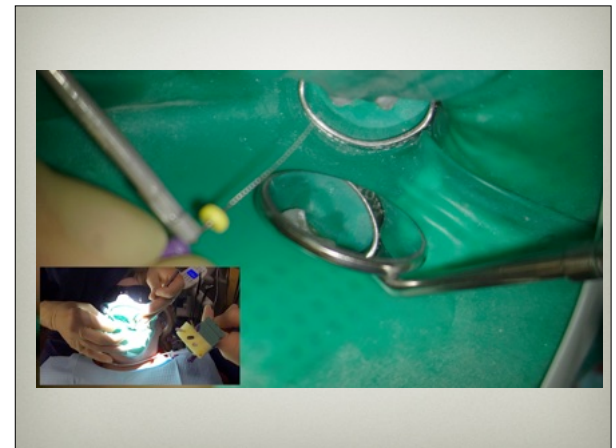
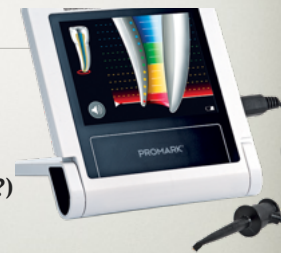
The data presented in the evaluated studies support the use of apex locators for WL measurements

J Endod 2015;41:1818-1823



## EAL CONSIDERATIONS

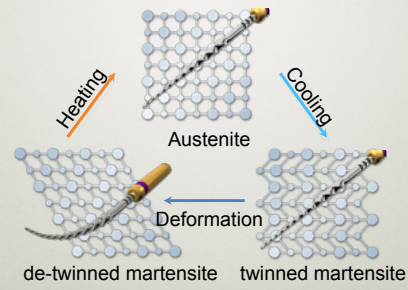
- Restorations
- Canal Moisture
- Pulpal Status
- File Size
- File Length (31mm?)
- Apical size
- Perforation/fractures
- Connections (x4)



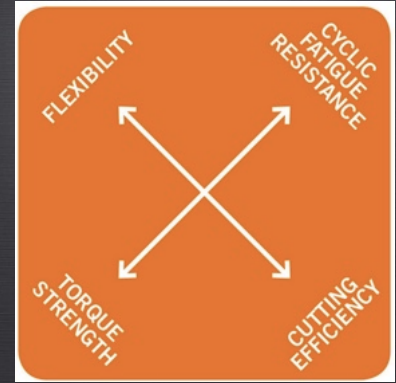
# INSTRUMENTATION

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## NiTi PHASES

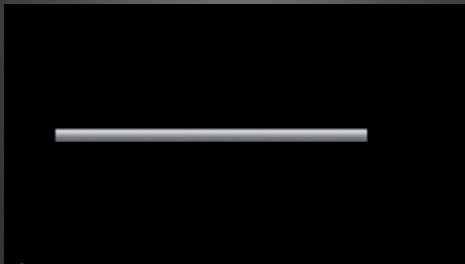


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## POST GRIND HEAT TREATMENT



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EDUCATION

wave • one<sup>®</sup>  
GOLD



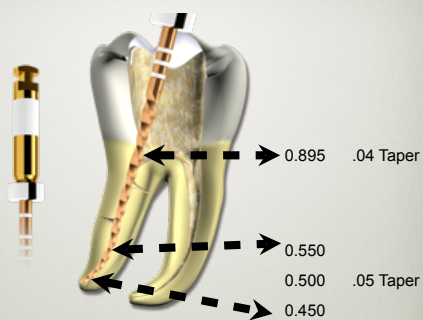
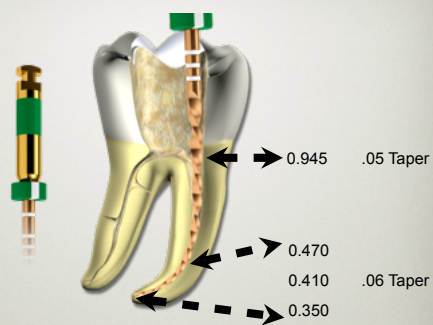
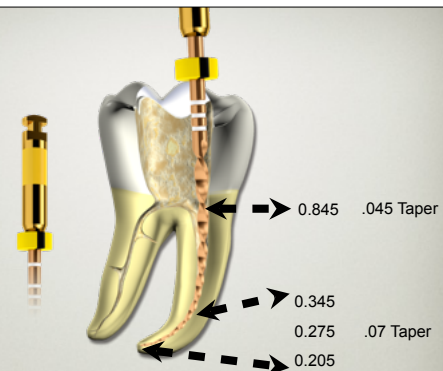
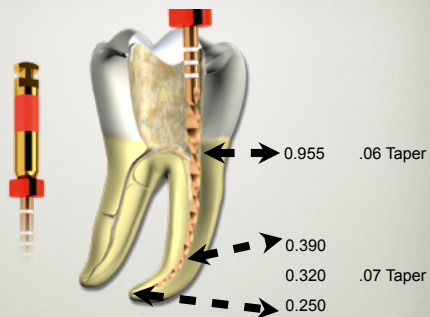
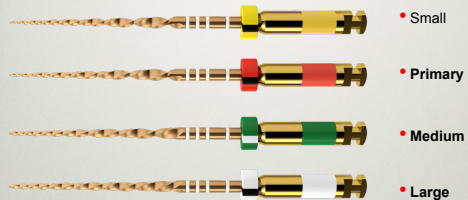
wave • one<sup>®</sup>  
GOLD

- GOLD results from post-grind heat treatment
- More flexibility
- Higher resistance to cyclic fatigue

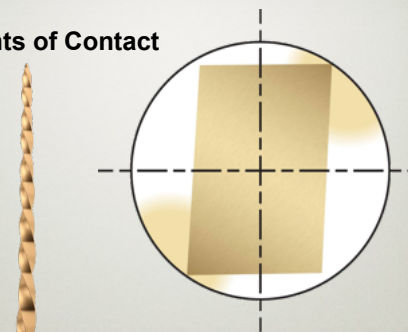
obtr8  
ADVANCING ENDODONTIC  
EDUCATION



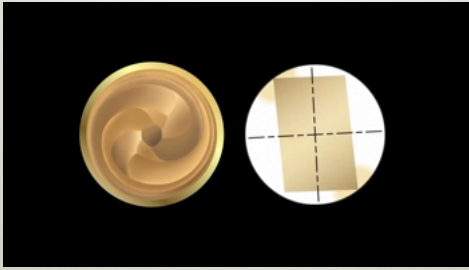
## WAVEONE® GOLD RECIPROCATING SYSTEM



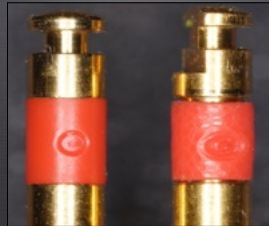
### 2 Points of Contact



## WAVEONE GOLD RECIPROCATATION



## SINGLE USE



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ADVANCING ENDODONTIC  
EDUCATION

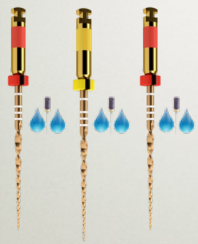
## WHY SINGLE USE?

PRIONS  
EUROPEAN EXPERIENCE  
**EFFICIENCY**  
SAFETY  
COST



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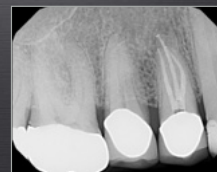
### Small Canals



### Large Canals



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EDUCATION

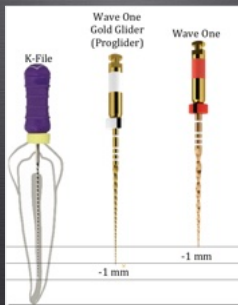


wave • one<sup>®</sup>  
GOLD

- Glide path
- Flood canals
- Brushing motion away from furcation
- Apical pressure to engage dentin
- Several passes will be required to achieve WL
- Rinse and patency file between each WaveOne™ gold cycle

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EDUCATION

# SIMPLE REVIEW



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EDUCATION



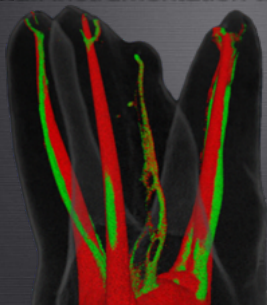
obtr8  
ADVANCING ENDOODONTIC  
EDUCATION

# IRRIGATION



obtr8  
ADVANCING ENDOODONTIC  
EDUCATION

“...all instrumentation techniques left 35%  
or more of the canal’s surface  
area unchanged.”



Peters OA, et al.  
Effects of four Ni-Ti preparation techniques on  
root canal geometry assessed by micro-  
computed tomography.  
International Endodontic Journal  
2001; 34(3):221-30

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EDUCATION



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### GOALS OF IRRIGATION

- Debride canal
- Dissolve tissue
- Remove smear layer
- Kill microbes

SEMs of smear layer partially covering instrumented sections of canal walls (Dr. Franklin Tay)

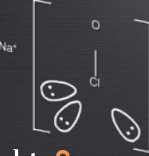
obtr8

### CURRENT IRRIGATION SOLUTIONS AND PROTOCOLS

obtr8

**NaOCl**  
**EDTA**  
**CHX**

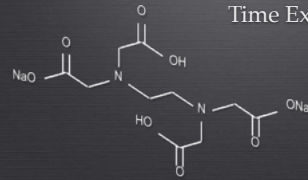
Dissolves organic tissue  
 Kills microbes fast  
 No effect on inorganic tissue  
 Weakens in contact with other materials  
 Toxic/caustic effect on PA tissue  
 Harmful effect on dentin structure??



**obtr8**  
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 EDUCATION

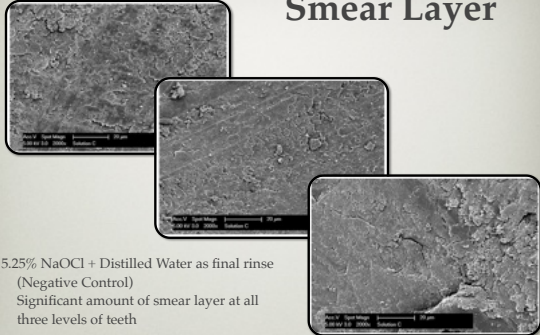
**NaOCl**  
**EDTA**  
**CHX**

Removes Smear Layer  
 No Bacteria Killing  
 Does Not Dissolve Soft Tissue  
 May Erode Dentin with Longer  
 Time Exposure



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 EDUCATION

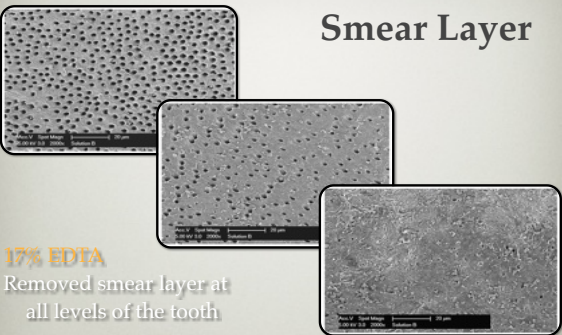
### Smear Layer



5.25% NaOCl + Distilled Water as final rinse  
 (Negative Control)  
 Significant amount of smear layer at all  
 three levels of teeth

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 ADVANCED ENDODONTIC  
 EDUCATION

### Smear Layer

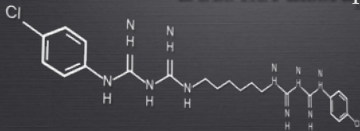


**17% EDTA**  
 Removed smear layer at  
 all levels of the tooth

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**NaOCl**  
**EDTA**  
**CHX**

Kills bacteria (not fast)  
 Improves long term dentin  
 bonding to resins  
 Does not dissolve tissue  
 Does not disrupt biofilm



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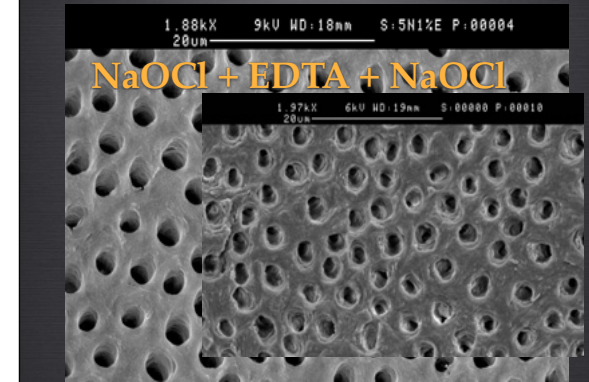
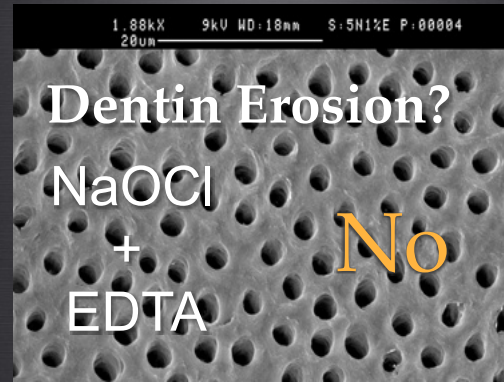
### MOST COMMON IRRIGATION METHODS

Bleach + EDTA:  
 Bleach + EDTA + CHX:  
 Bleach Only:  
**Bleach + EDTA + Bleach**

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USING HYPOCHLORITE  
AGAIN AFTER EDTA CAN  
CAUSE  
EROSION OF DENTIN



Final irrigation with  
long-term NaOCl  
after EDTA should  
be avoided to avoid  
weakening of the  
root



No single final irrigant  
does all of the  
required tasks



QMIX™ 2IN1  
CONTENTS

CHX  
EDTA  
DETERGENT



2 Sizes: 60 mL and 480 mL



# Surfactants

Reduce surface tension (increase wetting)  
Improve penetration

## QMIX™ 2IN1 BENEFITS

Comparable Smear Layer Removal  
To 17% EDTA

Disinfection  
Kills 99.99% Bacteria  
in 5 seconds

Easy Chair Side Handing  
Premixed

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ADVANCED ENDODONTIC  
EDUCATION

## QMIX AND BACTERIA

International Endodontic Journal  
Antibacterial and smear layer removal ability of a novel irrigant, QMix

QMix and NaOCl were superior to CHX and MTAD in killing *E. faecalis* and plaque bacteria in planktonic and biofilm culture

Ability to remove smear layer by QMix was comparable to EDTA

Int Endod J. 2012 April; 45(4):363-71

**obtr8**  
ADVANCED ENDODONTIC  
EDUCATION

## QMIX AND SMEAR LAYER

The Effect of QMix, an Experimental Antibacterial Root Canal Irrigant, on Removal of Canal Wall Smear Layer and Debris

QMix was effective as 17% EDTA in removing canal wall smear layers after the use of 5.25% NaOCl as the initial rinse

J Endod. 2011 Jan;37(1):80-4

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ADVANCED ENDODONTIC  
EDUCATION

## QMix 2in1 removes smear layer at all levels

**obtr8**

## Effect of EDTA vs. QMix™ 2in1 on Dentin Surface

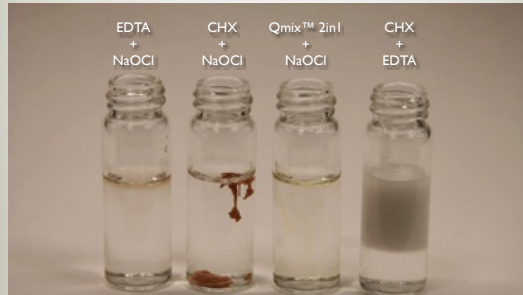
SEM EX-VIVO CLINICAL RESULTS

90 Seconds Final Rinse  
17% EDTA

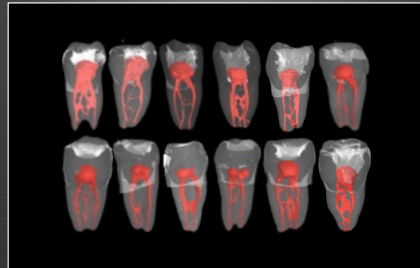
90 Seconds Final Rinse  
QMIX™ 2in1

Franklin R. Tay, Medical College of Georgia

## Immediate

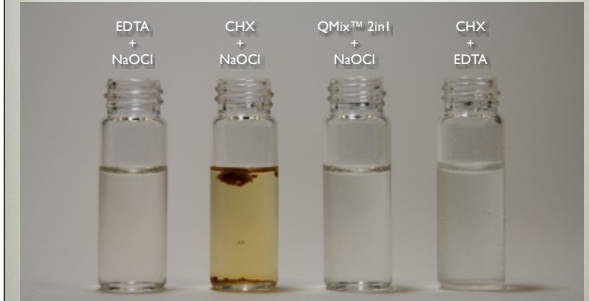


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ADVANCING ENDOODONTIC EDUCATION



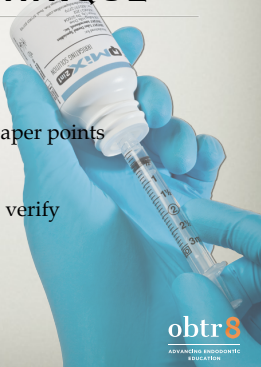
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## 24 hours



## QMix™ TECHNIQUE

- Final NaOCl rinse
- Activate
- Water rinse and dry with paper points
- QMix™
  - If gutta core fill then size verify
- Activate
- Dry
- Obtr8

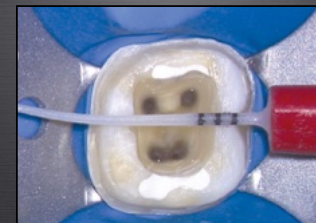


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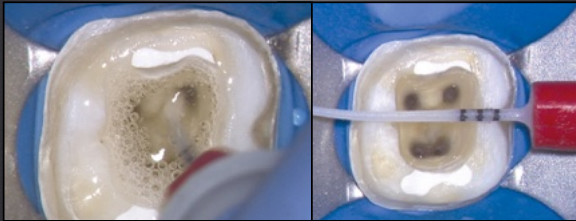
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## ACTIVATION



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# ACTIVATION



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TECHNOLOGY



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TECHNOLOGY

# WHAT'S NEW?



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TECHNOLOGY

## THE SMARTLITE PRO ENDOACTIVATOR

18,000 cpm



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TECHNOLOGY

## THE SMARTLITE PRO ENDOACTIVATOR

18,000 cpm  
Ergonomic Contra-angle Design



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TECHNOLOGY

## THE SMARTLITE PRO ENDOACTIVATOR

18,000 cpm  
Ergonomic Contra-angle Design  
22 and 28 mm lengths



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TECHNOLOGY

**THE SMARTLITE PRO ENDOACTIVATOR**

18,000 cpm  
Ergonomic Contra-angle Design  
22 and 28 mm lengths  
Elliptical Motion




**THE SMARTLITE PRO ENDOACTIVATOR**

18,000 cpm  
Ergonomic Contra-angle Design  
22 and 28 mm lengths  
Elliptical Motion  
Quiet

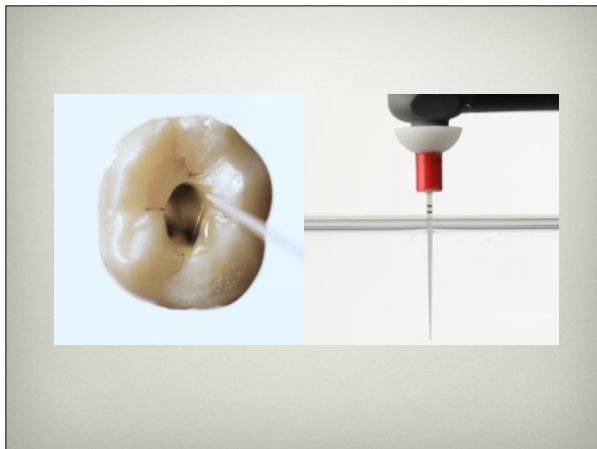



**THE SMARTLITE PRO ENDOACTIVATOR**

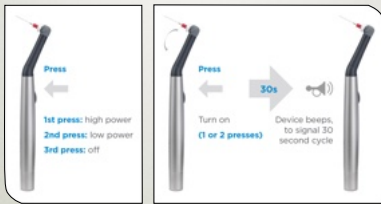


Activator Tips

- SMALL (18.5mm)
- MEDIUM (22mm)
- MEDIUM LONG (28mm)

**THE SMARTLITE PRO ENDOACTIVATOR OPERATION AT A GLANCE**



Press


1st press: high power  
2nd press: low power  
3rd press: off

Press

Turn on (1 or 2 presses)

30s

Device beeps, to signal 30 second cycle



**THE SMARTLITE PRO ENDOACTIVATOR**




**Transillumination: Diagnostic**  
(Carries, Cracks & Canal Access)

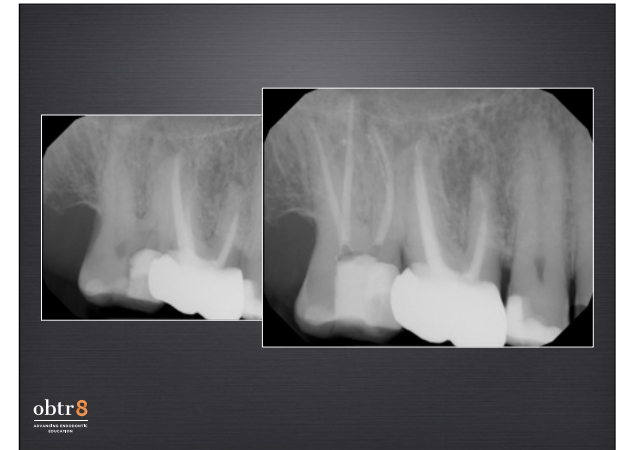


**EndoActivator: Endodontic Irrigation**  
(Debris, Smear Layer & Disinfection)



**Curing: Restorative**  
(Temp, Buildup & Final Restoration)





### ACTIVATION IMPACT

Exchange of activated irrigant deep within the dentinal tubules

Courtesy Roberta Pileggi

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ADVANCED ENDODONTIC  
TECHNOLOGY

### ACTIVATION

EndoActivator provided better obturation of lateral and accessory canals and resulted in less remaining debris

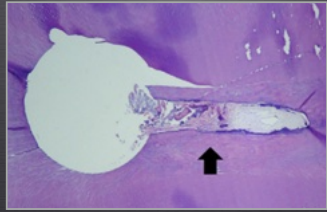
Kanter V, Weldon E, Pileggi R, et al: A Quantitative and Qualitative Analysis of Ultrasonic vs. Sonic Endodontic Systems on Canal Cleanliness and Obturation, Oral Surg, Oral Med, Oral Pathol, Oral Radio, J Endod 112:6, pp. 809-813, 2011

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### ACTIVATION

Root canal cleanliness benefits from solutions activation in comparison with no activation during the final irrigation regimen

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Glyde File Prep paste during rotary mechanical instrumentation favors the accumulation of debris in the apical third of the root canals

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## OBTURATION



## OBTURATION

Means nothing without a clean canal

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## OBTURATION GOAL:

Seal canal in three dimensions from orifice to apex with maximum gutta percha and minimal sealer

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## OBTURATION



cold lateral

## OBTURATION



cold lateral



warm vertical

## OBTURATION



cold lateral



carrier



warm vertical

## SINGLE CONE OBTURATION



cold lateral



carrier

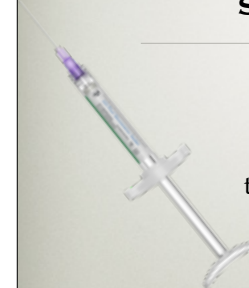


warm vertical

## AH PLUS<sup>®</sup> SEALER FAMILY



## CALCIUM SILICATE-BASED SEALERS



Tricalcium Silicate interacts with body fluids to release **calcium** and **hydroxide** ions that promote Hydroxyapatite formation and support the healing response



**AH Plus Bioceramic Sealer** has  
a fast and predictable set time  
of 2-4 hours



**Decreased shrinkage**

**Better flowability**

**Good adhesion to dentin with low  
solubility & film thickness**

**More radiopaque**



**Ease of Use!**



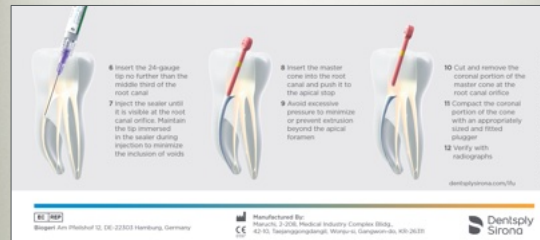
**AH PLUS®  
CALCIUM SILICATE-BASED  
SEALERS**



**Single Cone is  
Popular!**

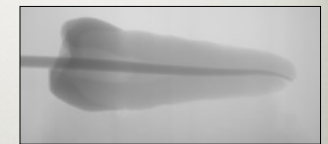


**AH PLUS BIOCERAMIC  
SEALER STEP-BY-STEP GUIDE**



**AH PLUS® BIOCERAMIC**

**No shrinkage  
No Expansion  
3D Seal**



# WARM VERTICAL CONDENSATION



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TECHNOLOGY

# GUTTASMART


1. Cone Fit should be tight and to within .5 mm of WL
2. Prefit pluggers and heat source
3. Seal @ orifice first
4. Downpack to within 5 mm of WL
5. Pack along sidewalls to prevent mounding of GP
6. Heat apical plug prior to placing final fill
7. Fill in stages depending on taper and size of canal
8. Add sealer as needed



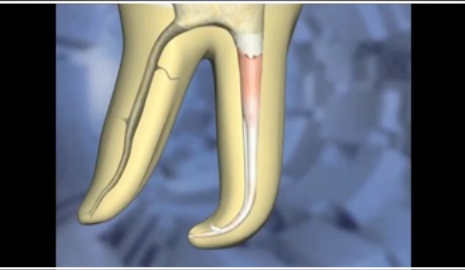
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ADVANCED ENDODONTIC  
TECHNOLOGY

# SYSTEM BASED GUTTA PERCHA

Injection Molded  
Tolerance +/- 0.02  
Multi-tapered cone/ Flat End  
Extended Heat Wave > 6mm




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TDS

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TECHNOLOGY



## CARRIER BASED OBTURATION



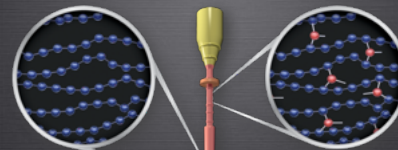
## WHY GUTTACORE®

- Gutta-percha
- Promote improved shaping, irrigation and shape verification
- Easy to create post space and retreat
- Take the most scientifically researched filling technique and make it better
- Solve the problem of gutta-percha melting when heated

## WHY GUTTACORE®

- Gutta-percha
- **REQUIRES** improved shaping, irrigation and shape verification
- Easy to create post space and retreat
- Take the most scientifically researched filling technique and make it better
- Solve the problem of gutta-percha melting when heated

## GuttaCore® Crosslinking



Crosslinkers bond the molecular structure of gutta-percha together, keeping it from melting when heated

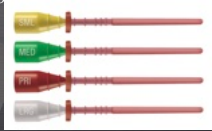
Crosslinkers bond to the gutta-percha to provide subtle strength and flexibility

## GUTTACORE TECHNIQUE



## CLINICAL TECHNIQUE - SHAPING

- Size matched to master file
- Recommend a minimal shape of 25 / .06 sizes 20-90
- .06 will usually match
- .04 one size smaller than MAF



Blister Pack  
(5 obturators + 1 Size Verifier)  
(25 obturators + 5 Size Verifiers)

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## CLINICAL TECHNIQUE - SIZE VERIFICATION



1. Irrigate the canal
2. Remove the GuttaCore™ size verifier from the obturator package
3. Confirm working length and passive fit
4. Rotate in the canal 180°
5. Dry the canal with a paper point

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## SIZE VERIFICATION



## CLINICAL TECHNIQUE - WORKING LENGTH



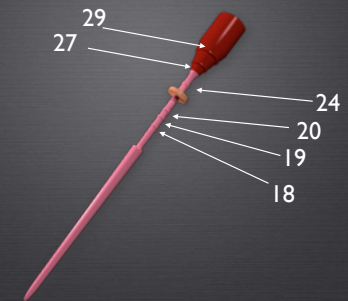
CALIBRATION RINGS:  
18, 19, 20, 22, 24

27 AND 29  
(ON THE OBTURATOR HANDLES)

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## CLINICAL TECHNIQUE – SEALER APPLICATION



1. Use a paper point to brush a very light coating of ThermoSeal® Plus Ribbon sealer throughout the canal
2. Use an additional paper point to wick up any excess sealer

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## CLINICAL TECHNIQUE – OBTURATOR PLACEMENT

Place obturator into canal in one smooth continuous motion  
Do not use excessive force  
Pressure should follow obturator direction into canal



\*Place paper point in any unfilled canals until time for obturation

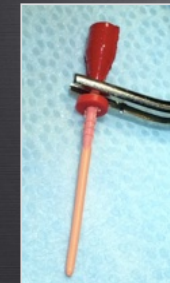
## SLOW PLACEMENT

Levitan et al. 2003  
J Endod 2003;29:505-08

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## LOCKING PLIERS



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# GUTTACORE™

## HANDLE REMOVAL – BENDS OFF

Remove the handle by bending to either side of the canal wall without affecting the seal



# GUTTACORE™

## POST SPACE AND RETREATMENT - SIMPLIFIED

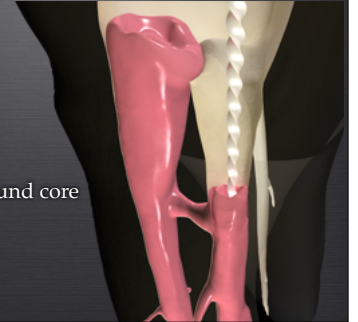
CREATE POST SPACE AND  
REMOVE THE OBTURATION  
MATERIAL WITH  
UNPRECEDENTED EASE



# GUTTACORE®

## CLINICAL TECHNIQUE – REMOVING MATERIAL

1. Use rotary file of same size as last file taken to working length
2. Use solvent to soften gutta-percha around core (if needed)





## GUTTACORE®

### KEYS TO SUCCESS



wave one  
GOLD  
Endodontic Obturators

Great Shape  
Size Verify  
Minimal Sealer  
Slow Placement



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**WHAT DOES THIS  
ANATOMY MEAN TO ROOT  
CANAL TREATMENT  
SUCCESS RATES?**

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## ROOT CANAL SUCCESS

Salehrabi R, Rotstein I. J Endod 2004;30:846-50.

**1.4 MILLION, 8 YEAR , 97%  
SURVIVAL**

Chen SC, Chueh LH, Hsiao CK, et al. J Endod 2007;33:226-9.

**1.5 MILLION, 5 YEAR, 93%  
SURVIVAL**

Lazarski MP, Walker WA 3rd, Flores CM, et al. J Endod 2001;27:791-6.

**44 THOUSAND, 3.5 YEARS, 94%  
SURVIVAL**

## ROOT CANAL SUCCESS



Between 68% and 85% when strict criteria were used

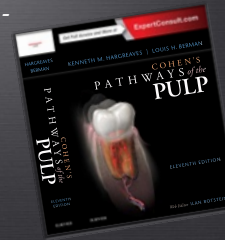
Reported success rates have not improved over the last four decades

YL NG, V MANN, S RAHBARAN, ET AL. INT ENDOD J 2007; 40:921-39.

## ROOT CANAL SUCCESS

A systematic review and meta-analysis of the factors affecting primary root canal treatment -

mean success rate:  
83% vital pulps  
72% periapical lesion



## RETREATMENT SUCCESS



Prospective trial of 858 retreated teeth

95% survival at four years

NG YL, MANN V, GULABIVALA K. A PROSPECTIVE STUDY OF THE FACTORS AFFECTING OUTCOMES OF NON-SURGICAL ROOT CANAL TREATMENT: PART 2: TOOTH SURVIVAL. INT ENDOD J 2011;44:610-25.

## RETREATMENT SUCCESS

Outcomes were similar

Ability to access and negotiate the root canal system to the apex



NG YL, GULABIVALA K. OUTCOME OF NON-SURGICAL RE-TREATMENT. ENDOD TOPICS 2011;18:3-30.

## RETREATMENT SUCCESS



Retreatment of 4744 teeth  
Delta Dental Insurance plan  
89% Retention for 5 years

SALEHRABI R, ROTSTEIN I. EPIDEMIOLOGIC EVALUATION OF THE OUTCOMES OF ORTHOGRADE ENDODONTIC RETREATMENT. J ENDOD. 2010;36:790-2.

## RETREATMENT SUCCESS



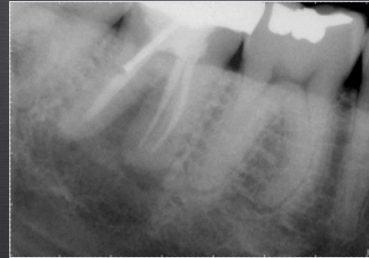
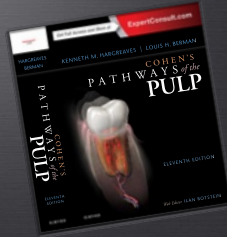
2 – 4 years:  
Endodontic surgery 77.8%  
Nonsurgical retreatment 70.9%  
4 – 6 years:  
Nonsurgical retreatment 83.0%  
Endodontic surgery 71.8%

TORABINEJAD M, CORR R, HANDYSIDES R, SHABAHANG S. OUTCOMES OF NONSURGICAL RETREATMENT AND ENDODONTIC SURGERY: A SYSTEMATIC REVIEW. J ENDOD 2009;35:930-937.



## RETREATMENT SUCCESS

The reported healing rates of nonsurgical retreatment range between 74% to 98%



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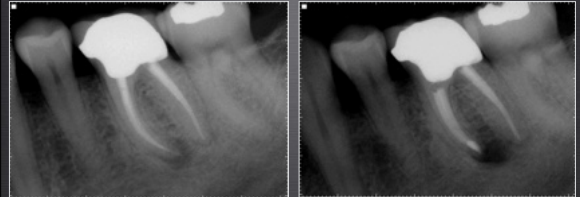
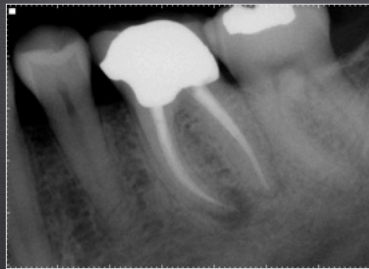
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EDUCATION

## SURGERY SUCCESS

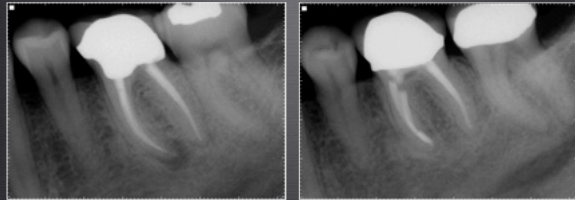


SETZER FC, SHAH SB, KOHLI MR, ET AL. OUTCOME OF ENDODONTIC SURGERY: A META-ANALYSIS OF THE LITERATURE—PART I: COMPARISON OF TRADITIONAL ROOT-END SURGERY AND ENDODONTIC MICROSURGERY. J ENDOD 2010;36:1757-65.

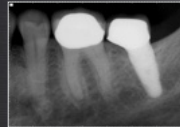
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EDUCATION



## SURGERY SURVIVAL VS. IMPLANT



Survival rates for single implants and endodontic microsurgery were both high



TORABINEJAD M, LANDAEZ M, MILAN M, ET AL. TOOTH RETENTION THROUGH ENDODONTIC MICROSURGERY OR TOOTH REPLACEMENT USING SINGLE IMPLANTS: A SYSTEMATIC REVIEW OF TREATMENT OUTCOMES. J ENDOD 2015;41:1-10.

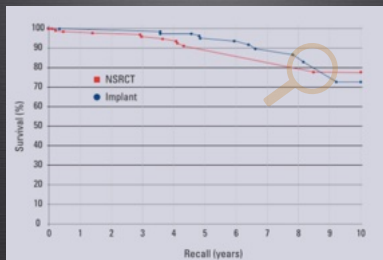
## ROOT CANAL SUCCESS

Restored endodontically treated teeth and single-tooth implant restorations have similar failure rates

implant group:  
longer average time to function  
higher incidence of postoperative complications requiring subsequent treatment intervention

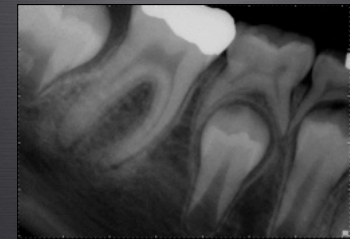


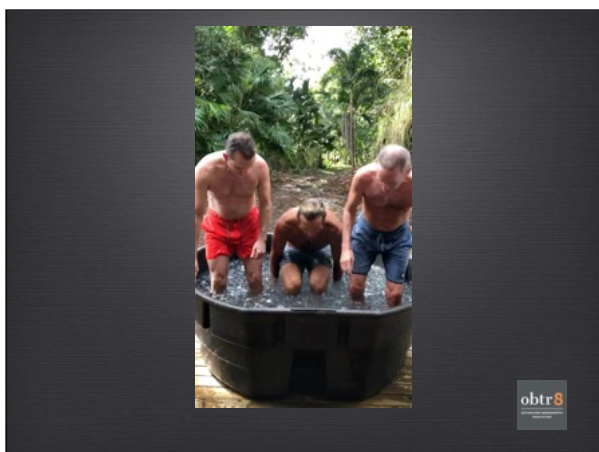
## IMPLANTS VS. ROOT CANAL TREATMENT



## DIAGNOSIS OF POST-TREATMENT DISEASE

White Line  
vs.  
Clean White Line



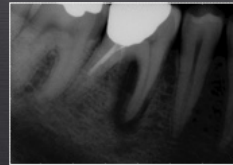


POST-TREATMENT DISEASE  
TREATMENT OPTIONS

No Treatment  
Retreatment  
Apical Surgery  
Extraction / Implant

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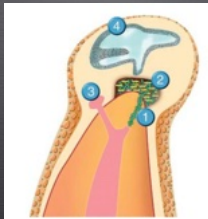


6 month

You want to know the difference  
between a master and a beginner?  
The master has failed more times  
than the beginner has ever tried

MASTER YODA

## ETIOLOGY OF POST-TREATMENT DISEASE



NAIR, PNR. PATHOGENESIS OF APICAL PERIODONTITIS  
AND THE CAUSES OF ENDODONTIC FAILURES.  
CRIT REV ORAL BIOL MED. 2004; 15(6):348-381.

## ETIOLOGY OF POST-TREATMENT DISEASE

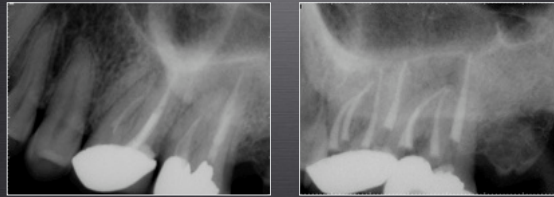
Microorganisms  
Extraradicular Infection  
Foreign Body Reaction  
True Cysts

## ETIOLOGY OF POST-TREATMENT DISEASE

Microorganisms  
Extraradicular Infection  
Foreign Body Reaction  
True Cysts



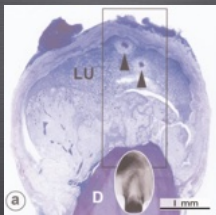
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## ETIOLOGY OF POST-TREATMENT DISEASE

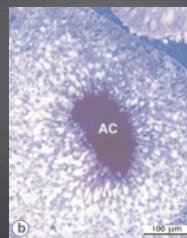
Microorganisms  
Extraradicular Infection  
Foreign Body Reaction  
True Cysts

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NAIR, PNR. PATHOGENESIS OF APICAL PERIODONTITIS AND THE CAUSES OF ENDODONTIC FAILURES  
CRIT REV ORAL BIOL MED. 2004;15(6):348-381.

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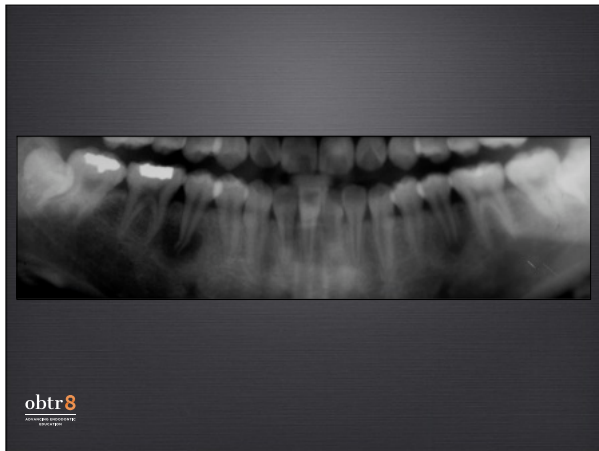
NAIR, PNR. PATHOGENESIS OF APICAL PERIODONTITIS AND THE CAUSES OF ENDODONTIC FAILURES  
CRIT REV ORAL BIOL MED. 2004;15(6):348-381.

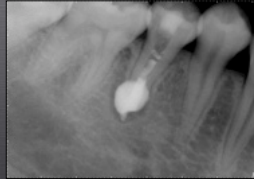
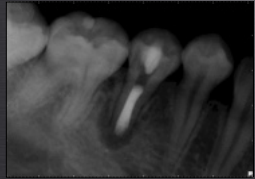
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## ETIOLOGY OF POST-TREATMENT DISEASE

Microorganisms  
Extraradicular Infection  
Foreign Body Reaction  
True Cysts

obtr8



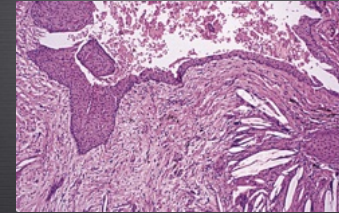


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## ETIOLOGY OF POST-TREATMENT DISEASE

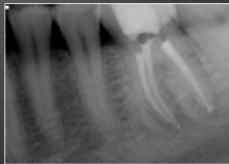
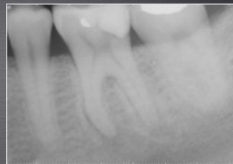
Microorganisms  
Extraradicular Infection  
Foreign Body Reaction  
**True Cysts**

obtr8



Neville, Damm, Allen. Oral and Maxillofacial Pathology, 4th Edition. Saunders, 2016

obtr8



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## RETREATMENT INDICATIONS

Coronal leakage/bacterial recontamination

Surgical intervention not possible due to health of patient or anatomical considerations

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## RETREATMENT CONSIDERATIONS

Persistent bacteria in root canal system - **untreated canal**

Tooth in need of **new restoration** requiring disassembly

**Pain** and/or evidence of post treatment disease and a technical issue with previous treatment - voids, filling type, ledges, iatrogenic issues

obtr8

## SURGERY INDICATION

Non-odontogenic etiology suspected

BIOPSY

obtr8

## SURGERY CONSIDERATIONS

Fractured file preventing access to apex

Posts

Overfill/Overextension of filling

Pain and/or evidence of post treatment disease and a technical issue with previous treatment - voids, filling type, ledges, iatrogenic issues

obtr8

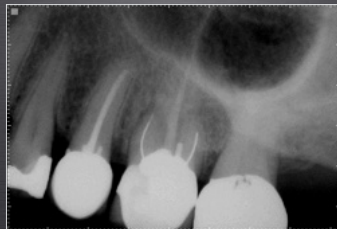
## RETREATMENT AND SURGERY CONTRAINDICATIONS

Fractured Roots

Compromised Periodontal Status

Unrestorable Tooth

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obtr8



obtr8



obtr8





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## GUIDELINES

Nonsurgical retreatment is recommended when there is sufficient evidence to indicate **coronal leakage** or **bacterial recontamination** of the root canal system

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## GUIDELINES

Nonsurgical retreatment should be the intervention of choice when **medical history** or **anatomical considerations** preclude microsurgical retreatment

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## GUIDELINES

Nonsurgical retreatment should be considered prior to a new full coverage restoration when a technical shortcoming or other iatrogenic issues are identified with the original root canal treatment

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## RETREATMENT CONSIDERATIONS

Coronal restoration  
Core Material  
Post ?  
Filling material  
Periapical lesion?

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## RETREATMENT CONSIDERATIONS

**Coronal restoration**  
Core Material  
Post ?  
Filling material  
Periapical lesion?

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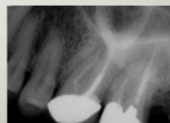
## CORONAL RESTORATION

Defective Margins

Recurrent caries

Ceramic vs Metal vs Both

Round diamond+Fissure bur+ straight diamond



## RETREATMENT CONSIDERATIONS

Coronal restoration

**Core Material**

Post ?

Filling material

Periapical lesion?

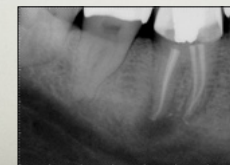


## CORE MATERIAL

What material

Where in chamber/canal

High Speed vs Ultrasonic or Both



## RETREATMENT CONSIDERATIONS

Coronal restoration

Core Material

**Post ?**

Filling material

Periapical lesion?



## POST CONSIDERATIONS



Material  
Taper/Threads  
Length



# POST REMOVAL

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Pathways figure 8-28

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## RETREATMENT CONSIDERATIONS

Coronal restoration

Core Material

Post ?

**Filling material**

Periapical lesion?

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## FILLING MATERIAL

Gutta percha

Carrier?

Paste

Silver point

Nothing / Untreated canal

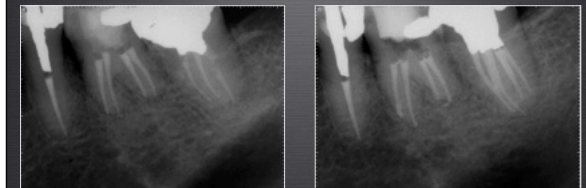
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## GUTTA PERCHA

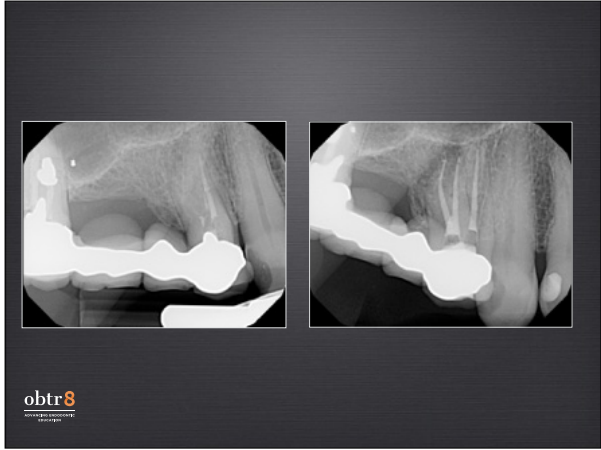
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## SOLVENT?

**CHLOROFORM**

**DANGER**

HARMFUL IF SWALLOWED. CAUSES IRRITATION OF MUCOUS MEMBRANES. SUSPECTED OF CAUSING CANCER. MAY CAUSE DAMAGE TO ORGANS THROUGH PROLONGED OR REPEATED EXPOSURE.

**PRECAUTIONS**

Other special instructions: Chloroform for use inside with all safety precautions have been met and authorized. Do not breathe vapors directly. Wash hands thoroughly after handling. Do not use in enclosed areas. Do not use for drinking water. Do not use for food preparation.

**PREVENTION**

If SWALLOWED: Never induce vomiting. Call your physician or poison control center. If IN EYES: Flush with plenty of water and never get material absorbed. If IN EARS: Flush immediately with water to prevent infection. Remove contact lenses. A physician should be consulted if irritation persists. If INHALED: Get fresh air immediately. Do not breathe vapors. Use of respiratory protection and avoid 2nd hand smoke.

**STORAGE**

Store in a cool, dry place.

**DISPOSAL**

Dispose of contents/container in accordance with local, state and federal regulations. For more information, reference SDS.

**C+ FILE**  
FOR CALCIFICATION

21mm O15  
Content: 8 Pins

Caution: U.S. Federal law restricts this device to sale by or on the order of a dentist.

**DENSPLY**  
SWISS MADE  
Manufactured for  
DENTSPLY MAILAND, JR  
London City, TN 37054

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ADVANCED FREQUENCY  
INDICATION

**DOES THIS CANDLE SMELL LIKE CHLOROFORM?**

**DOES THIS PILLOW SMELL LIKE CHLOROFORM TO YOU?**

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ADVANCED FREQUENCY  
INDICATION

## TRUSHAPE®

300 RPM  
Torque 300 g-cm

sizes 20, 25, 30, 40

21, 25 and 31 mm

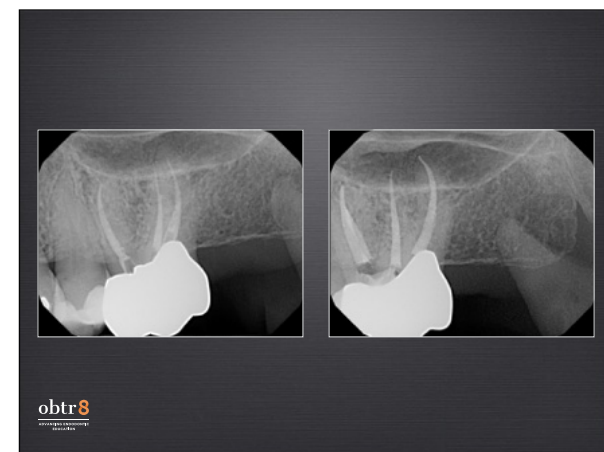
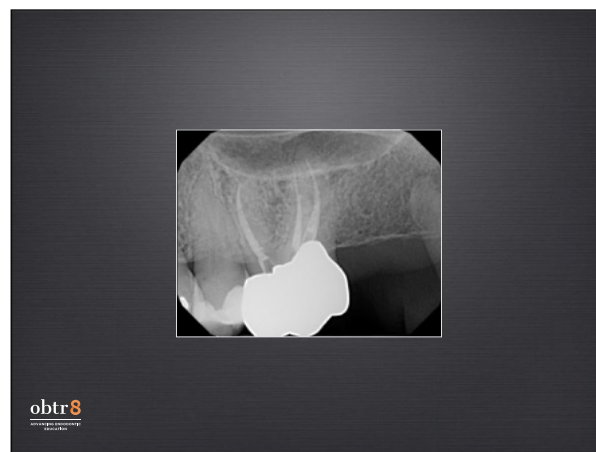
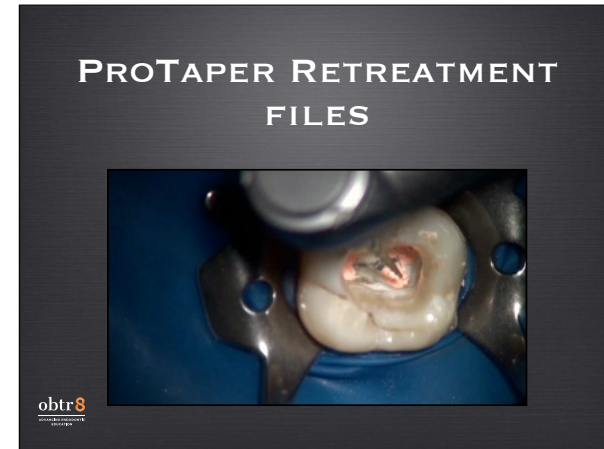
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ADVANCED FREQUENCY  
INDICATION



## HAND FILES AT APEX?

10 C file  
15 file

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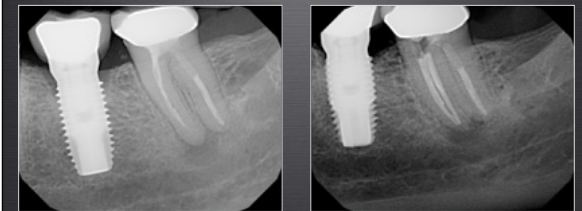
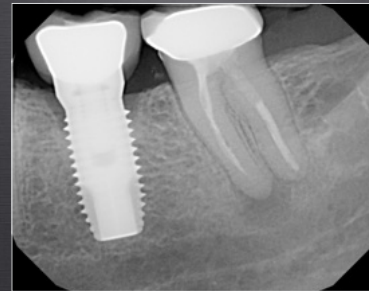
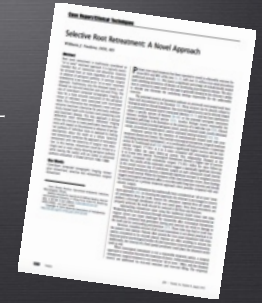


WHEN COMPLETING AN APICAL MICROSURGERY, IS IT NECESSARY TO TREAT EACH ROOT END?

WHEN COMPLETING A NON-SURGICAL RETREATMENT, IS IT NECESSARY TO TREAT EACH ROOT?

## SELECTIVE ROOT RETREATMENT

NUDERA WJ.  
SELECTIVE ROOT  
RETREATMENT: A NOVEL  
APPROACH. J ENDOD  
2015;41:1382-1388.







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ORAL BIOMATERIALS  
RESEARCH



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ORAL BIOMATERIALS  
RESEARCH

# SILVER POINTS

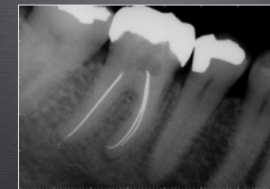
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ORAL BIOMATERIALS  
RESEARCH



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ORAL BIOMATERIALS  
RESEARCH



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RESEARCH



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ORAL BIOMATERIALS  
RESEARCH



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# PASTE FILLING

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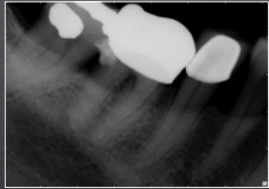
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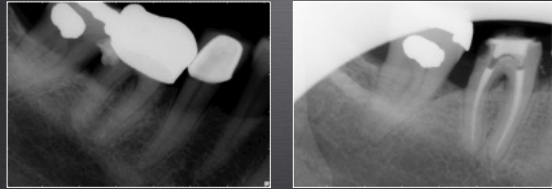
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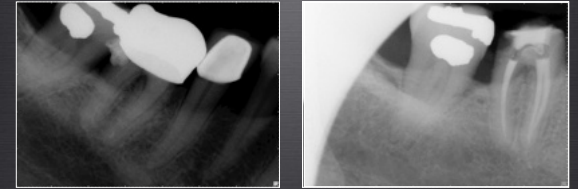
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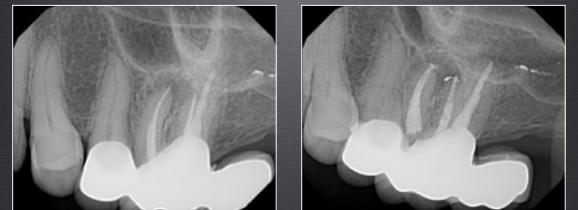
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## CARRIER-BASED OBTURATION

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## CARRIER REMOVAL

TruShape 20 or 25

Hedstrom Braid

Heat Source Sink

Hand Files

CREATING ROOM FOR  
REMOVAL



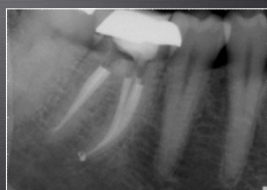
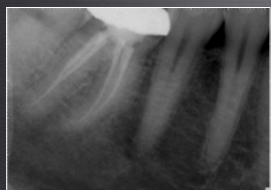
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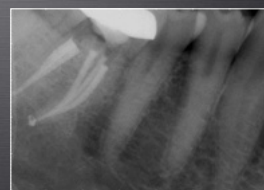
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## RETREATMENT CONSIDERATIONS

Coronal restoration

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Post ?

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**Periapical lesion?**

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