



Today- is greatness possible?

FRIEDRICH NIETZSCHE



Root Canal Treatment  
Efficiency Through Simplicity



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Capital Endodontics  
Madison, Wisconsin



ADVANCING ENDODONTIC EDUCATION

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DISCLOSURES

Bringing new technology to the dental medical field.

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

KNOW MORE with 3D transparency





Dentsply Sirona Academy

wave•one GOLD

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Do as little as needed,  
not as much as possible

HENK KRAAIJENHOF



ENDODONTIC SUCCESS

Restoration

Diagnosis

OBTURATION

Case Selection

INSTRUMENTATION

IRRIGATION



## REMEMBER

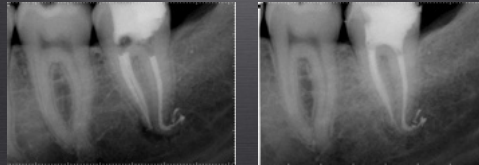
None of the clinical outcomes have been altered in any way



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## REMEMBER

None of the clinical outcomes have been altered in any way



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6 month

## REMEMBER

This is my story !

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## 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.

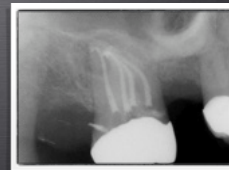
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## GOALS OF TREATMENT

Prevent / resolve apical periodontitis by:

Removal of all organic substrate from the canal system

Prevention of re-infection



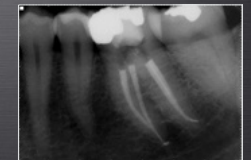
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Schilder, Dent Clin Nor Am 1974

## GOALS OF TREATMENT

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

Preserve the natural anatomy of the tooth

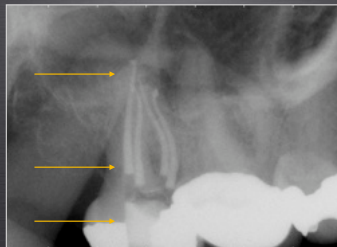


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## GOALS OF ROOT CANAL TREATMENT

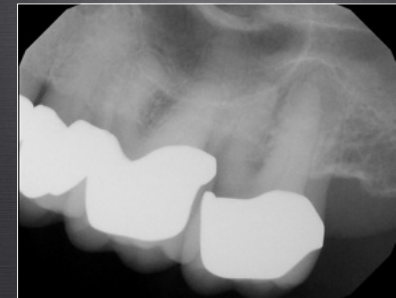


## CASE EXAMPLES

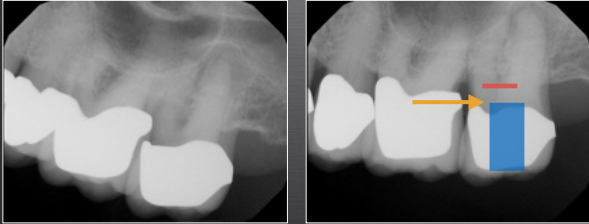


## ACCESS, ANATOMY & GLIDE PATH MANAGEMENT

## ACCESS

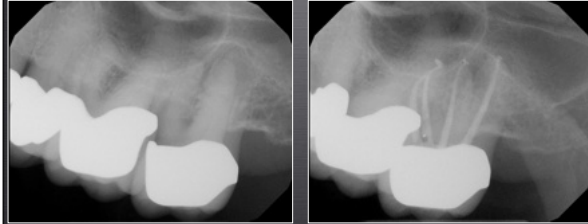


# ACCESS



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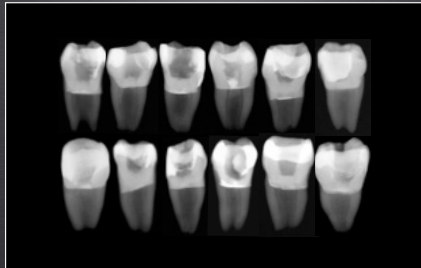
# ACCESS



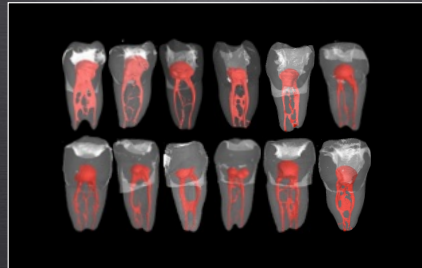
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EDUCATION

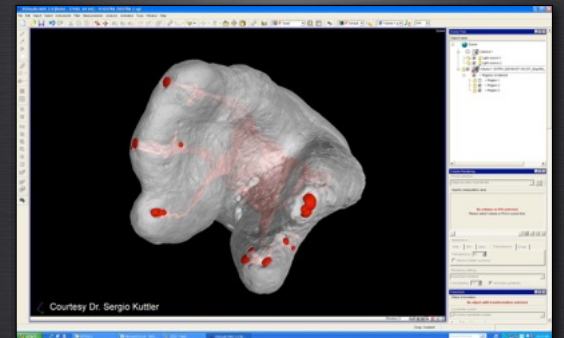


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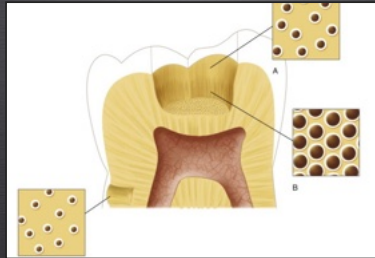
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# ROOT CANAL ANATOMY



Courtesy Dr. Sergio Kuttler



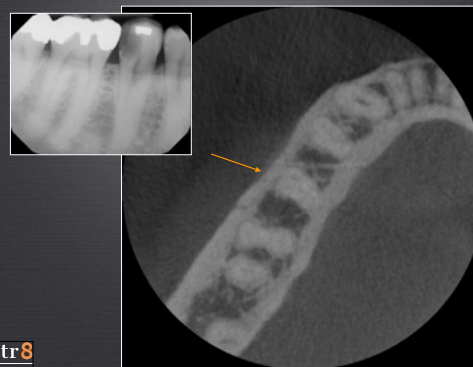


## DENTIN INFECTION



## DENTIN INFECTION

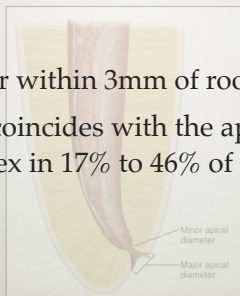
Bacterial infection of the cervical and midroot areas was similar, characterized as a heavy infection with bacteria penetrating as deep as 200  $\mu$ m





### APICAL LOCATION

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



### APICAL LOCATION

**VARIABLE**

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



### 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



## APICAL SIZE

Teeth	Mean (um)
Mx incisors	289.4
Mn incisors	262.5
Mx premolars	340
Mn premolars	169.25
Mx molars	298
Mn molars	235.05
Mx Mandibular	232.2
Mn Mandibular	257.5
Mx Maxillary	392
Mn Maxillary	

Morfis et al OOO 1994

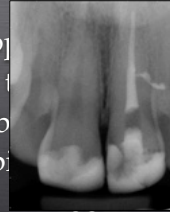


**VARIABLE**

## APICAL ANATOMY



Apical anatomy of the root canal system is a variable feature of the root canal system.



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.

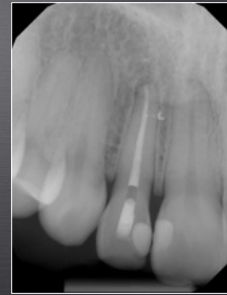
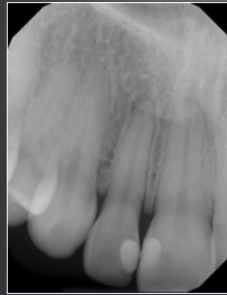
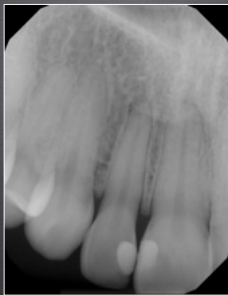


## APICAL ANATOMY

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.



## LATERAL CANALS



74% in the apical third of the root  
11% in the middle third  
15% in the cervical third

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



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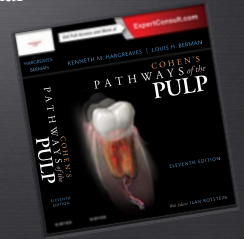


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## ROOT CANAL SUCCESS

A systematic review and meta-analysis of the factors affecting primary root canal treatment -  
mean success rate:

83% vital pulps  
72% periapical lesion



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## ROOT CANAL SUCCESS

Salehrabi R, Roitstein 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**

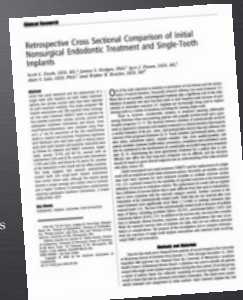
Lazarski MP, Walker WA 3rd, Flores CM, et al. J Endod 2001;27:791-6.

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

## ROOT CANAL SUCCESS

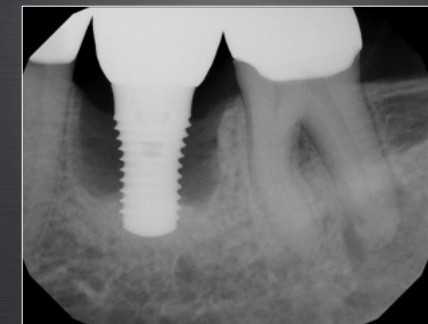
Restored endodontically treated teeth and single-tooth implant restorations have similar failure rates

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



JOE 2006

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## ROTARY GLIDE PATH ARMAMENTARIUM



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## All Mechanized Instrumentation Begins with a Hand File

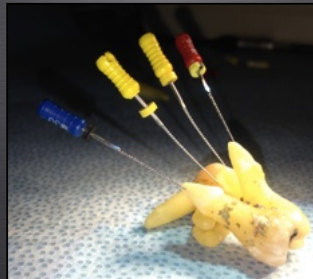


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## APICAL SIZE

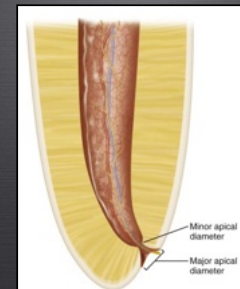
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## APICAL LOCATION



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## GLIDE PATH GOAL




Verify Glide Path

10 LEXICON




## PATENCY



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

J Endod 2009;35:189-192



## GLIDE PATH MANAGEMENT






## GLIDE PATH MANAGEMENT






## GLIDE PATH MANAGEMENT

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

## TECHNIQUE

- Access
- Irrigate canal
- Open orifice/canal **SHORT** of WL (coronal to any MD curve)
  - 10 file
  - Vortex orifice opener

## TECHNIQUE

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



## VORTEX ORIFICE OPENERS

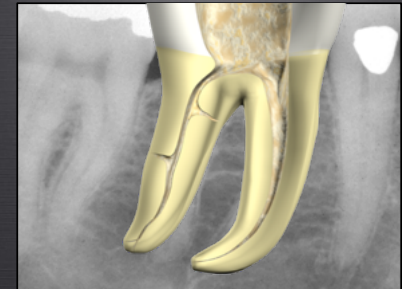
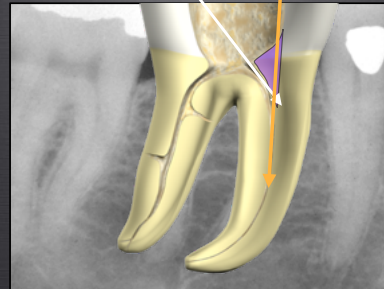
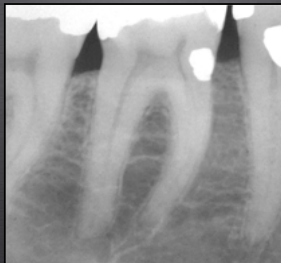


12mm of cutting flutes  
Parallel flutes in the last 3 mm  
500 RPM  
16 mm, 19 mm lengths



## 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 17-18 mm
- WOG Glider 1mm short of 10 file binding



## WAVEONE GOLDGLIDER

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



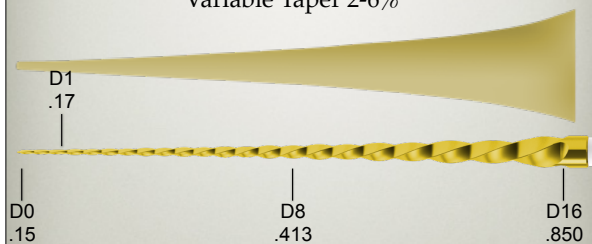
## WAVEONE GOLDGLIDER

- Prepackaged
- Single use
- Metallurgy

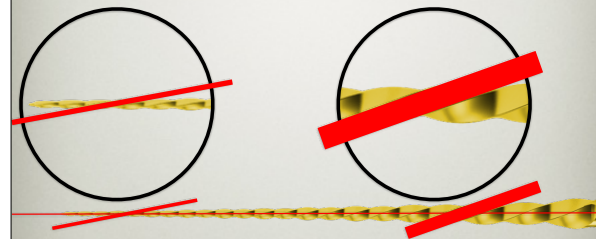


## WAVEONE GOLDGLIDER

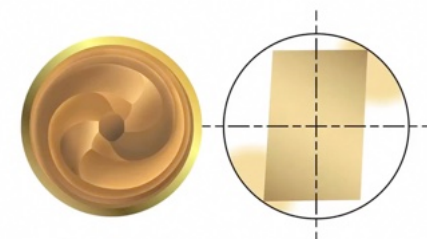
Variable Taper 2-6%



## Variable Helical Angles



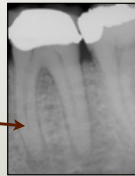
## RECIPROCATING MOTION





## TECHNIQUE

- 10 file apical to first curve, coronal to 2nd curve
- 20-21 mm
- WOG Glider 1mm short of 10 file binding



## TECHNIQUE

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

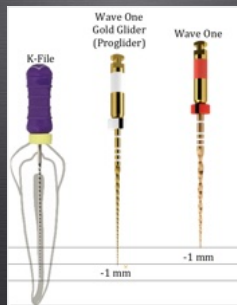


## IF 10 FILE NOT ADVANCING

- 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)



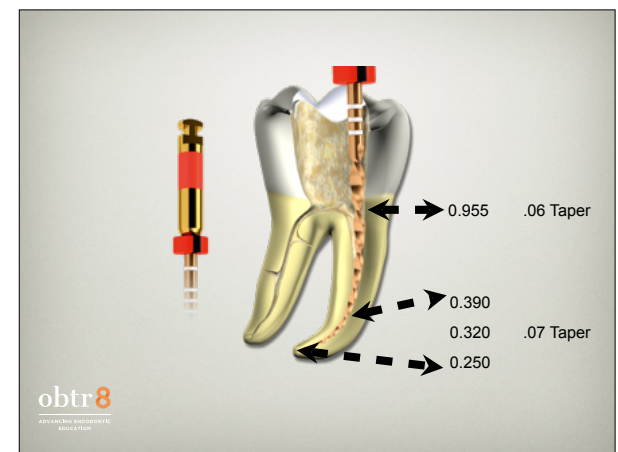
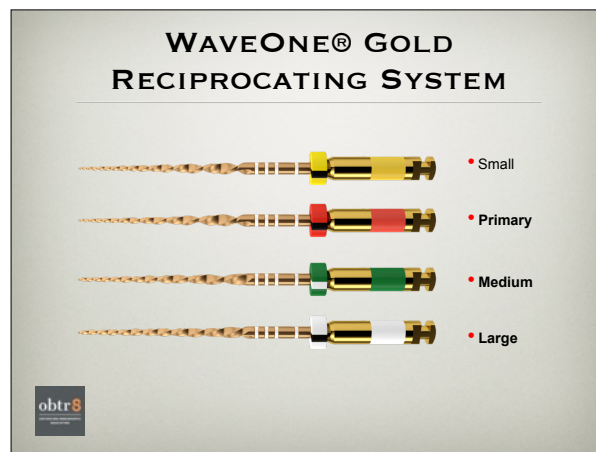
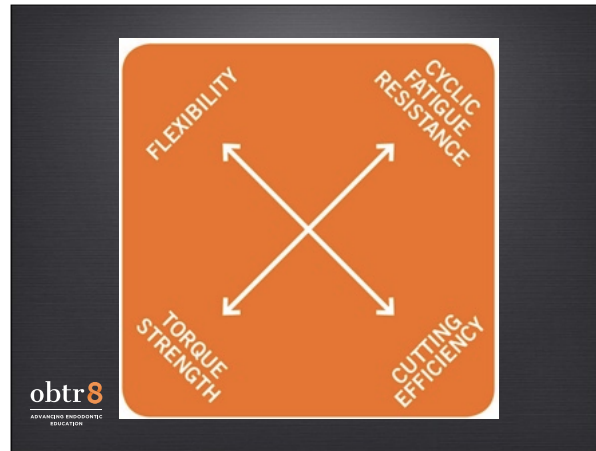
## SIMPLE REVIEW



## TECHNIQUE REVIEW

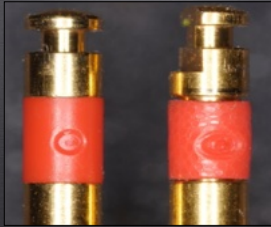
- 10 file into canal (past dentin triangle)
- Orifice open (Vortex orifice opener 20/08, 16mm)
- 10 file tap to resistance (or est WL)
- WaveOne Glider @ 1 mm short of 10 file (or at WL)
- If not at estimated WL repeat sequence of 10 file and WaveOne Glider until estimated WL
- Final instrumentation





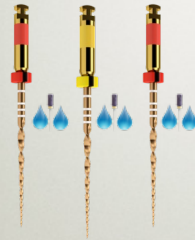


# SINGLE USE



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## Small Canals

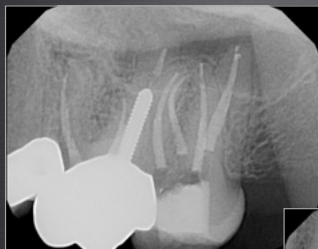


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## Large Canals



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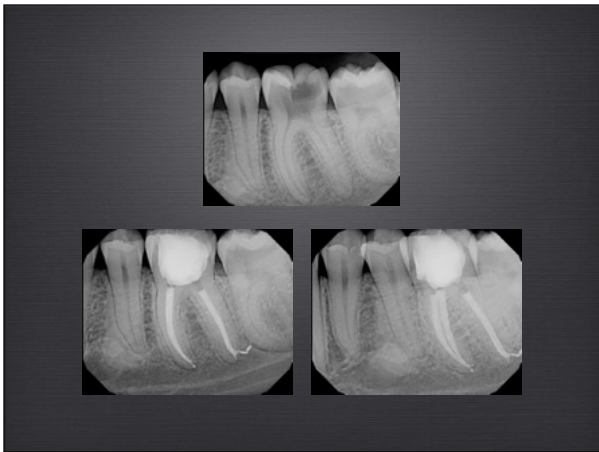


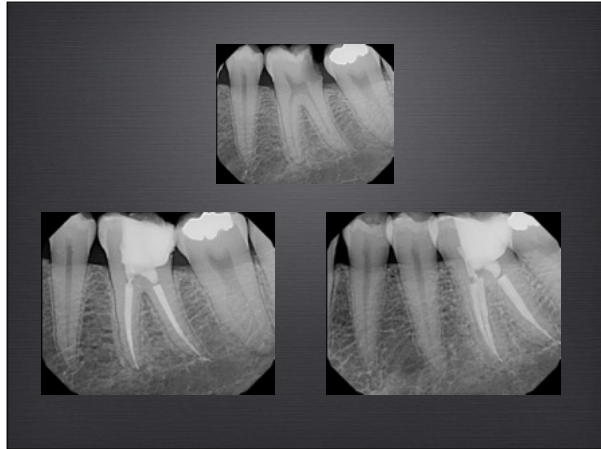
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wave • one®  
GOLD

- 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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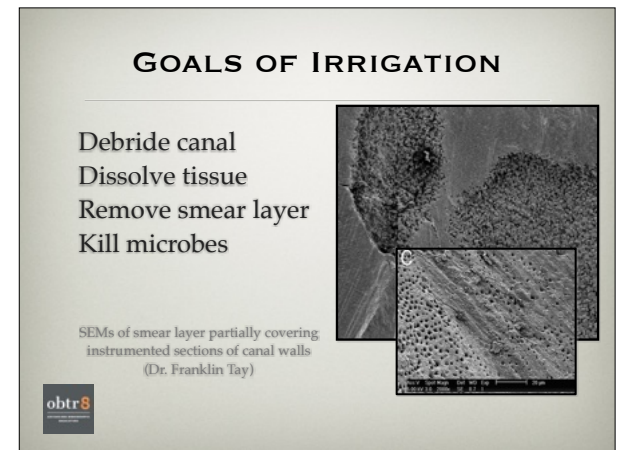
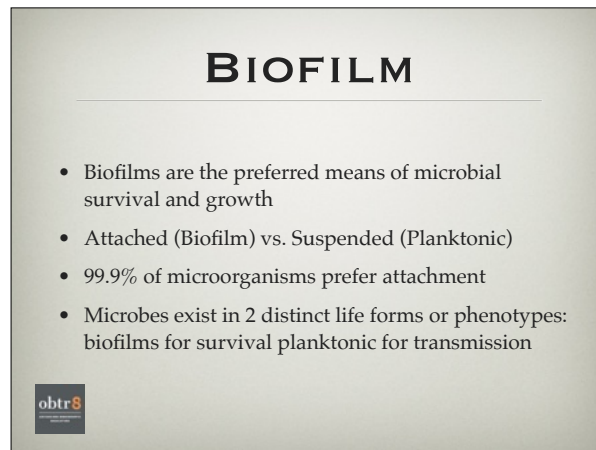
## IRRIGATION



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# CURRENT IRRIGATION SOLUTIONS AND PROTOCOLS



**NaOCl**

**EDTA**

**CHX**



Dissolves organic tissue

Kills microbes fast

No effect on inorganic tissue

Weakens in contact with other materials

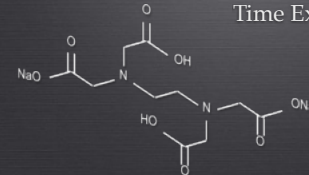
Toxic/caustic effect on PA tissue

Harmful effect on dentin structure??

**NaOCl**

**EDTA**

**CHX**



Removes Smear Layer

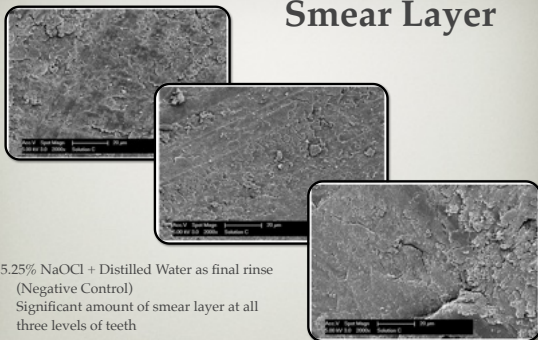
No Bacteria Killing

Does Not Dissolve Soft Tissue

May Erode Dentin with Longer

Time Exposure

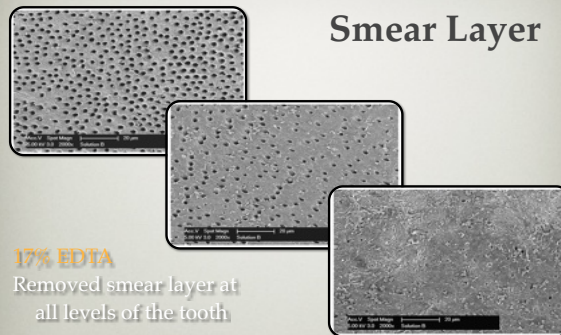
## Smear Layer



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



## Smear Layer



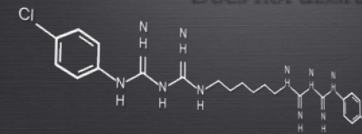
**17% EDTA**  
Removed smear layer at  
all levels of the tooth



**NaOCl**

**EDTA**

**CHX**



Kills bacteria (not fast)

Improves long term dentin  
bonding to resins

Does not dissolve tissue

Does not disrupt biofilm

## MOST COMMON IRRIGATION METHODS

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

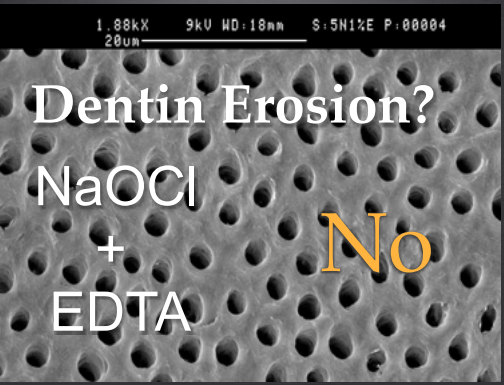
## USING HYPOCHLORITE AGAIN AFTER EDTA CAN CAUSE EROSION OF DENTIN

1.88kX 9kV WD:18mm S:5N1%E P:00004  
20um

# Dentin Erosion?

NaOCl  
+  
EDTA

No



1.88kX 9kV WD:18mm S:5N1%E P:00004  
20um

## NaOCl + EDTA + NaOCl

1.97kX 6kV WD:19mm S:00000 P:00010  
20um



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



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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

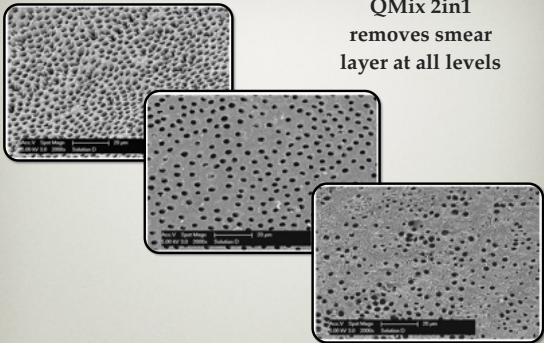
Disinfection  
Kills 99.99% Bacteria  
in 5 seconds

Easy Chair Side Handing  
Premixed



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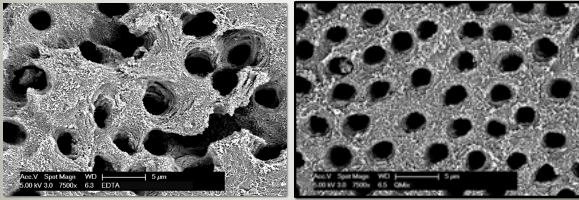
QMix 2in1  
removes smear  
layer at all levels



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

SEM EX-VIVO CLINICAL RESULTS



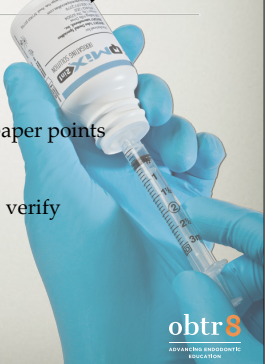
90 Seconds Final Rinse  
17% EDTA

90 Seconds Final Rinse  
QMIX™ 2in1

Franklin R. Tay, Medical College of Georgia

# QMIX™ TECHNIQUE

- Final NaOCl rinse
- Activate
- Water rinse and dry with paper points
- QMix™
  - If gutta core fill then size verify
- Activate
- Dry
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**THE SMARTLITE PRO ENDOACTIVATOR**

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



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**THE SMARTLITE PRO ENDOACTIVATOR**



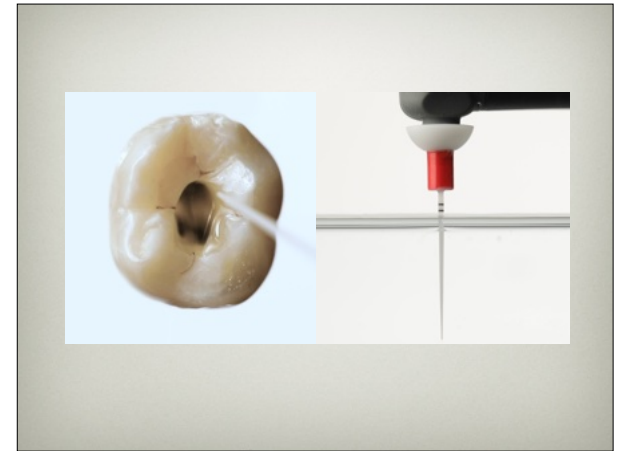
Activation Tips

SMALL (10/12)

MEDIUM (16/18)

MEDIUM LONG (22/28)

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**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

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**THE SMARTLITE PRO ENDOACTIVATOR**



Transillumination: Diagnostic (Carries, Cracks & Canal Access)



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

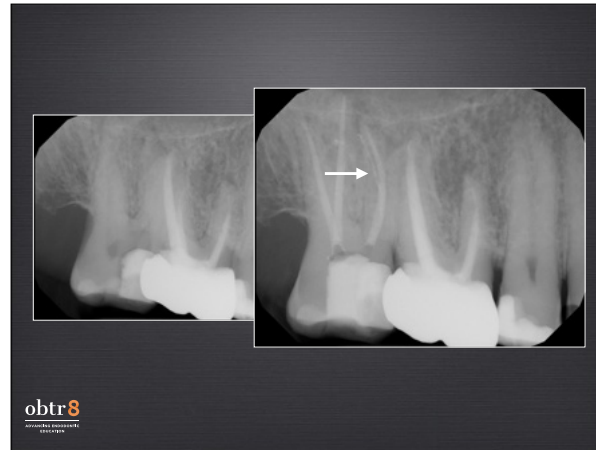


Curing: Restorative (Temp, Buildup & Final Restoration)



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## ACTIVATION IMPACT

Exchange of activated irrigant deep within the dentinal tubules

Courtesy Roberta Pileggi

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## 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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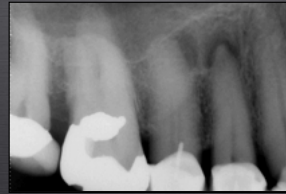
## ACTIVATION

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

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# OBTURATION



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# 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

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# 8 CASE EXAMPLES







## DEPTH OF HEAT






J Endod 2000;26:668-72

## DEPTH OF HEAT

Deeper heat penetration increased the quality of GP adaptation to the canal walls


Thermoplasticized GP extended **2** to **3** mm apical to the depth of heat penetration

J Endod 2000;26:668-72

## CARRIER BASED OBTURATION

- Evidence supports its superior fill
- Great for difficult anatomies
- Difficult to retreat or remove material
- Difficult to create post space
- Minimal shaping possible



## 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



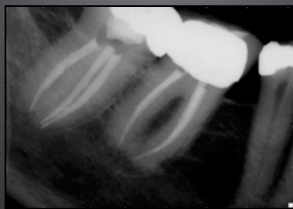
## WHY GUTTACORE®

- 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® INDICATIONS

Long Narrow Canals  
Curves  
Ledges  
Anatomy





Dr. Scott Doyle



Dr. Scott Doyle



Dr. Scott Doyle



Dr. Scott Hetz

## GUTTACORE TECHNIQUE



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EQUIPMENT



## CLINICAL TECHNIQUE - SHAPING

- Recommend a minimal shape of 25 / .06
- sizes 20-90
- .06 will usually match
- .04 one size smaller than MAF
- waveone primary 25 or 30



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EQUIPMENT

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

## CLINICAL TECHNIQUE – SIZE VERIFICATION



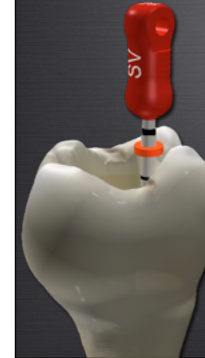
1. Irrigate the canal
2. Remove the GuttaCore™ size verifier from the obturator package
3. Confirm working length and passive fit
4. Rotate in the canal 180°
5. Dry the canal with a paper point

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## SIZE VERIFICATION



## CLINICAL TECHNIQUE – WORKING LENGTH



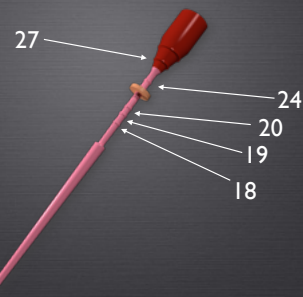
CALIBRATION RINGS:  
18, 19, 20, 22, 24

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 ThermaSeal® Plus Ribbon sealer throughout the canal
2. Use an additional paper point to wick up any excess sealer

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# AH PLUS<sup>®</sup> SEALER FAMILY



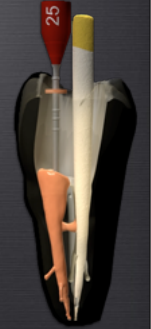
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## CLINICAL TECHNIQUE – OBTURATOR PLACEMENT

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

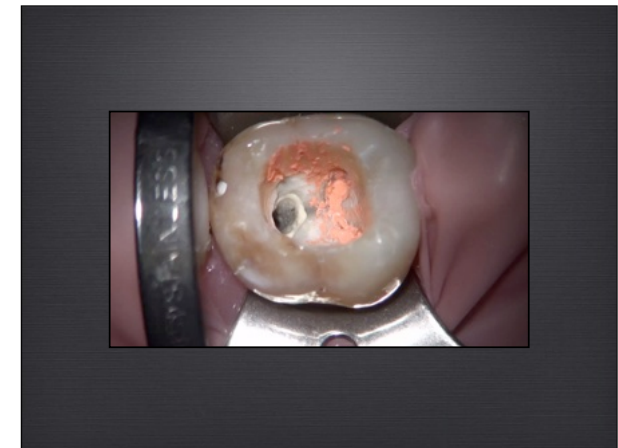
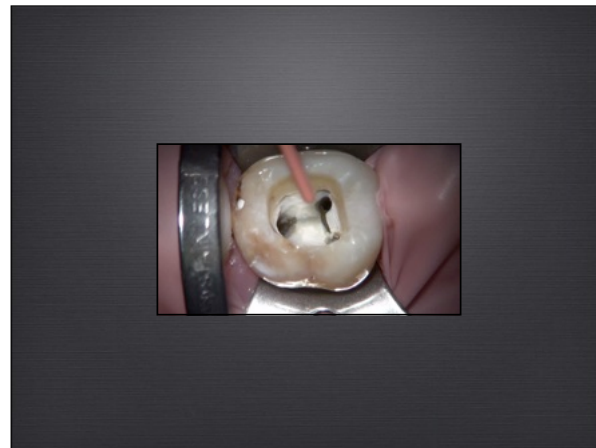
\*Place paper point in any unfilled  
canals until time for obturation



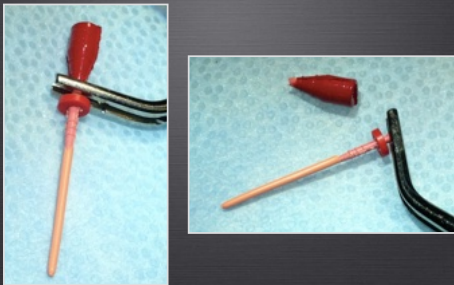
## SLOW PLACEMENT

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

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TECHNIQUE



## 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



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## GUTTACORE™

### POST SPACE AND RETREATMENT - SIMPLIFIED

CREATE POST SPACE AND  
REMOVE THE OBTURATION  
MATERIAL WITH  
UNPRECEDENTED EASE



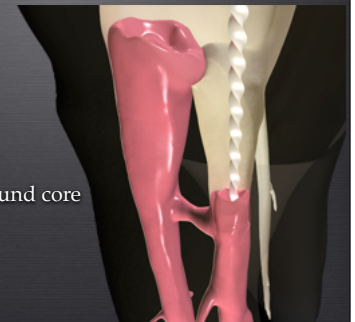
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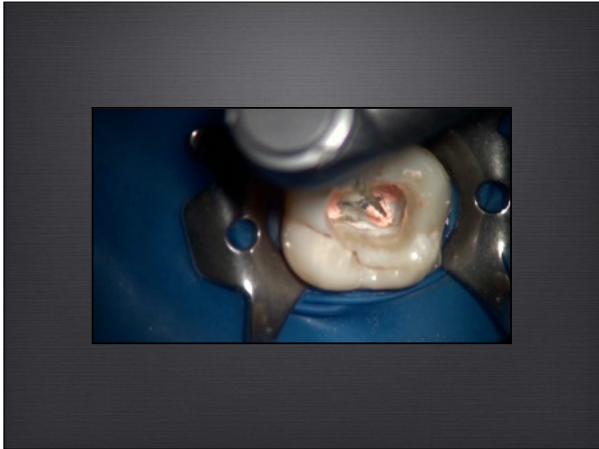
## GUTTACORE®

### 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)



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Dr. Michael Thompson



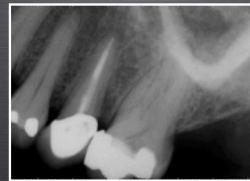
Dr. Michael Thompson



Dr. Larry Farsakian



Dr. Larry Farsakian





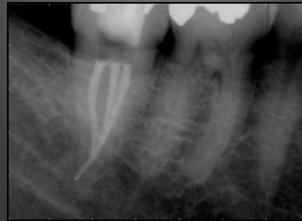


Dr. Bill Nudera



Dr. Scott Doyle

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# GUTTACORE®

KEYS TO SUCCESS



Great Shape  
Size Verify  
Minimal Sealer  
Slow Placement

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