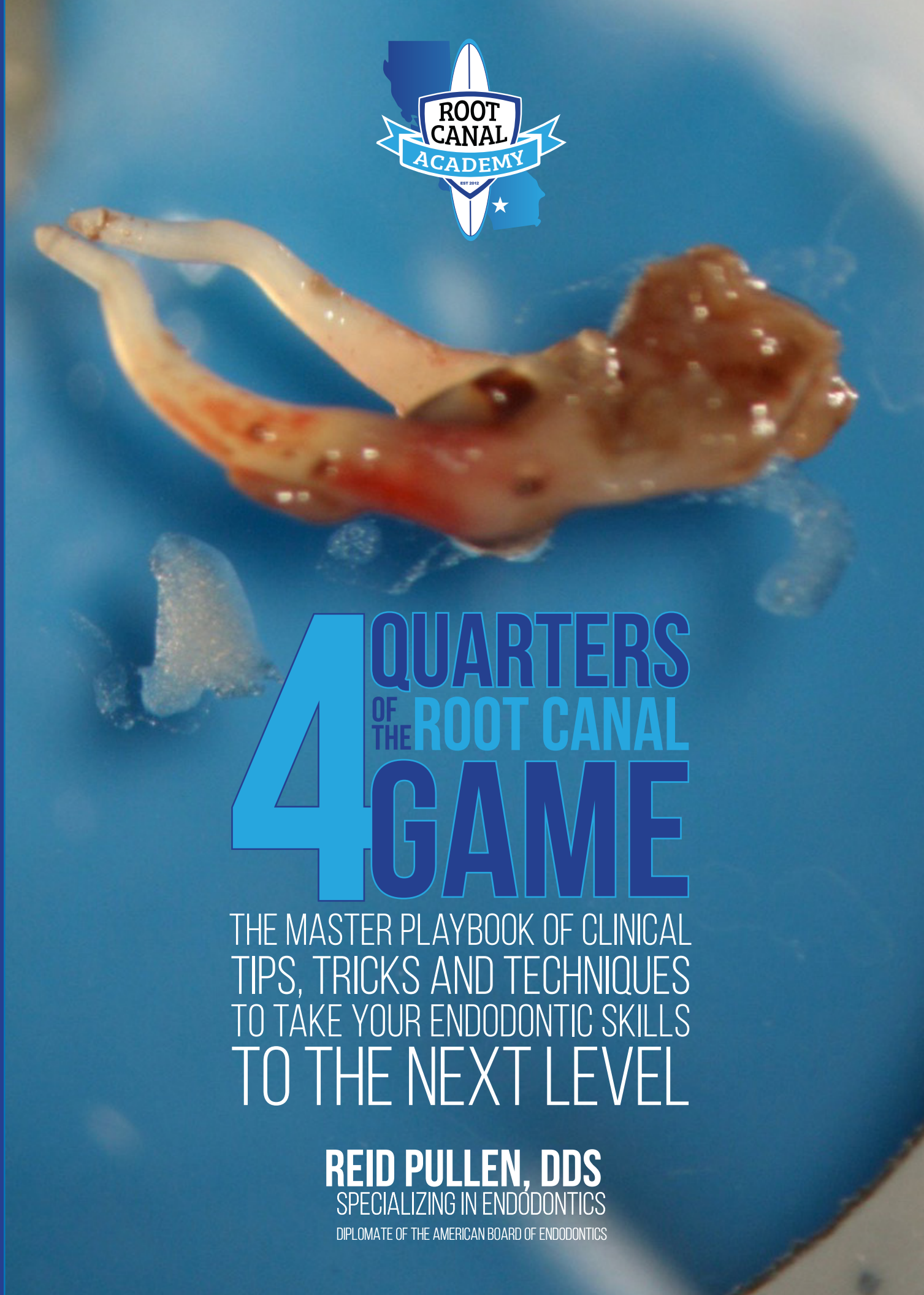

4 QUARTERS OF THE ROOT CANAL GAME

THE MASTER PLAYBOOK OF CLINICAL TIPS, TRICKS AND TECHNIQUES TO TAKE YOUR ENDODONTIC SKILLS TO THE NEXT LEVEL

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ROOT
CANAL
ACADEMY
EST 2012

4 QUARTERS OF THE ROOT CANAL GAME

This book contains clinical advice and tips that are designed to greatly improve your root canal game. This book will take you deep into the secret Endo underworld and into complete root canal Immersion; enough so that you will dream about endo.

As everything in endodontics, the instruction given in this book is just one way a clinician performs a root canal. There are many ways to accomplish the root canal objective and the recommendation of the author is to only use the tips given in this book if it works in your hands. You may have learned a different technique that works well for you and I encourage you to stay with that, but to keep an open mind regarding the material contained in this book. Some of the tips may not work as well in your hands and you may need to make adjustments on certain techniques. As any lecture or knowledge that I have obtained over the years in endodontics, I take what works and discard what doesn't. I recommend you doing the same with this book and course. My sincere desire is to help you in every way perform an excellent root canal with as few problems as possible. Please use caution and sound clinical judgment in treating and incorporating any of these techniques mentioned in this book. Rootcanalacademy.com or Rootcanalmastery.com or the author are not responsible or liable for any problems or lawsuits that may arise during the root canal process. Please be smart, cautious and use intelligent hands!

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INTRODUCTION

PROBLEMS WE CLINICIANS FACE: The "Do You's . . . "

Do you have trouble obtaining an accurate pulpal/periapical diagnosis?
Do you know how to pulp test a quadrant effectively and interpret the findings?
Do you know how to obtain deep anesthesia on a hot lower molar?
Do you know how to place a rubber dam in 30 seconds?
Do you have trouble accessing pulp chambers?
Do you have trouble finding canals?
Do you have trouble locating calcified canals?
Do you know how to open the orifii (open orifice or coronal flare)?
Do you struggle with fully negotiating to working length?
Do you find it difficult to obtain an accurate working length?
Do you ever struggle with getting a #15 K file to length even though the #10 K is loose at the apex?
Do you struggle with achieving an open glide path?
Do you ever ledge or block yourself out during the glide path or shaping procedure?
Do you have trouble shaping your canals with Nickel-Titanium rotary or reciprocation files?
Do you lose patency sometimes during the shaping process?
Do you ever ledge the canals while using Nickel-Titanium rotary orreciprocation?
Do you know the advantages and disadvantages of the ProTaper, Pro Taper Gold, ProTaper Next, Vortex Blue, TruShape (All Dentsply), ESX (Brassler) rotary files and WaveOne Gold reciprocation files (Dentsply)?
Do you feel comfortable with shaping the complex, deep root anatomy of the apical one-third?
Do you routinely under instrument and underfill your root canals?
Do you routinely over fill your canals with gutta percha and/or excess sealer?
Do you often overprep the apical foramen?
Do you struggle with achieving a good cone fit?
Do your cones crinkle?
Do you have trouble getting your gutta percha cones to slide to working length?
Do you know the advantage and disadvantage of the different gutta percha cones?
Do you have trouble or are confused about warm vertical condensation?
Do you know how to use Pulp Canal Sealer EWT (Kerr) sealer, Thermaseal Plus Ribbon-Bond (AH-Plus) sealer, or Bioceramic sealer?
Do you know how to use GuttaCore obturation?
Do you know the advantages and disadvantages of each sealer and why having more than one sealer in your practice is a good idea?
Do you know how to handle a sodium hypochlorite accident (God forbid)?
Do you know how to handle a post-endodontic flare-up?
Do you know how to perform an incision and drainage?
How to know what cases to refer and what cases to treat
How to diagnose whether a tooth needs a root canal
How to use the SOAP note format to record accurately the patient interview, clinical testing, and radiographs
What "pain" questions should you ask the patient during the consultation
How to perform clinical endodontic testing
How to give a correct pulpal and a periapical (or periradicular) diagnosis (every tooth that you are treating needs to have one!)

Root canal treatment is fraught with errors and potential errors. Sometimes it can be a real fight just to put out a good solid case that is filled to the apex, not short, not long, but filled right to length with just a tiny little puff. That puff states to every dentist who views the radiograph that you were PATENT and hopefully the apex is locked and sealed.

SOLUTIONS

This book will provide answers to the problems we face during the root canal process. Answers will be given in a TOP to TIP progression, just as you would face during the root canal procedure. A prescription or playbook will be provided so that you can predictably and repeatedly perform excellent root canal treatment. This root canal prescription or game plan is flexible and you will be able to adapt it to your style and technique. My goal in writing this book is to provide you with clarity so that you will have the confidence and competence (the 3 C's) to nail your next root canal. Dentists appear hungry for root canal knowledge, and often the four hour workshop I'm presenting on a rotary or reciprocation system, turns into a Root Canal 101 Basics class. Part of it is dentists want to make sure they are doing the "correct" technique, and part of it is that they are not really sure or confident that they are.

THIS BOOK WILL PROVIDE ANSWERS FOR YOU! IT WILL PRESENT A ROOT CANAL GAME PLAN OF HOW TO PERFORM AN EXCELLENT ROOT CANAL.

INTRODUCTION

WHAT DOES THIS BOOK COVER? The "How To's . . . "

How to effectively anesthetize a hot tooth and my Plan A, B, C, and D when every area is numb but the tooth

What anesthetic, needles, and injection techniques I use for the various teeth

How to choose the correct rubber dam clamp (I typically use 5 clamps for 98% of my cases)

How to punch a hole in the rubber dam so that it fits perfectly on the patients face

How I place the rubber dam in 30 seconds

How to place a rubber dam sealer in case an extra seal is needed

What magnification and lighting do I recommend

How to correctly access the pulp chamber and to know what types of burs (regular and surgical) to select

How to locate all the canals, calcified canals, and the pesky MB2

How to perform coronal negotiation prior to coronal flare

How to coronal flare or open the orifice (1st of the four pillars of the 2nd QTR)

How to negotiate to working length and patency (2nd of the four pillars of the 2nd QTR)

How to obtain an accurate working length (3rd of the four pillars of the 2nd QTR, 4th of the four pillars)

How to obtain an open glide path (4rd of the four pillars of the 2 QTR)

How to use the ProGlider, WaveOne Gold Glider, Vortex Blue 15/04, or the Expeditor (ESX) to achieve a glide path

Discuss the Zen Endo principles of "Be"

How to properly shape the root canal system with rotary and reciprocation Nickel Titanium files- ProTaper Gold, ProTaper Next, WaveOne Gold, Vortex Blue, TruShape, ESX, and TruNatomy

Discuss the advantages and disadvantages of various rotary and reciprocation files such as: WaveOne Gold, ProTaper Gold, ProTaper Next, Vortex Blue, TruShape (all Dentsply), ESX (Brassler) and Edge Files (Edge Endo)

Discuss the clinical use of rotary and reciprocation files and what files work the best in tight, long, curved canals

How to hand file the redzone or apical one-third to get a deep shape

How to apical gauge and what hand files I recommend

How to properly irrigate the root canal procedure throughout and at the end of the procedure

What type of gutta percha cone should you use and in what case

Discuss advantages and disadvantages of the different sealers: Pulp Canal sealer EWT (Kerr Sealer), Thermaseal Plus Ribbon sealer, AH-Plus, and BC sealer

How to achieve a 3-D seal of the root canal system with warm vertical condensation using the continous wave technique and incremental GP removal technique

What types of gutta percha heat devices do I recommend and what type of gutta percha backfill devices do I recommend

How to use the new GuttaCore oven obturation system and the GuttaCore technique

How to use BC (Bioceramic) sealer and the Hydraulic Condensation technique

How to clean up the different types of sealer in the access

How to place a temporary restoration so that it will not leak (at least for 4 weeks)

How to remove Calcium Hydroxide at the second visit

How to know when a second visit is needed

How to describe the entire root canal process to the patient

How to discuss post-operative instructions

What post-operative medication is recommended for pain

How to know when should to give your patient antibiotics

How to handle a flare-up and when should you perform incision and drainage

How to handle a patient with continued, diffuse swelling

How to handle continued apical bleeding from a very inflamed tooth

How to handle a sodium hypochlorite accident

CHAPTER 1
TRAINING CAMP

Goal of Endodontics

E^3 Endodontics: Three dimensional, apical, lateral, and coronal seal of the cleaned root canal system in an EXCELLENT, EFFECTIVE and EFFICIENT (**E**^{3}) manner. Excellence first, effective techniques second and then efficiency in those techniques is what **E**^{3} Endodontics is all about.

Course Goal

#1 GOAL: BE BETTER TOMORROW!

① **Become excellent, effective, and efficient while striving for root canal mastery**

② **Greatly improve your root canal game**

③ **Develop Clarity, Confidence and Competence (3 C's) in the root canal game**

④ **To obtain 95% success in your root canal game (I want you to win 95 of 100 games)**

⑤ **Know when to treat (correct diagnosis) and what to treat (when to refer)**

⑥ **Build an endodontic foundation- all the tips, tricks and technique will be provided**

⑦ **Get better every case- learn from your failures, learn from your successes**

Course Theme

ZEN ENDO

BREATHE, BE RELAXED, BE SMOOTH, BE GENTLE, BE PRESENT, BE THE CANAL, BE THE FILE. I call these principles the 6 "Be's."

The principle of **ZEN ENDO** came as a result of my many failures. I have a very aggressive personality and that translates into my endodontic treatment style: impatient, rough, aggressive. The opposite of theses three adjectives is patient, gentle and smooth. Can you accomplish excellent, effective, and efficient root canals with this mentality: patient, gentle, and smooth (The easy does it mentality)? I believe that is the mentality you must have to treat every root canal. Yes, you can get away with a rough style on many cases, but to be predictable and excellent you must adopt a style that is smooth, gentle and patient. This style will get you out of a lot of potential binds during the root canal treatment procedure.

Just the other day I took part in a product demo where we (a few endodontists) performed root canals on extracted teeth with new products at a dental school lab. First of all, it felt like a dental school lab test. The adrenaline and headache started immediately (I thought by age 42 I would have a tougher mental state, but instead showed my true mental midget self). I was given an extracted #14 already accessed with a wicked MB root curve (nearly categorized as a dilaceration). As

I started filing and following the principles that will be outlined in this book, audio lectures and video lectures, I realized that the MB canal was not going to be easily negotiated to working length and that patency would be even more difficult. This was a big deal because I was in the midst of some very big names and we were going to be "evaluated" for our work with final radiographs. Really a company wanted feedback on the different products we were using, but of course I had to make it a competition. The game was on. I placed bleach in the canals and started the process. After opening the orifice I started the negotiation to working length process. Unable to gain more than an estimated 2/3 of the root negotiation in the MB canal, I stopped and moved on to the "easier" DB and palatal canals. The **ZEN ENDO** principles took over and I allowed another principle to take affect.

The principle of "soak time." I left the NaOCL in the MB canal and immediately did my thing in DB and Palatal and then came back 10 minutes later to the MB canal. Guess what? Low and behold, I was able to carefully and smoothly gain full negotiation with patency. I then completed the root canal with a nice fill and with the final radiograph felt a little like a superstar who just achieved brilliance and an A on the test. I was also able to articulate to the "examiners," I mean product testers, how their product helped accomplish this "excellent" result. In the end I left with a feeling of accomplishment and confidence that **ZEN ENDO** and the principles to be taught do really work (even though I see it every day in my own practice). Sometimes, you need an out of practice experience to confirm what you already know.

Root Canal Fun

The truth of the matter is that root canals can be just plain difficult. Some days in my practice, I drive home feeling like a brilliant endodontist and clinical master. I have the "golden" touch. On other difficult days, where I performed rather poor endodontics I entertain the thought of driving into a ditch on the way home and ending it all. Those are the days where the thought loop runs through my head, "Maybe I should go back to endo residency?" The fact is root canals can be easy and they can be quite difficult. I don't give a crap what endodontists say, root canals are downright tough. If anyone tells you they have 100% success rate or that they never fail they are full of it! I once had an endodontist friend tell me he has never had a failure. That ended my bid to open a practice with him. Guess what? Fast forward 8 years later and I see one of his patients that he performed endo on 1-2 years prior and it's failing. I have to admit a smile crossed my face when I heard his name echoed by the patient and saw the radiograph.

The main point here is that some root canals are just a plain struggle and others are quick and easy and you look and feel like a master. You never know what you are going to get. Try your very best to kick out the difficult cases to the endodontist. That's what their there for. Utilize them. I can tell you my referrals utilize me and I am always grateful for the referrals even if its a hard case. Most of the dentists that I WORK FOR (Yes, I work for my referring dentists!) send softball and hardball cases. I take what I can get and I'm happy. Don't let your endodontist be a baby. Refer out those tough ones!

CHAPTER 2
COACHES CORNER, MY STORY

I grew up playing all sports all the time. I never played any music or took art lessons and never did anything of a micromovement nature unless it was in making small adjustments to throw strikes, hit a ball, score a basket or catch a football. Most of what I did was what you would call macromovements. I played football at U.C. Davis (Division2) as a 220 pound tight end for two years until I broke my leg. I attended USC Dental School and struggled as a Freshman in lab classes. I just did not have an artistic bone in my body or at least that is what I made myself believe. Early on, as I was struggling, an irritating female teacher told me that I was really going to struggle here in school because I just didn't have the hand skill. That really made me angry. I hated losing and would push myself as far as needed to succeed.

That little comment by the unhelpful female dental teacher motivated me to get better and be the best that I could be. The saying, "Get good, Get better, Be the best," by Matt Furey encouraged me every day to push forward and nail it. At the beginning of my junior year I listened to a Brian Tracy audiobook and was inspired to put up a goal board that kept track of every clinical point I earned. At the time, I needed about 2300 clinical points and to pass competency exams. Each dental speciality had a certain requirement of points something we all know and fondly remember. By the end of the first trimester I had completed 700 points by working every available minute in day and night clinic. I was very proud of this and every day worked towards achieving those 2300 points. By the last trimester of my junior year, I had almost finished with all of my clinical requirements plus or minus a few procedures and was able to really relax and enjoy school. I ended up graduating 33 out of 120 in my class and was very proud of that. Not bad for a guy that was told he had no hand skill.

I then entered the Army Dental Corps since they had paid for three of my four years of dental school. I served three years in Germany and completed a one year Advanced Education in General Dentistry Residency in Landstuhl, Germany. I trained under some great instructors and they generally treated us like their own sons and daughters. In my third year, our excellent endodontist became pregnant with twins and was unable to work for a period of time. This left more endodontic procedures for my friend, Adam Colombo and myself to treat. At the time I hated root canals and was scared to perform upper molar endo. My friend, Adam, now an endodontist in Kansas City, and the clinic endodontist helped further my education and I started to realize that I could do this. I probably did fairly poor endo in the beginning but at least I was able to get to length and learned some general principles that helped me achieve consistent results. The root canals were not great but they were passable and that is a good place to start. My military career came to an end in October 2002. I travelled back to southern California and worked as an associate in a great private practice with two other dentists. I worked for two years in this practice as an associate making 25% of collections. After two years in private practice , I felt that specializing in endodontics may be a better option. I was told that because of my dental school ranking that I would not get into an endodontic residency program and that it might take me four to five years. That motivated me again to make sure that I was accepted. I love when people tell you that you won't get in or that you can't do something. I applied to numerous endodontic residencies and to my surprise was granted interviews at University of Alabama Birmingham, USC, Long Beach VA, and Boston. I was shocked and excited that I at least had a chance to get accepted. I was also confident that if they met me I would have a better chance because I am one funny ginger. As luck would have it, I was accepted into the University of Alabama, Birmingham, USC and the Long Beach VA Endodontic Residencies. I obviously accepted the Long Beach VA position mainly because they paid you $38,000 a year to attend school and the director was awesome!!!!! I also utilized the GI Bill and earned another $14,000 a year.

I completed my endodontic residency and was awarded a certificate in Endodontics in 2006. For over a year I travelled 5 days a week applying my

endo craft to numerous offices in Orange County and Los Angeles. I waited patiently and looked for opportunities to either associate, buy in or to open my own practice. I finally took the plunge and opened my own office in 2007 in Brea, CA which is located in beautiful North Orange County. Within a month I was busy and eventually hired an associate 3 years later. Over the years I have added a CBCT, a Lightwalker Laser that performs Photon Induced Photoacoustic Streaming (PIPS), GentleWave and numerous other smaller endodontic items. I constantly try to think outside the box and perform endodontics with a dynamic technique. In other words, if a NiTi file or sealer performs better, and if research comes out supporting it, then I am willing to try that technique. Sometimes I get burned and jump into a sealer or technique too fast without properly researching it. The main point is I try everything. I get free samples of NiTi files and sealers all the time and I try them and learn the "feel" and "behavior" ("signature feel") of the file or product. My goal in doing this is two fold: 1) To continue the search to find better materials and files and 2) To test out different products so that I can provide feedback to you all and when asked about certain products during my lectures.

The struggle has been worth it. Life is not perfect and there are ups and downs in my practice. I have lost some referrals for various reasons, but I have gained many more and am excited to be a part of this great field and have a burning desire to impart my endo knowledge TO YOU. So hang in there with me on this wild ride and let's win this root canal game. It's time for the Endo pregame.

CHAPTER 3
PREGAME

PART 1 - CASE SELECTION

When Do I treat? When Do I refer?

The principle of "Intelligent case selection" is one that must be mastered. There is no reason for you to treat the exceptionally difficult cases when they can be referred to your endodontist. Start easy and work your way up to medium and slightly difficult cases. Why treat difficult cases that will take hours of your time, decrease your overall production, and cause major increases in blood pressure when those can be treated by an endodontist. Stay away from theses cases. Why lose confidence over the crazy ones (crazy teeth and/or crazy patients). Ship those out of the office!!!

Let's define the cases that you may want to "ship out":

DIFFICULT CASES

① Calcified canals (you are unable to see the canals on the radiograph). A BWX will help you evaluate this!

② Extreme curved canals - Carefully examine the radiographs prior to treatment and visualize the way the roots curve. Is there the dreaded S curve, dilacertion, or long curve? If your intuituion starts to ring an alarm pay attention and refer the patient out.

③ Long canals - These canals can be difficult to shape and obturate due to increase surface area of the canal. Often these cases take 31mm "long" files and smaller taper gutta percha points to fit to working length.

④ Limited opening patients

⑤ Uncommon Anatomy - Lower Premolars with a bifuraction (the canal splits 1/2 to 3/4 of the way down the root). Lower molars with 2 distal roots.

⑥ PITA (Pain In The Ass) Patients

⑦ Kids - It's difficult for an 11 year old to sit still for an hour and a half and often these cases have immature apices.

LOW SUCCESS CASES

1 Large, circular or well-circumscribed lesions, that have been present for more than a year (higher incidence of an apical cyst) - apical cyst incidence is about 8-10%. Some of the biopsy results from my apicoectomies come back with an apical granuoma diagnosis. I always feel guilty and wonder if I could have done something more to achieve healing. Usually this diagnosis means something else was going on inside or outside the tooth. Either I was unable to fully clean the root canal system due to operator error, anatomical variation, or there was apical root plaque or biofilm that just wasn't going to be removed with conventional treatment.

2 Furcal lesions- these lesions do not heal well and often need periodontal therapy.

3 J Type lesions- These are radiolucent lesions that start apically but then extend vertically along the root on one side indicating a probable vertical root fracture. Vertical root fractures are a no win for you and the patient. They just don't heal and extraction/implant is the treatment of choice. The problem with vertical root fractures is that their difficult to spot on the CBCT and are rarely seen on a PA radiograph. If there is a deep, isolated probing in conjunction with vertical bone loss or a J Type Lesion then there is a probable vertical root fracture.

4 Lower molar distal marginal ridge crack lines that extend down to the pulpal floor or into the distal canal. If the crack extends down to the pulpal floor but not into the canal I tell the patient there is a decreased chance of success. If the crack extends deep into the canal I recommend extraction.

The key is to know what you can do and know when to refer. I like to compare it to a 4th and long situation in football. Don't try to be a hero and go for it, instead PUNT the difficult or low success cases to the endodontist.

PART 2 - Pain Referral Patterns

Sometimes patients will experience referred pain from a tooth. There are specific pain patterns that can aid in the diagnosis of a tooth. These pain referral patterns are not 100% specific for a tooth or area, but they can give you a general idea of which area the problem may be coming from.

The following are pain referral patterns that I often see in private practice:

Maxillary anterior: pain refers to inferior of the nostril. The patient will often push with their finger just under the nose which usually corresponds with the apex of the symptomatic tooth.

Mandibular anterior: pain referral patterns are less common. Some patients will feel pain in the submental area.

Maxillary premolar: pain refers to the infraorbital area. The patient will usually push on an area just under the orbit and state they feel the pain run to that area.

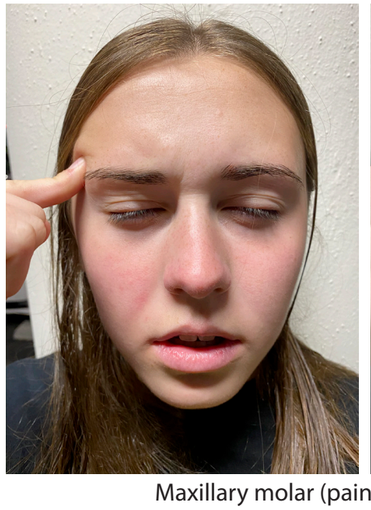
Mandibular premolar: pain can refer to the back of the ear (more common in mandibular molars) but often submandibular.

Maxillary molar: pain refer to the temple area

Mandibular molar: pain refers to the ear area, inside the ear or to the back of the ear. Often times patient have already been to the ENT and have been told that they do not have an ear infection. Pain can also refer submandibular.

I ask the patient to point to the problem tooth

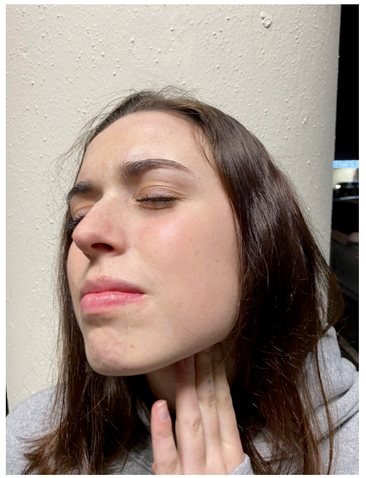
Maxillary premolar (pain to the sub-orbital area)



Maxillary molar (pain to the temple area)

Posterior mandibular tooth ache and/or swelling

Mandbibular molar (pain to the back of the ear)



Mandibular posterior (submandibular pain)

All hell has broken loose!

PART 3 - DIAGNOSIS

TOOTH #14 EXTREME PURULENCE

Diagnosis - **SOAP** Note

Do you remember the SOAP (Subjective, Objective, Assessment, Plan) format for notes from dental school? Most of the people I poll during lectures do not remember this or vaguely can recall something related to it. This is an excellent way to organize the patients thoughts (S), clinical testing (O), radiographic interpretation (O) in order to come up with a correct diagnosis (A) and form a treatment plan (P). After all, the correct diagnosis is often 50% of the cure.

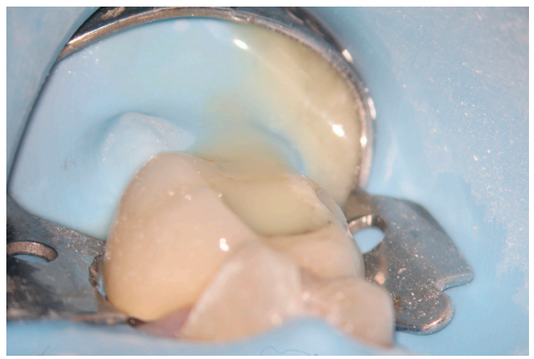
S = Subjective

This is the detailed patient complaint or chief complaint. This is where we need to listen and ask the right questions and sometimes pull information out of the patient. My recommendation is to train your dental assistants to perform the patient interview and then after reviewing the notes you can come in and ask more detailed, pertinent questions.

The following are most of the questions we will ask a patient in order during the initial patient interview: "What is the main problem? Can you point to the problem tooth? When did it start? What makes it hurt? Do you have chewing pain? Do you have hot/cold pain? Does the pain linger after you drink hot or cold fluids? Are you taking Advil, Ibuprofen, or Motrin (say all 3), Tylenol or any other pain medications for the the pain? Do you avoid that side? Is it getting worse? Does the pain come and go? Does the tooth ache all day? Do you have spontaneous pain while you are watching TV or driving (not functioning on the tooth)? Does the pain wake you up at night? Does it hurt more in the morning (potential bruxism)? Do you grind or clench your teeth? Do you have a nightguard? Do you have chronic sinus problems (upper molars)? Do you feel that the tooth is "high" (apical infection has pushed the tooth up ever so slightly)? Have you had nerve, tooth pain before and needed a root canal? Does it feel similiar?

Often you will be able to form a possible pulpal and periapical diagnosis just with an adequate patient interview. So be thorough in your questioning. It should almost feel like a gentle interrogation and you can use the dental light to apply a little pressure if the patient is refusing to answer your questions. Just kidding.

Sometimes during the patient interview, the patient states that the pain will be present for a day or two and then will be gone for a week only to come back with a vengeance for two days. Over the years I have heard this pain trend over and over again in irreversible pulpitis and necrotic cases. I mention this because sometimes the patients refuse treatment because they are not having any pain at the moment even though their tooth clearly tested necrotic. This is where good patient communication is vital. You definitely want to explain to the patient the diagnosis and



the fact that the tooth pain or flare up will come at inopportune times: first day of vacation, Friday night, Christmas Day.

O= Objective

The objective phase of the SOAP note consists of clinical testing and radiographic interpretation.

Radiographs

Start with two radiographs of the suspected tooth or area. One straight periapical radiograph and one slightly angled, either mesial or distal. I instruct my assistants to take a third radiograph if either of the first two are not of high quality. I still see a high number of cone cuts and poor radiographs from my assistants and they all know the rule, "When in doubt, take another one." I also recommend a BWX to evaluate the pulp chamber and see if there are any pulp stones or canal calcification and to look for any deep interproximal caries. I use the BWX to decide if the tooth is restorable or if it may need crown lengthening and I can clearly show the patient the deep caries and the caries approximating the pulp chamber or pulp horn. The dose of radiation with digital radiographs is so low it is worth taking two to four to help obtain an accurate diagnosis. I explain to the radiation phobics that we can take 8 "new" digital radiographs and it is equal to 1 conventional PA radiographs. I also believe that you do not, by law, need to place the lead shield on the patient anymore during radiographs, but I would check with your state dental association to be sure. And of course, you would definitely place the lead shield on any pregnant patient. We still use the lead shield for every radiograph mainly becuase the patients are used to it and expect it and I don't want to explain eight times a day why we don't really need the lead shield anymore (collimated beam).

CBCT (Cone Beam Computed Tomography)

I first purchased the Kodak 9000 3D CBCT ten years ago. I then upgraded to a Morita CBCT. It has a limited or focused view and typically captures 4-6 teeth. There are a number of excellent CBCT's on the market and I would highly recommend one if you perform impants, extraction, root canals, retreatments or apicoectomy's. I take a CBCT of every possible apicoectomy and on most retreatments. I tell the patient that this "CT Scan" will give me the most information possible regarding your tooth. I use the book analogy: "It used to be we could only read the front and back cover of the book (digital two dimensional radiographs) but now we can open the book and look inside and really get the knowledge we are seeking." CBCT's on average cost around $50,000-$80,000. I started charging $265 per scan but reduced it to $150 because patients were refusing it due to cost. At $150, I have 98% compliance. I recently raised it to $197 and still have about the same compliance rate. Unfortunately, most dental insurances do not pay for the CBCT scan so its typically out of pocket for the patient. The CBCT company told me that we could bill medical insurance but that never panned out and I felt that it was very misleading. All in all, I cannot live without my Cone beam and I put it in the category of must haves if you are an endodontist or GP who performs a lot of root canals, retreatments, tooth extractions and implants.

Clinical testing

I typically test an entire quadrant. If tooth #3 is suspected, I will test #2, #3, #4, and #5 and evaluate the radiographs for all those teeth. Often the patient thinks they know the problem tooth only to be one or two teeth off. I usually start pulp testing a "normal" tooth and not the suspected one because sometimes patients are very jumpy and can give you a false positive.

Here is my clinical testing routine:

I take the mirror and examine the quadrant of teeth and all the surrounding tissue. I'm looking for obvious caries, cracks, tissue redness, swelling, or sinus tracts with a parulis. I then flip the mirror around and percuss each cusp of every tooth. I list the results of all tests as WNL, (+), (++), or (+++), each successive (+) sign indicating increased pain. No response or lingering (greater than 10 seconds because most teeth do not have cold pain that lasts more than 5 seconds) with Endo ice. Obviously, the plus grading system is very subjective but it still gives you a baseline that you can refer to if another re-evaluation visit is needed.

After percussion, I grab the periodontal probe and check mobility (WNL, Class I- slight movement, Class II-movement less than 1mm, Class III-movement greater than 1mm in horizontal and the tooth is depressible) of each tooth with the end of both instruments placed on the buccal and lingual areas. I then flip the periodontal probe around and check all probing sites (6 per tooth- MB, B, DB, ML, L, and DL) for all teeth in the quadrant.
After probing, I put down the periodontal probe and perform apical palpation by placing my finger on the apex of the root on the buccal aspect and press down to feel for any apical swelling and to see if it illicits any pain.

Now check bite pain with a bitestick. I test each cusp and also the central fossa (you have to place the bitestick at a 45 degree angle) and record WNL, (+), (++), or (+++). Next I use a medium sized cotton pellet (DO NOT USE A Q TIP FOR COLD TESTING- the fibers are wound too tight to hold the cold for long) and spray the Endo Ice can for 2-3 seconds on the cotton pellet. Place the cotton pellet on the buccal aspect of each tooth. If the patient's chief complaint is extreme cold sensitivity then be nice and place the pellet on the B surface ready to remove it as soon as the patient reacts. Record WNL, (+), (++), (+++) and if the pain lingers for more than 10 seconds. I recommend Endo Ice over CO_2 mainly because its accurate and much quicker and easier and less messy. Endo Ice works well through gold and porcelain crowns. There is a cheaper version of Endo Ice (Coltene $24) called Endo Cool Spray (Henry Schein $14) and Endo Frost (Darby $10). One trend that occurs over and over again is that the maxillary premolars do not always respond to cold tests. It can be a perfectly healthy premolar, caries and restoration free, and yet the patient does not seem to feel the cold. So please keep this "premolar ice" phenomenon in mind when developing a diagnosis.

The Endo Ice test is my last pulp test performed because it "freezes" the pulp and further pulpal testing can be inconsistent. This is a subjectve and debatable finding but just one that I observe in my clinical practice. If the testing is unclear, I usually wait a few minutes and let the pulp "reset" prior to pulp testing again. If the patients chief complaint (CC) is pain to hot fluids or food, which usually indicates a late irreversible pulpitis or possible missed canal on a prior RCT, then I will proceed to a hot test. Testing teeth for hot pain is obviously more difficult because we need it hot enough to activate the pain receptors in the tooth but not burn oral tissue. A normal response to heat from a healthy pulp is no response. There a few different types of hot tests. My associate likes to heat water up in a microwave (you should be able to dip your washed, clean finger in the water and not burn it- about 105 degrees Fahrenheit) and dip a cotton roll into the hot water and have the patient bite down on the suspected tooth. This isn't a perfect test, by all means, but it is probably the fastest and easiest. I really do think someone needs to invent a hot spray and call it Endo Heat!!! It would make it so much easier to diagnose the tooth that only fires with hot substances. Hot test #2 is more difficult but probably more tooth specific then the hot cotton roll bite test. Cut a hole in a rubber dam and place it on the frame. Heat up water in a microwave, test it with your finger and fill up a monoject syringe. Place the rubber dam over the tooth in question and hold it with two split fingers (index and middle finger) of one hand. Use the other hand and inject the hot water onto the tooth in question and record the response. Move the rubber dam to an adjacent tooth and repeat. By testing at least three teeth you are able to establish a hot test baseline. I rarely perform the hot test, mainly because the cold tests and all the other tests usually give me the answer. I perform hot tests five times a year in my practice. So its a pretty limited test. Sometimes a symptomatic tooth will present the perfect results. I call this the "Baseball Syndrome." This occurs when a suspected tooth tests Percussion (++ or +++), Bite Stick (++ or +++) and Endo Ice (++ or +++ and/or lingering). Baseball Syndrome= three strikes and your out (more like three strikes and your nerve is out). 3 strikes = RCT! I tell the patient that this tooth has three strikes against it and it definitely needs a root canal.

I like the patient to OWN the tooth and OWN the root canal treatment. As you know, certain patients are certified crazy and will blame you for anything. I remove a lot of the confusion over which tooth needs a root canal by having a patient own the tooth. Once I have established a problem tooth I re-test and ask them, "This is the tooth, right?" I want them to OWN it so there will be no confusion in case another tooth in that quadrant needs treatment later on. I don't always do this because some cases are so obvious and so painful that I don't want to repeat the torture.

A= Assessment or Tooth Diagnosis

Every tooth that you are performing a root canal on must have an inside the tooth diagnosis (pulpal) and an outside the tooth diagnosis (periapical or periradicular). If you are ever sued over root canal treatment the lawyer will ask if you used a rubber dam and if you had a tooth diagnosis. The American Association of Endodontics (AAE) has worked hard to come up with a pulpal and periapical diagnosis that makes sense and takes out some of the ambiguity of the prior guidelines.

The following are the AAE pulpal diagnosis':

Normal Pulp = Pulp normal or tests normal

Reversible pulpitis (RP) = Vital pulp that is sensitive and inflamed after a restoration but is still reversible and can heal on its own.

Irreversible pulpitis (IP) - asymptomatic = Vital pulp with radiographic caries into the pulp chamber or carious pulpal exposure yet the patient is surprisingly asymptomatic

Irreversible pulpitis (IP) - Symptomatic = Vital pulp where one, two, and/or three of the pulpal tests (Percussion, Bite Stick, Endo Ice) are positive and the patient is symptomatic. This diagnosis is usually fairly easy to determine.

Pulp necrosis = Necrotic pulp and the tooth does not respond to cold.

Previously initiated therapy = prior pulpotomy or pulpectomy

Prior RCT = obvious- Do you see the white lines?

The following are the AAE's periapical or periradicular (either term is correct) diagnosis':

Normal periapical tissues (WNL) the patient responds normal to all pulpal tests and the radiographs are WNL.

Asymptomatic apical peiodontitis (AAP) - this occurs when a radiolucent lesion is present but the patient is asymptomatic (no pain to percussion / bite stick / or palpation).

Symptomatic apical periodontitis (SAP) - this occurs ***with*** or ***without*** a radiolucent lesion, ***with*** or ***without*** PDL widening but the patient is symptomatic. Percussion, Bite stick and/or Apical palpation is (+), (++), or (+++). ***This is the most common Dx in my practice. It's a catch all.***

Acute apical abscess (AAA) = this Dx occurs if the patient has swelling but a sinus tract is not present. ***This is often the most painful periapical Dx and is the most difficult to deal with. Patients usually have limited opening and it is difficult to fully anesthitize for endodontic treatment and an Incision and drainage (I and D).***

Chronic apical abscess (CAA) = this occurs if a sinus tract or parulis is present. Contrary to popular belief, you do not need to put this patient on antibiotics, but in saying this, always follow your intuition. ***Over the years I have developed a fairly good intuition on which patients I should give antibiotics for even when the book answer is a definitive "NO!"***

Condensing apical osteitis (CAO) = this occurs when an expansion of bone is seen around the periapical area caused by pulpal inflammation and/or pulpal necrosis.

The two most common diagnosis' are IP-Symptomatic/Symptomatic apical periodontitis (SAP) and Pulp necrosis/Symptomatic apical

periodontits (SAP). Always list the tooth number in front of the pulpal and periapical Dx. The second most common diagnosis that I see in my office is #3 or #14 Prior RCT/Symptomatic apical periodontitis **(SAP)** (Retreatment is needed usually because of a missed MB2. *Check out THE 4 QUARTERS OF THE SIMPLE RETREATMENT GAME and THE LEARNING LESSONS: THE DREADED MB2*). The third most common diagnosis is Pulp necrosis/Chronic apical abscess **(CAA)** (sinus tract). Remember any swelling (usually B space swelling) the periapical Dx is Acute apical abscess **(AAA)**. I encourage you to use the AAE diagnosis tree (aae.org) and initially write out every diagnosis until you are confident that you understand the Dx and then switch to the abbreviations.

P = Plan or Treatment
List a primary or recommended treatment and an alternative treatment. Typically the primary Tx is RCT or ReTreatment (ReTx) and the secondary Tx is typically extraction/implant or in my office apicoectomy.

What do you do if you are unsure of the Dx?

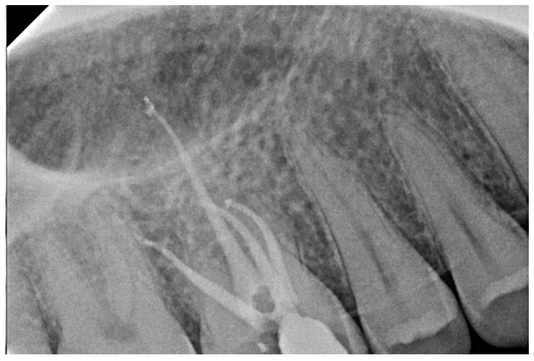
I recommend to "Wait and Watch" and reevaluate the patient in 2-4 weeks or sooner if the symptoms (Sx) worsen. I make sure the patient understands that if the Sx increase that they can come back prior to 2-4 weeks. Also, I tell patients that reevaluating a tooth does not cost anything and that there is a one-time consult fee ($143) and then all future reevaluations and recalls are free. Some patients refuse to come back because they mistakenly believe that there is a cost to every office visit (medical model).

PRACTICE CASES:
WHAT'S YOUR FULL ENDODONTIC TOOTH DX?

PATIENT ONE

S: Patient (Pt) states that they have cold pain duration 2 weeks in the URQ and that they are avoiding that side during function. "My tooth hurts when I drink cold beer." What other questions might you ask the patient? (remember: S= patient interrogation) You can glean a lot of great information if you **ASK** the right questions and **LISTEN** to the response. The Dx picture can become much clearer from just the interview and patients answers.

Possible other Questions: Do you have lingering pain when you drink cold water? Does it hurt to chew on the tooth? Do you take pain meds for the tooth? Does the tooth wake you up at night? Do you have spontaneous pain (pain when you are watching television or not functioning on the tooth)? Train your assistants to ask all of these questions prior to you entering the room.



CASE 1 - TOOTH #3- MAXILLARY RIGHT 1ST MOLAR

O: Radiographic- straight and an angled radiograph and BWX if there are interproximal caries present. Radiographs show a moderately deep radiolucent occl. composite restoration on tooth #3 (maxillary right first molar) Clinical tests: Test #2, #3, #4, and #5. Percussion- #3 (+), #2, #4, and #5 WNL, Bite Stick- #3 (++)MB cusp, #2 (+) DB cusp, #4 and #5 WNL, Endo Ice or Cold Test- #3 (+++)lingering (I call lingering 10 seconds or more because most teeth do not have cold pain that lasts for more than 5 seconds). #2 (+), #4 and #5 WNL, Probing/ Palpation/Mobility- All WNL

A: What is your Dx for tooth #3 (Maxillary Right 1st Molar)?

#3 IP-Symptomatic/Symptomatic apical periodontitis
= Test results: Perc (+)/Bite Stick (++)/Cold (+++). Sometimes only one, two or three of these tests will be positive and then you must match the S (Subjective- patient interview and chief complaint of the symptoms) with the clinical and radiographic findings to come up with an accurate diagnosis.

P: What is the treatment or plan of choice? What is the alternative treatment? Primary Treatment (TX): RCT #3, Alternative Tx: Extracton #3

PATIENT TWO
Tooth #3- Maxillary Right 1st Molar

S: Pt states that they have deep, boring ache in their lower left jaw. The ache extends along the jaw line to the front of the ear. The Pt has seen the ENT and has been cleared for an ear infection or other ear problems. Pt received a porcelain restoration one year ago on tooth #19 (mandibular left 1st molar) and the tooth has never felt right. Note: The patient interview is already starting to paint a clear picture of your Dx. The Pt did not mention any thermal pain and discussed a deep ache. So you should be starting to think Pulp necrosis with a probable apical lesion.
Possible other Questions: Do you have any hot or cold pain? BE CAREFUL because sometimes they say yes, but fail to mention that this was prominent one to three weeks ago and since that period the pulp has undergone pulp necrosis. Also, the patient is often avoiding function on that tooth or side entirely and may not know if they have thermal sensitivity. Sometimes patients just say yes not realizing how important the answer really is. Also, patients say yes to thermal pain because they have "cold sensitive" teeth. Sometimes you have to ask the patient to be very clear and to think about the answer.

CASE 2 - TOOTH #19- MANDIBLUAR LEFT 1ST MOLAR

Some other good questions to ask this Pt: Does it hurt to chew on the tooth? What do you mean the tooth never felt right? How often do you have the "deep, boring" ache? Does the tooth pain keep you up at night? Do you take pain meds (Advil, Tylenol, Narcotics) for the pain?

O: Straight and angled radiographs reveal a widened PDL and a small apical radiolucenecy (RL) on the Mesial and Distal root of tooth #19.

Clinical assessment and Pulp tests: Test #18, #19, #20 and #21. All tests for #18, 20, 21 were WNL. #19 porcelain restoration that appears to be well sealed. #19 Perc (++), Bite Stick WNL, Endo Ice or Cold Test- No response. Probing/ Palpation/Mobility- WNL

A: What is your Dx for tooth #19?

#18 Pulp necrosis/Symptomatic apical periodontitis

P: What is the treatment or plan of choice?
Primary Tx: RCT #19, Alternative Tx: Extraction #19

PATIENT THREE

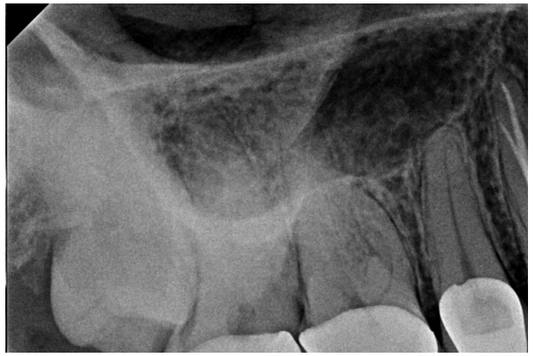
Upper Right Quadrant (URQ)

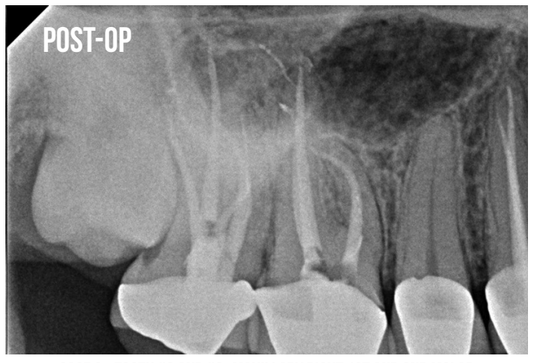
Dental History: ER Pt from the Oral Surgeon in my building. Pt referred to the O.S. for Extraction #1. Pt in extreme pain and O.S. believes that #3 is the problem but asks to evaluate the entire URQ.

S: Pt states she is in extreme pain and has had cold pain but mostly it is just a continuous, severe ache. Pt is not sure which tooth is the culprit but points to tooth #2 or tooth #3 area
.
What other questions might you ask this Pt?

Possible other Questions: When did the pain start? When was the last time you felt cold pain in the area? Does it hurt to chew on a specific tooth? Have you been taking Advil, Tylenol, or Narcotics recently for the pain? Can you point to the tooth you think is the main problem?

O: Straight and angled radiographs show a retained, impacted #1 and #2, #3, and #4 PFM's. #5 Prior RCT. It does not appear that there are any radiolucencies or evidence of pulpal disease in the URQ. I walk downstairs to the O.S. office and read the CBCT of the URQ and do not see any evidence of a periapical radiolucency (PARL) in the URQ.





CASE 3 - TOOTH #2 AND #3- MAXILLARY RIGHT 1ST AND 2ND MOLAR

Clinical testing: Tested #2, #3, #4, and #5. Percussion- #2 (+), #3 (++), #4 (+), #5 WNL, Bite stick- #2, #3, #4 (++), #5 WNL, Endo Ice- #2 No response, #3 (++), #4 No response, #5 Prior RCT, Probing/ Mobility- WNL, Buccal Palpation- #2 and #3 (+).

A: What is the diagnosis for the URQ?

Difficult Dx because #1, #2, #3, and #4 may be involved. Here is my Dx for the URQ: #1 Impacted molar, #2 Pulp necrosis/ Symptomatic apical periodontitis, #3 IP- Symptomatic????/ Symptomatic apical periodontitis???, #4 Pulp necrosis???/ Symptomaic apical periodontitis???

P: What is the recommended Tx for this quadrant?

Primary Tx: Extraction #1 by Oral Surgeon at a future date, RCT #2, Re-eval #3 with possibility of future RCT, Re-eval #4 with possibility of future RCT

Alternative Tx: Extraction #1, Extraction #2
Tx: #2 was necrotic and a pulpectomy was performed and calcium hydroxide was placed and antibiotics prescribed. Pt's severe pain resolved after 2-3 days.

7 month later the Pt presents with continuous cold pain and RCT #3 was completed. Pt remembers that I warned her that #3 may need treatment.

This was a very difficult Dx to make because 3-4 teeth were potentially involved. It took me thirty minutes to evaluate and Dx this quadrant in the middle of an extremely busy day. I warned the Pt that #3 and #4 may also need root canal treatment and that #1 should be extracted. Pt was in severe pain and near tears and understood that I was treating #2 but was not 100% sure that would solve all of her dental pain. I also was not 100% sure that #2 was necrotic even though both #2 and #4 tested No response to Endo Ice. Because her chief complaint was one of a extreme, continuous pain I errored on the ***pulp necrosis*** side and not the ***IP-Symptomatic*** side.

PRACTICE CASES:
WHAT'S YOUR FULL ENDODONTIC TOOTH DX?

DIRECTIONS: Through the supplied information. You will be given the subjective chief complaint of the patient (**S**) and the radiographs and the results of the clinical exam (**O**). Some cases may have a prior dental history and that will also be supplied. It is your job to review the (**S**) and the (**O**) and come up with a diagnosis (**A**) and a treatment plan (**P**). The diagnosis must consist of an inside the tooth diagnosis (pulpal) and an outside the tooth diagnosis (periradicular) for every case.

The answers will be provided on the following pages as well as the post-operative radiographs and any description that may help you understand the case better. Please feel free to write in the (**A**) and (**P**) sections and write any notes that may help you decipher the problem and come up with a solution.

PATIENT DATA

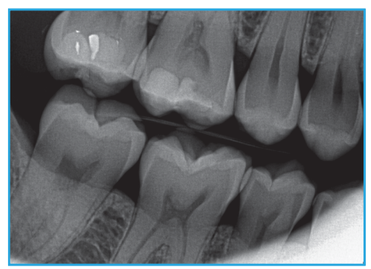
PRACTICE CASE #1

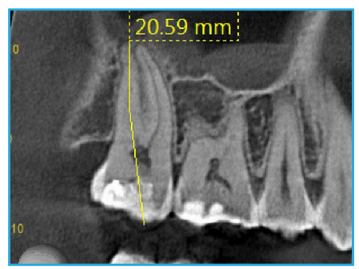
MALE ○ FEMALE ● OTHER ○

AGE 43

S SUBJECTIVE

"This tooth is driving me crazy. I can't chew on it or drink anything cold. I'm ready to pull it out."
The patient points to tooth #3 as the culprit. What are some more questions you could ask the PT?





NOTES ON IMAGES: Questions you can ask the pt are: How long has this tooth been hurting? Have you had any recent trauma events, bit down on an almond, etc? Do you take any pain meds for the tooth pain? Does it wake you up at night? How consistent is the pain? Have you had any recent restorations (new pt)? Are you chewing on the other side? How long does the cold and chewing pain last? Does it linger?

O OBBJECTIVE

Radiographic exam - Both #2 and #3 have composite restorations. I do not see any clear periapical raidolucency (PARL)

Clinical exam - Tested teeth #2-4. #2 Percussion and Bite stick (++) and #3 Percussion (+) but Bite Stick WNL. Endo Ice- #2 (+++), #3 (+). #4 tested WNL to all tests. I re-tested #2 and #3 Percussion and Bite stick and was able to get a fairly normal response on #3.

USE THE ABOVE SUPPLIED INFORMATION TO FILL IN YOUR DIAGNOSIS AND PLAN BELOW

A ASSESSMENT

DX:

P PLAN

PATIENT DATA

PRACTICE CASE #1

MALE ○ FEMALE ● OTHER ○

AGE 43

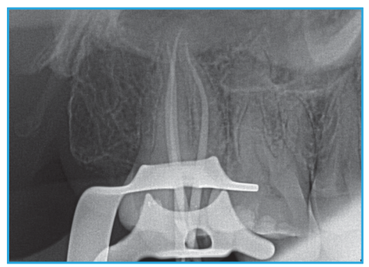
A P TX

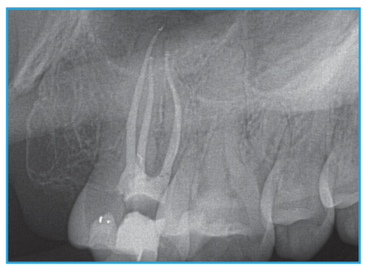
#2 IP-Symptomatic/Symptomatic apical periodontitis

RCT #2- It is important to have a clear discussion on which tooth is the problem. The patient came in certain that tooth #3 was the problem but after clinical testing it appears that #2 is the real culprit. I re-tested and as I was percussing #2 I was saying, "You see this back one is the real problem." I wanted the patient to agree with me and take ownership.

After treatment was complete I restated that tooth #2 was definitely the "main" problem and that I could see how inflamed the pulp was (hyperemic). I then told the patient that we will continue to watch tooth #3 (just in case).

TREATMENT





NOTES ON IMAGES:

QUESTIONS

WHAT WOULD YOU HAVE DONE?

PATIENT DATA

PRACTICE CASE #2

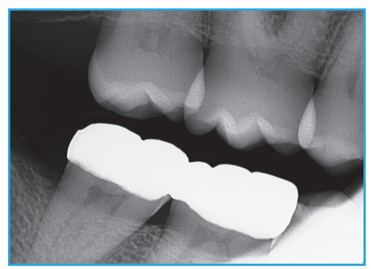
MALE ○ FEMALE ● OTHER ○

AGE 63

S

"I have had cold pain on this tooth (#30) for the last month. The pain will be there for a few days and then I won't notice it for a while and then it will be sensitive to cold again. I'm not sure what is going on but this one is the problem (#30)."

SUBJECTIVE



NOTES ON IMAGES:

O

Radiographic Exam- Both #30 and #31 have full coverage restorations and the PDL does not appear to be widened. The alveolar area around the roots appears to be WNL
Clinical exam: Tested #28-31- #28 and #29 Test WNL to all tests. #30 and #31 test WNL to Percussion, Bite Stick, Probing, Mobility, and Palpation. #30 tests slightly delayed to Endo Ice and #31 tests slight sensitive (+) to Endo Ice.

I waited 5 minutes and retested the LRQ again with the same results. The only real slight sensitivity I noted was Endo Ice on tooth #31.

OBBJECTIVE

USE THE ABOVE SUPPLIED INFORMATION TO FILL IN YOUR DIAGNOSIS AND PLAN BELOW

A

DX:

ASSESSMENT

P

PLAN

PATIENT DATA

PRACTICE CASE #2

MALE ○ FEMALE ● OTHER ○

AGE 63

A

P

TX

#31 IP-Symptomatic???/WNL, #30 Re-eval at next visit
Wait and watch and re-test in 1 week or if symptoms increase

I called the GP and asked for dental history associated with #30 and #31. History: The crowns were placed 2 years ago and there was a crack line noted on the distal marginal ridge of tooth #31. The GP warned the patient that #31 could "be a problem." Pt was asymptomatic at the time of preps and cementation.

Re-evaluation appt: I retested this patient a 2nd time (2 weeks later) and was still unable to obtain clear testing results that points to Tooth #30 or #31. I suspect #31 is the problem but I am not confident enough to pull the trigger and perform endodontic treatment until I see further symptoms. On top of this, the patient swears that the pain is coming from tooth #30 not #31. At this moment I still have not treated either one of these teeth and are continuing to wait and watch teeth #30 and #31.

TREATMENT

NOTES ON IMAGES:

QUESTIONS

WHAT WOULD YOU HAVE DONE?

PATIENT DATA

PRACTICE CASE #3

MALE ○ FEMALE ● OTHER ○

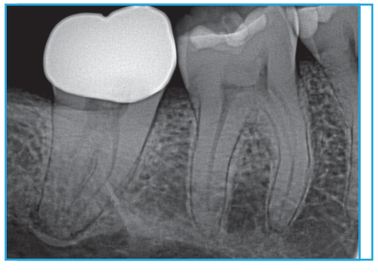
AGE 37

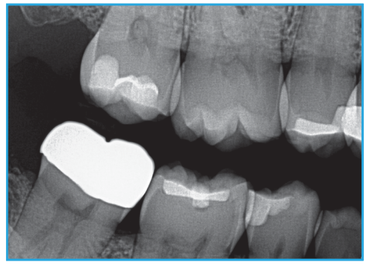
S

DENTAL HX: Pt. received a new crown placed 5 months ago. Referral card states #31 apical lesion. Please perform RCT.

"Everything hurts this tooth; chewing, cold, hot. I tried to give it enough time but it hurts."

SUBJECTIVE





NOTES ON IMAGES:

O

Radiographic Exam- #29, #30 shallow composite restorations, #31 full coverage restoration with what appears to be a well-fitting crown. #31 slight apical PDL widening but I do not see what appears to be a lesion as stated on the referral card

Clinical Exam- Tested #29-31. #29 and #30 tested WNL to all tests. #31 tested Percussion (++) and Cold (++)

OBBJECTIVE

USE THE ABOVE SUPPLIED INFORMATION TO FILL IN YOUR DIAGNOSIS AND PLAN BELOW

A

DX:

ASSESSMENT

P

PLAN

PATIENT DATA

PRACTICE CASE #3

MALE ○ FEMALE ● OTHER ○

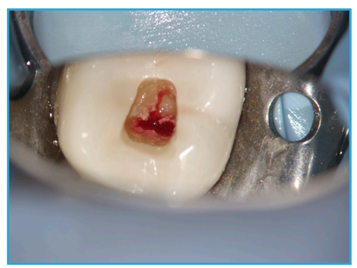
AGE 37

A #31 IP-Symptomatic/Symptomatic apical periodontitis

P RCT #31

TX The Dx was confirmed upon entering the pulp chamber and noting a hyperemic pulp.

TREATMENT



NOTES ON IMAGES:

QUESTIONS

WHAT WOULD YOU HAVE DONE?

PATIENT DATA

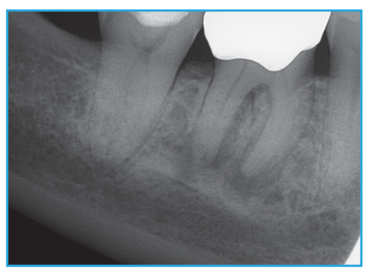
PRACTICE CASE #4

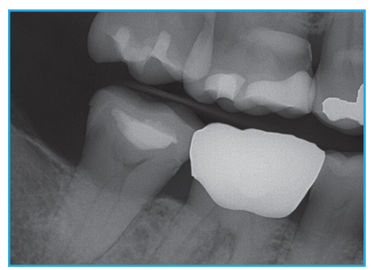
MALE ● FEMALE ○ OTHER ○

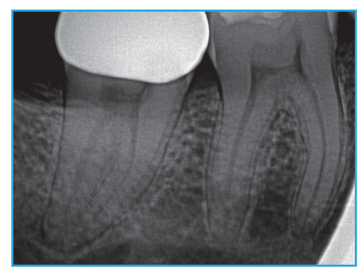
AGE 51

S "My tooth was hurting last week but is fine now."

SUBJECTIVE







NOTES ON IMAGES:

O Radiographic Exam- #30 mesial and distal root PARL. #29 and #31 appear WNL

Clinical Exam- Tested #29-31and #29 and #31 tested WNL. #30 tested WNL to all tests except No response to Endo Ice.

OBBJECTIVE

USE THE ABOVE SUPPLIED INFORMATION TO FILL IN YOUR DIAGNOSIS AND PLAN BELOW

A DX:

ASSESSMENT

P

PLAN

PATIENT DATA

PRACTICE CASE #4

MALE ● FEMALE ○ OTHER ○

AGE 51

A

Dx- #30 Pulp necrosis/Asymptomatic apical periodontitis

P

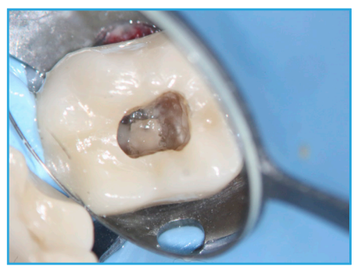
Dx NOTE: I listed the periradicular diagnosis as asymptomatic apical periodontitis because he CURRENTLY does not have any discomfort and did not respond with pain to Percussion, Bite Stick, or Palpation.

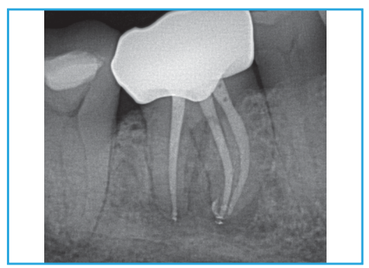
TX

RCT #30

Upon access I noticed mesial internal caries and suspected either a marginal discrepancy or submarginal caries (this did not show on the BWX). I recommended to the patient and dentist to remove the existing crown, check for any caries that I could not remove, and then place another crown. I listed the prognosis as guarded.

TREATMENT





1 Year- The recall shows excellent healing and the patient is symptom free.

NOTES ON IMAGES:

QUESTIONS

WHAT WOULD YOU HAVE DONE?

PATIENT DATA

PRACTICE CASE #5

MALE ○ FEMALE ● OTHER ○

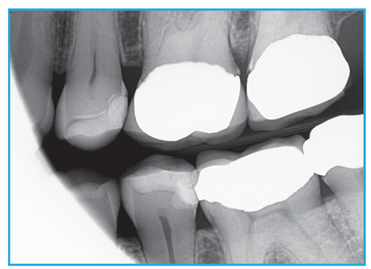
AGE 56

S

DENTAL HX: Referral card states that they have been watching tooth #14 for a while.

"It's weird. The tooth will ache for 3-4 days and it hurts and then it gets better."

SUBJECTIVE



NOTES ON IMAGES:

O

Radiographic Exam- There is a clear apical lesion or periapical radiolucency (PARL) present on the palatal root of tooth #14. BWX and PA shows a calcified pulp chamber and canals.

Clinical Exam- Tested #13-15. #13 tested WNL. #14 tested Percussion (+), but Bite Stick, Palpation, Probing, Mobility WNL. #14 did not respond to Endo Ice.

OBBJECTIVE

USE THE ABOVE SUPPLIED INFORMATION TO FILL IN YOUR DIAGNOSIS AND PLAN BELOW

A

DX:

ASSESSMENT

P

PLAN

PATIENT DATA

PRACTICE CASE #5

MALE ○ FEMALE ● OTHER ○

AGE 56

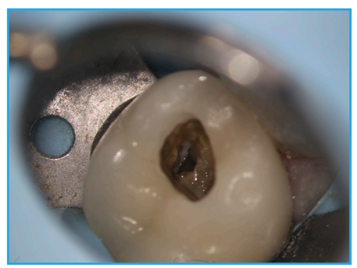
A
P
TX

Dx- #14 Pulp necrosis/Symptomatic apical periodontitis
Dx NOTES: Pt has a palatal lesion and has symptoms with clinical testing (percussion) and thus Symptomatic apical periodontitis

RCT #14

TREATMENT NOTES: This was a difficult treatment due to the extreme calcification. I was able to finds all the canals but it was a longer and harder case to treat. I recommend to refer this case out.

TREATMENT



NOTES ON IMAGES:

QUESTIONS

WHAT WOULD YOU HAVE DONE?

PATIENT DATA

PRACTICE CASE #6

MALE ● FEMALE ○ OTHER ○

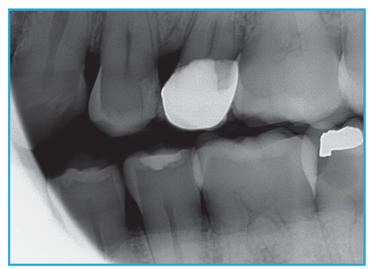
AGE 31

S

DENTAL HX: The referral card states please evaluate tooth #13 and #14 for endo.

Pt does not have any pain and the infection was seen during his cleaning appointment.

SUBJECTIVE



NOTES ON IMAGES:

O

Radiographic Exam- #12 Deep DO composite, #13 Possible poor fitting crown, #14 no restorations noted, #18 fractured cusp or caries.
CBCT- The root of #13 shows an apical lesion along with apical resorption that appears aggressive. #14 PARL present that extends into the furcation. Is it possible that the lesion from #13 extended to the roots of #14?

Clinical Exam- Tested #12-15. #12 and #15 tested WNL to all tests. #13 Tested WNL to all tests except no response to Endo Ice. #14 tested WNL to all tests and responded normally to Endo Ice (I tested #14 2x with Endo Ice and then again when the patient came back 2 weeks later for treatment)

OBJECTIVE

USE THE ABOVE SUPPLIED INFORMATION TO FILL IN YOUR DIAGNOSIS AND PLAN BELOW

A

DX:

ASSESSMENT

P

PLAN

PATIENT DATA

PRACTICE CASE #6

MALE ● FEMALE ○ OTHER ○

AGE 31

A

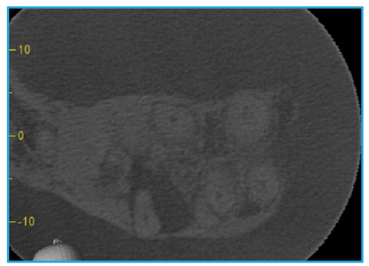
P

TX

Dx- #13 Pulp necrosis/Asymptomatic apical periodontitis, #14 WNL (pulp tested normal)/Periodontal lesion?

Referred the patient to the oral surgeon for evaluation of the "aggressive" lesion "eating" the roots of tooth #13 and also recommended the patient see a periodontist (I should have referred to the periodontist for evaluation of the apical lesion along with a perio consult (one trip for the patient not two). The oral surgeon called me and did not seem worried at all. He recommended that I perform a root canal on #13 and then we will continue to observe healing with possible future surgery to remove and Bx the lesion.
TREATMENT NOTES: I treated #13 in two visits and am currently mid-treatment. #13 was necrotic and had open apices due to the apical resorption from the lesion. The plan is to obturate the apical 1/3 with MTA.

TREATMENT



NOTES ON IMAGES: FINAL PX: #13 very guarded - probable apicoectomy with biopsy, #14 guarded and I recommended for patient to see a periodontist for evaluation.

QUESTIONS

WHAT WOULD YOU HAVE DONE?

PATIENT DATA

PRACTICE CASE #7

MALE ● FEMALE ○ OTHER ○

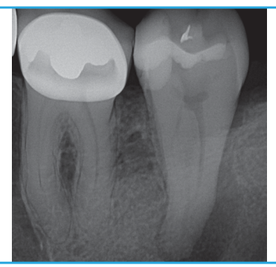
AGE 64

S

DENTAL HX: Referral card states prior deep mesial caries 7 months ago. Please evaluate for endodontic treatment.

"I can't really use this tooth. It hurts to touch and aches all the time."

SUBJECTIVE



NOTES ON IMAGES:

O

Radiographic Exam- #19 full coverage crown, #18 Deep mesial composite, Large PARL extending up the distal aspect of the root. It appears that the canals merge in the apical one-third.

Clinical Exam- Tested #18 and #19. #19 tested WNL to all tests. #18 was Percussion/Bite Stick (+++), Palpation/Probing/Mobility- WNL, Endo Ice- No response

OBJECTIVE

USE THE ABOVE SUPPLIED INFORMATION TO FILL IN YOUR DIAGNOSIS AND PLAN BELOW

A

DX:

ASSESSMENT

P

PLAN

PATIENT DATA

PRACTICE CASE #7

MALE ● FEMALE ○ OTHER ○

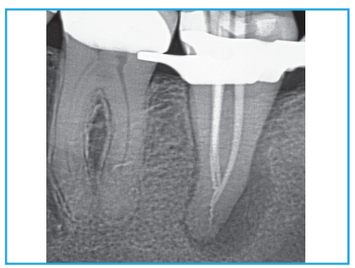
AGE 64

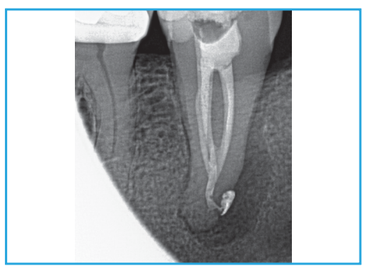
A Dx- #18 Pulp necrosis/Symptomatic apical periodontitis

P RCT #18

TX TREATMENT NOTES: This was a medium difficult tooth to treat because the canals merged in the apical one-third and the foramen exits the distal side of the tooth. I had to place a 45 degree apical bend on all of my hand files. Note the cone crinkle in the cone fit radiograph. This occurred because the cone could not slide around the apical curve. I went back in and hand filed the apical one-third up to a #25 K file. I did use GentleWave to clean out the root canal system. I recommend prescribing antibiotics for this case since it is necrotic and the patient came in with a lot of pain.

TREATMENT





NOTES ON IMAGES:

RECALL: 6 months - Pt is asymptomatic and the lesion appears to be healing

QUESTIONS

WHAT WOULD YOU HAVE DONE?

PATIENT DATA

PRACTICE CASE #8

MALE ○ FEMALE ● OTHER ○

AGE 48

S "My tooth does not feel right. It feels different. Cold, chewing and pushing on it hurt."

SUBJECTIVE

NOTES ON IMAGES:

O Radiographic Exam- #30 shallow MOD composite, #31 MO composite. No PARL noted around tooth #30

Clinical Exam- Tested #29-31. #30 and #31 were Percussion (+) but Bite Stick WNL. Probing/Mobility/Palpation were all WNL. Endo Ice- #29 and #31 tested WNL, #30 tested No response. Note: the clinical testing does not match up with the chief complaint (S). This happens sometimes and it most likely results from the pulp transitioning from inflamed to necrotic.

OBBJECTIVE

USE THE ABOVE SUPPLIED INFORMATION TO FILL IN YOUR DIAGNOSIS AND PLAN BELOW

A DX:

ASSESSMENT

P

PLAN

PATIENT DATA

PRACTICE CASE #8

MALE ○ FEMALE ● OTHER ○

AGE 48

A

P

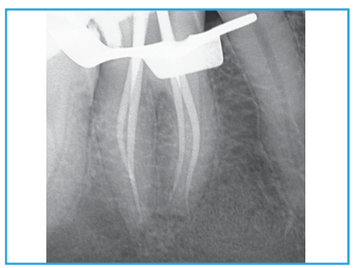
TX

Dx- #30 Pulp necrosis/Symptomatic apical periodontitis (she had symptoms upon percussion)

RCT #30

TREATMENT NOTES: This turned out to be a medium-difficult case because there were 4 necrotic canals with two separate canals with their own foramen in the mesial root. Can you do this? Yes you can. It will take knowledge and practice. Unfortunately there are no short cuts in endo.

TREATMENT



NOTES ON IMAGES:

QUESTIONS

WHAT WOULD YOU HAVE DONE?

PATIENT DATA

PRACTICE CASE #9

MALE ○ FEMALE ● OTHER ○

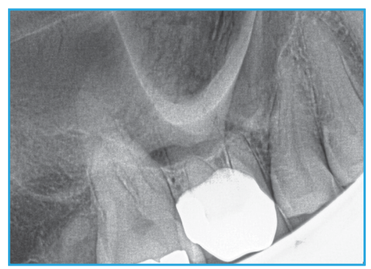
AGE 35

S

DENTAL HX: Referral card states please evaluate #2 for Endo.

"My back tooth hurts when I eat chilled fruit."

SUBJECTIVE



NOTES ON IMAGES:

O

Radiographic Exam- #2 occlusal amalgam. #3 full coverage restoration. No PARL's noted on #2 and #3.

Clinical Exam- Tested #2-4. #2 tested slight percussion sensitive and slight sensitivity to Endo Ice, but WNL on all other tests. Pt then states that is the one. #3 tests percussion WNL but Bite Stick (+). #3 tests Endo Ice (++). #4 tested WNL to all tests. I waited 5 minutes and then re-tested #2 and #3 and again obtained the same results. I informed the patient that it was the second tooth in not the back. It took convincing but once I said let's test #3 with cold again she relented and said, "No, please! That tooth (#3) really hurt."

OBBJECTIVE

USE THE ABOVE SUPPLIED INFORMATION TO FILL IN YOUR DIAGNOSIS AND PLAN BELOW

A

DX:

ASSESSMENT

P

PLAN

PATIENT DATA

PRACTICE CASE #9

MALE ○ FEMALE ● OTHER ○

AGE 35

A

Dx- #3 IP-Symptomatic/Symptomatic apical periodontitis

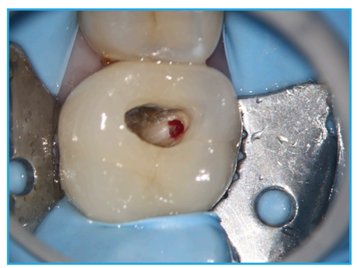
P

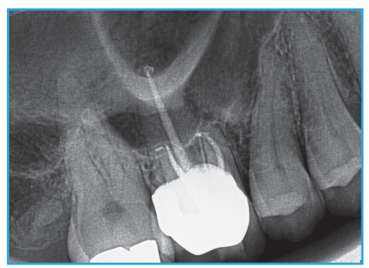
RCT #3

TX

TREATMENT NOTES: Upon access the diagnosis was verified with a hyperemic pulp. I took a picture of it to show the patient who still did not believe me that #3 was the problem.

TREATMENT





NOTES ON IMAGES:

QUESTIONS

WHAT WOULD YOU HAVE DONE?

PATIENT DATA

PRACTICE CASE #10

MALE ● FEMALE ○ OTHER ○

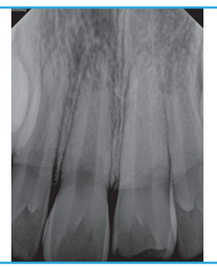
AGE 11

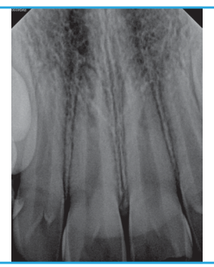
S

DENTAL HX: 11 year old had trauma 4 months ago when he dove Into a pool and hit his face.

"My teeth in the front are hurting. It hurts to touch them."

SUBJECTIVE





NOTES ON IMAGES:

O

Radiographic Exam- PA's are inconclusive. No PARL's noted.

Clinical Exam- Tested #7-10. #7 and #10 tested WNL. #8 tested Percussion (+) but Endo Ice WNL. #9 tested Percussion (++) and No response to Endo Ice.

OBBJECTIVE

USE THE ABOVE SUPPLIED INFORMATION TO FILL IN YOUR DIAGNOSIS AND PLAN BELOW

A

DX:

ASSESSMENT

P

PLAN

PATIENT DATA

PRACTICE CASE #10

MALE ● FEMALE ○ OTHER ○

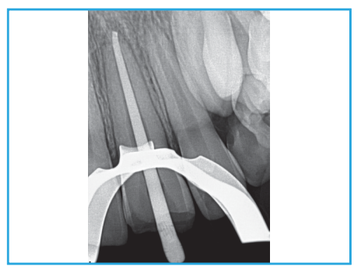
AGE 11

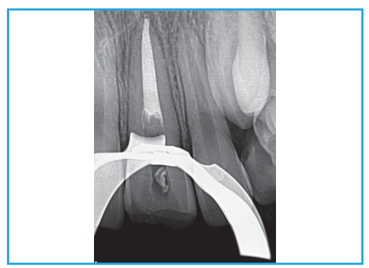
A P TX — TREATMENT

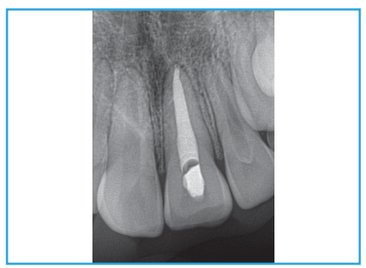
Dx- #9 Pulp necrosis/Symptomatic apical periodontitis, #8 WNL/WNL?

RCT #9, Re-evaluate #8 at 6 month recall appointment for #9

TREATMENT NOTES: Upon access I confirmed the necrotic diagnosis on tooth #9. This is a simple case but can be difficult because there is a large canal with lot's of necrotic tissue. Remember there are no root canal short cuts. This case will need a larger shape (finish with WaveOne Gold Large, ProTaper Gold F4 or F5, or Vortex Blue 40/06) and will take a lot of activated irrigation. I recommend using the EndoVac for 2 minutes with bleach in the canals after you are done shaping, and then for one minute with QMix in the canals to remove the smear layer. I recommend obturating with either GuttaCore or warm vertical obturation because single cone may not give you a dense enough fill and you may encounter lateral voids.







NOTES ON IMAGES:

QUESTIONS

WHAT WOULD YOU HAVE DONE?

PATIENT DATA

PRACTICE CASE #11

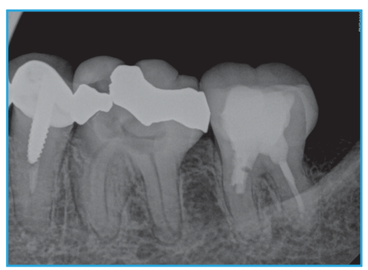
MALE ○ FEMALE ● OTHER ○

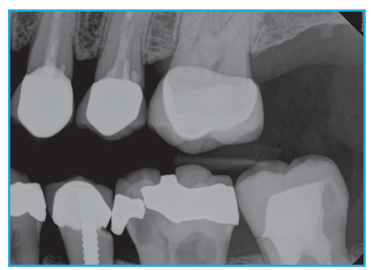
AGE 71

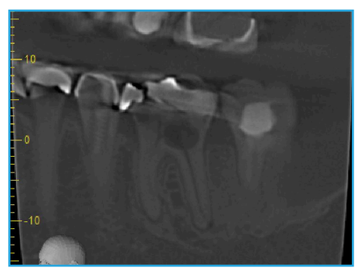
S — SUBJECTIVE

DENTAL HX: Referral card states- Please evaluate #19 for possible endo. Resorption noted.

"I don't have any pain. My dentist noticed something on the side of my tooth."







NOTES ON IMAGES:

O — OBBJECTIVE

Radiographic Exam- #18 Prior RCT. Short fill in the mesial and distal canals. It does not appear to have an apical lesion. #19 mesial caries approximating the pulp chamber. It appears to have a resorption defect present in the coronal aspect. #19 does not appear to have an apical lesion. #20 has a prior RCT with post. The fill is short but the root end appears WNL.
CBCT- large internal resorption defect in tooth #19. No PARL's noted on tooth #18-20. #19 shows slight widening of the PDL.
Clinical Exam- Tested #18-20. #18 and #20 tested WNL to Percussion, Bite stick, Palpation, Probing, and Mobility. #19 tested WNL to Percussion and Bite stick but noted (+) to Endo Ice.

USE THE ABOVE SUPPLIED INFORMATION TO FILL IN YOUR DIAGNOSIS AND PLAN BELOW

A — ASSESSMENT

DX:

P — PLAN

PATIENT DATA

PRACTICE CASE #11

MALE ○ FEMALE ● OTHER ○

AGE 71

A

P

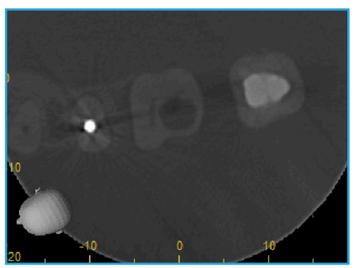
TX

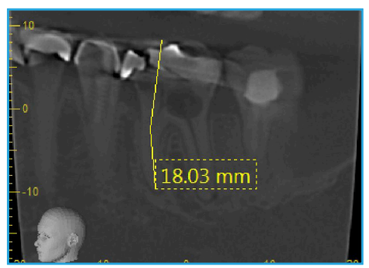
Dx- #19 IP- Symptomatic/WNL with internal resorption (the internal resorption add-on is not official but I like to note resorption and fractures in the diagnosis)

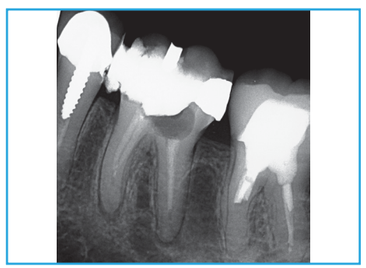
RCT #19

TREATMENT NOTES: I performed 2 visit Endo on this case.

TREATMENT







NOTES ON IMAGES:

QUESTIONS

WHAT WOULD YOU HAVE DONE?

PATIENT DATA

PRACTICE CASE #12

MALE ○ FEMALE ● OTHER ○

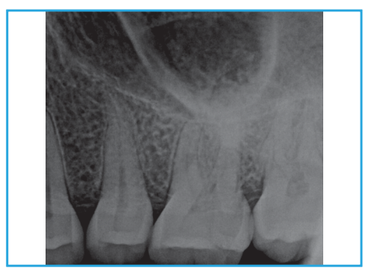
AGE 64

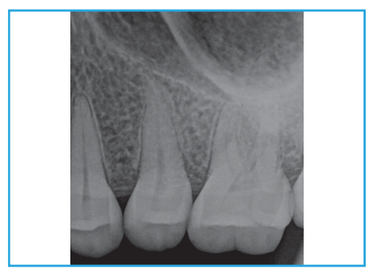
S

DENTAL HX: None stated

"I have pain when I hit my tooth just right (Pt points to #14)."

SUBJECTIVE





NOTES ON IMAGES:

O

Radiographic Exam- PA radiographs are inconclusive. Possible resorption defect on the mesial root of #14. No PARL's noted. Pt refused CBCT due to $197 cost.

Clinical Exam- Tested #12-15 and all teeth tested WNL except #14 which tests Bite stick (+). #14 tested WNL to Endo Ice

OBJECTIVE

USE THE ABOVE SUPPLIED INFORMATION TO FILL IN YOUR DIAGNOSIS AND PLAN BELOW

A

DX:

ASSESSMENT

P

PLAN

PATIENT DATA

PRACTICE CASE #12

MALE ○ FEMALE ● OTHER ○

AGE 64

A

P

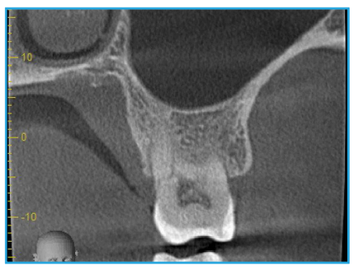
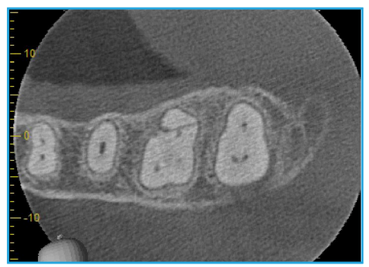
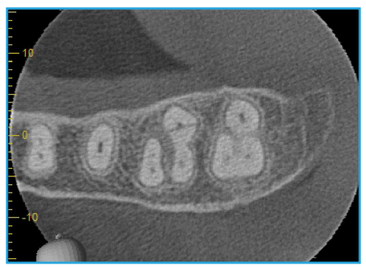
TX — TREATMENT

Dx- #14 ?/?= I am unsure of the diagnosis and this point

Wait and watch and re-evaluate #14 in 1-2 weeks or when it becomes more symptomatic

TREATMENT NOTES: Pt came back 3 days later and paid for the CBCT. Upon examination of the CBCT there was a fractured palatal root.

FINAL PLAN: Extraction #14

NOTES ON IMAGES:

QUESTIONS

WHAT WOULD YOU HAVE DONE?

PATIENT DATA

PRACTICE CASE #13

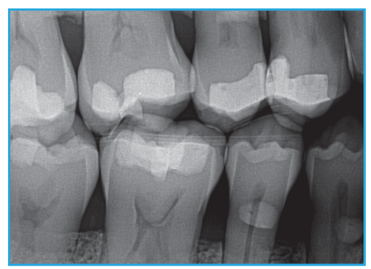
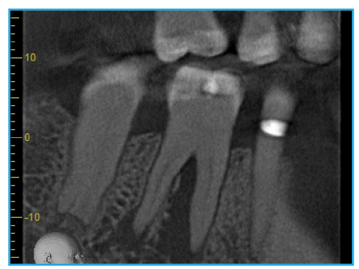
MALE ○ FEMALE ● OTHER ○

AGE 45

S — SUBJECTIVE

DENTAL HX: None given

"My tooth aches but only sometimes."

NOTES ON IMAGES:

O — OBBJECTIVE

Radiographic Exam- #30 occlusal composite, 2 separate distal roots with a PARL present

CBCT shows a lesion present on every root. There is vertical bone loss which extends into the furcation

Clinical Exam- Tested #29-31. #29 and #31 tested WNL, #30 was Percussion and Bite Stick (++) and did not respond to Endo Ice

USE THE ABOVE SUPPLIED INFORMATION TO FILL IN YOUR DIAGNOSIS AND PLAN BELOW

A — ASSESSMENT

DX:

P — PLAN

PATIENT DATA

PRACTICE CASE #13

MALE ○ FEMALE ● OTHER ○

AGE 45

A

P

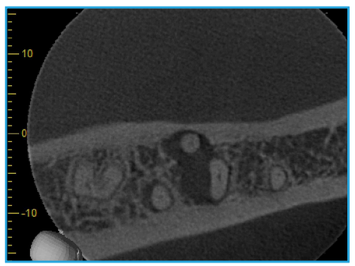
TX

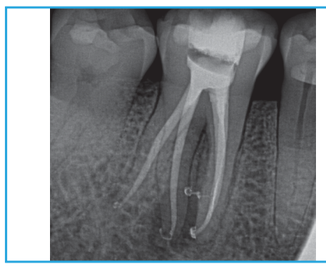
Dx- #30 Pulp necrosis/Symptomatic apical periodontitis

RCT #30
Guarded- I clearly discussed all Tx options for this pt and she understood the possibility of non-healing.

TREATMENT NOTES: This was a difficult tooth to shape because there were 4 canals that were long and curvy. If you follow the playbook and shape carefully you can treat a case like this. It just takes more time to shape than usual and a very light hand, continually irrigating out the debris with bleach and recapitulating with a #10 K file.

TREATMENT





NEED:
POST OP

NOTES ON IMAGES:

QUESTIONS

WHAT WOULD YOU HAVE DONE?

PATIENT DATA

PRACTICE CASE #14

MALE ○ FEMALE ● OTHER ○

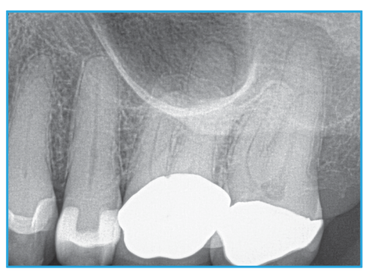
AGE 59

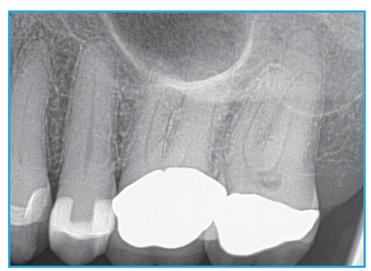
S

DENTAL HX: Crowns placed on #14 and #15 1 1/2 years ago

"I have a tooth ache. It just aches all the time and if I drink cold water it sets the tooth off."

SUBJECTIVE





NOTES ON IMAGES:

O

Radiographic Exam- PA's show full coverage restorations on tooth #14 and #15. No PARL's noted on either tooth. A CBCT was not taken of either #14 or #15 (take one if you have one!)

Clinical Exam- Tested #12-15. #12 and #13 tested WNL except only slight response to Endo Ice. #14 was Percussion and Bite Stick (+++) and did not respond to Endo Ice. #15 was Percussion (+) and (+++) to Endo Ice.

OBBJECTIVE

USE THE ABOVE SUPPLIED INFORMATION TO FILL IN YOUR DIAGNOSIS AND PLAN BELOW

A

DX:

ASSESSMENT

P

PLAN

PATIENT DATA

PRACTICE CASE #14

MALE ○ FEMALE ● OTHER ○

AGE 59

A

P

TX

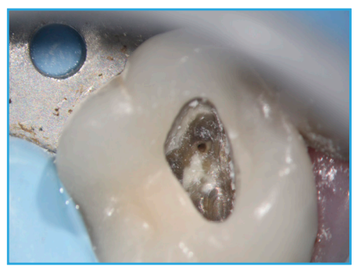
Dx- #14 Pulp necrosis/Symptomatic apical periodontitis, #15 IP-symptomatic/Symptomatic apical periodontitis

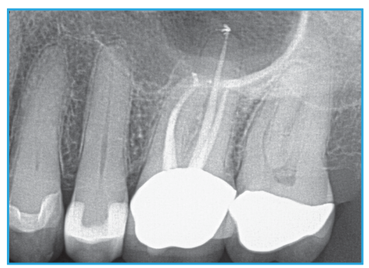
RCT #30

Guarded- I clearly discussed all Tx options for this pt and she understood the possibility of non-healing.

Start with RCT #14 - since it is infected and the patient has a chronic tooth ache. NEXT VISIT: RCT #15- explain to the patient that there are two teeth involved and that you will work on the infected tooth first but the cold pain will still be there. Patients think all their problems will be solved when you treat one tooth so be clear in your communication. Proper expectations makes happy patients.

TREATMENT





NOTES ON IMAGES: This was a difficult tooth to shape because there were 4 canals that were long and curvy. If you follow the playbook and shape carefully you can treat a case like this. It just takes more time to shape than usual and a very light hand, continually irrigating out the debris with bleach and recapitulating with a #10 K file.

QUESTIONS

WHAT WOULD YOU HAVE DONE?

PATIENT DATA

PRACTICE CASE #15

MALE ● FEMALE ○ OTHER ○

AGE 68

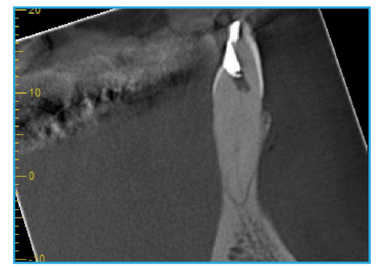
S

DENTAL HX: GP started RCT on #25 but was unable to locate the calcified canal. The referral card states please perform RCT on #24 and #25 (radiolucency). Prescribed Clindamycin and Tylenol #3

"I have no pain and have never had any issues with these teeth. I guess the doc saw something on the x-ray."

SUBJECTIVE

NEED image 3
PA



NOTES ON IMAGES: Radiographic Exam- PA's of #24 and #25 show restricted, somewhat calcified canals. Both teeth due appear to have a "darkened" apical area. Both teeth have an incisal composite restoration.

O

CBCT shows that the bone pattern appears WNL in both teeth. Access on #25 was too facial
Clinical Exam- Tested #23-26. All teeth tested WNL to Percussion, Palpation, Bite Stick, Mobility, and Probing. All teeth tested no response to Endo Ice. I then expanded my testing to #22 and #27 and both tested no response to Endo Ice. I then tested #19 and the patient exhibited a slight, delayed cold response.

Clinical exam note: Some patients normal response to Cold is no response or very slight response. All this information needs to be taken in account when forming a diagnosis. Also, often times the maxillary premolars do not respond to Endo Ice. I do not know why this is, but it is a pattern I see in my office and it is good to note.

OBBJECTIVE

USE THE ABOVE SUPPLIED INFORMATION TO FILL IN YOUR DIAGNOSIS AND PLAN BELOW

A

DX:

ASSESSMENT

P

PLAN

PATIENT DATA

PRACTICE CASE #15

MALE ● FEMALE ○ OTHER ○

AGE 68

A

Dx- #24 and #25 WNL?(possible Pulp necrosis)/WNL

P

Complete RCT #25 since the GP started the case and has nearly accessed the canal.

TX

TREATMENT NOTES: Tooth #25 was necrotic but I am not sure if it was infected. If I had seen this case prior to the access attempt I would have just "watched" both of these teeth since the CBCT was clear and both teeth exhibited a normal apical bone pattern.

TREATMENT

NOTES ON IMAGES:

QUESTIONS

WHAT WOULD YOU HAVE DONE?

PATIENT DATA

PRACTICE CASE #16

MALE ○ FEMALE ● OTHER ○

AGE 49

S

DENTAL HX: Pt referred over for RCT #10 by her brother a dental anesthesiologist

"I don't have any pain except if I push at the end of my tooth it feels funny."

SUBJECTIVE

NEED CBCT

NEED CBCT

NOTES ON IMAGES:

O

Radiographic Exam- PA's show a well-circumscribed RL between #10 and #11. #10 large mesial composite.

CBCT shows a large, pear shaped RL centered between #10 and #11 but it is unclear whether the apices are involved

Clinical Exam- Tested #9-11. #9 Prior RCT and tested WNL to all tests. #10 and #11 both tested WNL to Percussion, Probing, and Mobility. #10/#11 tested Palpation (+). Both tested VITAL to Endo Ice (tested 3x)

OBBJECTIVE

USE THE ABOVE SUPPLIED INFORMATION TO FILL IN YOUR DIAGNOSIS AND PLAN BELOW

A

DX:

ASSESSMENT

P

PLAN

PATIENT DATA

PRACTICE CASE #16

MALE ○ FEMALE ● OTHER ○

AGE 49

A P TX — TREATMENT

Dx- #10 and #11 WNL/WNL. Possible Dx: Globulomaxillary cyst (common between the maxillary lateral incisor and canine and presents in the bone as an upside pear shape)

Surgical enuculation of the cyst- Inform the patient that it is possible that #10 and #11 may need a root canal after surgical enuculation due to aggressive debridement which could devitalize one or both teeth.
TREATMENT NOTES/RECALL: I removed the cyst completely and noted some natural bone healing (I did not place a bone graft because I wanted to evaluate healing and make sure that this cyst did not reoccur) at the 6 month recall

NEED surgery pic

NEED surgery pic

6 MONTH RECALL

NOTES ON IMAGES:

QUESTIONS

WHAT WOULD YOU HAVE DONE?

PATIENT DATA

PRACTICE CASE #17

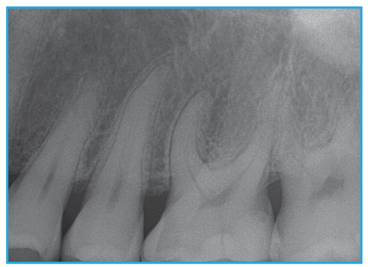
MALE ● FEMALE ○ OTHER ○

AGE 51

S — SUBJECTIVE

DENTAL HX: None given

"I am swollen man."



20_10979_ General

Foster.JPG

NOTES ON IMAGES:

O — OBBJECTIVE

Radiographic Exam- #14 occlusal composite with possible fracture. PA's show possible MB PARL starting on #14.

CBCT- #14 MB root PARL

Clinical Exam- #14 exhibits buccal swelling and an occlusal crack line. Tested #13-15. #13 and #15 tested WNL, while #14 tested Percussion and Bite Stick (+++) and No response to Endo Ice. There was slight mobility but WNL probing. I did not palpate apically due to extreme pain and clear buccal swelling.

USE THE ABOVE SUPPLIED INFORMATION TO FILL IN YOUR DIAGNOSIS AND PLAN BELOW

A — ASSESSMENT

DX:

P — PLAN

PATIENT DATA

PRACTICE CASE #17

MALE ● FEMALE ○ OTHER ○

AGE 51

A

P

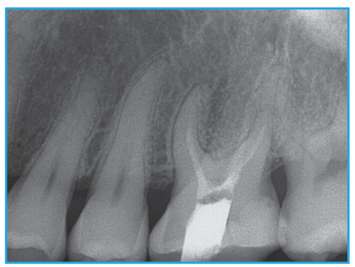
TX

Dx- #14 Pulp necrosis/Acute apical abscess

Start RCT #14 and then I and D at the end of the appointment

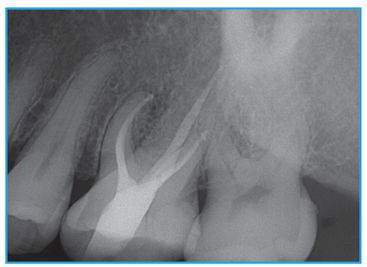
TREATMENT NOTES: I performed a pulpectomy and thoroughly debrided the root canal system. There was a lot of purulent drainage which is always good because this will help relieve the patents pain. I placed CaOH2 and then re-anesthetized the buccal area with a 1/2 carpule of 3% Carbocaine (lowest pKa so is able to anesthetize infected areas better) and performed an Incision and Drainage. I completed the case 2 weeks later.

TREATMENT



CaOH2

22_10979_
General



I and D pic

NOTES ON IMAGES:

QUESTIONS

WHAT WOULD YOU HAVE DONE?

PATIENT DATA

PRACTICE CASE #18

MALE ● FEMALE ○ OTHER ○

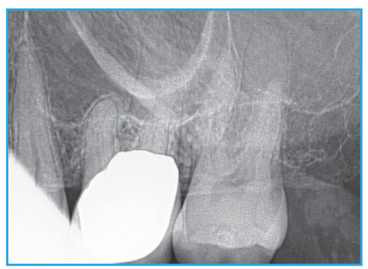
AGE 64

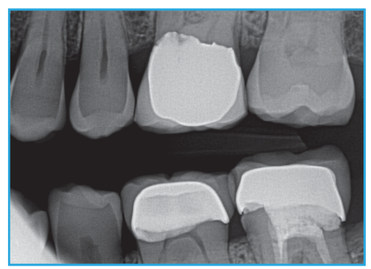
S

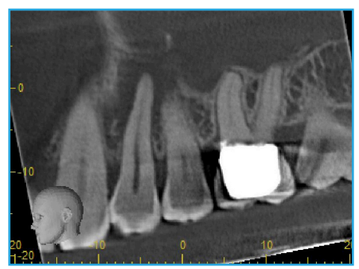
DENTAL HX: The referral card states please evaluate #14 for RCT and leave post space

"I have a bump on my gum."

SUBJECTIVE







NOTES ON IMAGES:

O

Radiographic Exam- #14 Full coverage restoration. PA's of #14 are inconclusive but it does not appear there is a PARL on #14 and #15

CBCT- #14 and #15 appear WNL. #12 apical PARL

Clinical Exam- Buccal sinus tract present with parulis between #12 and #13. Tested #12-15. #13-15 test WNL and Vital (WNL to Endo Ice). #12 tests No response to Endo Ice and there is a mesial-distal crack line present

OBBJECTIVE

USE THE ABOVE SUPPLIED INFORMATION TO FILL IN YOUR DIAGNOSIS AND PLAN BELOW

A

DX:

ASSESSMENT

P

PLAN

PATIENT DATA

PRACTICE CASE #18

MALE ● FEMALE ○ OTHER ○

AGE 64

A

Dx- #12 Pulp necrosis/Chronic apical abscess

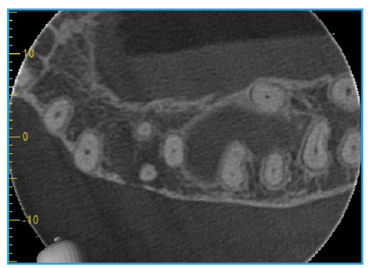
P

Exploratory RCT #12 to evaluate depth of fracture or Extraction #12/Implant

TX

TREATMENT NOTES: Pt decided to have an oral surgeon consultation for Extraction/Implant #12 once he learned of the very guarded Px

TREATMENT



NOTES ON IMAGES:

QUESTIONS

WHAT WOULD YOU HAVE DONE?

PATIENT DATA

PRACTICE CASE #19

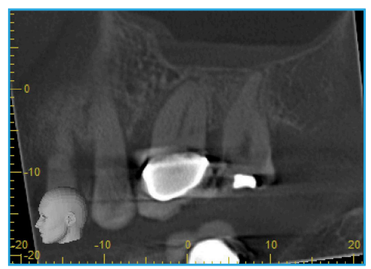
MALE ○ FEMALE ● OTHER ○

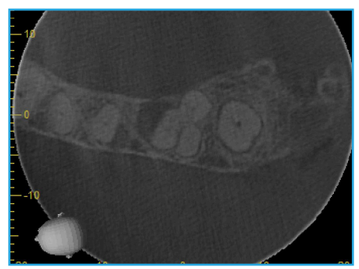
AGE 58

S

"The dentist noticed a dark area on the x-ray."

SUBJECTIVE





NOTES ON IMAGES:

O

Radiographic Exam- #13 and #15 shallow occlusal composites. #14 Full coverage restoration. PA's show a lateral radiolucency located along the MB root of #14

CBCT confirms a clear lateral radiolucency along the MB root.

Clinical Exam - Tested #13-15. #13 and #15 tested WNL. #14 Tested WNL to all tests except no response to Endo Ice. The probing on #14 was also WNL

OBBJECTIVE

USE THE ABOVE SUPPLIED INFORMATION TO FILL IN YOUR DIAGNOSIS AND PLAN BELOW

A

DX:

ASSESSMENT

P

PLAN

PATIENT DATA

PRACTICE CASE #19

MALE ○ FEMALE ● OTHER ○

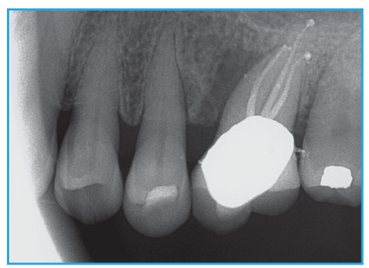
AGE 58

TREATMENT

A Dx- #14 Pulp necrosis/Asymptomatic apical periodontitis with lateral lesion (possible MB vertical root fracture or lateral periodontal cyst)

P RCT #14

TX RCT #14 completed- shaped minimally to ProTaper Gold F1 and used GentleWave with warm vertical obturation and Thermaseal Plus Ribbon Sealer. Note the lateral canal leading right to the lesion!!!! This is always a good sign.



NOTES ON IMAGES:

RECALL: 1 year shows excellent bone fill and healing. Pt is asymptomatic and all clinical tests are WNL

QUESTIONS

WHAT WOULD YOU HAVE DONE?

PATIENT DATA

PRACTICE CASE #20

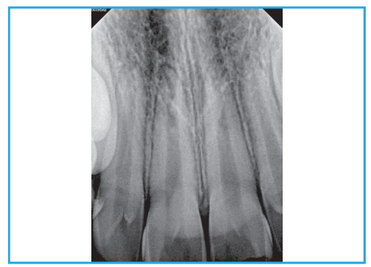
MALE ● FEMALE ○ OTHER ○

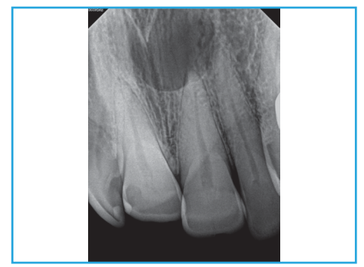
AGE 69

SUBJECTIVE

S DENTAL HX: Referral card states to evaluate #9 and perform endo.

"My teeth are sensitive to pressure and if I push on my gums it's a little sensitive."





NOTES ON IMAGES:

OBBJECTIVE

O Radiographic Exam- PA's show a large, well-circumscribed radiolucency between #8 and #9. The lesion does not appear connected to the apices of either #8 or #9.

CBCT shows a large well-circumscribed radiolucency just lingual to the apices of #8 and #9

Clinical Exam- Tested #7-10. All teeth tested WNL to all tests and responded WNL to Endo Ice. Tested #8 and #9 2x with Endo Ice to assess vitality

USE THE ABOVE SUPPLIED INFORMATION TO FILL IN YOUR DIAGNOSIS AND PLAN BELOW

ASSESSMENT

A DX:

PLAN

P

PATIENT DATA

PRACTICE CASE #20

MALE ● FEMALE ○ OTHER ○

AGE 69

A

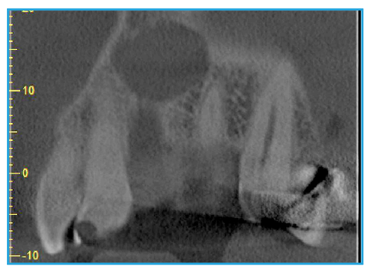
P

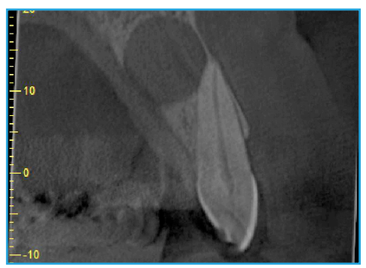
TX

Dx- #8,#9 WNL/WNL. Possible Nasoplataine Duct Cyst

Referred pt to the oral surgeon for consultation. Informed pt of the possibility of #8 or #9 becoming devitalized once the cyst is removed.

TREATMENT





NOTES ON IMAGES: FINAL PX: #8 and #9 Good (if the cyst can be removed without damaging the roots or nerve)

QUESTIONS

WHAT WOULD YOU HAVE DONE?

PATIENT DATA

PRACTICE CASE #21

MALE ○ FEMALE ● OTHER ○

AGE 72

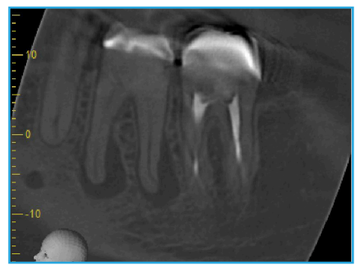
S

DENTAL HX: This is my 2nd grade school teacher. I was 46 yrs old when I treated her so I had her as a teacher 38 years ago. She remembered me and said, "You were a very active kid." I don't think she meant this as a compliment.

"I had a lot of pain last week but my dentist gave me antibiotics 2 days ago and it is slowly getting better."

SUBJECTIVE

NEED 1st preop



NOTES ON IMAGES:

O

Radiographic Exam- #18, #19 Full coverage restorations. #18 Prior RCT. #20 DO composite. #19 appears to have a M and D root apical lesion

CBCT shows two clear PARL's centered around the mesial and distal root ends.

Clinical Exam- Tested #18-20. #18 tested Percussion (+) but Bite Stick WNL. All other tests on #18 and #20 were WNL. #19 Percussion and Bite Stick (++) and No response to Endo Ice. Slight buccal swelling with apical palpation (++)

OBBJECTIVE

USE THE ABOVE SUPPLIED INFORMATION TO FILL IN YOUR DIAGNOSIS AND PLAN BELOW

A

DX:

ASSESSMENT

P

PLAN

PATIENT DATA

PRACTICE CASE #21

MALE ○ FEMALE ● OTHER ○

AGE 72

A

P

TX

Dx- #19 Pulp necrosis/Acute apical abscess

RCT #19

TREATMENT NOTES: I performed this endo in 1 visit because I felt that I was able to shape and clean the root canal system well. I used activated irrigation and upon drying with paper points noted that there was zero purulent or serous seepage back into the canals. Since the canals stayed dry, I obturated. I do recommend when in doubt place calcium hydroxide in these cases. To finish this case in 1 visit is pushing the envelope a bit.

TREATMENT

NOTES ON IMAGES:

RECALL: 6 months. There is some bone fill and it appears to be healing. Pt is asymptomatic and all clinical tests were WNL

QUESTIONS

WHAT WOULD YOU HAVE DONE?

PATIENT DATA

PRACTICE CASE #22

MALE ● FEMALE ○ OTHER ○

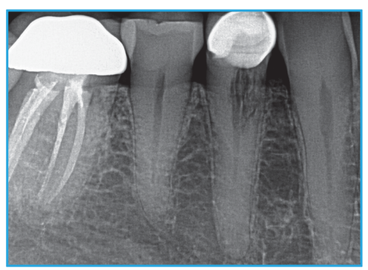
AGE 61

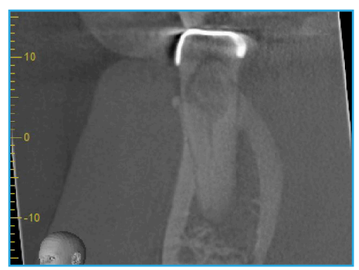
S

DENTAL HX: Pt was referred for an Endodontic consult on #28 one year ago and never came in.

"I don't have any pain on this tooth."

SUBJECTIVE





NOTES ON IMAGES:

O

Radiographic Exam- #28 Full coverage restoration. PA's show a large resorption defect in the coronal/cervical area. It appears external in nature.

CBCT- large external resorption defect located interproximally on the mesial side and extending to the lingual

Clinical Exam- Tested #27-29. #27 and #29 tested WNL. #28 tested WNL to all tests and vital.

OBBJECTIVE

USE THE ABOVE SUPPLIED INFORMATION TO FILL IN YOUR DIAGNOSIS AND PLAN BELOW

A

DX:

ASSESSMENT

P

PLAN

PATIENT DATA

PRACTICE CASE #22

MALE ● FEMALE ○ OTHER ○

AGE 61

A

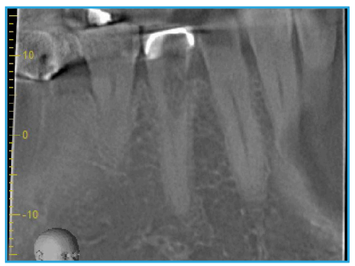
P

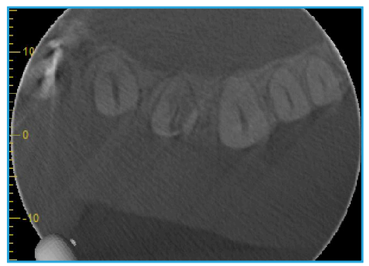
TX

Dx- #28 WNL/WNL with invasive cervical root resorption (ICRR) or external root resorption

Referred PT to periodontist for Extraction/Implant consult #28- One recommendation is for the pt to have a work up with the periodontist and then just wait and allow the resorption process to slowly resorb the tooth. This can take years and sometimes the PT has no pain. If the pt becomes symptomatic then they can have the tooth extracted.

TREATMENT





NOTES ON IMAGES:

QUESTIONS

WHAT WOULD YOU HAVE DONE?

PATIENT DATA

PRACTICE CASE #23

MALE ● FEMALE ○ OTHER ○

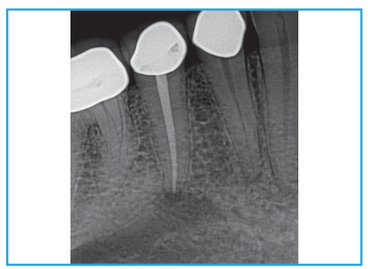
AGE 47

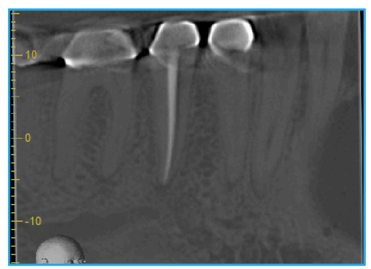
S

DENTAL HX: I performed endo on tooth #29 one year ago. The referral card states please evaluate #29 and retreat. Apical lesion present.

"I don't have any pain but my dentist noticed a dark spot."

SUBJECTIVE





NOTES ON IMAGES:

O

Radiographic Exam- #28-30 full coverage restorations, #29 shows a well shaped and filled canal (of course!) with a possible apical radiolucency. #27, 28 and the mesial root of #30 appear WNL.

CBCT- the scan shows that the possible radiolucency is actually the mental foramen over-shadowing the apex of #29

Clinical Exam- Tested #28-30 and all tests were WNL (except no response to Endo Ice on #29- Previous endo)

OBBJECTIVE

USE THE ABOVE SUPPLIED INFORMATION TO FILL IN YOUR DIAGNOSIS AND PLAN BELOW

A

DX:

ASSESSMENT

P

PLAN

PATIENT DATA

PRACTICE CASE #23

MALE ● FEMALE ○ OTHER ○

AGE 47

A

P

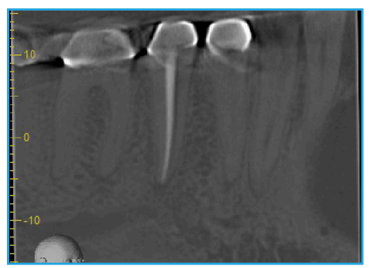
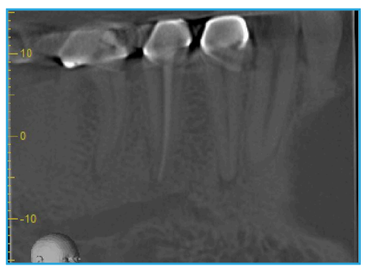
TX

Dx- #29 Previously treated/WNL

No treatment needed. Continue to recall #29

DX NOTES: I though this was a good case to analyze because the mental foramen can often overlay onto the apex of the lower premolars and it is imperative that we perform clear and accurate testing prior to treating a tooth.

TREATMENT

NOTES ON IMAGES:

QUESTIONS

WHAT WOULD YOU HAVE DONE?

PATIENT DATA

PRACTICE CASE #24

MALE ● FEMALE ○ OTHER ○

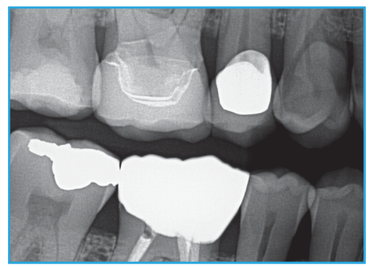
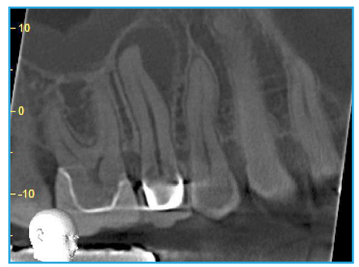
AGE 58

S

DENTAL HX: This Pt is a local police officer and a good friend of mine. His dentist noticed a "weird lesion" on tooth #4.

"I have some sensitivity with this tooth up here." Ask more questions? What hurts the tooth? Do you feel hot or cold pain? How long have you had tooth sensitivity? Pt's answers: "The tooth has been hurting off and on for a few months and I thought it would go away. It hurts sometimes when I chew and I have never noticed hot or cold pain."

SUBJECTIVE

NOTES ON IMAGES:

O

Radiographic Exam- #3 and #4 full coverage restorations, #5 buccal composite, #4 lateral PARL located on the mesial side of the root.
CBCT- #4 PARL located on the mesial side of the root. The canal appears to stop 4mm from the radiographic apex and possibly turn mesially.

Clinical Exam- Tested #3-5. #3 tested Percussion (+), Endo Ice (+) but all other tests were WNL, #4 Tested Percussion, Bite stick (+) and Endo Ice no response. #5 tested WNL to all tests but no response to Endo Ice (I often notice that the maxillary premolars do not respond to Endo ice).

OBBJECTIVE

USE THE ABOVE SUPPLIED INFORMATION TO FILL IN YOUR DIAGNOSIS AND PLAN BELOW

A

DX:

ASSESSMENT

P

PLAN

PATIENT DATA

PRACTICE CASE #24

MALE ● FEMALE ○ OTHER ○

AGE 58

A Dx- #4 Pulp necrosis/Symptomatic apical periodontitis

P RCT #4, Re-evaluate #3 at recall

TX TREATMENT NOTES: The foramen exited 4mm short of the radiographic apex on the mesial side and right into the "lateral" lesion.

TREATMENT

NEED recall

NOTES ON IMAGES:

RECALL: 6 months. There appears to be some bone fill and the area seems to be healing. Pt is asymptomatic and all clinical tests are WNL

QUESTIONS

WHAT WOULD YOU HAVE DONE?

PATIENT DATA

PRACTICE CASE #25

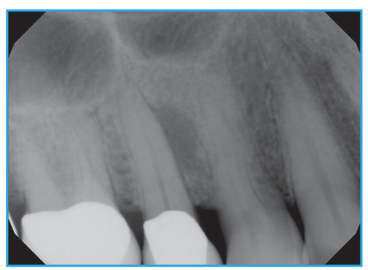
MALE ● FEMALE ○ OTHER ○

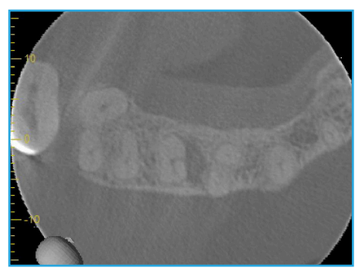
AGE 74

S DENTAL HX: The referral card states please evaluate the mesial lesion on #4. Pt is a retired college football coach and quite grumpy.

"I don't have any pain and don't want a root canal."

SUBJECTIVE





NOTES ON IMAGES:

O Radiographic Exam- #2-4 full coverage restorations. #5 occlusal amalgam. PA's show mesial root lesion on #4

CBCT- #4 lateral root lesion. The axial CBCT slice shows a lateral canal extending to the lateral lesion (look closely).

Clinical Exam- Tested #3-5. #3 and #5 tested WNL. #4 tested WNL except no response to Endo Ice

OBBJECTIVE

USE THE ABOVE SUPPLIED INFORMATION TO FILL IN YOUR DIAGNOSIS AND PLAN BELOW

A DX:

ASSESSMENT

P

PLAN

PATIENT DATA

PRACTICE CASE #25

MALE ● FEMALE ○ OTHER ○

AGE 74

A

Dx- #4 Pulp necrosis/Asymptomatic apical periodontitis (I explained to the pt that he has a bone infection and it will continue to grow if left untreated- he chose treatment)

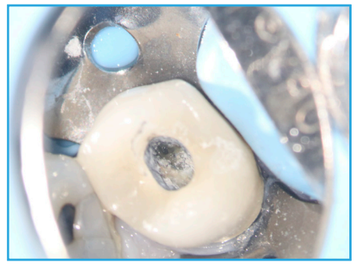
P

RCT #4 (I was really hoping that I would be able to fill the lateral canal with gutta percha or sealer. I recommend activated irrigation. I used GentleWave in this case but the EndoActivator would also work very well.)

TX

TREATMENT NOTES: I shaped up to a ProTaper Gold F1 and then used GentleWave. I sealed the case using warm vertical obturation with Thermaseal Plus Ribbon sealer and was able to get a nice lateral canal gutta percha/sealer fill.

TREATMENT



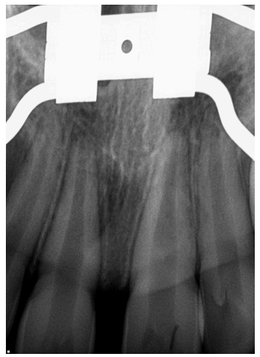
NOTES ON IMAGES:

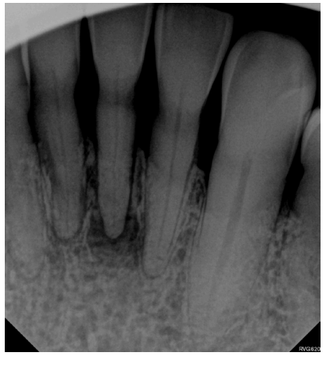
QUESTIONS

WHAT WOULD YOU HAVE DONE?

CASE SELECTION ASSESSMENT — SIMPLE

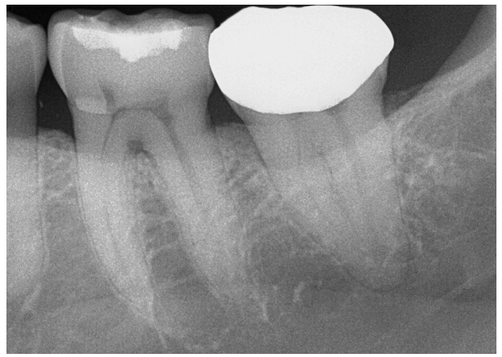
The following radiographs are examples of simple, medium and hard cases. These radiographs will help you gain a deeper understanding of which cases you can treat, **simple to medium** and which cases you should refer to the endodontist, **hard** cases.







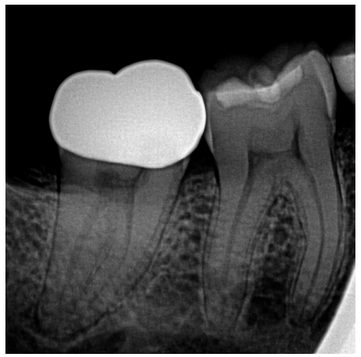
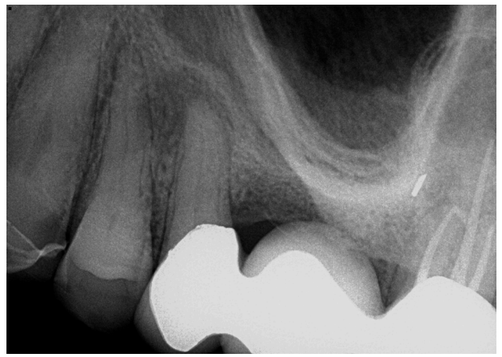






CASE SELECTION ASSESSMENT MEDIUM

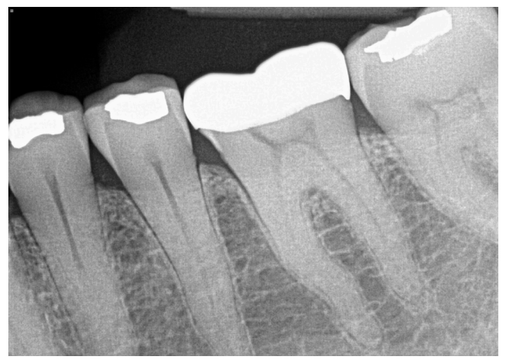



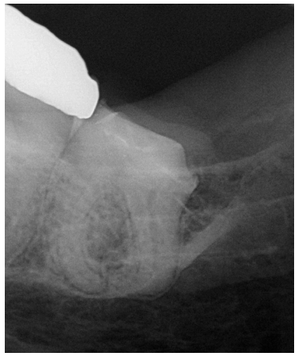


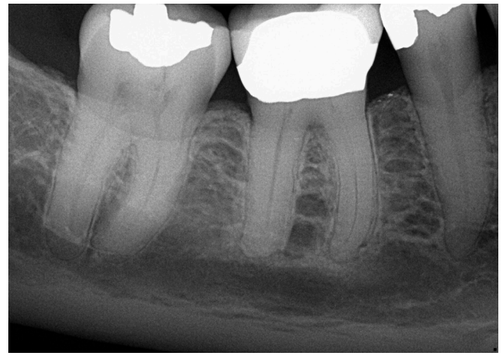
CASE SELECTION ASSESSMENT HARD

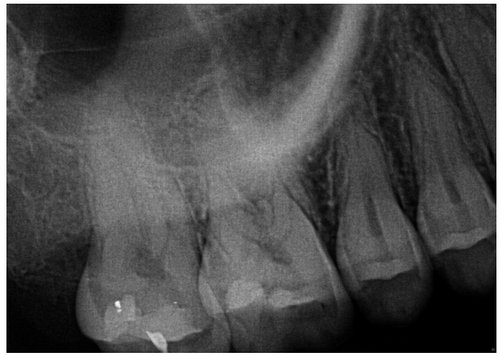


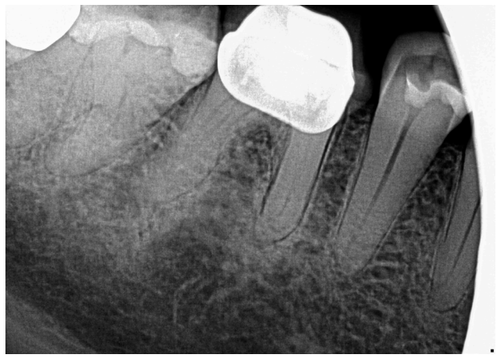


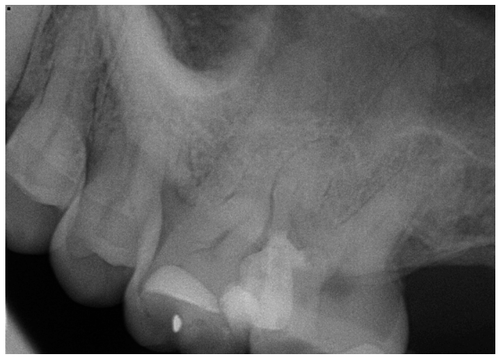



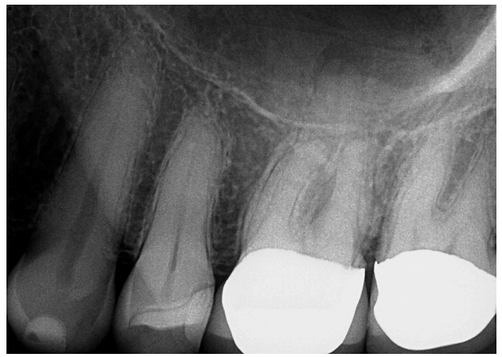


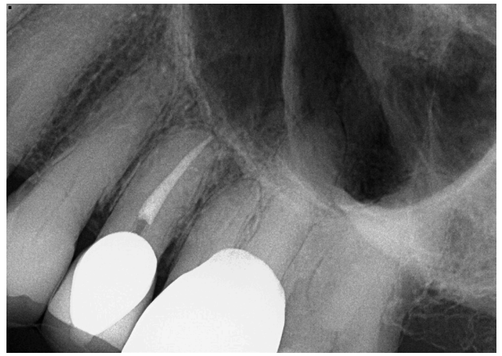









CHAPTER 4
TIMEOUT: PRE-OPERATIVE PATIENT COMMUNICATION

So you need a Root Canal!

How do you explain to the patient that they need endodontic treatment?

I do this in a few different ways:

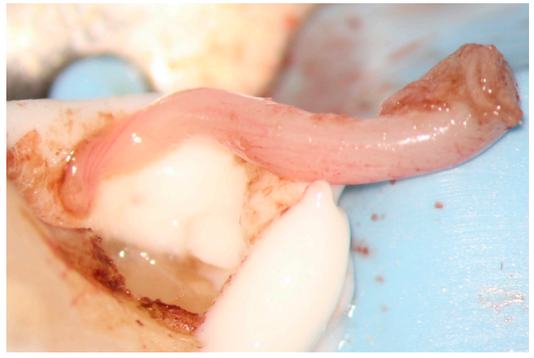
Verbal - Based on all my tests, this tooth is going to need a root canal. Let me show you what I am going to do. I then move to the radiograph and draw on my digital radiograph a very rough and quick summary of the the RCT procedure.

TOOTH VISUAL AID (Best way) I have a tooth model that shows 4 teeth in various stages of the root canal. I explain to the Pt that I will remove (Roto Rooter out) the red part (on the model the nerve) and will seal that area with a filling. Pt's seem to love the Roto Rooter analogy because they can picture the snake going down and cleaning their bathroom drain. The model also shows the composite core and crown so I am able to stress the post-operative need for a restoration. This explanation takes 30 seconds and 98% of the patients are happy. The 2% engineers need further explanation. I then explain that I need to mechanically and chemically remove all the nerve tissue and bacteria in the canal system and then seal the open area so microbes (bacteria, virus', and fungi) cannot reinhabit the root canal system. In essence, mechanically Roto Rooter out the canals but with an anti-bacterial chemical (bleach). I explain that I use alot of anesthetic (Blitzkrieg approach) and you will be very numb and the numbness may last a good part of the day. Our motto is, "More numb is better than less numb." I then tell the Pt that my goal is to bore you and that the root canal will take an hour to an hour and a half and it may take 2 visits based on the infection and tooth difficulty. It is ***VERY IMPORTANT*** to clearly explain to a Pt the RCT process so that they can adjust their expectations. Many patients think that a root canal is synonomous with a 30 minute filling and get antsy after 20 minutes of treatment time. I like to prepare my patients mentally that it is going to take an hour to an hour and a half and the root canal may take two visits. This way, they can prepare mentally for a longer procedure.

If a tooth is necrotic and you are unable to finish the root canal due to time or difficulty, I like to tell the patient, "I have cleaned out the infection and have placed an antibacterial medicine inside your tooth to continue to kill the infection and to allow you to heal. I am giving you antibiotics (if needed) to kill the infection and help heal the outside tissue surrounding the tooth. Once you heal, I will then complete the root canal." I usually appoint the second visit ***2 weeks*** later because I found that 1 week was sometimes to soon and on the more nasty infections the tooth was still draining serous fluid and I was unbale to seal and complete the treatment.

SINUS TRACT - WHAT IS YOU DX?

CHAPTER 5
1ST QUARTER OF THE ROOT CANAL GAME
GAMETIME



PART 1 - ANESTHETIC (numb that nerve!)

Time to get them NUMB! The 3 carpule rule!

I always start with 4% Benzocaine topical. I believe the injection sets the tempo or precedence for the rest of the appointment. If it hurts, the patient is going to have more anxiety and less cooperation. If it is relatively painless then we are setting the patient and ourselves up for success. Typically on any Necrotic or IP premolar or molar case I recommend 3 carpules of anesthetic to start (healthy patient). Most of the time this will suffice, but in the cases with "Hot" teeth more anesthetic will probably be needed.

"HOT" MANDIBULAR PREMOLAR/MOLAR

TECHNIQUE

I always give a Gow Gates block for the lower molars and premolars and sometimes for the anteriors. The Gow Gates is nearly the same as the Mandibular block except you insert the 27 gauge LONG needle (Yellow) right under the maxillary second molar occlusal table and inject anteriorly to the neck of the condyle. Its on average 1/2 to 1" higher than the Mandibular block. Ideally the Gow Gates block can anesthetize the buccal branch, lingual branch and alveolar branch because you are blocking the nerve trunk prior to it splitting into the three main branches. The injection site of the Gow Gates is also less vascularized so there is much less chance of giving an intra-vascular injection. Also, the Gow Gate injection path catches less muscle than the standard mandibular block and can be less painful. After topical, I locate the ramus with my fingers (left thumb) and gently insert the needle with a "shaky, shaky" of the tissue. The shaking tissue serves as an excellent "tissue distraction" technique and the patients barely feel the insertion (this works great on kids!). People are usually extremely fearful of the injection portion of the procedure so if we can give an excellent, fairly painless injection we will have them for life. After needle insertion, I very slowly inject a few drops of anesthetic and I wait a few seconds for the tissue to start to anesthetize and then slowly advance another few millimeters and then inject again. I slowly advance to and try to gently hit the ramus (bone) and then adjust the needle more posteriorly and find my "drop in" point. Prior to injecting, I aspirate once, move the needle very slightly and aspirate again. I will then inject very slowly, and if it's an at risk patient, I will typically aspirate 2-3 more times during the injection. My Gow Gates injection typically takes 1 minute to accomplish!!! I pride myself in giving pretty painless injections and have received numerous compliments from patients on this technique. The Gow Gates block technique takes about ten minutes to achieve full anesthesia verses the mandibular block which takes 4-5 minutes (by the time you give 2-3 carpules, 3-4 minutes have already passed). I like to describe this injection technique as getting a single in baseball and then stealing second, stealing third on a passed ball and then getting singled in to score. This is not the home run injection where you insert the needle and go right to bone and to length and then inject. This is what a lot of patients are used to and are quite happy when you go for the single and wait a few pitches and then steal second, wait for the passed ball, steal third, and then let your player (anesthetic) do the work and single you in to score (complete anesthesia). This process in baseball takes a few minuets to accomplish just like the injection.

STANDARD CASE

Maxillary Anterior - Use 30 gauge short (Blue) needle and 1 carpule of 4% Septocaine w/1:100,000 epi followed by 2% Lidocaine w/1:100:000 epinephrine (alternative is to you use 2 carpules of 2% Lidocaine with 1:100,000 epi). I always tell the patient that their nose will be numb. I give a palatal injection on all maxillary teeth. PALATAL INJECTION = I save about 1/4 of the carpule of 2% Lidocaine w/1:100,000 epinephrine and use that for palatal numbness. Yes its slightly painful for the patient, but I have found over the years that it is worth the five uncomfortable seconds because it gives a fuller anesthesia to the palatal roots of the premolars and molars and anesthitizes the lingual tissue so they don't feel the rubber dam clamp. We are dealing with inflamed, hypersensitive nerves, infection, and swelling so when in doubt give a palatal injection. I have my assistant spray Endo Ice on a medium sized cotton pellet with cotton pliers and then immediately give me the frozen pellet. I have already bent the 30 gauge, short Blue needle at a 45 degree angle and place the frozen pellet near the apex of the target tooth. I freeze the tissue for 1 second and then slightly move the pellet, but keep it on the tissue, and then inject 1/4 of the carpule of 2% Lidocaine w/1:100,000 epinephrine. I always warn the patient that they will feel a "slight" freeze and the injection can be a bit uncomfortable. I tell the guys that they need to go Navy Seal style and just, "suck it up."

SIDE NOTE

Interesting, the best patients are mothers. Mothers have gone through child birth and the difficulty of raising children and generally have a pretty tough mind set and proper perspective on the whole root canal process. The tattooed, muscled guy with UFC shirts are usually the most difficult to deal with. I have treated 9 year old girls who didn't move a muscle or even wince once during the injection or root canal procedure and then have moved into the next room with the 220 pound 25 year old ripped "fighter" who turned out to be the biggest skirt I have ever seen. Some of these guys moan during the injection and act like I am sawing their leg off. I also had a middle aged female emit a loud orgasmic sounding moan during the entire injection. I was sweating and trying not to laugh at the same time. I was worried about my other patients hearing these moans and thinking that I was Seinfeld's dentist. When I finally "finished up" and walked in to the next room the female patient looked at me with a straight face and said, "I'll have what she had."

Maxillary Premolar or Molar - Use a 30 gauge short needle (Blue) and 1 carpule of 4% Septocaine w/1:100,000 epinephrine and 2 carpules of 2% Lidocaine w/1:100,000 epinephrine and give a buccal infiltration. Save 1/4 of a Lidocaine carpule for the palatal injection and inject right at the apex of the tooth to be treated.

Mandibular Anterior - Irreversible Pulpitis-Symptomatic cases = Use a 27 gauge long needle (Yellow) and give a Gow Gates mandibular block of 2 carpules of 2% Lidocaine w/1:100,000 epinephrine and then a buccal infiltration (vestibule area of the inflamed or infected tooth) of 1 carpule of 4% Septocaine w/1:100,000 epinephrine. In some cases I will give a mental block (1 carpule of 2% Lidocaine w/1:100,000 epinephrine) instead of a mandibular block and palpate/push the anesthesia into the mental foramen for 30-60 seconds. In necrotic cases I will just give a buccal infiltration of 4% Septocaine w/1:100,000 epinephrine (1-2 carpules) and a few drops in the lingual.

Mandibular Premolar or Molar

I like to recline the patient back with their head below the chest (Modified Trendelenburg position) because it is easier to give a mandibular block injection in this position. Use 27 gauge long (Yellow needle) and 3 carpules of 2% Lidocaine w/1:100,000 epinephrine using the Gow Gates method of mandibular block. Aspirate numerous times and inject slowly. On a healthy patient who has eaten and is not "sensitive" to epinephrine, I will give all three carpules in a row, but on other patients I will give one or two at a time and then come back in a few minutes and give another (titrate). I do not use Septocaine for a mandibular block. The studies do not support this, but I have had one case of permanent lip anesthesia possibly caused by Septocaine. The mandibular buccal infiltration around the molar region is not always needed when you give a Mandibular or Gow Gates block. A majority of the time these Pts will achieve buccal anesthesia. Most of the time I do need to supplement with a buccal infiltration for a "hot" lower molar and I use 1 carpule of 4% Septocane w/1:100,000 epi.

I will obviously give less anesthetic for high BP or high risk heart patients. These patients I will aspirate at least five times and inject very slow. Also, I will give 1 carpule of 2% Lidocine w/1:100,000 epi and then wait for 5 minutes before I give another. The basic rule on high risk heart patients is no more than 2 1/2 carpules of anesthetic with epinephrine. If more is needed use 3% Mepivacaine Plain or 4% Citanest Plain.

Maxillary Molar "HOT" tooth

Plan A: 1 carp of 4% Septocaine w/1:100,000 epinephrine in a buccal infiltration and 2 carps of 2% Lidocaine w/1:100,000 epinephrine leaving a small amount for a palatal infiltration (1/4 carpule) at the end. I then wait 5 minutes and allow the patient to, "marinade." Test the "Hot, Hot" tooth with Endo Ice. If the patient feels pain with this or while while drilling then proceed to Plan B.

Plan B: 1 more carpule of 4% Septocaine w/1:100,000 epinephrine in a buccal infiltration and 1/4 carpule of 2% Lidocaine w/1:100,000 epinephrine in a palatal infiltration. I then wait 5 minutes and allow it "soak" in. If the patient still feels pain while accessing then proceed to Plan C. THIS RARELY HAPPENS ON A MAXILLARY TOOTH!

Plan C: I take a new, sharp bur and quickly access the pulp chamber being careful not to perforate. I then give 1 carpule of an intrapulpal with 2% Lido or 4% Septo. Be mindful of the amount of anesthetic you are giving the patient. If they still feel pain while filing, I will give one more carpule intrapulpally as apical as possible. If they still feel pain, then I perform a pulpotomy or mini-pulpectomy (1/2 pulpectomy) and I place calcium hydroxide into the canals and close it up. I reappoint to finish the root canal in 2 weeks and the patient is typically pain free. The Maxillary "Hot, Hot" tooth occurs 1-2 times a year and the last time it happened was to, of course, on a police officer (LAPD)!

Mandibular Molar "HOT" tooth

Plan A: I give 3 carpules of 2% Lidocaine w/1:100,000 epinephrine using the Gow Gates block technique. I then give 1 carpule of 4% Septocaine w/1:100,000 epinephrine in a buccal infiltration and I wait 10 minutes prior to starting the root canal. I tell the patient, "We have to let you marinade for a while and let it soak in." Obviously the patient has to be heathy and has hopefully eaten within the last 4 hours. Sometimes I will give 1/2 the amount of anesthetic, wait five minutes and then give the other half. This is a judgement call that you must make. For instance, you have a 95 pound female in severe pain who hasn't eaten in 12 hours. It is recommended to titrate the anesthetic dose.

Prior to starting, my assistant tests the tooth with Endo Ice. If the patient feels it then I proceed to Plan B.

Plan B: I give a PDL injection with either Lidocaine or Septocaine. Test again with Endo Ice. If the patient is mostly numb, I start accessing. In 98% of the cases the patients will be fully anesthitized after the under utilized PDL injection. If the patient still feels the Endo Ice and/or feels pain while I am accessing then I proceed to Plan C.

Plan C: Stabident or X-Tip Intraosseous injection technique. I use Stabident but have used X-Tip. X-Tip is easier to use because the sleeve remains in the drilled pilot hole that you made through the buccal cortical plate, allowing easy insertion of the needle and placement of the anesthetic into the medullary space. The X tip drill does seem to be larger than the Stabident drill and it can be more difficult to pop through the B cortical plate. Just keep curved hemostats at the ready because sometimes the X-Tip sleeve is hard to remove without hemostats. If you use Stabident, and you are anesthitizing a lower molar, I like to pre-bend the needle at a 45 degree angle and then use a pen grasp and follow the bleeding point into the pilot hole and through the cortical plate into the medullary space. The problem with the Stabident, is that I can't always find the drilled pilot hole through the buccal cortical plate and end up having to drill another one in about a third of the cases. Follow the instructions on each system for the correct RPM, but I typically run the pilot drill at 3000 RPM and try to "pop" through the cortical plate as fast as possible. The patient should have buccal infiltration prior to the intraosseous injection (I assume you have done this if you are following the "Hot" tooth prescription). I use 4% Septocaine w/1:100,000 epinephrine or 2% Lidocaine w/1:100,000 epinephrine for my intraosseous injections. I am not sure if it really matters! Always warn the patient on intraosseous and PDL injections that they may feel a racing heart. I equate it with 3 shots of espresso. NOW: What if the patient still feels pain?

Plan D: I give 1 more carpule of 2% Lidocaine w/ 1:100,000 epi intraosseus. What if they still feel pain? MINDFUL of the amount of anesthetic you have given so far. My assistant always records and saves all spent carpules until the appointment is finished.

Plan E: (starting to run low on the bag of tricks): I access the pulp chamber quickly with a new bur and give an intrapulpal with Lido or Septo (it doesn't matter except Septocaine is more expensive). I sometimes will give 2 carps of an intrapulpal- one coronal and then one more apical later in the procedure and after I have opened up the orifi (coronal flare). What if the patient still feels pain while you are filing?

Plan F: This occurs about 5 times a year on "Hot, Hot" lower molars. Remember this is not you fault! I always felt like an extreme failure in these cases and I think the patients lose some confidence. "My other dentist is always able to get me numb. I'm not sure whats going on." The implication is you don't know what the F@$% your doing. In these cases, and its always occurs with someone you now like your kids football coach, music and geometry teacher (true story), I perform a pulpotomy or mini- pulpectomy, whatever the patient can handle, and then place calcium hydroxide into the canals. I reappoint in 2 week and the "Hot, Hot" tooth is now normal and they are pain free and I am then able to adequately clean and shape all canals. I tell the patient that this happens in 5 patients a year. Misery loves company, and patients seem to feel better when they realize this happens to other "Hotties" (Hot teeth). I also explain that this is the "perfect storm" where there is so much inflammation it is difficult to completely "numb" the tooth.

How do you anesthetize a "hot" tooth on a patient who is sensitive to epinephrine?

I use 3% Mepivacaine Plain and if the patient only gets the shakes and doesn't have some crazy adverse reaction to epinephrine, I will use 1 carpule of 3% Mepivacaine w/1:20,000 Levonordephrin. For some reason, patients that are sensitive to epinephrine can usually handle Levonordephrin much better. I do not understand the chemistry, but I have used this trick hundreds of times and it seems to work. Thank you Dr. Terry K.

Septocaine

I do not use 4% Septocaine with epinephrine for mandibular blocks (Gow Gates) or for palatal infiltrations or on pregnant patients and am careful when using it on young kids. In my endodontic residency, myself and other co-residents saw a few cases of palatal tissue sloughing after giving septocaine palatal infiltrations. Some of my colleagues have told me they use Septocaine all the time on the palate and have never had a problem so it may have been poor technique and giving too much anesthetic of a high concentration in a tight tissue spot. Its always easier to blame the anesthetic. Also, I have been sued and mediated for a fairly ridiculous sum of money because I used Septocaine in a mandibular block on a "Hot, Hot" tooth and the patient ended up with anesthesia on a small patch on his/her lower lip. This may have also happened if I had used Lidocaine in that case, but I do not feel the need to use Septocaine in a Gow Gates or Mandibular block because I am able to fully anesthetize 99% of my "Hot" mandibular molar patients.

Pregnancy and Anesthetic

Only use 2% Lidocaine w/1:100,000 epinephrine or 4% Citanest (Prilocaine) plain or w/1:200,000 epinephrine. These two anesthetics are Category B which means they are not known to cause harm to the unborn baby.

It is recommended to NOT USE Mepivacaine (Carbocaine), Septocaine (Articaine), or Marcaine (Bupivacaine) because these are Category C anesthetics and can cause harm to the developing unborn baby AND possibly lower the unborn baby's heart rate.

Six Rules of the Endo Game

1 Tell patient prior to starting that it may take 2 visits to complete the root canal (adjust expectations). "These teeth are difficult to treat and it may take two visits to complete."

2 Prepare the patient that the process can take an hour to two hours but that if they get tired you can stop at any point. They remain in control. "The appointment will take about an hour to an hour and a half and it may take two visits."

3 Follow the ***ZEN ENDO*** principles

4 ***WHEN IN DOUBT*** place calcium hydroxide (if you follow this one rule, your cases will turn out so much better and you will have fewer long-term problems). If the procedure is not going well and you are starting to hurry and do not feel that you have done a good root canal then place CaOH2. Examples: "I can't get patency.""My cones just aren't fitting." "This curve is hard to get around." "There may be another canal." You can also choose to refer these cases to your endodontist prior to the point of no return (canal ledge or perforation).

5 Stay present during the entire root canal process. Do not let your mind wander.

6 Stay focused on the 2nd visit - I always think this visit will be quick and easy because I was nearly done with the root canal at the first appointment. So sometimes I don't have the patience to take more time and be excellent. So make sure you stay in the endo game and do not allow a mental let down at the 2nd visit.

PART 2 - RUBBER DAM

Always, always use a tooth rubber so that you can practice safe dentistry. A rubber dam is an absolute must when you perform root canals. Without it your success rate will decrease significantly and it is below the standard of care. Why use one? ① Safety. It prevents files or small instruments from dropping into the throat and chemicals like bleach or EDTA washing into the mouth ② It keeps the saliva from re-infecting the canal system. Sure your assistant can keep the access free of saliva during the procedure, but what about during working length or cone fit radiographs? The patients saliva will wash into the prior disinfected root canal system during these radiographs. IT IS JUST GOING TO HAPPEN! ③ IT'S THE STANDARD OF CARE! ④ It makes your root canal procedure so much easier and faster because the lips, tongue, and cheek are retracted and out of the way and you are able to focus in on just the tooth and procedure (TRUST ME ON THIS).

What is the best way to place a rubber dam and what clamps should I use?

Placing a rubber dam should take you no longer than 30 seconds in most cases. All the benefits listed above and it takes you 30 seconds to accomplish. Now that is a pretty good deal. The problem that I see when I lecture is that many dentists are out of practice placing a rubber dam and therefore don't do it because their not sure what clamp to use and how to place it. I want to walk you through step by step the process of clamp selection and dam placement. First of all use a non-latex, medium gauge blue (my preference) rubber dam. We buy ours from Ultradent or Henry Schein.

Clamp Selection

I use only six clamps for 98% of the teeth I treat. Pretty easy right? (I prefer IVORY clamps but any companies clamps will work and I just want you to ***USE A RUBBER DAM***).

#9 CLAMP - USE FOR ALL ANTERIORS

Maxillary/Mandibular Anterior teeth = W-9 (clamps 12 teeth)

How to place the clamp and rubber dam over anterior teeth: place the W-9 clamp into the rubber dam with the dam hooked on the buccal and lingual wings of the clamp. Place the clamp and rubber dam together over the tooth to be treated. KEY = Make sure you place a finger to mark the correct anterior tooth when placing the rubber dam in a one shot method so that you treat the correct tooth. Especially in the lower anterior teeth, I double and triple check that I have clamped the correct tooth and the best way to ensure this is to leave a finger on the tooth to be treated while placing the clamp and dam. Now, take a Glick instrument, release the rubber dam from the wings of the #9 clamp and the dam will seal up around the tooth. I also attempt to floss both contacts and push the dam through to obtain an even more intimate seal if needed. When I was first out of residency I worked at an office in northern Los Angeles and I remember placing the W-9 clamp backwards onto a #9 and the assistant chuckling. So which way does the W-9 clamp face? Place the more open side pointing to the facial aspect (both ways work and I believe some dentists prefer placing the more open side facing the lingual). Each side of the clamp arches should

be angled more back towards the lingual with the open side on the facial. Just go grab or buy a W-9 clamp and you will see what I am talking about. By the way, at the northern Los Angeles office the endodontist used the W-9 clamp for every tooth. He loved it and swore by it. I tried it, but feel that it gets in the way when treating molars.

If all other clamps fail, the W-9 will work on any tooth that is restorable. This is my final choice if all other clamps fail to stay in place for a posterior tooth. Again, I don't use it on posterior teeth because it's large and cumbersome and gets in the way when I file, but its good to have in your bag of tricks.

Maxillary/Mandibular Premolars = #1 (clamps 8 teeth)

I prefer to place the clamp onto the tooth to be treated first and then place the rubber dam. The other choice is to place the #1 clamp into the rubber dam hole and catch the dam on the wings. Then place the dam and clamp altogether on the targeted tooth. This works fine too and I used use this technique right out of residency but now feel there is an easier way. I recommend placing the clamp first in all posterior cases and then placing the rubber dam over the clamp and teeth. Here is why: ① I know for sure when I place the clamp separate from the dam that I am treating the correct tooth. Well not for sure, but I think it cuts down on the possibility of placing the clamp and dam on the wrong tooth because your visualization of the teeth are cut in half. Will this happen? Probably not, but in a lifetime of placing rubber dams and performing root canals it may prevent one or two mistakes. To me that is worth it. ② It is easier to place the clamp first and then the rubber dam. Sure the one shot placement is easier for the premolars, but what about the maxillary second molars or even the first molars? It gets tough to place the clamp and dam in a one shot technique in those cases. There is just too much tension on the patients lips and cheek. The main thing is ***use a rubber dam*** and use whatever technique you find works in your hands.

MY PREMOLAR DAM TECHNIQUE: I place the #1 clamp onto the premolar tooth that I'm going to treat, and then pull up on the distal wing to make sure it is tight. Place the dam over the treated tooth and one tooth **MESIAL**. Floss the dam through the contact 2 times, so that at least two teeth can be seen. This is called a "modified" split rubber dam technique. A true split rubber dam technique occurs when the clamp is placed distal to the treated tooth and then the dam is extended along the quadrant so that 3-5 teeth are visible. I used to always do this, but have changed to a "modified" split rubber dam technique ever since I incorporated the PIPS laser and GentleWave into my irrigation arsenal (more on this later).

I like the "modified" or full split rubber dam technique because you can see all the tooth contours and adjacent teeth while accessing. This will really cut down on perforations and removing unnecessary tooth structure because you are able to compare your access prep to the tooth contours of the targeted and adjacent tooth. ***What you can see, you can do!*** I continually check, during my access, the treated and adjacent tooth contours, access walls and CEJ to make sure I am drilling in the correct place. Any extra information while accessing helps! Obviously, in the easy access cases this is not needed, but the split rubber dam really helps when accessing a difficult, calcified pulp chamber.

So what are the disadvantages to the split rubber dam technique?

The main disadvantage is that the rubber dam is not as sealed and there is the possibility that some bleach can leak into the mouth during the root canal procedure. I use Kool Dam rubber dam sealer to seal those areas (mostly lingual) when needed.
I use Kool Dam because after 2000+ cases I trust in the seal that it gives. This is a light curable rubber like material that seals the dam and it takes about 20-30 seconds to place and cure. Thirty seconds and your dam is sealed for the rest of the hour! Pretty easy stuff. I have tried the majority of the rubber dam sealing products, Oraseal, Oracaulk, LiquiDam, Opaldam, etc and Kool Dam has become my favorite. Again, one of the course themes is use what works in your hands! So if you like LiquiDam then use it. I use Kool Dam exclusively because over and over (2000 cases+) and it has proved itself. The only disadvantage to using a light cure rubber dam sealer is that it adds expense (one tube lasts for 3-4 root canals) and you need to have a light ready to cure the material. Not a big deal.

Maxillary Molars = Right #13A, Left #12A (6 Teeth)

I recommend placing the clamp first, pulling up on the distal wing to make sure it is tight and won't fly off the tooth, and then place the rubber dam over the clamp and tooth, advancing the dam at least one tooth mesial of the tooth to be treated. Floss the dam through the contact of one tooth mesial and seal with Kool Dam if necessary. Sometimes I wait until my access is complete and I have removed all caries and am ready to place bleach into the chamber before I seal the rubber dam with a rubber dam sealer like (Kool Dam). Why? I only place Kool Dam after I have removed caries and the access is complete so I can keep a clear visualization of the tooth contours and tissue. Kool Dam is great to use if an interproximal wall is missing. I use it to temporarily "build up" the interproximal wall so that I am able to fully irrigate with 6% bleach (NaOCL). This way I do not get any leakage of bleach into the mouth. My associate places the clamp and rubber dam all together and just clamps the tooth to be treated and does not pull the rubber dam over mesially. Another option is to access without the rubber dam and then place it once you enter the pulp chamber. There is no harm in doing it this way. The point is whatever technique works for you, go for it. I just want to present different options that I think will improve your game.

THIS IS MY FAVORITE LOWER MOLAR CLAMP!

Mandibular Molars = #56 (6 Teeth)

The technique is the same for mandibular molars. Place the #56 clamp onto the tooth and pull up on the distal wing with your finger to check the tightness of the clamp. Place the rubber dam over the clamp and treatment tooth and if possible extend the dam one tooth forward and floss it between the contact two times to make sure it is down. Seal any areas of leakage after the access is complete and before you place bleach into the chamber. I don't always need to seal the rubber dam perfectly because I work so well with my wonderful assistants and they suction any excess bleach running over the access walls. It is never a bad idea to proceed with caution and SEAL that RUBBER DAM! When in doubt, seal the deal and prevent bleach from running into he patient's mouth and down their throat.

Prepped Molars = #14

Poor Retention/Broken Down Teeth = #14 A

Molars where the prior clamps are not fitting or immature molars. You will need to give a buccal infiltration for the mandibular molars because this clamp will pinch the tissue and is very aggressive. On the other hand, the #56 is pretty nice to the tissue and I do not always give a buccal infiltration

when using this clamp. Problem teeth - No clamp fits = ***Use #W-9 (last resort for the posterior teeth)***

What do you do if you are working on two maxillary or two mandibular anterior teeth at the same time?

Now you have to get creative. You probably can't use the W-9 clamp because it will block you from accessing the other adjacent tooth (assuming the teeth are next to each other). Now I use #0 or #00 and pinch the jaws together tight to increase the clamp tension. I place one clamp on each tooth or one clamp on one tooth and use a split dam technique.

I want you to be prepared and confident that you can clamp any restorable tooth or teeth in the mouth at any given time. There are times when you have to be creative and it's okay to do that. It's okay to use any clamp on any tooth in the mouth at any given time as long as it works!

Should you tie floss on each clamp prior to placement?

In dental school and endodontic residency we were required, and for good reason, to tie floss to the clamp prior to placement. This was required because if the clamp dislodged during placement or even somehow during radiographs and the patient swallowed it, you could pull on the floss and retrieve it from the throat area. I do not tie floss onto my clamps anymore EXCEPT when I am treating any individual 15 or younger. If you perform 1-2 root canals a week I recommend having your assistant tie floss onto the the distal wing of clamp. I do 4-8 cases a day and no longer tie floss onto the clamp and have never had a problem with the patient swallowing or even coming close to swallowing the clamp (knock on wood!). Although yesterday, and this happens every now and then, the #12A broke in half (cyclic fatigue) when placing the clamp onto the tooth. It did fall on the tongue and my heart did race as I attempted to retrieve it with my fingers only failing and pushing it back more towards the throat. Thankfully, my quick assistant handed me cotton pliers and I was able to grab it prior to the patient swallowing it. Most patients are fairly intelligent and don't automatically swallow when a clamp falls on their tongue. I guess we are mainly worried about the not-so-with-it patients.

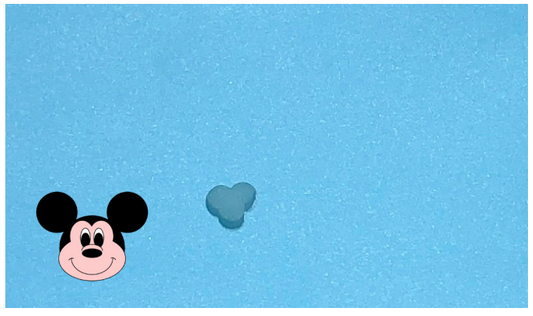
What I do now, is carefully place the selected clamp onto the tooth and then I test it's retention on the distal wing of the clamp using my fingers. I can tell when it may pop off and when its ON TIGHT. If I am having trouble fitting a clamp on a "broken down" tooth then I usually tie floss onto the clamp. I recommend doing it every time, but a good rule of thumb is when in doubt tie floss onto the clamp.

Where do you cut the rubber dam hole?

You can buy a rubber dam tooth chart that tells you exactly where to cut the hole for each specific tooth. I have used this in the past but now have taught my assistants where to cut the hole "free hand."

How big should you cut the hole?

Cut the rubber dam in a 3 punch clover leaf pattern or Mickey Mouse pattern (Face with two ears).



Maxillary Anterior - This is the easy one. Always place the rubber dam on the plastic yellow U frame. ***Key Point:*** I do not like a lot of excess at the top portion of the frame but prefer the excess rubber dam at the bottom. So place the rubber dam flush with the top of the frame. Cut a hole about 1 1/2" down from the top and just SLIGHTLY off center (1/4" right or left) to the correct side the tooth is on.

Mandibuar Anterior - Cut the hole an 1 1/2" up from the BOTTOM of the rubber dam frame. This will seem low but your goal is to make sure the rubber dam covers the upper lip. If it covers the nose also, the dam can always be trimmed back. Better to cover the nose with the rubber dam and trim it back with scissors in a moon shape trim then to be short of the upper lip and have an opening. When this occurs, saliva will get all over your fingers when hand filing. This is a huge pet peeve of mine because for an hour plus I'm battling slippery fingers and I lose tactile feel.

Maxillary Premolar and Molar - Cut the hole 1 1/2" down from the top of the rubber dam (remember the rubber dam is already mounted on the U frame prior to the cut) and just slightly off center (1/4") to the right or left. If its a left molar then cut just off center to the left (sorry- I am trying to be exceptionally clear here. I learned during my lectures never take anything for granted and always articulate the obvious).

Mandibular Premolar and Molar - This is where I see the majority of the mistakes. Place the rubber dam on the frame and cut the hole 1 1/2" up from the BOTTOM of the frame.

ENDO GAME TIP: ***The hole must be cut correctly for the mandibular molars or you will end up with "Wet Finger" Syndrome.*** "Wet finger" Syndrome means you have slippery gloves, you lose tactile feel, and it's messy. This occurs when the dam does not properly cover the upper lip. The next hour when you hand file, saliva from the upper teeth will transfer to your working fingers and it will be a continous nuisance.

Bite Block

We use a Nu Block (877-744-9339). This is a disposable plastic block with a styrofoam outer layer to reduce slippage. The cost is $40 for a 100. I have tried almost every bite block on the market and really like the Nu Block because it's not too large and not too small, it fits well in the mouth, it has a slight spring to it, and it has pretty good tooth traction. In other words it does not "slip" off the teeth and "float" in the mouth as much as the other blocks. The disadvantage is that it is disposable and costs 40 cents per block. **Bad News:** All bite blocks slip and float in the mouth. Some patients just produce more saliva and are unable to stay biting down on a bite or resting block (I like the phrase "resting block" because it educates the patient to "rest" their jaw on the block or tooth pillow).

Again, in keeping with the theme of this book, I will give recommendations of what works well in my hands. Keep an open mind and if you have a bite block that you use and like then USE IT!

REVIEW

Here is my treatment order so far: ① Diagnose the correct tooth to be treated ② Anesthetize and wait ten minutes if it's a mandibular tooth. If it's a maxillary tooth you can start immediately - Our office philosophy is, "More numbing is better than less numbing." I get the patients to agree with me on this and tell them they will be numb for a good part of the day. On healthy patients use the Blitzkrieg anesthetic approach: 3 carpule rule to start on Irreversible pulpitis and Necrotic cases (yes I said Necrotic cases too!). It is crazy not to anesthetize a patient with a necrotic tooth unless they are a Navy Seal. Patients will feel the patency file and any long filing into the periapical tissues. Numbing a necrotic tooth also gives the patient some relief from any post-op symptoms and time to take Advil. If it's a retreatment and they are asymptomatic, I sometimes use only 2 carpules and will give more later if needed. ③ Place the clamp and then the rubber dam (unless its an anterior tooth then I place the clamp and rubber dam together) ④ Place a Bite block or "Resting block." ⑤ Time to Access

Key Point: *When I recline the patient I tell them, "Okay, you are in control here. If you need to stop, sit up and rest, rest your jaw or use the restroom just raise your hand. It will be no problem. This procedure takes a little time."* The patient should have been prepped before this time that the procedure will

take at least an hour and that it may take 2 visits. I'm reminding the patient of the time expectation and to prepare their mind to go Zen and chill. Meeting and exceeding patient expectations is the key to a happy patient.

What mirrors do I recommend?

I use three types of mirrors: a standard mirror with a metal handle, a ZIRC mirror with a plastic handle, and a Flexi mirror (microscope mirror). I use the standard mirror (19mm) for maxillary teeth and if I am taking pictures or video from under the microscope, I use the ZIRC mirror. The ZIRC mirror is plastic and autoclavable and has excellent light reflection. The light reflection is better than the standard mirror with the metal handle. The only two disadvantages is that it is larger than the standard 19mm mirror, so it is sometimes hard to use on molars, and there is a slight extra cost. The ZIRC mirrors cost $34 for a set of 10. We use them over and over again without too much loss of light reflection. I also use a 10mm and 19mm Flexi Mirror from EIE2.com for mandibular teeth. Primarily I use the 19mm sized Flexi mirror, but will use the 10mm mirror on second molars with a limited opening. I use this mirror because it is flexible and can the handle can bend to a 90 degree angle and it allows me to use the microscope and see while treating mandibular molars. The Flexi mirrors are wonderful and I could not live without them (again I am treating these teeth through a microscope so if you use Loupes you may not need them. Not a bad idea to invest in one 19mm mirror and handle and try it out). The only disadvantage is that the Flexi Mirrors cost $80 per mirror head and $35 per mirror handle (you only need to buy the handle once). We are able to use them for about a year before they get scratched.

Magnification

I use the Zeiss ProErgo microscope with an assistant side microscope and a photo/ video camera attached. This is a motorized microscope and the best on the market. I am able to zoom in and increase my light output with just the touch of a button. The disadvantages are that it is bulky and it costs $70,000. I have four of them in my office and will be paying off my office loan for quite some time.

COACHES TIMEOUT

It is not likely that you will have a $70,000 plus microscope in your office. The next best magnification source are high magnification loupes with an attached light source. A 4.5x expanded field with attached light source costs around $1000 - $2000. Lumadent is a good, inexpensive light source. I highly recommend investing in one and doing the proper research to find the loupes and light source that work best for you. High magnification with a bright, quality light source is a must if you are going to perform root canals. ***AVOID*** *the "Black Hole" Syndrome. Without magnification and good light the access of the tooth appears to be a black hole and this hole just eats up files and time. I think the #1 problem in root canal treatment (assuming you have the experience, knowledge and skill) is dentists* ***CAN NOT SEE*** *what they are doing.*

CHAPTER 6
2ND QUARTER OF THE ROOT CANAL GAME

The 2nd quarter of the root canal game is here! This chapter will cover Access, Coronal Negotiation, Coronal Flare or Open Orifice, Negotiation to Patency, Accurate Working Length, and Open Glide Path. The root canal game is won or lost in this quarter. If you blow this part you might as not come out for the second half. This is bar none the most important part of the root canal procedure and if you can own the 2nd quarter you will own tooth after tooth and end up with excellent results. Shaping with rotaries/ reciprocation and obturation all flows from this quarter, so lets nail this!

In a football game, the offensive team usually starts with the ball at their 25 yard line. Play after play, they continue to drive down the field and move the ball, at times slowly, gaining a few yards, and other gains bigger, fifteen plus yards. Moving the ball from your own twenty-five to first and goal is equivalent to Open Orifice, Negotiation to Patency, Accurate Working Length, and Open Glide Path. First and goal, and the plays that ensue, are equivalent to the shaping procedure and scoring the touchdown and extra point is the obturation component. The hard work is moving the ball from the twenty-five to first and goal.

PART 1- ACCESS

Access Rules

1 Start drilling with water, but then turn it off as you get deeper (3-4mm) into the tooth. Your assistant should hold the suction nearby to reduce the dust and smell of drilling dry.

2 Avoid drilling "blind" when accessing!!! "When you can see well, you can do well."

3 Start with a conservative access prep and then open up as needed.

4 Always assume every premolar has 2 canals and every molar has 4 canals until proven otherwise. Every tooth is assumed guilty of extra canals until proven innocent.

5 Drill towards darkness and away from light (General rule).

6 Do not drill where it is chalky or mottled white (that is the wrong area!).

7 Calcified canals take a lot of patience and time- If it is taking a lot of time to locate the canals then start thinking TWO visits. This will take a little pressure off of you. There is no easy, quick tip in locating calcified canals. It takes time and slow drilling in the correct areas (more on this later).

8 Use high magnification with a bright light source.

Calcified Canals (Remember Zen Endo)

Locating calcified canals is the number one question I get asked during my lectures. If you can't locate the canals it is hard to complete the root canal! Add a patient in a great deal of pain with calcified canals, well now you have a very stressful situation, especially if its 5:30pm on a Friday and you are it! Here are some general rules that I follow when searching for calcified canals:

① High magnification with bright light (have I said this enough?)

② SLOW DOWN. You are now in the 2 visit mode. Once I am deep and should have located canals but haven't, I switch to a #1/4 or #1/2 surgical length round bur and drill, with the water off, very gently toward the darker tooth structure (towards the center of the pulp chamber) and where I feel the canals are. If it's a lower molar try to find the larger distal canal. If it's a maxillary molar try to locate the palatal canal. If there's caries that extend near the MB pulp horn of the upper first molar, then the MB canal will be more difficult to locate due to secondary dentin build up and "calcification." I recommend leaving that canal (MB) and locating the palatal or DB first and then coming back to the more difficult canal. The drill towards dark rule works about 95% of the time. Every now and then I will be surprised and find a canal under white tooth structure, but this is usually not the case.

③ Check for a stick with a NEW sharp Endo explorer. The Endo explorer will dull and in these tough calcified cases I ask for a new one and check often for a little stick.

④ The deeper I get the more likely I will switch from a surgical length #1/2 or #1/4 round bur to an Endo 4 or Buc-1 (Dentsply) or a Workhorse (EIE2.com) ultrasonic tip. Ultrasonics allow great visibility while accessing and exceptionally careful, pinpoint tooth structure removal.

⑤ Locate 1 canal if possible and open up the orifice (coronal flare) and then use this canal as a road map for the other canals. Often, you will see a line running from the located canal pointing you in the right direction.

⑥ If you can only locate 1 canal, then prepare and shape that canal, allow soak time, and then come back later to search for the others. Remember, this is now two visit endo territory so remove the one visit stress from your mind. WHEN IN DOUBT PERFORM TWO VISIT ENDO. If you do this you will avoid the "Shitty Endo" syndrome and we have all been there. I just went there yesterday (embarrassing) and as I looked at the post operative radiographs "mumbled" silently, "Why the @#$% did I fill this?"

I now want to give a very specific description of my access routine. Again, look at what I do and keep an open mind. I will describe my technique and the technique of my endo friends. If your access routine is perfect, great. My recommendation is to read this chapter, let it sink in, mull it over, and then add the parts that you like and make the access changes that will help you achieve the objective: Finding those canals. I use 2-3 high speed burs when accessing at $1 each. I would rather spend a few dollars more per case on new burs and new rotary/reciprocation files then perforate or separate because of cheapness.

Access through Gold crowns

Accessing through gold crowns is different from accessing all porcelain or porcelain fused to medal crowns. The biggest problem while accessing full gold crowns is the "**skippage**" phenomenon. If you try to access the way you access normally, the bur can sometimes grab the gold and skip all over the crown leaving train track marks on the gold. I unfortunately have done this a number of times while accessing and it always catches me by surprise. If this happens, then you just have to polish the gold but that adds an extra step and sometimes I am unable to polish every "train track" out of the crown.

PERSONAL FOUL

Unnecessary roughness with a gold crown
(15 minute penalty)

MY TECHNIQUE: I take a new #701, #557 regular carbide (the TriHawk Talon carbides are also very sharp burs) bur and place it just above the gold crown in an area 3mm from the mesial marginal ridge and in the center (buccal-lingually) of the molar tooth. It is rare to see gold crowns on premolars, but if you do I start drilling dead center of the occlusal table. Use water and take the new #701 shorty (regular) and sink it into the tooth and through the crown. The goal is to make a hole the size of the bur through the gold crown. When you do this correctly, the bur will not skip and run all over the gold crown. After the hole is made, I then access laterally with the bur placed into the initial "pilot" access hole and cut out an initial conservative prep shape (oval shape for anterior and premolars and a triangular shape for molars). MOLAR: Start 3mm from the mesial marginal ridge in the center and cut an outline to the MB cusp back to the palatal cusp and then extend out to the DB cusp. This will form a a triangle shape. Once, I have my initial conservative access prep I switch to a **#557 SURGICAL LENGTH** (Great White 557L) bur (you can use a #701 surgical length but for some reason I like the #557 surgical better- I have used both for years and the #557 bur has come out the winner). Why surgical length? VISION- the surgical length allows you to see where you are drilling and I recommend to access with VISION! A short bur keeps the head of the handpiece to close to the access and it can block your vision. There are a few

cases where I cannot see 100% of the time where I am drilling. Thats just real life. Limited opening or second molars can at times be difficult to access let alone see where you are drilling. **I recommend to use water initially while accessing, but when you switch to the #557 surgical length, turn the water off but still have your assistant suction the dust and smoke.**

COACHES TIMEOUT

Use a sharp Endo Explorer instrument to check for canal "sticks." I use this instrument on every case and it tells me that a canal or caries are present.

Access through Porcelain Fused to Metal crowns

MY TECHNIQUE: This technique is slightly different than full gold crowns and I think is easier. DRILL WITH WATER! I start with a tapered diamond and remove the porcelain down to the metal and form a nice conservative access outline. Place the tapered diamond 3mm from the mesial marginal ridge in the buccal-lingual center of the occlusal table and start removing porcelain down to the medal. Keep it somewhat conservative because you can always open the access shape later. Once I cut my initial access prep down to the metal, I switch to either a TriHawk Talon #8 or #10 or a #701 carbide shorty (insert your favorite carbide bur here), drill through the metal and then "flush it up" to the porcelain border. If you need to make the access bigger you can cut the porcelain and metal at the same time with the TriHawk Talon or #701 bur (water on). Once I start to drill deeper (4mm), I turn off the water, change burs to a #557 surgical length (so I can see where I am drilling). Again, my assistant continues to suction the dust and smoke.

vPorcelain fracture

It is rare, but when the porcelain does fracture it is usually when I am attempting to remove a post using ultrasonics at high power. I see a 0.5% porcelain fracture rate when I access porcelain fused to metal crowns in my practice. I always tell the patient prior to access that sometimes the porcelain will crack off while drilling and that they may need a new crown. I don't say it outright, but allude to the fact that I am not responsible if the porcelain fractures. Most of the time a piece of porcelain will fracture off with ultrasonic use, not bur access, usually while trying to remove a well cemented post or locate calcified canals.

Access through All Porcelain crowns

I use the same technique as the porcelain fused to metal crowns except I use the diamond (always with water when drilling porcelain) to cut through the porcelain down to tooth structure and then switch over to the #557 carbide surgical length. I don't need the #701 shorty carbide to cut through the metal since there is only porcelain.

Access through Zirconia or EMAX crowns

These all porcelain crowns require a special ZIRC bur (flat diamond or ball works best) to cut through the extremely hard porcelain. Regular diamond burs will not work. The ZIRC burs have a finer diamond grit and cut slowly but will cut through the porcelain. Again always use water when cutting porcelain or zirconia. My favorite diamond is a cylinder style diamond bur (835/012C) from Lusterdent that I order on EBay for all Emax/Zirconia and regular porcelain fused to metal crowns.

An EMAX crown can be removed with laser energy. The settings for the Lightwalker laser are at Tech4Med.com. I have never done this but need to learn this technique. The technique requires a painting of the entire EMAX crown with the RO2 handpiece for 3 minutes to "melt" the cement. The crown loosens and can be removed. If you can do this this will make your life easier and help the patient tremendously because its easier to access a prepped tooth without the crown and the patient does not necessarily need a new crown.

ANTERIOR ACCESS

Mandibular Incisors

These are difficult teeth to access because of the narrow mesial to distal width. I am extremely careful when accessing lower incisors. I take a lot

of time because the game here is won or lost with proper access. If you can find the canal usually you can own it, but you must find it first without destroying unnecessary tooth structure.

MY TECHNIQUE: Use a ***#330L bur (this is a great bur for all anterior and premolar access. It has a longer cutting head and the bur is longer in length than standard carbide burs)*** and very carefully start the oval access shape dead center of the lingual. I start drilling in a slight facial manner and then readjust lingual as I get deeper. Start with water, but after 2-3 mm drilling depth, I turn it off and access dry. Accessing dry as you approach the pulp chamber helps you see and allows pinpoint access. Vision, Vision, Vision! The biggest mistakes on accessing incisors is drilling to fast, to facial and taking away to much mesial-distal tooth structure on the initial access. So go slow and try not to remove too much tooth structure!

PERSONAL FOUL

Access has strayed mesially. Unnecessary tooth structure removal with the hand piece= 15 yard penalty.

I take a lot of time (3-5 minutes) and have my assistant rinse and dry the access often so I can double check that I am in the right spot. Once I pop in to the pulp chamber, I breathe a sigh of relief.

The rate of a second lingual canal in lower incisors can be as high as 40% (I don't see this) but thankfully 98% of the time that lingual canal joins back with the buccal canal in the apical 1/3. Usually if you miss a second canal (lingual), and you allowed proper NaOCL soak time, you will see a little white line of sealer superimposed over the filled buccal on the final radiograph. This also occurs on a missed MB2 in the maxillary molars.

Maxillary Incisors

MY TECHNIQUE: Access with the water on and with a ***#330L*** short carbide bur dead center mesial-distal on the lingual, and cut an initial oval outline shape. Access 2-3mm and then turn off water after and continue pinpoint drilling. Usually you will pop into the pulp chamber fairly quickly but if you don't feel "the drop" then switch to a ***#1/4 surgical length round bur***. Take your time and have your assistant rinse and dry the access prep so that you can continually check that you are in the right location. The biggest mistake on accessing the maxillary anteriors is again drilling too facial. I access towards the facial about 2mm and then change the angle of the bur in a more lingual direction, along the long axis of the tooth or root. Usually I pop into the pulp chamber within 30 seconds to a minute (and this is me taking my time with my assistant rinsing and drying the access prep).

COACHES TIMEOUT

My access rule is if I have any doubt that I may be drilling in the wrong area, I stop and rinse and dry and inspect. This little voice in my head has saved me numerous times. Later on you will also hear this voice when you are using rotary files and going for the deep apical shape on a curved canal telling you to, "PULL OUT, PULL OUT, ABORT, ABORT!" I have learned the hard way, you must learn to heed the advice of your inner endo voice. If not, separation can occur which then leads to separation anxiety.

NEED TO BUY

ENDO GAME TIP: Once I access the pulp chamber and complete the coronal flare (we will discuss this in the next chapter), I then inspect the canal. Most of the time the canal will be positioned in a lingual direction. There is a lingual triangle of dentin that often blocks full straight line access. I will use a long, thin diamond and carefully (under high magnification) remove the lingual dentinal triangle. This gives me excellent straight line access and allows for easier shaping and obturation.

PREMOLAR ACCESS

Maxillary/Mandibular Premolars

Remember the earlier stated rule: Always expect 2 canals in premolars! Better stated: All premolars are guilty of two canals until proven innocent of 1.

MY TECHNIQUE: I use a #330L carbide bur and start the access in the middle of the occlusal table. I start with a conservative access oval shape 2-3 mm in depth. Most of the time I will "drop" into the pulp chamber with a #330L, especially in lower premolars (the easiest pulp chamber to access in the mouth). If after 2-3mm you are not locating the pulp chamber, then I recommend switching to a #1/2 or #1/4 surgical length round bur and turn the water off. Often I will use a #1/2 or #1/4 surgical length round bur on the maxillary premolars if I am getting too deep and have not located the canals. Drill slowly and carefully! ***TAKE YOUR TIME ON ACCESS.*** Have your assistant continually wash and dry the access so you can check and make sure you are in the right spot. Accessing can go good to bad in seconds if you are too aggressive. When in doubt rinse, dry and INSPECT! The mandibular premolars are usually fairly easy to access and treat. My opinion is that the maxillary premolars can be difficult to access and treat and are not easy as most think.

MOLAR ACCESS

Maxillary Molars

MY TECHNIQUE: I use a #701, #557, or Trihawk Talon #8 or #10 carbide shorty and start at the MB cusp 3mm from the mesial marginal ridge (MMR). I drill a line to the MB cusp area, then to the palatal cusp and then back to the MB and then carefully expand out to the DB cusp forming a triangular (sometimes it looks oval) access shape. Keep your access shape conservative and refine later as needed. I will access 3-4mm deep and then turn off the water and switch to a #557 surgical length carbide (SS WHITE) for the rest of the access. The majority of the time I enter the mesial pulp horn first because It's usually closest to the surface. Once I enter the MB part of the pulp chamber I will then remove the roof and locate the DB and palatal canals.

TriHawk Talon carbide bur

557 SL carbide bur

How do I find the dreaded MB2 canal?

The MB2 is usually "hiding" slightly under the mesial marginal ridge and just mesial from an imaginary line drawn from the MB orifice to the Palatal orifice. I gently remove a small amount of mesial tooth structure near the pulpal floor with the #557 surgical length bur to expose the MB2 canal. In some cases you will see an isthmus line from the MB1 leading to the MB2. In other cases, the MB2 is hiding under tooth structure that needs to be removed. After using a #557 surgical length carbide bur or a long diamond and have removed a little bit of the mesial wall, I switch to a #1/4 or #1/2 surgical length round bur and trough along the area just mesial of the imaginary MB-Palatal line. Most times, you will see dust collect in the MB2 line/orifice which will present as a white dot. I do not let my assistant rinse and dry when I see the white dust dot and take a short (21mm) #8 or #10 C file with RC Prep or ProLube and attempt canal negotiation. I will also use a Endo-3 or 4 (DentsplySirona) or a small ball or pear shaped ultrasonic tip to trough 1-2mm down from the MB1 to the MB2 area.

Remember that all molars are guilty of 4 canals until proven innocent of 3. Locating the MB2 can be a time consuming and frustrating adventure. I struggle everyday with MB2 location and negotiation. It is a difficult canal to locate and to deal with and that is why the maxillary first molar is the most common RCT tooth to fail in the mouth. If it fails, there is usually an apical lesion or Periapical radiolucency (PARL) located around the MB root. Please see ***THE LEARNING LESSONS: THE DREADED MB2*** book for more details.

Mandibular Molars

MY TECHNIQUE: Use a #701, a#557, or a TriHawk carbide "shorty" bur with water. I start 3mm from the mesial marginal ridge, centered buccal-lingually and drill a straight line from the mesial to the distal and then expand the prep to form a triangle shape with the apex at the distal orifice. I initially keep the access prep conservative and then later will open the shape from a triangle to a rectangle if a second distal canal is suspected. Usually a lower molar has a second distal canal if one distal canal is off-centered and either in line with the MB canal or ML canal. If the D canal lies

between the two mesial canals then its less likely that there is a 2nd D canal. After 3-4mm of drilling toward the pulp camber, I switch to a #557 surgical length carbide bur and turn the water off for better visualization. My assistant continues to suction the tooth dust which cuts down on the smoke and smell. Remember that a surgical length bur keeps the head of the hand piece away from the tooth and allows me to see exactly where I am drilling. Always expect 4 canals and when in doubt open up the access for better visualization and straight line access.

MB - ML trough

It is rare, but a middle mesial canal can lie in the isthmus region between the MB and ML canals. I rarely find this clinically but see this in lectures and on chat groups. I recommend troughing 1-2 mm with either a #1/4 surgical length round bur or an Endo 4 ultrasonic tip (My favorite tip-DentsplySirona). Even if you don't find a middle mesial canal, I noticed by troughing, I open up the isthmus region coronally and this increases tissue removal and bleach contact throughout the procedure.

PART 2 - CORONAL NEGOTIATION Coronal Negotiation

Let's walk through a case together. Tooth #19 (mandibular left first molar): 4 hyperemic canals are located with a sharp Endo Explorer (DG-16) (Dx: #19 Irreversible pulpitis - Symptomatic/Symptomatic apical periodontitis) and the pulp chamber has been deroofed.

Here is my technique (Endo Playbook) that I feel gives the best predictability to perform E³ Endodontics:

I place an EndoRing onto my left ring finger. I have the K files organized from left to right #6-35 and a glob of file lubricant (RC Prep from Premiere or ProLube from DentsplySirona) on the ruler part of the ring against the plastic wall. You can also have your assistant wear the ring on their hand and hold it out for you when you need a file. If I need a different file we have circular sponges in plastic containers with larger K files, C files (stiff files), Flexo files (flexible stainless steel files), Sure Flex (Nickel Titanium hand files), and Hedstrom files all labeled for ease of selection. I recommend having a set-up of hand files #6-35 in a sponge always ready to go so that if a restorative procedure turns into a root canal it will just take moments to switch gears and set-up. Wait and open new NiTi files when you are ready to start shaping so in case you don't use them they're not sterilized over and over again.

The first step after access is to irrigate the bleeding pulp chamber with either 5.25% NaOCL or a quick water rinse and dry by your assistant. Now take a #10 C, 21mm length hand file and check for coronal/middle 1/3 negotiation. I am not trying to proceed to working length at this point. All I am doing is checking that the canals are open in the coronal 1/3. I am also working to pre-flare the canals to obtain ***WORKING WIDTH*** prior to the coronal flare. I take the #10 C, 21mm length file and dip it into RC Prep or ProLube and thread it about 10mm into each canal. All I want is to check that the canals have a free and clear coronal slide path (coronal negotiation) and to obtain ***working width*** for the rotary orifice opener. I start with a #10 C shorty file (use lot's of RC Prep) and make sure it is LOOSE (25 push/ pulls or up/downs) in the coronal and middle 1/3's of the canal (10-15mm). It should be a slip and slide in there! The coronal negotiation takes about 15 seconds total but is important because if you skip this step and just go to an orifice opener (Nickel-Titanium rotary or Gates Glidden) you can coronally ledge or separate an orifice opener and that my friend is not a good way to start the root canal. That is equal to the very fist snap of the Broncos vs. SeaHawks Super Bowl when the center snapped it over Peyton's head into the end zone.

PART 3 - OPEN ORIFICE (Coronal Flare)

I use and ***LOVE*** the ProTaper Gold SX orifice opener (DentsplySirona) at 300 RPM's for my initial coronal flare. The Vortex 25/08 orifice opener is also a good file. Run this at 500 RPM's. These are Nickel Titanium rotary orifice openers and have new and improved metallurgy which makes them hard to separate. ***Place passively into each canal and run down to the same level or shorter as the loose #10 C file (10-15mm on average).*** As the orifice opener is lifted up and out of the canal, brush in a outward direction away from the furcation. So if it is the MB canal, brush the orifice opener upon exiting to the MB wall, ML- Brush to the ML wall, D- brush to the D wall. You got it! This is a light brushing with the main goal of opening up the orifice. I usually stop here but sometimes I use Gates Glidden drills at 1700 RPM and GENTLY open the orifice in a brushing manner with the #2 (usually in tight access' or 2nd maxillary molars). I never go more than a bud length deep (about 3mm) with the Gates Glidden (careful not to go too deep with the Gates Glidden Drills because it removes unnecessary tooth structure and gives you an upside down coke bottle shape.)

Why do we perform an ***OPEN ORIFICE*** (coronal flare)?

1 Removes bulk coronal tissue (I have pulled out major pieces of nerve just with the ProTaper Gold SX and Vortex 25/08 orifice openers).

2 Helps obtain straight line access.

3 It allows easier access and makes it easier for you to place the hand and NiTi files into the canals during the RCT. During a root canal, hand and NiTi files, paper points, and gutta percha are placed into each canal on average 20-50 times.

COACHES TIMEOUT
Don't work through DOTS! Open up the orifice.

4 Allows space for the NaOCL to start working and dissolving the pulp tissue, lubricating the canal and killing microbes.

5 Less stress on the hand and rotary files because they do not bind as much in the coronal or middle 1/3.

6 Gutta percha points are less likely to bind coronally with an open orifice.

IRRIGATION TIMEOUT = Why use 5.25% NaOCL?

I use 5.25% NaOCL because it ***DISSOLVES PULPAL TISSUE, KILLS MICROBES and LUBRICATES*** the canal for hand and NiTi filing. ***DO NOT*** use anesthetic, water or hydrogen peroxide as your main canal irrigation. These irrigants are not either anti-bacterial or do not dissolve pulp tissue. ***Endodontic treatment is a 2 part process: chemical debridement and mechanical debridement.*** Because of the isthmuses, lateral canals, secondary and accessory canals, and the ***COMPLEX DEEP ANATOMY***, we are unable to completely instrument all spaces and walls of a root canal system. This is why the chemical debridement is important. We must rely on our chemical irrigant to dissolve tissue and kill microbes in the complex deep anatomy. It was found in a study by Ove Peters that we only touch 65% of the walls with our hand and NiTi filing. Cliff Ruddle stated that he did a study where he found we can touch 80% of our walls if we gently brush laterally to the outer wall on the outstroke with our NiTi files (rotary/reciprocation). I have not read this study but do believe that it's possible. (Sidenote: Dr. Cliff Ruddle is an excellent endodontist and one of the best educator's in the world).

Can you cut the bleach to 3 or 4%? (Bleach piranhas)

It is okay to dilute the beach to 3% or 4%. Right before the RCT, place a 1/2 cup of 5.25% or 8.25% bleach in a Dixie cup and add a 1/2 cup of water and mix. Remember that bleach is light sensitive so if you make 5-10 bleach syringes for the day store in a dark drawer. Also, new Chlorox has a higher concentration of bleach (called Concentrated Chlorox Regular Bleach (8.25%)). If you can find Chlorox at 5.25% or 6% that it is the best brand of bleach to buy. At this time I do not recommend using the new super concentrated bleach (8.25%) until we know that the higher concentration is safe. I don't think it would cause any problems but the majority of studies were done with 5.25% or a lower bleach concentration. I use 5.25% or 6% concentration because I want as many bleach piranhas in the canals as possible. I would rather have 6 bleach piranhas in the canals eating pulp tissue over 3 bleach piranhas. Also, if you inject 3% or 6% Bleach into the apical tissue under pressure there will be a terrible sodium hypochorite

accident. The lower concentration is not going to prevent a sodium hypochlorite accident.

COACHES TIMEOUT

Place 5.25% NaOCL in the pulp chamber as soon as possible and replenish it often. You want NaOCL to work in the root canal system the entire time you are filing and shaping.

BOTTOM LINE = USE BLEACH AS THE MAIN IRRIGANT

How to irrigate

Use a 12 cc syringe with a side vented 25, 27, or 30 gauge needle (the syringes can be cold sterilized and used over and over again until the rubber stopper sticks). Place the needle no more than 1/2 way (working length is pre-estimated) into the canal in a ***NON BINDING MANNER*** (the needle is completely loose) and ***GENTLY IRRIGATE BLEACH***. Never force it and always use a light hand.

SIDENOTE: I prefer side vented 25 or 27 gauge irrigation needles. The 30 gauge works well but the bleach comes out much slower (this is much safer). ProRinse needles from DentsplySirona are excellent irrigation needles. Vista also carries good side vented irrigation needles called Vista-Probe.

Estimated Working Length

Obtain an estimated working length from your traditional radiograph by holding a #10 K file up to each canal and curving it to match the canal outline. Place the stopper at the cusp tip. This is a very rough estimate but it gives you an idea of where to start. If you have digital radiographs, use the software measurement tool. This can be pretty accurate, but make sure that the measurement tool has been calibrated.

PERSONAL FOUL

Unnecessary apical roughness - The #10 file extended 8mm into the apical tissue on the working length radiographs. I have done this many times when I didn't take the time to get an estimated working length- 15 yard penalty.

Should I use 21mm or 25mm length hand and NiTi rotary/reciprocation files?

This is a personal preference. I use mostly 25mm length hand and NiTi files and I am treating difficult, tight 2nd molar cases. I always have 21mm hand and NiTi files ready for the limited opening and exceptionally tight cases. 95% of the time I only use 25mm length files. Some cases I will place a small complete file curve on a 25mm hand file to place it easier into the MB canal of upper and lower molars.

My associate, who has great hands, uses a lot of 21mm hand and NiTI files. It is all preference. The average length of a canal is 21mm and I run across many that are longer. This is why I prefer the longer files because I am able to run the files right to the stopper (working length) and I feel that it is easier and more precise than running it 1-2mm past the end of the 21 mm file length to get to 22 or 23mm.

PART 4 - NEGOTIATION TO PATENCY

Here we go, this is the time to clutch. Put on your game face and work those files to patency, but be gentle and careful and ***never force a file***. This is the time to follow Zen Endo principles and play with gentle hands; hands that do not drop the football or fumble. Avoid the turnover and avoid the pain of an iatrogenic mistake because I'm about to discuss the most important part of the root canal game, ***NEGOTIATION TO PATENCY!***

I start with a little bit of bleach in the canals and take the #8 or #10 K file and dip it into the RC Prep or ProLube that is on my EndoRing and I gently see what the canal will give me. I don't initially place an apical bend on the files and will do this later when it is needed. Usually I start with a #10 K file unless the estimated working length appears to be long (23mm +) or the roots have a fairly difficult curve. In these cases I start with a #8 K file.

Use ***A LOT*** of ProLube (or RC Prep) when negotiating to patency and obtaining an open glide path. It can't hurt and only helps! In about 70% of my cases I am able to get the #10 K file down to estimated working length on at least one of the canals and feel it pop through the apical constriction. If this is the case, I immediately attach the lip clip of the Root ZX or ProMark electronic apex locators (EAL) and attempt to obtain a confident, accurate working length reading (more on this later). If I am unable to advance the #10 K file to the estimated working length or I don't feel the "***patency pop***" then I move down a file size to an #8 K file. I place a small 45º apical bend (I use my fingernails), dip the #8 K file in ProLube, place a small apical bend (I use my fingernails) and GENTLY see what the canal will give me. Make sure that after you place an apical bend on the file that you adjust the rubber stopper line so it is in line with the apical bend. This way once you do obtain patency you can tell which direction the canal curves and you will be able to find and replicate that curve again with a larger #10 K file. Usually, I can find patency around a small apical curve by moving the #8 K file with a small apical bend around in a very slow 360 degree manner until I find the "keylock" or the "patency path" around the curve. I call this "taking the file for a walk," just like you walk the dog around a cul-de-sac. I now gain patency in the difficult canal and am starting to feel pretty good that I have nailed 2 of the 3 canals. If the #8 K file with a small apical bend does not advance to the estimated working length then I will remove the file and move down. I do have some slight worry as I grab the #6 K file and dip it into Lube (RC Prep) and place it in the tight third canal. In some cases the #6 will go to length and then I will gently work the #6 file up and down 50 times or micro push/pulls (SMOOTHIES) until it's loose at the estimated working length then do the same for the #8 and then the #10 K file (50 smoothies). After this I obtain an accurate working length measurement. Sometimes a canal or two just won't allow you to get to working length. What do you do? Panic? I can't lie, I do a little. You may see a bead of sweat form at my forehead. Practice your Zen Endo principles. Take a breath, relax, take it slow, be easy, be gentle, be the file, be the canal, yes all at once.

So what do you do? I let the canal "soak" and come back to it later. Start working on the canals that you have presumed patency and obtain an accurate working length and then move to an open glide path. I will come back to the tight canal in about 5-10 minutes and usually I am able to negotiate to estimated working length and obtain presumed patency because some of the apical tissue has loosened or dissolved from the bleach piranhas eating it.

What about the cases where you can only get 1/2 way down the canals?

These are the tougher cases and require a very delicate touch. Be gentle, don't hurry, go slow and realize you are heading to the 2 appointment zone. This takes the pressure off of you and allows you to be delicate and careful when attempting to negotiate. ***THE GAME IS WON OR LOST RIGHT NOW!*** If you can't negotiate to patency, you can't fully clean the canal, and if you can't fully clean the canal, you can't be sure that the apical redzone (1/3) is clean. ***PRAYER OF REID:*** Dear God - Please give me, your faithful disciple, a pass on this one. Just one pass. Let this case heal in which I was not patent and I won't sin again.

PERSONAL FOUL

You lost your patience. Frustration took over and you forced a #10 K file to "estimated" working length and now you are hitting a "brick wall" and have no stick. 15 yard penalty for ledging the canal.

In these cases, where I am unable to negotiate to patency and obtain an accurate working length, I make sure that I slow down and allow enough time for the chemical debridement to do its thing. I make sure I have plenty of bleach in the canals and I work a #6,8,10 and #12 1/2, with ProLube/RC Prep, down to what the canals will give me. I am being very careful here to not yet push apically. All I am interested in is getting some lateral space in the coronal and middle 1/3 to allow the bleach to dissolve and loosen more tissue. Once I have an adequate 1/2 to 3/4 of estimated working length or mini glide path, I take a ProTaper Gold Shaper 1 (purple band) or a ProTaper Next X1 (yellow band) rotary file or a WaveOne Gold Primary reciprocating file and place it in the canal and shape to just short of my 1/2- 3/4 working length glide path. Irrigate with bleach (always) and then recheck with a #8 K file and see if you are able to get a stick in any of the

canals. Notice that I still have not yet recommended switching to a C file (stiffer file). We will do that in a moment. I like K files in these cases because I am worried about ledging with the C files. Remember delicate, artistic fingers produce great results. If you feel a stick then gently push apically and work the stick. Usually this is a collagen apical plug of pulp tissue and small apical picking will do the trick. Another possibility (more common) is that the canal has an apical curve. This is the time to place a small apical bend on the file. I use my finger nails to place small apical bends on the file. There is a file bender available for $100+ if you desire. It does do a good job but I have not used it for 10 years. In a lot of cases I am able to gain patency by placing a small apical bend on a #8 or #10 K file and carefully moving the file around like you are a picking a lock trying to find just the right spot (or take the file on a walk around the apex and look for the opening). Once I do achieve patency, I perform 50 micro push/pulls and then I look to see which direction the apical bend points. Always place the stopper groove or line in line with the apical bend so that you know which way the apical curve points. Once I have achieved patency with a #8 K file, then I place a small apical bend on a #10 K file and work that file to patency and perform 50 micro push/pulls until its loose. I then check for an accurate working length with the ProMark or Root ZX II apex locator.

What if I can't get patent in one or all the canals?

These are the frustrating cases that make you wonder, "What on God's green earth am I doing? Why am I doing this again? Some ginger told me I could do this." Don't despair, there is always a way. In these cases, I do what I can and get a mini glide path up to the length that the canal will give me (but not ledging) and then I "force" calcium hydroxide down the canal. I actually bind the needle and extrude calcium hydroxide (Ultradent XS) GENTLY into the canal and close it up with a blue or yellow sponge and cavit. I do this for 2 reasons: 1) I am able to take a breath because I'm starting to get frustrated with the tooth and 2) CaOH2 seems to "soften" up the pulp tissue and the dentinal walls and the MAJORITY of the time I am able to break through the "block" and achieve patency during the 2nd visit. Again, this book is purely focusing on initial root canals not retreats. Retreat patency is an entirely different game although the approach is not much different. ***See The 4 Quarters of the Simple Retreatment Playbook***.

TURNOVER

FUMBLE on your 25 yard line. The #15 K file was forced down to WL and you apically ledged!

Negotiating to working length is a delicate process. Start with a #8 or #10 K file, use lots RC Prep, and let the canal "show you the way" like a safari guide. There are days when the canal and file work in unison and appear to be good friends. The file easily slides down the friendly canal and you wonder why your not an endodontist. And then there are days when the file and canal are mortal enemies and you wonder why God would torture you with this canal design and if the devil himself is inside this tooth and if your endodontist is still in the office or golfing. These are the cases that you must apply the principles listed above and in most canals you can achieve full negotiation. I struggle with difficult cases every day and if I follow these negotiation guidelines things tend to work out 99% of the time. Ill take that.

THE SECRET NEGOTIATOR:

PROTAPER GOLD S1- THE MAGIC FILE

The ProTaper Gold S1 is in my opinion the greatest NiTi file of all time (in second place is the WaveOne Gold Primary reciprocating shaping file). It is truly a magic file and I use this every day in my practice to obtain an easier path to patency. This one piece of highly engineered gold nickel titanium has made me a better endodontist and has given me the opportunity to negotiate to patency much simpler in medium to difficult canals.

The secret technique of all negotiation techniques

1 Complete coronal negotiation and the coronal flare

2 Take a #10 K file, dip it into RC prep and see what you can get. How far will it go down the canal? 20mm. Great. No reason to push it or attempt negotiation to patency. Why? We have a secret weapon in our arsenal. A #1 draft pick: the ProTaper Gold S1.

3 Use the ProTaper Gold S1 at 300 RPM's and place it in the canal. Let it advance down the canal until it engages and starts to cut the canal wall. Allow the file to engage and disengage 4-5 times (slow up and down movement), brushing gently to the outer wall on the disengagement. Remove it, wipe the clogged flutes with an alcohol 2x2 and then irrigate with bleach.

4 Go back in with the ProTaper Gold S1 and engage/disengage 4-5 times until you advance to 20mm or slightly less. Remove the file and clean the flutes free of debris. Irrigate out all the debris with bleach.

5 Now attempt to negotiate to patency with a #10 K file. You will find that the magic in this technique occurs now: the #10 K file usually slips effortlessly to working length and pops through the foramen to patency.

6 Hook up the EAL and establish an accurate working length.

7 Obtain a loose #10 K file to working length (50 smoothies)

8 Continue shaping with the ProTaper Gold S1 (Tip size is #18) to working length (this is your glide path) and then advance through the ProTaper series or after S1 switch to the WaveOne Gold Primary and shape to length.

The key to this technique is that the ProTaper Gold S1 opens up the coronal and middle 2/3rd's of the canal and allows the #10 K file to slide with little resistance to the apical 1/3. I have used this technique on almost every standard case in my practice for the last year and a half and it has worked like magic for me almost every time. Even if I still can't negotiate to patency with a #10 K file, I will step down to the #8 K file with an apical curve and will then usually get my working kength. Even if I still do not obtain patency with the #8 or the #6K file I will continue to shape down to as far as the #8 or #10 K file advances. And then usually the #10 K file will advance deeper after the ProTaper Gold S1 has cut the shape. So in essence, after initial shaping with the ProTaper Gold S1 the #10 K file will slide another 1-2mm and usually out the foramen to patency.

PART 5 - ACCURATE WORKING LENGTH

The game continues. The 2nd quarter is ticking away and this game is yours to win. All you need to do is achieve an accurate working length, one that you are confident will bring you that perfect fill. 2nd you will need an open glide path and then proper shaping with Ni-Ti files and finally obturation. But the game is here and now and what happens in the 2nd quarter (access, open orifice, negotiation to patency, accurate working length, and open glide path), tends to be the most important part of this game.

Once I feel that I have negotiated to my estimated working length or have felt the small "pop" of the file through the apical constriction I am ready to check for an accurate working length. I use an electronic apex locator (EAL) called the ProMark (DentsplySirona) or the Root ZX II (Morita). It is very accurate with a 95-97% accuracy within 0.5mm of the apical minor constriction. EAL's are much more accurate than working length radiographs and I highly recommend using an EAL to obtain working length and radiographs to confirm (if needed).
Turn the ProMark or Root ZX II on and then place the lip clip (grounds the current) onto the lip opposite the treatment side (there is open space on the side away from the rubber dam clamp where it is not so tight). Make sure that the lip clip engages some moisture of the oral cavity. The older population may be on various medications that cause dry mouth so in these patients, I spray the lip clip with a little water and then clip on the lip. Does this matter? I don't know, but I am able to achieve working length consistently in these individuals.

Now either my file is already in a canal, because I felt the "pop" of the apical minor constriction or feel that I am right at my estimated working length, or I am placing it back in to the estimated working length. Make sure all the connections are tight and

that the lip clip is seated all the way into the cord. The ProMark and the Root ZX II are sturdy but the cords and connections can wear out and may need to be replaced after a few years. If your EAL stops working consistently, either you suck at getting working length or your cords and connections are bad.

Once I connect the ProMark or Root ZX II file clip to the hand file in the canal, I look at the reading. Usually the reading at this point is not accurate because the chamber is full of a bubbling mixture of bleach and RC Prep or ProLube (remember when negotiating to estimated working length use ALOT of LUBE. LUBE IT UP!). I take my air/water syringe and wash out the chamber, with everything connected, and ***GENTLY*** dry the pulp chamber with 2 seconds of air at a 45 degree angle to the access walls. If you remember dental school, you are never supposed to blow air into a canal because an air embolism could result. I am very careful and have never seen any issues with this. I do not blow the air directly into the pulp chamber but at a 45 degree angle, gently, and only for 2 seconds. You can also remove the majority of bleach from the chamber with the high speed suction prior to full negotiation. This is recommended in a lot of, "How to" articles that I have reviewed. Then you do not have to blow a few seconds of air into the pulp chamber.

A somewhat dry ***pulp chamber*** is the key to an accurate working length. Notice I didn't say dry canal but somewhat dry PULP CHAMBER. I can also use the macrocannula of the EndoVac to presuction out the pulp chamber prior to the EAL reading with my #8 K or #10 K file. With the ProMark/Root ZX II reading and all EAL's, you want to exit the foramen by 0.5mm and see the "long" reading (ProMark- Red Circle/ Root ZXII- Red zone). Then slowly bring the file back into the canal and watch and see where the reading goes from RED (apical tissue) to GREEN (in the canal) for the Root ZX II or from the red circle to the fat red line for the ProMark. Right when the reading goes from red to green (red-green border) is your sweet spot. Place the stopper flush with the MB cusp (reference point) and remove the file and measure the accurate working length. If the Root ZX II is giving odd readings and "jumping around" go to a larger file. In other words if you are using a #10 K file try a #12 or #15 K file. You will see this works in canals that have a larger foramen and necrotic cases with a periapical lesion and a resorbed apex.

I recommend keeping the lip clip attached (if its comfortable) and the ProMark/Root ZX II on and checking your working length a few more times during the procedure. I recommend checking after the glide path and prior to mechanical shaping and once during shaping. My associate also checks prior to obturation. Some may say this is overkill but when you nail the working length you usually end up with a fill that is right on the money. The working length can shorten during the procedure because mechanical shaping will slightly straighten a curved canal.

Reference Point

Method #1 = I always use the incisal edge for anteriors, the B cusp for all premolars and mesiobuccal cusp for all molars. **Method #2** = My associate uses the corresponding canal and cusp for the reference point. So the reference point for the DB canal is the DB cusp, and the MB canal is the MB cusp, etc. **Method #3** = In residency, we were taught that the lingual or palatal cusps were the recommended reference points but allowed to decide for ourselves. There is no right answer. I like the MB and B cusp for all my posterior reference points because I can always see it when I am filing. Try all three methods and see what you like the best.

PART 6 - OPEN GLIDE PATH

We are nearing the end of the 2nd quarter. We have an opportunity to go to half time with the game in our hands. If you can obtain an open glide path to at least a size #15 then you can "own the canal" and win the game right here in the 2nd quarter. The majority of the All-Pro endodontists agree that creating a slip and slide glide path is HUGE to "owning" the canal. If you can get to the end and open it up a bit (open glide path), you will own the canal. Always use an EDTA/ Chelating lubricant like RC Prep (Premiere) (My favorite), ProLube, Glyde (DentsplySirona)= 2nd favorite, FileEze (Ultradent), SlickGel ES (Sybron), etc to help you achieve full negotiation and an open glide path.

I use the phrase "open glide path" because too many times in workshops I see tight, constricted glide paths.

There are a number of excellent techniques to achieve a slip and slide glide path. I find that for the most of my cases (and these are typically the more challenging ones) the ProGlider NiTi glide path file works extremely well and is easier, quicker, and safer than hand files in obtaining an effective and efficient open glide path. In saying that though, there are some quality rotary glide path files on the market. DentsplySirona makes the NiTi rotary the ProGlider rotary path file (16/.02 variable taper) and the WaveOne Gold Glider (15 tip size, variable taper). In the following paragraphs I am going to describe 2 glide path techniques that I use and find very effective.

Hand File (K File) Glide Path

Recap: All the canals are located (easier said then done), the orifi are opened, we have negotiated to patency, accurate working length achieved and now we are ready to create a slip and slide glide path. The glide path goal is to at least get a loose #15 hand file to working length and remain patent. After obtaining working length with the ProMark/ Root ZX II and confirming (if needed) with straight and angled PA radiographs, I go back with my #10 K hand file and dip it into RC Prep. I want the #10 K file " super" loose at working length and patent. All of this work is done with 5.25% NaOCL soaking in the canals. Always use an EDTA/ Chelating lubricant like RC Prep (Premiere) (My favorite), ProLube, Glyde (DentsplySirona)= 2nd favorite, FileEze (Ultradent), SlickGel ES (Sybron), etc to help you achieve full negotiation and an open glide path. I use the phrase "open glide path" because too many times in workshops I see tight, constricted glide paths. I now check all the glide paths prior to handing out the NiTi rotary or reciprocating shaping files because I find that the dentists were at working length and patent, but the #15 K file was tight at working length. The #15 hand file should be somewhat loose prior to introducing NiTi rotary files. This is the "open" glide path concept.

Hand File Open Glide Path: #10 K file with RC Prep to working length and loose. Perform the "push/pull" technique 50 times until is it super loose at working length. Irrigate with 5.25% NaOCL, confirm patency and then re-irrigate. Irrigating initially cleans out the file debris and after confirming patency its recommended to re-irrigate to flush any new canal debris. I now take a #12 or #12 1/2 K hand file and perform the "push/ pull" technique until that is loose, irrigate with bleach, check patency with a #10 K file and then advance to the #15 K file. Once the #15 K hand file is loose at working length I am ready for NiTi shaping.

There are a TON of iatrogenic mistakes that occur at this point. Most clinicians go from a #10 K file to a #15 K file and find that it is very tight and difficult to fully negotiate down to working length. They then start to force or push the #15 K file possibly causing an apical tissue plug or an apical ledge and block lateral and/or accessory canals. This all occurs because the tip diameter increases by 50% from the #10 to the #15. So help yourself, and decrease this diameter by using a #12 or #12 1/2 K hand file. The #12 1/2 K (Henry Schein) file is colored brown where the #12 K file (Mani) is colored light purple. There is also a #17 1/2 K file that can ease the transition from the #15 to #20 K file. I don't use this file often unless it is a very, long, tight, curvy canal. In these cases I typically use the rotary ProGlider (DentsplySirona). If you don't use the ProGlider to obtain your Open Glide Path than I believe in the #12 file and feel that this will help you immensely

in achieving your glide path in an efficient and predictable manner. The #12 file will reduce your root canal turnovers and personal fouls and will make you look like Jimmy Garoppolo.

What if you are unable to get around the last 2mm of an apical curve? How do you shape the canals?

Obtain your "glide path" just short of the apical curve. Be careful not to ledge, so DO NOT PUSH the file, at least not yet (there is a time to push or get "rough" with the apex but this is not the time). Take your time and allow bleach to soak and dissolve tissue and open some canal space. Use rotary/reciprocation files just short of your "glide path" and short of the apical curve. Irrigate with bleach and check patency with RC Prep and a #8 K hand file with a small apical bend. If it won't move around the curve yet, no problem. Try a #6 K file with an apical bend and RC Prep. Try to find the slot or curve and make sure the line on the stopper is lined up with the apical bend on the file so that if you do achieve patency you will know which way the canal curves. These last two techniques really open up the coronal/middle/and part apical areas of the canal and allow the bleach to get down into the system and perform its job of dissolving tissue. Usually after 1 or 2 passes with mechanical files, lots of RC Prep, and a small apical bend on the file, I am able to move around the curve to working length. If I didn't have an accurate working length prior, and was just estimating, then I leave the #8 K file at "length" and connect the Root ZX II. I will check the reading to see if I am at the actual working length. If so, I still do not remove the #8 K file until I have accomplished 50 ***VERY SMALL*** push/ pull strokes (smoothies) to open up the 2mm apical curve. I will then remove the file, irrigate with bleach, place a small bend on a #10 K file, gain patency and then perform 50 ***VERY SMALL*** push/pull strokes in the last apical 2mm. This serves to open up the apical 2mm and smooth the curve even more. On the ***VERY SMALL*** push/pull strokes I like to use both hands. I use one hand (right- because I am right handed) to perform the small push/pull strokes and the other hand helps brace and anchor the hand performing the push/pull strokes. I use my thumb and index finger and place it over the opposite hand thumb and index finger and then push/pull together. This helps gives more leverage and prevents the file from exiting coronally from the apical 2mm curve area.

Rotary Glide Path (MY FAVORITE)

The second method of achieving a predictable, open glide path is by using rotary or reciprocation NiTi files to achieve a nice, smooth slip and slide glide path. There are a number of glide path files on the market. The two that I prefer are the ProGlider or the WaveOne Gold Glider (DentsplySirona). I use these glide path files on LONG, TIGHT, CURVY canals and ***only after I have a loose #10 K file to working length***.

These glide path files RARELY separate and make glide path creation easy and quick. ***The KEY here is you MUST HAVE A LOOSE #10 K FILE to working length PRIOR to using these glide path rotary files (I will keep saying this until you apply it in practice)***. Once the #10 K file is loose to working length, then proceed with the ProGlider or WaveOne Gold Glider. These two files are extremely efficient and safe at cutting an open glide path. It's actually quite remarkable how easy it is to create a nice open glide path in a very efficient manner. It may take more than one time to get to working length so irrigate often, check patency and follow Zen Endo principles: Easy, breathe, don't push but brush, and be the canal. "Be a brusher, not a pecker" (Cliff Ruddle). Also, BONUS TIME, these files often pull out a big plug of apical tissue.

PROGLIDER TECHNIQUE

The technique with the ProGlider is as follows: Run at 300 RPM's and place into a canal that has a ***LOOSE #10 to working length***. Let it run naturally down the canal and allow it to engage the canal wall and after an engagement of 3-4mm, disengage from the canal wall about 1mm back and then engage again slowly advancing down the canal. Engage/ Disengage 4-5 times and then pull the ProGlider out of the canal, wipe the flutes with an alcohol gauze and irrigate the canals with bleach and check patency with a #10 K file. Follow this technique until the ProGlider cuts an OPEN GLIDE PATH to the ACCURATE WORKING LENGTH.

WAVEONE GOLD GLIDER TECHNIQUE

This technique is the same as the ProGlider except this file reciprocates. Allow it to engage/disengage 4-5x down the canal, pull-out, wipe the file clean, irrigate the canals with bleach and check patency with a #10 K file. Pass #1. Continue doing this until you reach working length (usually in 2-3 passes).

You have a chance to own this tooth and gain huge momentum in this root canal game in the here and now. So right now, at the end of this 2nd quarter of the root canal game, own the glide path. Dominate it and open those canals up for the bleach to flow, the nickel titanium to shape and the gutta percha/ sealer to seal and heal.

Finally we are ready to move to the third quarter of the root canal game. We have done the pre-work, the hard work necessary to shift the momentum to our favor. Its now time to score a touchdown with our nickel titanium shapers. These new rotary and reciprocation nickel titanium files are so well made and designed with such high quality material that you are absolutely set up for shaping success. If you clearly win the first and second quarters and the follow the game plan you will easily score a TD with the NiTi shapers. We have driven 70 yards and its now 1st and Goal. We have 4 downs to cross the goal line. Let's score and not just win but dominate this game.

CHAPTER 7 HALF-TIME

EXPAND?

Let's review some 2nd quarter key concepts before we move forward to shaping the canals.

KEY TIP #1 - Locate all the canals. Start with a short carbide bur. When the head of the hand piece blocks your access vision, switch to a surgical length #557 bur.

KEY TIP #2 - Use a #10 C 21mm file with RC Prep to initiate coronal negotiation into each canal.

KEY TIP #3 - Use a ProTaper Gold SX orifice opener to perform a coronal flare (open orifice).

KEY TIP #4 - Use a #10 K file with RC Prep to negotiate to patency. Place the file into the canal, gently reciprocate through any tightness and then smooth out any canal constriction. Continue to advance down the canal until you reach estimated working length or you feel the file pop out through the foramen. If the file gets stuck, pull it out and move to #8 K file with a 45 degree apical bend.

KEY TIP #5 - Obtain an accurate working length with an EAL (ProMark or Root ZX II).

KEY TIP #6 - Make sure the #10 K file is LOOSE at working length.

KEY TIP #7 - Use the ProGlider or WaveOne Gold Glider NiTi files to obtain a nice open glide path. 4-5 engagement/ disengagements= Pass #1.

KEY TIP #8 - I like to use the ProTaper Gold S1 to really open the coronal/middle 2/3's. I use this a lot as my "glide path" file.

KEY TIP #9 - Continue to irrigate with bleach and check patency (recapitulate) often during this time.

GO BACK AND REVIEW THE 2ND QUARTER KEY CONCEPTS AND MAKE SURE YOU FEEL CONFIDENT IN THE ROOT CANAL GAMEPLAN AND PLAYBOOK.

CHAPTER 8
THE THIRD QUARTER: NICKEL TITANIUM SHAPING

KEY CHAPTER CONCEPTS

This is my favorite part of the game. I truly believe in the shaping files that I am going to discuss. The companies have set us up for great shaping success as long as you follow the 1st and 2nd quarter game plan. Yes, these files are pricey, but we must change our mindset on this and select a new file for every unprepped root canal system. Build the price of the file into your fee. This is the best way to change your mindset and stop stressing over the price of rotary/reciprocating files. ***Again, the best way to avoid an iatrogenic incident, read file separation, is to #1 follow the game plan of the 1st and 2nd quarters and to #2 use a new file for every root canal***. Yes, I am advocating SINGLE USE rotary/reciprocation files. So first, you cannot enter the 3rd quarter of this game unless you have finished the first and second quarters. This is just how sporting events work. Use the first and second quarters to build momentum and a lead so that by the time the 3rd quarter (shaping) and the 4th quarter (obturation) hits, you are cruising. Spend the time in the first half scoring and dominating so that the 2nd half is mellow and stress free. Maybe you can even put in your second string (just kidding).

So we have achieved our 2nd quarter goal of an ***OPEN GLIDE PATH*** to at least a size #15. Later on in the chapter I will discuss 4 different rotary/reciprocation files that I mostly use and share my two favorites the ProTaper Gold rotary system and the WaveOne Gold reciprocation file system (DentsplySirona). With these two systems, along with K hand files, you can shape any canal safely and effectively.

SHAPING PRINCIPLES

Always use rotary/reciprocation files in canals that are irrigated and full of 5.25% NaOCL (bleach). All rotary and reciprocation file systems have a certain feel and signature to them. I will describe each system that I use, the signature or feel of the file, and the best way to use each system. But first I want to discuss general shaping principles that apply to any rotary/reciprocation file system.

With all rotary/reciprocation systems you must follow these ***4 core principles of shaping***:

1 Gentle, Gentle, Gentle! Patience, Patience, Patience! ZEN ENDO (Get in your Zen while shaping) = you do not have go for the touchdown, homerun, or goal all in one shot (1 pass). It may take 4-6 passes before the file shapes to working length. In other words you don't have to score on 1st down. Run a few plays, gain a few yards and then put the ball in (shaping to working length).

2 Place the file in the canal freely and with straight line access and carefully so it doesn't "catch" or grab the side of the canal. No need to place extra stress on the file by placing it at an off angle where its already bent.

3 Brush with the file. "Be a brusher, don't be a pecker" Dr. Cliff Ruddle. You are an artist wielding a "paintbrush." Don't slap the paint on the canvas; use gentle brushing strokes and GENTLY brush to the outer wall on the outstroke (when you are moving back out of the canal or exiting). This creates lateral space and allows better mechanical shaping, chemical cleaning, and easier obturation (THE CONE FITS!)

4 If the file binds or stops in the canal remove it immediately. Irrigate with 5.25% NaOCL and check patency with a #10 file. If there is any type of ledge or roughness then hand file to your glide path or one file higher (#20). DO NOT push the NiTi rotary/reciprocation file past the stoppage!

The best way to describe the shaping procedure is by the phrase, "***Engage, disengage, engage, disengage, engage, disengage, engage, disengage and out." THIS IS 1 PASS***. A pass is defined as 1 entry and 1 exit from the canal. You may engage and disengage the NiTi file 4-5 times while in the canal, but as soon as you fully exit the canal that is equal to a pass. Now re-irrigate with 5.25% NaOCL and check patency with a #10 K hand file to make sure the canal is still open and free of an apical collagen plug or mechanical ledge or pulp stone or some other debris. Patency means advancing the #10 K hand file 1/2 mm past the foramen (end of the electronic apex locator apex reading or in some cases the radiographic apex). Most times you can feel patency, but not always so we can't always rely on "patency pop" feel.

Typically, when you go back in after the first pass with your NiTi files, you will be able to advance deeper into the canal with the second pass, sometimes even shaping to working length. On easier cases, it will take me on average 2-3 passes to get to working length on all canals. On the more difficult, curved cases it takes on average 4-7 passes to shape to working length. On these cases I have my "Zen on" and I'm very very careful during the shaping process.

The phrase engage, disengage, engage, disengage, engage, disengage means that the rotary/reciprocation file is engaging the dentin of the canal wall. You will feel the file engage, bite, screw, or increase in workload as it advances down the canal. I let it engage into the dentin of the canal wall 3-4 mm and then disengage the file from the dentin by pulling back 3-4 mm (brush gently to the outer wall after you disengage) and then I go right back to engaging the canal and slowly advance a few millimeters down the canal. The whole engaging/ disengaging process is pumping the 5.25% NaOCL down the canal and also producing canal debris. Remember, this whole process is accomplished with a very light, artistic hand, in a gentle brushing stroke. While shaping, act like you're VanGogh and let your rotary/reciprocation files create beautiful abstract Ruddlesque shapes. After 4-5 engagements/disengagements exit the canal wall (outstroke) and brush to the outer wall, away from the furcation. So if you are shaping the MB canal, brush to the MB wall, the DB canal, brush to the DB wall, and brush on the outstroke of the disengage cycle and when you are pulling out of the canal. Irrigate with 5.25% NaOCL and check patency with the #10 K hand file. Continue this process until the rotary/reciprocation file reaches the working length. "Touch and brush" the apex 3-4x and on the outstroke brush in an outward fashion. Irrigate with 5-6% NaOCL and check patency with a #10 K file. The canal should be shaped and ***nearly*** ready to obturate. I sometimes hand file the apical 1/3 because in some canals the appropriate gutta percha cone does not slide to length even after NiTi shaping. Hand filing takes about 1-2 minutes to accomplish. So after re-irrigating and checking patency with a #10 K file, I move to a #15 and #20 K hand file and make sure those files slide easily to length. I then use #25 and #30 (if necessary) and file to working length. NiTi hand files which are very flexible are also a good choice to hand file the apical 1/3. The nickel titanium hand files are gentle on the apex and any apical curve and typically will not ledge but at the same time allow you to adequately shape the apical 2mm and later apical gauge. I used to use Hand NiTi but now mostly use K files for this process.

SHAPING PRINCIPLES - APICAL SHAPE

I typically shape the apical 2-3 mm of tighter, smaller, curvier canals to a #25 hand file. Any other "normal to larger" canals I like to shape the apical 2-3 mm to a size #25-30 or #35 in the palatal canals of upper molars or distal canals of the lower molars.

COACHES CORNER:

My final apical shape is typically the last shaping file to length; for example the ProTaper Gold F2 or the WaveOne Gold Primary (both #25 tip size)

This allows the appropriate gutta percha cone to slide to working length and gives better chemical and mechanical cleansing and debridement. Most of the mesial canals or distobuccal canals of maxillary/ mandibular molars will have an apical foramen size around #25 or #30 unless there is a periapical radiolucency (PARL) surrounding the root. If this is the case, apical resorption may be present and the foramen may be larger. I am wading in extremely controversial waters here on correct taper size for canals and correct foramen size. Endodontists fight and yell at each other over these specifics. I have sat in on the debates while a few specific endodontists use the ad hominem (to the man) fallacy (name calling) during the debate. Larger taper/smaller foramen vs. smaller taper/larger foramen? West coast or east coast endodontics? It sounds sometimes like two rival gangs fighting it out. The key is that they are both right. It just depends on the case. Sometimes I use

smaller taper and apically file what the foramen allows. Sometimes, I have a larger taper smaller foramen. The new answer is that we have excellent rotary/reciprocation file systems that adequately clean the root canal system in a mechanical fashion so that we can achieve excellent chemical debridement. Its a combo action of mechanical/ chemical debridement. Both need to be done in a high quality predictable fashion. With the advent of newer chemical debridement technologies like Photon Induced Photoacoustic Streaming (PIPS) and SonEndo's Multisonic cleansing systems this taper vs. foramen size argument may be a moot point.

My goal is to give you the information of what I do and what I find works. I'm not perfect but I do a lot of cases and I have a lot of success and I collaborate with many of my successful colleagues on what they do and have taken the "best of" collection of all of us. So now you have information from some of the best endodontists that I know on how they treat the root canal system mechanically!!! Pretty good deal. You have the Greatest Hits Volume 1, 2 and 3 on root canal shaping.

ProTaper Universal/ProTaper Gold Rotary (DentsplySirona)

The ProTaper file system is the #1 selling rotary file in the world. It is an excellent file system and has always been my favorite until WaveOne Gold came out. I grew up on this file. This file helped me become an Endo man and not just a boy. This was my endo milk and I drank ProTaper only for 8 years prior to the introduction of the WaveOne Gold system. I used ProTaper Universal a little as a general dentist and it became my file of choice (and all my resident colleagues) during the endodontic residency. In fact, after residency, the majority of the endodontists that I knew used ProTaper. It is that good and it cuts "like butter." ProTaper also gives beautiful shapes. In my endodontic circles we compare all files to ProTaper. ProTaper is like chicken and it serves as the focal point or standard of comparison. You say in food, "Yes, it tastes like chicken," well in the endo world we say, "Its like the ProTaper but it cuts smaller shapes." Or, "This new file cuts well but not as well as the ProTaper finishers." ProTaper serves as the gold standard in which you compare all files to.

Now that you have an understanding of the general shaping procedure and techniques, lets get more specific and discuss the actual rotary and reciprocation nickel titanium systems that I use and recommend. This next section will discuss the file geometry, the file signature feel, and how to use the NiTi file system to effectively shape a complete root canal system.

ProTaper Universal/ProTaper Gold Description

The ProTaper rotary series has a convex triangular cross-section with a progressively tapered design. The series consists of the SX (orifice opener, 0.19 tip size/.04v), which can be used as a stand alone orifice opener or mixed in with other file systems, the Shaper 1 (S1- Purple band, 0.18 tip size/.02v), the Shaper 2 (S2- White band, 0.20 tip size/.04v), the Finisher 1 (F1- Yellow band, 0.20 tip size/.07v), the Finisher 2 (F2- Red band, 0.25 tip size/.08v) and the Finisher 3 (F3- Blue band, 0.30 tip size/.09v). There is also the Finisher 4 (F4- Black band, 0.40 tip size/.06v) and the Finisher 5 (F5= Yellow band, 0.50 tip size/.05v) which are used for larger canals. (These are the ProTaper Gold dimensions which should be the same as the ProTaper Universal. V stands for variable taper).

The advantages of the ProTaper Universal rotary file is that it is sturdy, cuts extremely well, and stays fairly centered in the canal. The disadvantages of the ProTaper Universal file is that is not made of M-Wire nickel titanium and the length of the handle is still standard length (13mm) and not shortened (11mm) like the ProTaper Next (PT next), WaveOne Gold or ProTaper Gold. It is also an aggressive file and is an end cutter so you have to be careful not to tear the foramen. But, If you follow the Root canal playbook and complete each quarter of the endo game correctly than you will rarely separate the ProTaper rotary files or have any problems with them. They are great files and they handle most canals very well. I have completed over 4000 ProTaper Universal cases and have had excellent results.

COACHES CORNER:

I recommend to use the ProTaper Gold over ProTaper Universal because the Gold is much more flexible, resistant to cyclic fatigue, stays centered in the canal better and has shorter handles.

How do you use the ProTaper Universal or ProTaper Gold NiTi system?

Prior to shaping with ProTaper rotary what must be accomplished? REMEMBER: Complete the 2nd quarter of the root canal game in its entirety - ***Open Orifice, Negotiation to Patency, Accurate Working Length, and Open Glide Path (with the PT Gold series I only use a loose #10 K file to WL for my glide path)!***

Now lets talk about the ProTaper Gold rotary file and technique. The number one rule on all rotary files is to ALWAYS ALWAYS use a ***NEW*** ProTaper Gold file. This will greatly reduce your file separations and file separation anxiety. 99% of my file separations in my practice come from multiple file use and every time it happens I angrily tell myself, "Don't be a moron use a new file." Even my assistants give me stinkeye when I grab a used NiTi file. Please don't incorporate "cheapass file syndrome" into your office. Now on to the technique: First run these files at 300 RPM's at the maximum torque setting of 520 N/gcm on the ProTaper SX/S1 setting on your electric motor. The ProTaper files are designed to run at maximum torque. I can't emphasize the importance of having an ***OPEN ORIFICE*** (coronal flare), ***ACCURATE WORKING LENGTH and OPEN GLIDE PATH*** prior to introducing the ProTaper files into the canal! Make sure you do your prep work prior to your NiTi shaping.

Start with ProTaper Gold Shaper 1 file or S1 (the purple band). ***This is the workhorse file and will take the longest to shape to WL.*** The entry point should be a slow smooth insertion. Place it carefully into the canal without kinking it or catching it on the canal orifice or entry point. Activate the ProTaper Gold Shaper 1 and engage the canal wall in smooth, SLOW engagement/ disengagements. Perform 4-5 engagement/ disengagements all the while slowly advancing down the canal. The ProTaper Gold Shaper 1 will start to "grab and cut" the canal dentinal wall. Allow the file to "grab and cut" 3-5 mm of the wall (engagement) and then pull back or release back 3-5mm (disengagement) with an outward brush. Perform this again but this time the file will advance farther down the canal. Continue this "grab-cut-release" (engagement/ disengagement) 4-5 x and then pull the file out of the canal with a gentle brush to the outer wall. This is not a fast pecking movement but a slow gentle up and down movement like an artist painting a canvas. ***ALWAYS*** Irrigate with 5-6% NaOCL using a 27 or 30 gauge ProRinse side vented needle to remove all the canal debris. ***ALWAYS*** check patency with a #10 file. The ProTaper Gold Shapers are meant to shape the CORONAL/MIDDLE 2/3rds of the canal so you will see a debris pattern located on the middle/coronal part of the NiTi file. Continue shaping with the ProTaper Gold Shaper 1 or S1 using 4-5 enagement/ disengagements or grab-cut-release until you reach working length. Sometimes the ProTaper Gold Shaper 1 will reach working length on the first pass (4-5 engagements/ disengagements) and sometimes it may take 3-4 passes and stressful dental environment. Shaping with any rotary file takes patience and Zen Endo. This is not the time to speed through the process. Shut out the outside world and let the ProTaper Gold Shapers and Finishers do the work for you. They will make your job easy if you allow them to gently shape the canal without extreme force. Resist the "hurry, hurry" Endo syndrome. You are an artist working on a masterpiece.

Once the ProTaper Gold Shaper 1 reaches working length then pull out, irrigate with bleach and check patency. Proceed with the ProTaper Gold Shaper 2 or S2 (the white band) and perform the same file engagement/disengagement (grab-cut-release) technique as you did with the Shaper 1 until it reaches working length. Make sure that you gently brush on every out stroke to the outer wall. Again, use patience because this may take 1 pass or 3-4 passes per canal. Between every pass (4-5 engagements/ disengagements), irrigate with bleach to wash out all the debris and check patency.

The ProTapers Gold Shapers 1 and 2 set you up for the ProTaper Gold Finishers to come in and FINISH the job and give you that deep beautiful, full shape. Next select the ProTaper Gold Finisher 1 or F1 (#20 sized tip) and again perform 4-5 engagements/ disengagements (grab-cut-release) until you reach working length. ***KEY POINT HERE***: Don't apically push on the ProTaper Shapers or Finishers more than you would a pen on a piece of paper (they usually say pencil but I think pen pressure is more realistic). YES there is very slight apical pressure on the ProTapers (or sometimes nothing would happen) but be careful not to force it down and ledge the canal and go off track and start to form your own canal. This is especially important with the ProTaper Gold finishers because you are now shaping near the apically area where there is often a canal curve. Luckily, the ProTaper Gold does a great job following canal curvature as long as you have an OPEN GLIDE PATH and you don't force the Finishers down the canal.

Continue shaping with the ProTaper Gold Finisher 1 until you reach working length. You will notice a debris pattern or debris collection at the end of the Finisher 1 or in the apical part of the file. This part may take multiple passes. Irrigate with bleach and check patency.

If there is little or no debris accumulated at the end of the ProTaper Gold Finisher 1 file then advance to the ProTaper Gold Finisher 2 or F2 (#25 sized tip) until it reaches working length. Use the same 4-5x engagement/disengagement technique throughout. I typically finish the majority of my molar cases with the ProTaper Gold Finisher 2. I will stop with the ProTaper Gold Finisher 1 on the very tight, curvy canals. These are the canals that were difficult to initially negotiate and to obtain an open glide path and then took multiple passes to get the ProTapers down to working length.

Once you have reached working length with the ProTaper Finisher 2 then examine the debris accumulation at then end of the F2. On some cases you will see little or no debris accumulated at the end of the file and then you would advance to the ProTaper Finisher 3 (F3) file. This will most likely occur in the palatal canal of maxillary molars or the D canals of lower molars or lower premolars or maxillary incisors. There are also the ProTaper Gold Finisher 4 and 5 (F4 and F5) with a tip size of #40 and #50 for the larger canals. I rarely use these files but it is a good idea to have these files in your office because there will be certain cases when you will want the larger ProTaper Gold Finishers (maxillary incisors).

TIMEOUT: ProTaper Gold (DentsplySirona)

This is a very exciting file from DentsplySirona. They have taken the ProTaper Universal file and have changed the nickel titanium and made it more flexible and 50% more resistant to cyclic fatigue than ProTaper Universal. The ProTaper Gold series also has a shorter 11mm handle than the ProTaper Universal (13mm) which makes it easier to get the file into tight canal spaces. This is a great improvement to the ProTaper Universal file. It is the same exact file design but with enhanced metallurgy, great flexiblitiy and a shortened handle. This is basically a 4 file system, not counting the SX orifice opener, Shaper 1 and 2 and Finisher 1 and 2 (stop with Finisher 1 on tighter cases). Again, the ProTaper Gold provides beautiful "gold" standard shapes. If you want to show off how brilliant you are then use the ProTaper Gold on your next root canal, finish with the F2 and you will see a very nice deep shape. ***PROTAPER GOLD AND WAVEONE GOLD ARE MY MAIN SHAPING SYSTEMS.***

ProTaper Next (DentsplySirona)

The ProTaper Next is an excellent file shaping system and can shape the canals that are "difficult"; tight, long, and/or curvy. This is also a great everyday utility rotary file and can be used on every case. The ProTaper Next has a rectangular, center offset tip geometry that makes the file appear to swagger when rotated. The ProTaper Next rotates in a sine wave pattern and almost looks like a snake slithering down the road (very small slithers). The center is offset and the rectangular tip was designed so that there is only 2 points of contact between the file and the canal wall at any given time. Since the whole file is not contacting the wall it puts less stress on the file and reduces torsional failure. The ProTaper Next is made from M Wire nickel titanium and has a 400% increase in cyclic fatigue resistance. One of the nicest features of the PT Next is the reduced handle length. The handle has been reduced to 11mm allowing the file to be easily placed into the more restrictive canals.

The ProTaper Next (PT Next or PTN) rotary file system consists of 3 main files: X1 (Yellow) 17/04v tip, X2 (Red) 25/06v tip, X3 (Blue) 30/07v tip. There is also an X4 (Black) 40/06v and X5 (Yellow) 50/06v. I rarely use the X4 and X5 but if I need to shape bigger these are excellent files to use. Typically I use the PTN X4 or X5 in maxillary incisors. My recommendation is to just buy 1-2 packs of the X4 and X5.

ProTaper Next Technique

This is such a great file system because it can shape the difficult canals but also give you a nice clean, deep shape on the standard cases. I also have great confidence that this file will not separate on the more difficult cases if I have followed my root canal game plan or prescription (Don't skip to the 3rd quarter until the 2nd quarter is completed). Yes, these can and do separate but it is so far and few between that I have very little "separation anxiety" when using this file. The ProTaper Next (PTN) gives you an excellent shape but it is a little more conservative than the standard ProTaper Gold and so you have to slightly adjust your obturation cone sizes and technique to fit. Luckily their is ProTaper Next gutta percha that fits well to the corresponding finishing file (more on this when we get to the 4th quarter of the root canal game).

Assuming that you have completed the 2nd quarter of the root canal game: ***Open Orifice, Negotiation to Patency, Accurate Working Length, and Open Glide Path*** (I need a slip and slide glide path!), you are now ready to use ProTaper (PT) Next rotary.

These files are run at 300 RPM and 200-520 gcm torque. The torque setting is debatable, but I like to increase torque to maximum at 520 gcm because I do not like when the rotary file suddenly reverses course in the canal. First of all it scares me half to death, and secondly it weakens the file or at least that is when the file is at its weakest when undergoing a nickel titanium phase change at the reversal (austentite to martensite).

Start with the ProTaper Next X1 (Yellow) and gently and FREELY insert into the canal at the same angle as the hand files. In most cases, if you have a nice open, slip and slide glide path, the ProTaper Next X1 will slide right to working length in 1 or 2 passes. Follow the "let it run, engage and disengage" principles, with a light artists touch and if you feel any binding whatsoever, remove the file immediately. Allow the canal to lead you on this journey. If the canal allows you to go to working length, great. Touch and brush the apex 3-4 time with the X1 and brush to the outer wall on every outstroke. Again, this is a LIGHT brushing to the outer wall, away from the furcation (MB canal, brush to the MB wall, DB canal, brush to the DB wall, palatal canal brush to the palatal wall). If the canal only allows you to shape to 17mm of the 21mm length, no problem. Engage until it bites then disengage. Engage, bite, disengage. Remove the X1. Irrigate with NaOCL, recapitulate (patency) with #10 K file 1/2mm past the foramen. I ALWAYS irrigate and recapitulate between every rotary/reciprocation file pass. I want to insure that the canal is still "FREE AND CLEAR." Irrigating with 5-6% NaOCL (bleach) removes the debris build-up and loose nerve tissue and checking patency insures that the canal is free of debris, still patent, and that no ledging has occurred. Typically, if you have a nice glide path, you will not ledge in the coronal or middle 1/3. Most of the ledging cccurs in the apical 1/3 and the last 2mm of a curved canal. Usually ledging will start when the clinician is in a hurry and gets over-aggressive with the larger rotary/ reciprocation files like the ProTaper Next X2 or WaveOne Gold Primary. If you can catch it early enough, usually you can "smooth" the ledge with a little apical bend on a #10 and #15 K file and lots

of RC Prep. That is why I irrigate and check patency after every NiTi file pass.

If the X1 slides to working length and you have "touched and brushed" the apex 3-4 times and have irrigated and checked patency then it is now time to proceed to the ProTaper Next X2. If the X1 slid to working length on the first 1-2 passes then the X2 will shape to working length usually in 1-2 passes. "Touch and brush" the apex 2-3 times and you are done shaping that canal with rotary. Proceed with hand filing the apical 1/3 with either K or NiTi hand files. I use the #15-25 K files and apical gauge and will go larger if necessary. In some cases the final shape is cut with the ProTaper Next X2 and you do not need to hand file the apical 1/3.

On easier cases the X1 and X2 will shape the canal in 1 pass. In the moderate difficult cases it will take 2-3 passes each to fully shape the entire canal. In the more difficult cases it may take 4-7 passes to complete the shape. The point is, keep the shaping principles in mind, and play the role of an artist. You are a brusher, not a pecker, and you have gentle hands of an artist; hands that will create a beautiful shape in any canal. If a canal takes 8 passes to shape to length no problem; no stress for you, just take your time and ***DO NOT FORCE*** any file. Let the bleach do its job and if you are unable to complete a proper shape during the first appointment, don't stress. Place calcium hydroxide (CaOH2) using the Ultracal XS (Ultradent). Place the CaOH2 needle 3-4mm from working length. ***Make sure the needle is not bound in the canal and inject gently and slowly.***

There is an excellent article on ProTaper Next in the Endodontic Practice US Journal. This is a fabulous mostly clinical endodontic journal and I highly recommend subscribing to it if you plan to do root canal treatment in your practice. I want this course to be a big part of your endodontic education, but it always helps to read about new developments or get a different perspective or learn a whole new file system that you may have been interested in. Please check out the article on ProTaper Next by Drs. Peet J. van der Vyver and Michael J. Scianamblo titled, "Clinical guidelines for the use of ProTaper Next instruments: part one" (Endodontic Practice: Jan/Feb 2014-Vol 7, No 1, p 12-20).

WaveOne (DentsplySirona) = ***(THIS FILE IS NOW THE WAVEONE GOLD. I LEFT THIS MATERIAL IN STRICTLY FOR INFORMATIONAL PURPOSES. THE WAVEONE REGULAR IS NO LONGER SOLD)***

ProTaper has always been my baby and from the beginning of my endodontic career and residency I loved and deeply cared for this wonderful, beautiful, angelic file. I almost felt like I was switching families and adopting a new kid when I "tried out" the WaveOne reciprocation NiTi file. I told my Dentsply rep back in 2011 that I would give it a shot but would probably never give up my true love: ProTaper Universal rotary files.

My first few cases with the WaveOne were well, different. It has a completely different signature feel and cutting stroke than rotary files. The file feels rough and CLICKS as its reciprocates or snakes its way into the canal. The handpiece moves around just a bit in your hand and in some areas of the canal you have to slightly push on the file to continue shaping. The file creates a ton of debris and soaks up the NaOCL in the canal fast forming a thick dry debris slurry. As with every new rotary or reciprocation file, there is a ten to twenty case learning curve. I somehow stuck with this file mainly because I was so intrigued that one file could shape the entire root canal system. Back in 2011 this was absolutely unheard of and considered 100% endo heresy (die heretic!). I really thought that I may be tarred and feathered for using this file.

The WaveOne is now one of my favorite files and is my "go to" on standard cases. These reciprocation files are sharp cutters and snake their way to length by cutting a path of reciprocation destruction. Okay, maybe I'm being slightly dramatic, but in essence the WaveOne is a safe, fast cutting file that can shape most every canal with just one file.

The WaveOne reciprocation system consists of three files made from M wire: WaveOne Small (Yellow) 20/06, WaveOne Primary (Red) 25/08v from D0-D3 (at the end) and then a decreasing .055 taper in the middle 1/3, and the WaveOne Large (Black) 40/08v. The WaveOne reciprocation file runs in a reciprocation motor called the ProMark (my favorite) or the e3. Both motors also come preset with settings for all the Dentsply rotary files. So the disadvantage of this system is that there is an initial new motor investment of approximately $2100. The 2nd disadvantage is that the files are single use and when they are sterilized in the autoclave the plastic handle swells and will not "fit" back into the handpiece. It took me approximately one week to figure out how to get around that. If you want to use the WaveOne file a second time, which I do not recommend for any new cases, simply take a diamond or carbide bur and cut the plastic part sitting on the metal handle off. I know you are probably thinking, "Why did it take him a week to figure out how to cut a plastic handle off?" Too much football.

In the majority of my cases I use the WaveOne Primary (Red) reciprocation file to shape the root canal system. On the tight, long, curvy canals I will select the WaveOne Small (Yellow) to shape the canal system. I use the WaveOne Large (Black) to shape maxillary anterior teeth.

The WaveOne shaping technique is the same as the ProTaper and ProTaper Next technique but just has a rougher, clickier feel (I have come to love the clicks because it represents fast shaping). Place the WaveOne file freely in the canal and let it run until it engages dentin. Engage a few millimeters and then disengage 3-4 mm and then engage, disengage, 4-5 times and then pull out. GENTLY brush to the outer wall upon disengagement and on the outstroke (pulling the file out of the canal). This file will produces more debris than any other NiTi shaper that I have seen. This makes sense since there is just one shaping file for the entire canal not 3-4. Irrigate with 5.25% NaOCL, recapitulate (check patency) with a #10 K file and then re-irrigate. Move on to Pass #2 and repeat the same procedure. A lot of the times the WaveOne files will proceed to working length in one or two passes making you feel slightly guilty because its supposed to be much harder than that. I also wonder if I should lower my root canal fee (just kidding). This morning I completed shaping a necrotic #9 (Left Maxillary Central Incisor) with the WaveOne Large (Black) in 1 pass (10 seconds). I had a #25 glide path prior to shaping and then gauged the apical foramen to a size #45. I was trying to figure out how to waste time because I had just told the patient that it will take about an hour and we were five minutes into it. I PIPSed and out of pure guilt allowed a little bleach soak time prior to obdurating the canal. More on this technique later.

After 4 years of using this wonderful reciprocating file, I have finally accepted the fact that it is okay to put SLIGHT apical pressure on the file while it is shaping. The key word is "slight." The apical pressure allows the file to advance further into the canal. The key to this file is to only engage/disengage 4-5 times and then withdraw and irrigate out all of the debris. I find that the dentinal debris sucks up the bleach and it prevents or clogs the WaveOne file from advancing. If I irrigate, check patency, and then start engaging again, the WaveOne will often advance down the canal. Some cases take 5-9 passes and 10-20 minutes of careful shaping, but the majority of cases are quick, 1-2 passes, quicker than any other NiTi shaping system that I have seen. Of course I don't want to sacrifice quality for quickness, but the WaveOne reciprocating file gives you both: a good solid shape that is easy to obturate and completed in a very efficient and debrided manner.

The next question that needs to be answered is how do you know which WaveOne to use for each case? I base this decision on the radiograph (shape, length, curve of the canal), negotiation to patency and the glide path. If I am able to achieve a glide path to a #15 or #20 K file rather easily than I will select a WaveOne Primary (Red) file. If negotiation to patency or the glide path is difficult then I will often select a WaveOne small (Yellow) to shape the longer, tighter canals. I typically use the WaveOne Large (Black) only in the maxillary anterior teeth. Although some of these maxillary anterior teeth are tight due to trauma and calcification so I will

use a WaveOne Primary (Red) file and in some rare occasions the WaveOne small.

If you read the DentsplySirona technique card it is recommended to always start with the WaveOne Primary and if you are having trouble advancing down the entire length of the canal switch to the WaveOne Small. Or in the opposite case, the WaveOne Primary is too small then move up to the WaveOne Large. Obviously, I don't always follow the technique card exactly and will sometimes start with the WaveOne Small or WaveOne Large.

WaveOne Reciprocation System Overview
Advantages: ① M wire NiTi= much more resistant to cyclic fatigue and thus file separation, ② Fast, ③ Single file for complete shape, ④ Good shape, ⑤ Safe (hard to separate)

Disadvantages: 1 Normal handle length (ProTaper Next handle reduced to 11mm) 2 Initial motor investment of about $2100. The ProMark or E3 motor will run both rotary and reciprocation and are great motors. If you are looking for a new motor I recommend the ProMark and then you can use both WaveOne reciprocation and rotary. 3 Single use - The plastic part on the handle swells. If you select a WaveOne Small but later realized the canal needs a WaveOne Primary then you have to use 2 NiTi $ files on one tooth. 4 Higher NiTi file cost. I would like more flexibility.

WaveOne Gold (DentsplySirona)

WaveOne Gold came out in August 2015. Since I was a WaveOne user since 2011, I was very excited to start using this file in my practice. ***WaveOne Gold is a home run and it is now one of my favorite files to use in my practice.*** I have switched over from WaveOne to WaveOne Gold and I use this file to shape many of my cases. WaveOne Gold has enhanced gold wire metallurgy and is even more flexible and resistant to separation than the M Wire WaveOne. It is 155% more resistant to cyclic fatigue and 90% more flexible and 61% faster than standard NiTi files. It reciprocates just like the WaveOne and requires the ProMark or IQ XSmart (cordless) reciprocation motor. I have never felt safer while shaping a long, curvy, tight canal.

WaveOne Gold has a different cross section and different dimensions than the standard WaveOne. WaveOne Gold has a parallelogram cross section (similar to ProTaper Next) while the standard WaveOne has a reverse helical cross section (it looks like a buzz saw).

WaveOne Gold comes in WaveOne Gold Small (Yellow- 0.20 tip size/.07v), WaveOne Gold Primary (Red- 0.25 tip size/.07v), WaveOne Gold Medium (Green- 0.35/.06v), and WaveOne Large (White- 0.45/.05v)

v= variable taper

Dentsply recommends to always start with the WaveOne Gold Primary (0.25/.07v) and then to either move down to the Small or up to the Medium as the canal dictates. This is a good general to rule to follow, but sometimes I will start with a WaveOne Gold Small in a tight canal (maxillary or mandibular second molar) or a WaveOne Gold Medium or Large in a larger canal (maxillary incisors or lower premolars). I gain canal information during the Negotiation to Patency and Open Glide Path phases. If the canals are extremely difficult to negotiate and to obtain an Open Glide Path than I will select the WaveOne Gold Small to shape the entire canal system. If during negotiation and glide path the canals are wide open than I may select a WaveOne Gold Medium to start shaping with. It is still a good idea to start with the WaveOne Gold Primary and then move up or down until you get 50 cases under your belt. Than after 50 cases you will have a better sense of which WaveOne Gold file to start shaping with.

WaveOne Gold Technique (Same as the WaveOne)

90% of my cases I start and finish with the WaveOne Gold Primary reciprocating file. **Follow the pre-shaping playbook**: *Open Orifice, Achieve Negotiation to Patency, Accurate Working Length and Open Glide Path.*

MAKE SURE BLEACH IS SOAKING IN THE CANAL WHEN SHAPING. ALWAYS IRRIGATE WITH BLEACH BETWEEN PASSES.

Place the WaveOne Gold into the canal and ***engage/disengage 4-5x*** slowly advancing down the canal, and brushing to the outer wall on the disengagement and outstroke. Pull out after 4-5 engagement/disengagements and irrigate with bleach and check patency with a #10 K file. **Pass #1 completed.**

Continue with ***Pass #2*** and ***engage/disengage the canal wall 4-5x*** while slowly advancing down the canal. Brush on the out stroke. Irrigate with bleach and check patency. ***Pass #2*** completed.

Continue until you reach working length in each canal. Sometimes I will reach working length in 2 passes but some canals can take 5-8 passes. In some cases the WaveOne Gold will advance to working length in 1 pass but I try and hold it back so that I don't extrude canal debris out the apex. It is better to take 2 passes or more to get to working length so you don't push out a lot of apical debris. Remember, we are shaping an entire root canal system with just one file so it produces a lot of canal debris.

Once you reach working length with the WaveOne Gold Primary I will "touch and brush" the apex 2-3 times to make sure the apical shape is adequate. In a lot of cases you will not need to hand file the apical 1/3 because the apex is shaped and the new WaveOne Gold gutta percha cones are extremely accurate.

In some cases the WaveOne Gold Primary will stop advancing towards working length even after a few passes (irrigate and patency in between each pass). This indicates that the WaveOne Gold Primary file may be to large and it is time to move down to the WaveOne Gold Small (Yellow) and finish the shape or use it as a bridging file to bridge back up to the WaveOne Gold Primary. The same holds true if the WaveOne Gold Primary slides right down to working length and it does not have any dentinal shavings on the cutting flutes. This indicates that you need to move up to the WaveOne Gold Medium (Green).

VORTEX BLUE: THE BLUE STANDARD (Dentsply Sirona)

Over the last year and a half I have fallen in love with the Vortex Blue file shaping system. Now that Schwed has developed micronized, nanoparticle, machine precision gutta percha points that fit 04 and 06 tapers it has made obturating after shaping with Vortex Blue much easier. (**Update** - there is now machine precision, new Vortex Blue gutta percha points that are extremely accurate). Vortex Blue consists of a special proprietary heat processed technique that colors the nickel titanium blue. The Vortex blue is similar to WaveOne Gold and ProTaper Gold in that it is much more resistant to cyclic fatigue and thus more resistant to file separation. It is also extremely flexible and will sometimes shape around curves that the WaveOne Gold would not advance down. This file runs at 500 RPM's with a varying torque based on 04 or 06 taper. If you are using Vortex Blue 04 Taper then use torque settings anywhere from 75-132 gcm. If you are using 06 taper the torque setting can be increased to 195-368 gcm (Vortex Blue Tip Card).

VORTEX BLUE TECHNIQUE

Again, the pre-shaping playbook is followed: Open orifice, Negotiation to patency, Accurate working

length, Open glide path. Once I have achieved an Open Glide Path with the ProGlider (or Vortex Blue 15/04) than it my green light to commence shaping. I typically select the 20/04 Vortex Blue (500 RPM's) and ***engage/disengage 4-5x*** until it reaches working length. The 20/04 will usually fly to working length within seconds, but it's okay if it takes multiple ***passes of 4-5 engagement/ disengagements***. Irrigate with 3-6% bleach and check patency with a #10 K file. Move up to the 25/04 and shape the canals as described above. Usually the 25/04 will also fly to working length in seconds. Again, it's okay if it takes multiple passes. Irrigate and check patency and then proceed to the 30/04, which will also advance quickly to working length, and follow the above protocol. I typically shape mesial canals of molars to 30/04 and the palatal or distal canals to a 30 or 35/04. I will shape maxillary premolars to a 30/04 (unless very tight then 25/04) and lower premolars to a 35/04 on average. If I'm using SonEndo and the GentleWave multisonic sound wave technique then I will shape to a Vortex Blue 20/06 0.5-1mm back from the working length.

TruShape (DentsplySirona)

TruShape (the mighty corkscrew) is a relatively new file that is 3D conforming to the canal wall. The concept behind TruShape is behind the engineered NiTi S shape. The file can expand and contract inside the canal system forming an envelope of motion that touches 75% of the canal walls thus disrupting and cleaning biofilm and microbes. Cleaner canal walls translates to cleaner canal systems. The TruShape file has also been shown to have 32% less apical transportation while removing up to 36% less dentin. In effect this is a dentin preservation file and belongs in the minimally invasive family. The TruShape is a good shaping file and it can be used in conjunction with the EndoActivator, laser activated irrigation (PIPS) or the SonEndo GentleWave procedure. The TruShape file comes in 06 taper and size 20, 25, 30, and 40 tip size.

TruShape Technique

The TruShape file has a rough shaping feel (the S shape design causes it to expand and contract as it progresses slowly down the canal) to it and takes a bit getting used to. My recommendation is to try at least ten cases with it and keep in mind the inherent benefits you get from using this dentin preservation file. Prior to using this file obtain an OPEN GLIDE PATH with a ProGlider and then start with the TruShape 20/06. Allow the mighty corkscrew to progress down the canal with 4-5 engagement/disengagements and then remove, irrigate with bleach and recapitulate (check patency with a #10 K file). This is Pass #1. Continue to work the 20/06 until it reaches working length. I find that the TruShape is a slower shaping file so it takes more patience when compared to WaveOne Gold or Vortex Blue. After the 20/06 reaches working length then proceed to the 25/06 and shape until this file reaches working length (it could take multiple passes). Finish with the 25/06 or 30/06 depending on canal size. Always irrigate with bleach and check patency between passes. In my opinion the TruShape 20/06 is a good shaping file if a clinician is using laser activated irrigation (PIPS) or the SonEndo GentleWave procedure.

ESX Rotary Files (Brassler)

The ESX file is a good NiTi file system from Brassler. The ESX has a triangular cross section and an asymmetrical flute design so that there is zero to three points of engagement along the canal wall. The NiTi is electropolished which increases resistance to cyclic fatigue and torsional failure and is designed to run at lower torque and higher RPM's (500-600 RPM's). The asymmetrical flute design allows debris to be flushed coronally instead of apically. There is a Booster Tip with six cutting edges that adds efficiency. The patented Booster Tip also has an anti-ledging and anti-perfing centering mechanism.

BRASSLER RECOMMENDED ESX TECHNIQUE

The ESX system consists of a 15/05 Expeditor file a 25/04, 30/04 and 35/04 size shaping files. The technique card states to obtain a glide path up to a #15 file and then use the Expeditor 15/05 NiTi file at 500-600 RPM's and gently work it to working length by cutting dentin in a one stroke and wipe method. Brassler recommends single cut and then pull out and wipe the file of any debris. Once the Expeditor reaches working length then proceed with the 25/04 ESX shaping file at 600 RPM's and shape to working length. ***Irrigate with bleach and check patency with a #10 K file every time you shape with a NiTi file.*** In standard canals move to the 35/04 ESX shaping file and shape to working length in one stroke cut and wipe method. ESX recently came out with the 30/04 ESX shaping file for smaller more restrictive canals. In my practice I have only used the 25/04 and 35/04 ESX shaping files and have completed a number of cases with this system with good results.

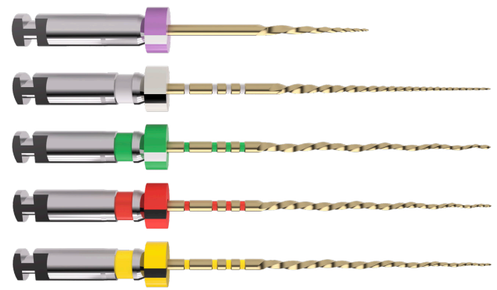
MY RECOMMENDED ESX TECHNIQUE

I have tried the Expeditor 15/05 file but still feel that the ProGlider gives you a safer and quicker Open Glide Path. I start with a Loose #10 K file to working length and then use the ProGlider at 300 RPM's and shape down to working length with the 4-5 engage/disengage technique. Irrigate with bleach and check patency. I then proceed with the 25/04 ESX file and shape the canals in the 4-5 engage/ disengage technique (the same technique I use for every rotary and reciprocation file). I remove the file, my assistant wipes the flutes with an alcohol gauze and then I irrigate with bleach and check patency. The 25/04 ESX file is pretty efficient and I am usually able to shape down to working length in 2-3 passes (1 Pass= 4-5 canal enagement/ disengagements). When I accomplish this I move on to the 35/04 ESX shaping file and follow the same technique as the 25/04. On average it will take me 2-3 passes to reach working length. I have never used the 30/04 ESX shaping file but it may come in handy in the tighter canals.

QUICK TECHNIQUE NOTE: I feel that the single cutting stroke and remove the file and wipe technique takes FOREVER! I have expressed this to Brassler and they state this technique is designed for safety. I have not had any problems with the 4-5 canal engage/disengage technique with these files as long as I have completed the 2nd Quarter and have an ***Open Orifice, Negotiation to Patency, Accurate Working Length and Open Glide Path.***

Once I have completed my shape I will do my final irrigation (1 minute 17% EDTA/Rinse with NaOCL) and then I will select the corresponding 35/04 BioCeramic (BC) Gutta Percha cone and BC sealer to seal. Sometimes the 35/04 BC GP cone will not fit to working length (+/- error rate). If this happens I will try in the 30/04 BC GP cone. If this cone doesn't fit then I will either re-shape the canal with the 35/04 ESX file or hand file up to #35 with Hand Niti's, re-irrigate, check patency and re-try in the 35/04 BC GP Cone cone. More on this in Quarter 4.

TruNatomy (Dentsply Maillefer)



In mid 2019 the TruNatomy file system came out on the market. This is an exciting file system that both preserves dentin and effectively shapes the canal system in an efficient manner. It has been engineered, " . . . to respect the true anatomy of the root canal system" (DentsplySirona website). Like WaveOne Gold and ProTaper Gold, TruNatomy is a complete system that comes with its own newly designed plastic, flexible, 2 side vented irrigation needle, paper points and micronized, conform fitting gutta percha.

The benefit of using this system is that you will preserve dentin, while effectively shaping the canal system and lessen the likelihood of a future root fracture. The disadvantage is that the shapes will look smaller than conventional ProTaper Gold or WaveOne Gold shapes so you will have to get used to a smaller "look." This does not mean the the canal is any less clean, it just means that less coronal and middle third dentin has been removed.

This file system comprises of an Orifice Modifier, Glider, and single shaping file called the Prime.

There are two other shaping files in the system, the Small (yellow) and the Medium (green), in case a smaller or larger shape is needed.

The file has an off-centered cross-section like ProTaper Next and WaveOne Gold and a small 9.5mm length handle. The smaller handle makes it much easier to place the file into the canals of second molars. The overall file diameter is 0.8mm as compared to the standard 1.2mm of other shaping files. The file is designed to conform to the canal wall instead of forcing the canal wall too conform to the file. The metallurgy consists of a heat treated enhanced nickel titanium that makes it up to 3x more flexible than ProTaper Next and up to 4x more resistant to cyclic fatigue than other heat treated files (Dentsply website).

The sizes of the Glider and shaping files are as follows: TruNatomy Small shaping file apical size 20 with variable taper, Prime 25v, and Medium 35v.

The technique is as follows: Perform a conservative access cavity prep. What does that mean? It means that we all strive to remove as little enamel and dentin as possible during access. The problem is a conservative outline shape is not always possible. Some clinicians just do not have the hand skill to locate 3-4 canals and keep the cavity preparation minimal and in some cases the canals are calcified and the access needs to be extended so that all canals can be located. Minimal access is important and we should always strive to keep it small, but do your best and just find the canals safely. If you open up the access a bit no problem. I do not hesitate to extend the access to enhance canal location. If you miss a canal there is a much higher chance of root canal failure when compared to a crown or root fracture as a result of a larger access preparation.

Next, locate all the canals and perform a coronal negotiation with a #10 C 21mm length file. Use the Orifice Modifier at 500 RPM's and gently brush 4-5x to the outer wall. This completes the coronal flare or coronal modification (new TruNatomy system term). Negotiate to patency (use ProLube or RC Prep) with a #10 K file (or #8 K if it's a restrictive canal). Obtain an Accurate Working Length and then a loose #10 K file to working length. Use the TruNatomy Glider at 500 RPM's and gently work it to length with slow up/down hand movements. Do not rush or push this file to working length. Instead, take your time and perform multiple passes if needed. One you get the Glider to working length then proceed with shaping with the TruNatomy Prime file. Continue to use it at 500 RPM's and shape gently and slowly to working length in a slow up/down movement. I have completed about 10 replica teeth and 10 clinical cases with this file system so I am still getting a feel of the file system and shaping technique.

This description is courtesy of Ove Peters, co-creator of TruNatomy. I wanted to include it since it it straight from his brilliant mind. The concept behind TruNatomy is to shape canals in a way that promotes longevity of the root canal-treated and restored tooth. This is achieved by a set of instruments purposely designed with specific shapes and a maximum fluted diameter of 0.8mm.

The clinical sequence for TruNatomy (TN) starts with a #10 K-file for scouting into the middle root canal third. Then the Orifice Modifier is used to create a receptacle for irrigation solution and to remove coronal interferences. Subsequently a #10 K-file or smaller if needed is used to establish working length and confirm patency.

The TN Glider is then brought to patency with the same settings and movements as all subsequent TN instruments: 500rpm, 1.5Ncm and 2-5mm long gentle movements. Following the rule of threes, each shaping cycle consists of 3 individual movements and WL is reached with 2-3 shaping cycles.

In most cases the TN Prime can follow directly after the Glider; in cases that were identified as very tight and curved, the glide path may be enhanced with TN Small.

After the preparing with Prime, a hand-held Prime file should be passively placed to confirm that appropriateness of shape. Is the canal too tight, the canal is not fully shaped and the TN Conform Fit gutta percha will not fit. An additional pass to working length with the TN Prime is in that case needed. If the apical dimension is larger than the hand-held TN Prime, further shaping with the TN Medium should be performed.

Irrigation for TruNatomy procedures is done with the dedicated TN irrigation needle and may be supplemented with activation techniques of the clinician's choosing.

Obturation also may be performed with the method of preference, for example warm vertical compaction or carrier-based obturation.

MISCELLANEOUS SHAPING FILES

Brassler USA

There are a large number of shaping files on the market. Brassler has created some good shaping files like Endosequence controlled memory (ES-CM- an improvement over the traditional Endosequence file), ESR (reciprocation copycat of the WaveOne Gold), and the XP-3D file. All of these files are interesting and work, but in my opinion the WaveOne Gold, ProTaper Gold and Vortex Blue are better and more reliable. Yes I know I am a DentsplySirona speaker and I understand that this is a biased opinion but it is an opinion based on 15 years of clinical endodontic experience. I have used every one of these files that I am discussing clinically and they are all good, but I want to use the best, and the best is WaveOne Gold and ProTaper Gold. Vortex Blue and ProTaper Next are right behind and TruNatomy is yet to be determined but so far appears very good.

Edge Endo

Edge has made a killing off of copying other companies files and selling them at a discounted rate. Edge has created the Edge Platinum (ProTaper Gold copy), Edge Sequel Sapphire (Vortex Blue, Endosequence copy), EdgeOne Fire (WaveOne Gold copy), EdgeTaper Encore (ProTaper Next copy), and Edge V-File (V-Taper copy). I have used Edge files off and on for years (I like to try all new files), and even though they are discounted, I naturally gravitate back to the REAL WaveOne Gold and ProTaper Gold, ProTaper Next, and Vortex Blue files. The copycat WaveOne Gold by Edge is not great and I do not use it. The ProTaper Gold knock-offs, EdgeTaper Platinum are not bad (I give it a B rating), but I still prefer the real ProTaper Golds. The Edge quality is "just okay" and not always consistent. Can you achieve a good final shape safely with these files? Absolutely. I just prefer the high quality, ever consistent engineering of the REAL WaveOne Gold and ProTaper Gold files.

V-Taper (Guidance Endo)

The V-Taper file has been around for a while and has gained some traction with the dentinal preservation community. I have only used this file clinically a few times so do not have a lot of experience. From what I hear and what I have seen it is a solid file that gets the job done. You will see smaller shapes with this file but as long as you achieve adequate chemical debridement with some kind of irrigant activation using the EndoActivator (DentsplySirona), EndoUltra (Vista), GentleWave (SonEndo), or the SWEEPS (Fotona) this system will work well.

V-Taper has a parabolic cross-section and is made from Endonol NiTi which is an enhanced metallurgy. They have non-cutting tips that help prevent ledging and transportation. There are 3 files in the system the Blue #30 tip (Variable taper 10), the Red #25 (V08) and the Yellow #20 (V06). Use these files in a crown down technique.

My main goal in this section is to introduce to you the different file systems on the market. There are many many more shaping systems and a lot of them are "just okay" to not bad. I have always gravitated back to DentsplySirona files, mainly the WaveOne Gold and ProTaper Gold and feel that they are the easiest to use, are made with the highest quality and give great clean shapes.

CHAPTER 9
TIMEOUT (APICAL PREPARATION)

Shaping is complete once you have filed to working length with the last selected NiTi file and "touched and brushed" the apex two to three times. Irrigate out any debris with 3-6% NaOCL and then check patency with a #10 K file. In many of my cases my shape from top to bottom is complete with the ProTaper Gold F2, WaveOne Gold Primary or Vortex Blue 30/04 or 25/06 shapes. Usually the corresponding cones slide to working length and I'm nearly ready to obturate (see 4th Quarter). But in some cases, I find that the cone will not slide to working length and I then will proceed to an apical gauging and apical preparation (I perform these

CONE FIT- CUT 1 MM OFF THE CONE IN THE PALATAL CANAL

two techniques concurrently) with K hand files.

It is sometimes recommended to enhance the NiTi apical shape with apical hand filing. I find that my cone fit and obturation is much easier and smoother if I prepare the apical 1/3 with K or NiTi hand files. So after checking patency with a #10 K file I proceed to work my way up with hand files. I now go to the #20 K file and make sure it smoothly proceeds to working length (which it usually does unless there is a curve or I have started to ledge with the NiTi rotary/reciprocation). Now I will either use the #25 K file or switch to the #25 NiTi hand file and proceed to working length. If its tight, I will shape the area with gentle up and down push/pull strokes. I sometimes move up to the #30 K or NiTi file and will continue to shape the apical 1/3. If it's tight I may not take it right to WL but will take what the canal gives me without being too rough. Remember Zendo (Zen Endo). I usually shape the mesial canals of upper/lower molars to a #25 or #30 K or NiTi hand file. A size #30 or #35 K or NiTi hand file usually shapes the D or palatal canals. The apical preparation with a K or NiTi hand files takes about 1-2 minutes, if not less, to accomplish and yet it has the far reaching benefits of achieving deep apical shape, a cleaner apical redzone and better fitting gutta percha cones.

NOTE ON APICAL SIZE: Apical preparation size is a very debatable topic. There are some endodontists who prefer small taper (04) with large apical preps (#40-45), while others like larger taper (06) shapes with smaller apical preps (#25-30). With the advent of laser activated irrigation (PIPS) and SonEndo's GentleWave technology smaller preparations are possible. It is now possible to shape minimally, preserve tooth structure, and debride the entire root canal system.

Apical Gauging

Once you have completed the apical preparation with K or NiTI hand files it is time to apical gauge the size of the foramen. In truth, I usually do this as I am shaping the apical 1/3 with K or NiTi hand files. But for the sake of clarity I want to separate these two techniques. Apical gauging measures the size of the apical foramen so that theoretically we can select a proper cone to fit that foramen.

Procedure

After apical preparation with hand files, select a #25 K or NiTi hand file and advance to the working length. Tap on the top of the file or give a very slight push and see if it advances through the apex. If it does, then move to the #30 K or NiTi hand file and repeat. If the #30 K or NiTI is tight and does not slide through the foramen then theoretically the foramen is a size #30. If the #30 slides through then move up to the #35 K or NiTi file and repeat tell a file is tight at working length. I find that most foramen's of the mesial canals of maxillary and mandibular molars are size #25 or #30 and the palatal and distal canals are size #30 or #35. (I use mostly K files to complete apical preparation and apical gauging).

CALCIUM HYDROXIDE (CAOH2)

Many clinicians feel that they have better success with a two visit treatment approach if they place an intracanal medicament like calcium hydroxide. Calcium hydroxide is an antibacterial paste or "medicine" that we place into the root canals for enhanced microbial kill. It is effective for about a week. Calcium hydroxide has a high pH (12.5) which makes it bad for bugs. Basically, CaOH2 is "bad to the bone" and kicks microbial ass when used effectively inside the root canal system. Dirty canals can be well . . . dirty and often require a little extra medicine and time

How do you place calcium hydroxide?

My favorite way to place calcium hydroxide is to use a pre-mixed syringe from Ultradent called Ultra-Cal XS (35% calcium hydroxide, a radio pacifier and other undisclosed proprietary materials). Each syringe of calcium hydroxide comes with blue Navi-Tips that are used to GENTLY express the paste into the canal system. Put the stopper on the blue Navi-Tip about 3-4mm from the working length. So if your working length is 24mm I place the stopper at 20 or 21mm and then place it into the canal and make sure that the tip is loose and not binding. This is extremely important so please read this again: The tip needs to be LOOSE and FREE in the canal (just like the irrigation side vented needle that we use to express bleach). I want you to close your eyes and envision the blue Navi-Tip gently sliding into the canal and down until you see the stopper (set at 21mm) hit your cusp reference point. You notice that the tip is slightly bound into the canal and hitting the canal wall. It is not FREE and you can feel it. So now pull back a mm or two until the needle is loose in the canal again and then GENTLY express the calcium hydroxide into the canal as you slowly lift the needle up and out. This is the more expensive way to place calcium hydroxide but it is much more efficient. I have been using this brand for over ten years and am very happy with it. It is water based without iodine and is easily removed at the second visit. Some of the calcium hydroxide brands are oil based and contain iodoform like Metapex and Vitapex. These mixes are made up of about 30% calcium hydroxide, 40% Iodoform, 22% silicone oil, and 7% other material. Although these types of mixes are not bad they are difficult to remove from the canal space and wall. The water based calcium hydroxide mixes are just as potent and much easier to remove the root canal system.

How do remove calcium hydroxide?

At the second visit, anesthetize and place a rubber dam. Remove the cavit and sponge. 1 Irrigate out as much calcium hydroxide as possible by placing the side vented, end capped bleach needle no more than half way down the canal. Make sure it is loose and not bound in the canal. Irrigate GENTLY and SLOWLY. 2 Take a #10 K file and place to working length and recapitulate every canal. 3 Re-irrigate again with bleach. 4 Take a #15 K file and place to working length. 5 Re-irrigate with bleach. 6 Shape to length with the last shaping file used in the initial appointment.

If you have only performed a pulpotomy or pulpectomy at the initial appointment than proceed with the root canal playbook 2nd, 3rd and 4th quarters. 2nd Quarter-Locate all canals, coronal negotiation, coronal flare, negotiate to patency, accurate working length, loose #10 and then perform an open glide path.

FINAL DISINFECTION

The shaping is complete and you feel that this case can be completed in one visit. There is no purulent or serous exudate draining back into the canal from the periapical tissues. You have established patency, an accurate working length and have shaped each canal and feel that the apical 1/3 or redzone is clean. Things are looking good. So let's talk about final irrigation and some different techniques to activate the bleach and EDTA piranhas inside the root canal system to get a final clean that is cleaner than clean.

Imagine a tall coffee thermos that has been sitting in your sink with dried coffee and whey protein powder on the bottom and edges (yes I know who puts whey protein in their coffee?- well I have a few times). The coffee and protein powder is caked on the sides and bottom and cleaning this mug is going to take some work. In a sense this dried film on the sides (canal walls) and bottom (apex) of the coffee thermos resembles a root canal system smear layer, or scum layer or debris layer or layer of crap caked on the walls circumferentially (you can also use this same analogy for a root canal system biofilm). We need to scrub and remove this smear layer that has collected on the dentinal walls due to our hand and NiTi filing to the best of our abilities just like we would clean the coffee thermos.

There are a few options to remove the smear layer. You can use 17% EDTA for 1 minute per canal and then rinse it out with sodium hypochlorite or you can use QMix. I prefer QMix from DentpslySirona because is it is a self-limiting EDTA (at some point it stops degrading the peritubular dentin around the dentinal tubules) and it contains chlorhexidine which is an antibacterial component to the final rinse. The EDTA portion is a weak acid and serves to chelate or remove the debris or smear layer. This smear layer consists mostly of inorganic debris like dentinal shavings and then some organic portions of live and dead microbes. It is important that we remove the smear layer because sitting under this are dentinal tubules which could hold more microbes. The EDTA chelates the smear layer and then once it is gone the chlorhexidine can move in and kill the microbes hiding in the dentinal tubular caves. At least that is the idea. Does this work perfectly every time? Do you think some smear layer is left on the canal walls? Only in a perfect world does the EDTA remove all the smear layer and the bleach and chlorhexidine kill all the microbes sitting in the root system. But let's up our chances and obtain the cleanest root canal system possible. So I place the QMix into each canal using a side vented 27 or 30 gauge needle (I use a 3cc syringe for QMix and a 12cc syringe for NaOCL). I place the needle about 1/2 down each canal, keep it loose and gently inject or irrigate out the QMix. I will place enough solution to fill the canal and then get some overflow. After I have done

this for each canal I like to use the EndoActivator (DentpslySirona) to sonically vibrate (10,000Hz) the QMix around each canal. I will activate the QMix piranhas for 30 to 60 seconds per canal and really get everything stirred up. Some studies show you get a cleaner canal system in the coronal, middle and apical 1/3 when you do this. Once I am finished with the EndoActivator, I will then re-irrigate with more QMix to rinse out any debris (optional) and then check patency with a #10 or #15 K file one final time. After that I am ready to take a cone fit, dry and fill. The reason I love QMix is because the EDTA component is self-limiting (it will not continue to degrade dentinal tubules if left in the canal for 5 minutes), it has Chlorhexidine which is antibacterial (EDTA is just mildly, almost zero antibacterial), and you do not need to rinse it out of the root canal system with sodium hypochlorite like normal 17% EDTA. All you do is dry the canals with paper points and fill. So in my estimation it is easier to use, safer to use and you get one more anti-microbial irrigation blast prior to obturation.

Another option is to use ultrasonics like the EndoUtra from Vista. The EndoUltra is a cordless ultrasonic unit that is made strictly for enhanced intracanal irrigation by using oscillation and vibration at 50,000Hz (ultrasonic). It uses 20/02 titanium activator tips which when placed inside a canal full of irrigant will cause cavitation and acoustic streaming. I recommend using the EndoUltra with QMix or 17% EDTA for 30 seconds per canal. I personally prefer the sonically activated EndoActivator over the EndoUltra because the small polymer tip (red) of the EndoActivator does not bind in the canal and lose energy like the EndoUltra tips do.

A third option to enhance final irrigation is to use lasers. For years I used photon induced photoacoustic streaming (PIPS) now called SWEEPS with the LightWalker laser from Fotona. I feel that the sonic boom effect of 1000's of micro bubbles forming and collapsing inside the root canals encouraged cleaner canal systems. Please see the appendix, off-season training, for a thorough explanation of the entire PIPS process.
The last disinfection/irrigation device that I want to mention is the GentleWave from Sonendo. This is an excellent disinfection system that uses multisonic sound waves to greatly disrupt pulpal tissues, microbes and biofilms. The GentleWave system is able to greatly enhance chemical debridement with just minimal shaping (20/04). Please see the appendix, off-season training, to read about this exciting technique.

CHAPTER 10
4TH QUARTER: OBTURATION

Obturation of the root canal system serves to accomplish the ultimate goal of sealing every portal of exit with a sealer coated gutta percha Obturation of the root canal system serves to accomplish the ultimate goal of sealing every portal of exit with a sealer coated gutta percha cone. The coronal seal will seal any portal of entry. This seal prevents bacteria from coming into the canal system and hopefully prevents bacteria left in the canal system from either migrating closer to the apical 1/3, recolonizing and then releasing their byproducts (endotoxin) and causing periapical periodontitis. The theory is that the sealer and gutta percha entombs any remaining bacteria in the canal or dentinal tubules and prevents them from recolonizing and releasing byproducts and causing an immune reaction and thus apical periodontitis. The sealer seals the portals of exits and the gutta percha cone acts as a filler, filling up any canal space where existing bacteria could find a food source and recolonize. The sealer in most systems does not bond to the gutta percha but more to the canal walls. The gutta percha also does not bond to the sealer or canal walls and again acts just as a filler. Some obturation systems have impregnated gutta percha cones and are attempting to form a complete 360 degree monoblock of bonding between the canal wall, sealer, gutta percha, sealer, and other canal walls. If you really stop to think about it we do really have archaic obturation systems and thus the advent of obturation systems like Resilon which attempted to form this monoblock.

Unfortunately, Resilon did not work well do to unforeseen variables. Some newer sealers on the market that may form a chemical or mechanical bond between the canal wall and GP cone are Bioceramic sealer, BioRoot, and EndoSeal MTA. Keep in mind that even though gutta percha with Pulp Canal Sealer EWT (Zinc oxide eugenol sealer) sealer (Kerr Endodontics) or AH-Plus/Thermaseal Plus Ribbon sealer (Epoxy-amine resin sealer) (Dentsply) does not really bond to each other or form a monoblock, the endodontic success rate is still very high at 80-95% depending on the pulpal and periapical diagnosis. Now that we are clear on what obturation is I would like to give you an obturation game plan that consists of different techniques that I use to obturate a canal so that you can dominate the 4th quarter and win the endo game.

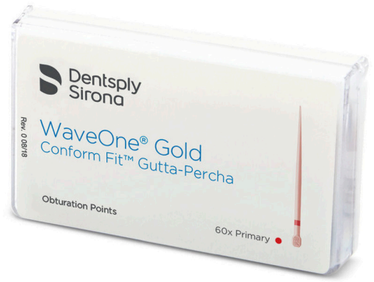
Which gutta percha should I have in my office?

NEW Precision machined Gutta Percha from DentsplySirona© and Schwed©

WAVEONE GOLD GUTTA PERCHA

There is a wide variety of good gutta percha cones on the market. My personal favorite are the new "precision machined, micronized, nano flow" gutta percha from DentsplySirona© and Schwed© that fit the WaveOne Gold, Vortex Blue, ProTaper Next, ProTaper Gold, TruShape and TruNatomy files.

Whenever I use any of these rotary systems I use the new corresponding gutta percha because the majority of the time they fit right to working length. These new gutta percha points are precision



MICRONIZED, NANOFLOW, PRECISION MACHINED GUTTA PERCHA

machined and not hand rolled to fit the NiTi shaping file. If you are looking for standard gutta percha Diadent makes great gutta percha. Prior to advent of the new DentsplySirona gutta percha, I was using Diadent gutta percha. I recommend buying the corresponding gutta percha that fits the NiTi system you are using. I am a big believer in systems based endodontics; NiTi files with matching paper points and matching gutta percha. Systems based endodontics makes treatment easier and more efficient. I also recommend starting with #15-40/.04,.06 and #45-70/ .04,.06 taper Schwed or Diadent gutta percha points. This is only 4 more boxes of GP to purchase.

Fine-Medium Gutta Percha cones (non-standardized) = My associate uses fine - medium gutta percha points from Hygienic and trims back the tip of the cone with a gutta gauge to fit the apically gauged foramen. Her cases are absolutely beautiful.

BioCeramic Coated Gutta Percha = I also have #15-70/.04,.06 taper Bioceramic (BC) coated gutta percha cones that I use with BC sealer. My recommendation is to have a variety of cones available to choose from in case you come across a difficult case.

COACHES NOTE: I do not use this technique anymore but wanted to leave it in the playbook in case you do.

How do I select the correct gutta percha cone?

WaveOne Gold Gutta Percha

The WaveOne Gold gutta percha is awesome! This micronized gutta percha is precision machined to fit the WaveOne Gold file shape. Wow, you mean there is gutta percha that actually fits the shape cut by the file and down to working length? The gutta percha game is over because now we have machine precision GP that will fit the shape cut but by the file with very little error. If for some reason it doesn't fit to working length, go back and re-shape the apical 1/3 with the WaveOne Gold Primary again, or use hand K or NiTi files to shape the apical 1/3 up to size #25 or #30. Irrigate with bleach and check patency and usually the GP will now fit to working length.

ProTaper Next Gutta Percha

The ProTaper Next gutta percha is also awesome! It is micronized gutta percha and precision machined to fit the ProTaper X2 NiTi file. It has very little, if any, error rate and it fits like a glove in the shaped canal. Again, if these cones do not fit then its probably a shaping error and not a gutta percha problem. Usually it is "defective shapes not defective gutta percha."

ProTaper Gold Gutta Percha

The ProTaper Gold gutta percha is also awesome! (starting to see a pattern?). It also is micronized and precision machined to fit the ProTaper Gold Finisher 1,2,3,4 or 5. I highly recommend if you are using WaveOne Gold, ProTaper Gold, ProTaper Next, Vortex Blue, TruShape, or TruNatomy to use the new corresponding micronized, machine precision gutta percha. These cones fit so much better than the standard hand rolled cones. The chemical properties and handling are also greatly improved.

Fine-Medium Gutta Percha

The fine medium gutta perch point will fit to length on longer, tighter, curvier canals but you have to trim back the tip of the point to fit the foramen (determined from apical gauging). This cut can be made with a gutta gauge or by hand with scissors. If your foramen size is size 30 (determined by apical gauging- remember?) then place the fine medium gutta percha cone into the 30 slot of the gutta gauge and trim off the excess. Sometimes I use a gutta gauge and sometimes I trim off 1mm of the end and then fit the fine medium cone to working length. Usually these cones will be 1-2 mm long and I will pull the cone out, check the measurement and then trim off the 1-2mm excess. I will then place the cone back into the canal and make sure it it right to working length and ideally has some tugback (although this does not always occur and is not a reason not to fill if you can't achieve it). I then take the cone and "butter" the apical 1/3 so that the entire 5-6mm end of the cone is completely coated with sealer. Place SLOWLY into the canal.

COACHES CORNER:

I rarely use these types of GP points. Now I almost always use the gutta percha point that corresponds with the last shaping file to length, usually the WaveOne Gold Primary or ProTaper Gold F2 or F3.

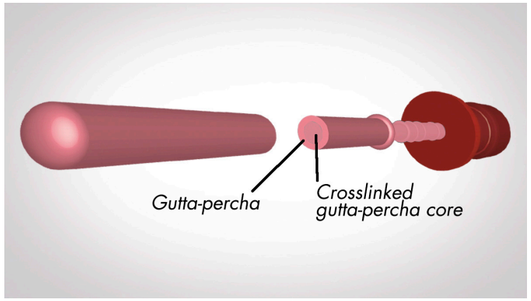
Vortex Blue Gutta Percha

This depends on your NiTi shaping and apical prep shape and foramen size. I typically use 20/04 (if using GentleWave) but my standard shape is 25,30/06 or 30,35/04. In these instances I would use the corresponding Vortex Blue gutta percha cone (micronized, and machine precision). The key to selecting the correct gutta percha point is to at least get it to working length or slightly beyond and then trimming back the tip of the GP point to fit the foramen and taking a cone fit to check the cone length. After trimming it back, you ideally want tugback, where the gutta percha cone tip slides into the minor constriction and fits the foramen just right providing a slight tugback or slight taper retention of the cone. A lot of times when a gutta percha cone does not fit to working length the cone is binding in the coronal 2/3 of the root canal either because the canal is underprepped (most likely) or the cone has a slight error in size. If I know that I nailed my prep and that its well shaped then I will select another gutta percha point of the same size assuming that the first one I selected that didn't fit had an enlargement error. There are some cases that I may select and try in 2-3 gutta percha points for a certain canal until the right one fits, usually going from larger tip to smaller tip and sometimes switching from an 06 to an 04 taper. This is a rarity but it does occur. If this is happening to you often then you may be underpreparing your canals or not properly hand filing the apical 1/3. Luckily, most of the time the newer machine precision, micronized gutta percha fits the shape you cut. This makes life easier and root canals much more fun.

GuttaCore

GuttaCore is an all gutta percha carrier based obturation system. It does not have a plastic carrier with gutta percha surrounding it like the older

Thermafil obturators. The GP carrier consists of a cross linked gutta percha core that does not melt when heated and a gutta percha outer core that softens when placed in the oven.



Size Verifier **=** In order for GuttaCore to work consistently a size verifier must fit to working length in each canal. The size verifier should ideally extend to WITHIN 0.5mm of working length

FAIRLY PASSIVELY and rotate 360 degrees without resistance. Typically I use the Red 25/06 size verifier if I use WaveOne Gold Primary, ProTaper Gold F2 and ProTaper Next X2. ***VERY VERY IMPORTANT***: Take a periapical radiograph "size verifier" fit with the size verifier to working length in the canals. ***A FAIRLY PASSIVE FIT WITHIN 1/2 MM OF WORKING LENGTH VERIFIED BY A SIZE VERIFIER FIT RADIOGRAPH IS THE KEY TO SUCCESS IN GUTTACORE. MOST DENTISTS DO NOT USE THE SIZE VERIFIER.***

Sealer = ***DO NOT*** place a lot of sealer when using GuttaCore (**unless your not patent**). Apply sealer in the ***CORONAL 1/3 ONLY (TRUST ME)*** with a paper point and then wick out any excess with another paper point. Place the correct GuttaCore

obturator (usually the red or #25 size) into the oven on setting 1 with the rubber stopper at the correct working length and ***UNDERNEATH*** the oven arm and push it down carefully. It is recommended to use the measurement lines on the GuttaCore for the most accurate working length. The lines equal in millimeters 18, 19, 20, 22, 24 plus 27 and 29 on the obturator handle. It takes about 10 seconds to heat the obturator and for the oven light to flash. Push down on the oven arm and it will slowly rise and bring the heated GuttaCore out. Grab the GuttaCore obturator by the handle (obviously!) with cotton pliers. Place the GuttaCore obturator ***SLOWLY AND CONTINUOUSLY*** to working length. The heated GuttaCore tends to push or squidgy the sealer down along the canal and can push out a large "puff" of sealer into the apical tissues if too much is applied and if you place the GuttaCore too fast. My first three cases with GuttaCore I had slight sealer overfills and stopped using it for a while because of that. If only I would have properly educated myself and watched some training videos or read up on it, I would have known to apply sealer only in the coronal 1/3 and then used a paper point to wick out the excess.

My advice is to not to use GuttaCore if you have a case with a large lesion and a resorbed open apex.

Bioceramic Sealer (BC) (Brassler) *(I NO LONGER USE BC SEALER- I LEFT THIS IN THE BOOK IN CASE YOU DO)* I used BC sealer FOR TWO years in my practice and had mixed results with this calcium silicate sealer. As with all sealers it has many advantages and some disdvantages which we will discuss later. I have found that the Bioceramic coated cones for whatever reason do not fit to working length as well as other cones. A 25/06 BC cone will at times slide 1-2mm short of the working length in a well shaped canal and then I will try in a 25/06 regular gutta percha cone and it will fit near perfect. So what's the solution? I now will sometimes select a BC gutta percha cone one size smaller than my master apical file (MAF). I will then fit the cone to working length and fit the tip to the apex (trim the tip back as needed).

Bioceramic Sealer Technique

I have tried a variety of techniques to place the Bioceramic (BC) sealer into the canal, including injecting it from the provided plastic syringe tip (I think this wastes a lot of the sealer and you lose apical control allowing for more sealer overfills or large "puffs"), placing it with the MAF (master apical file), placing it with paper points and finally placing the sealer with the master gutta percha point. In my hands, the best technique that gives me the best fill and least sealer in the apical tissues (apical control) is the ***DOUBLE BUTTER TECHNIQUE***. Here is the technique: Take the fitted, master BC gutta percha cone and butter it with the BC sealer and place to working length and coat the dentinal walls. I then take the cone out of the canal, re-butter it with BC Sealer, and SLOWLY place it back to working length. This process gives me good apical control (most of the time) and also gives me nice solid single cone fills. After placing the cone I will sear the cone at the orifice level and then gently push on the top of the cone with a condenser or plugger to make sure the cone is snug at working length and to achieve fluid hydraulics. This obturation method is a single cone technique which Brassler calls "Single Cone Hydraulic condensation".

I know some endodontists who use BC sealer but with normal gutta percha cones. They do this because they like the BC sealer sealing properties and tissue biocompatibility but they do not like the BC gutta percha cones and expense. Each BC cone costs approximately .90 cents and the BC cones are harder to perform a warm vertical down pack (if so desired). If you do want to forgo the single wave condensation technique and use warm vertical then it helps to have a heat source that heats to 270 degrees celsius. The System B heat tip can be calibrated to this heat level. Also, Brassler sells an excellent heat device called the Endo Pro 270 that has a heat range of 150-270 degrees celsius. This heat device works well with BC cones and all gutta percha. Also remember that for whatever reason the BC cones don't always fit well to working length, a regular 25/06 gutta percha cone will fit easier to length than a BC 25/06 cone. I am not sure why and this is not always the case, but after the treatment of 500+ BC sealer cases I find this this to be unfortunately true.

150 BC Gutta Percha Cones

These cones are softer than the standard BC coated gutta percha. These cones are made for dentists who would like to perform a warm vertical down pack. They fit well and now you can obtain a denser fill with a warm vertical down pack but still get all the advantages of BC sealer. These cones were made to work with the Heat Device set at 150 degrees celsius.

CALCIUM SILICATE Sealer Note: I have been "experimenting" with calcium silicate sealers (BC, BioRoot and EndoSeal MTA) for the last 4 years. Subjectively, I have less post-operative pain when I use calcium silicate sealer verses other sealers and it is a slightly faster obturation technique. ***IN MY OPINION THIS IS WHERE THE BENEFITS END. I HAVE HAD MIXED TO POOR RESULTS WITH SOME OF THESE SEALERS AND NO LONGER USE THEM***. I have not achived the success that I desired and have gone back to using the tried and true conventional sealers: Thermaseal Plus Ribbon (DentsplySirona) or Pulp Canal Sealer EWT (Kerr). These sealers are my money sealers and since 2004 I have seen very good healing when I shape well, allow for adequate soak time and use these sealers in conjunction with a warm vertical obturation technique.

Should I take a cone fit radiograph?

In some of my lectures and training courses dentists tell me that they don't use rubber dams and they don't take cone fit radiographs. I ask them how do they know their gutta percha cone isn't 2mm long or 2mm short. They say they really don't but mostly they are right on the money. I agree, I am mostly on the money with my cone fits because I am careful to obtain an accurate working length and I shape gently trying not to bust through and over enlargen the foramen. But the key word is "mostly." I don't want to "mostly" be on the money I want to always be on the money or at least try for "always." I want to "piss excellence" as former Navy Seal Mark Vertsynen would say. ***Just take a cone fit to check the fit of the gutta percha point prior to sealing it in (this is not even worth debating).*** This is the time to make small adjustments like trimming off 1mm off the gutta percha tip if it's long, or selecting a different cone if its short, to get that perfect fit. Also, I take all my cone fits with either bleach or QMix soaking in the canals. A question I often get in lecture is, "Doesn't the GP cones push the bleach or QMix out into the periapical tissue?" The answer is that the cones do not push out the irrigant anymore than hand or NiTi files do. There is a periodontal ligament and bone surrounding the roots that has an intraosseous pressure so that irrigants are not easily extruded. Aim for the best cone fit possible. This is your last chance to get everything pinpoint prior to sealing in the filling material forever and ever and ever.

How do I dry the canals?

I use an EndoVac (Kerr Endodontics) that is attached to one of my suction hoses. On the Endovac is a small plastic vacuum tip called the Macrocannula. This plastic cannula vacuums out the majority of the root canal fluid in 1 second. I then use 1 coarse and ***SOMETIMES*** 1 medium paper point measured to working length to dry the apical 1/3 of the canal. If I am using hydrophobic sealers like Thermaseal Plus Ribbon Sealer (AH Plus- Dentsply) or Pulp Canal Sealer EWT (Kerr Endodontics) I want the canals bone dry so I will use the EndoVac Macrocannula and then 2-3 paper points per canal. If I am using BC sealer (calcium silicate sealer that is hydrophilic) I usually use the EndoVac Macrocannula and 1 coarse paper point per canal. If you don't have an EndoVac (most people don't, although it is a great device) then use Extra coarse paper points first, then course and then medium paper points (if needed) and that should dry the canals. Some canals may take more than three paper points so use your best judgement. Vista Dental and Ultradent also make a small cannula that attaches to your high speed suction and can efficiently suck out the fluids in the canals. These are fairly cheap and easy to incorporate in your endodontic technique.

COACHES CORNER:

There are now WaveOne Gold and ProTaper Gold paper points. When you are ready to dry the canals use 1-2 paper points that correspond to the last shaping file used.

Should I put sealer in the canals before the gutta percha?

I typically do not unless it is BC sealer and I will describe that technique in just a bit. If you take your fitted gutta percha cone and butter the apical 1/3 with the sealer and then slowly insert it into the canal, there will be enough sealer to seal the apical 1/3 and most of the coronal 2/3. The goal is to have a small layer of sealer between the dentinal walls and gutta percha cone (traditional sealers) in the apical 1/3. In some complex cases with curved anatomy I may take a #15 K file and place sealer to the working length. I usually do this on cases where I am having trouble fitting a GP cone exactly to working length and may be 1-2mm short. Although this is not optimal I will place sealer with a hand file and then dip the apical GP point with more sealer and place it to length hoping to push more sealer around the curve to working length and seal the foramen. This technique is employed only when desperate and is better with calcium silicate sealers like BC because ***these sealers serve as a sealer and a filler and can effectively seal the foramen.***

How much sealer do I put on the gutta percha cones?

The amount of sealer I use depends on the type of sealer that I am using and how large and patent the foramen is. In necrotic cases with apical lesions, I use less sealer (but enough to seal the foramen) because it has the potential to run out the foramen and into the periapical tissues. I don't mind a small puff, but stay away from the large sealer overfills that can potentially cause post-operative pain, periapical inflammation and delayed healing.

If I am using Pulp Canal Sealer (also known as Kerr sealer = Zinc-oxide eugenol) EWT (extended working time) from Kerr Endo on a vital case (Irreversible Pulpitis- lots of vital inflamed tissue in the canal space) I will dip or butter the gutta percha cone generously and cover the entire end of the cone for 5-7mm. I will use slightly more sealer in these cases because vital cases usually do not have large resorbed apices and Kerr sealer has a nice flow and tends not to run out the apex. In other words I have excellent apical control with Kerr EWT sealer. Now if you accidentally overprepped the foramen (read "blew out the foramen") with your rotary or hand files then you may want to butter the cone with less sealer so it does not run out into the tissue.

Thermaseal Plus Ribbon sealer (DentsplySirona) or AH-Plus (both epoxy-amine resin sealers) tend to be less viscous and have excellent flow properties, so I butter or dip the cone with less of this sealer.

In cases with a large foramen I still prefer to use the warm vertical obturation technique with Kerr or Thermaseal Plus Ribbon sealer. You just need to make sure that the cone fits well with tug back. Try to use the largest GP cone possible and make sure that the cone fits about 0.5mm from the radiographic apex (take cone fit radiographs). You just need to be careful when using the heat tip not to push the cone through the resorbed or "open" foramen. In some more difficult cases with immature apices I will use MTA to seal the large open apex. These are extremely difficult cases to complete optimally and I recommend to refer these to an endodontist.

Advantages/Disadvantages of different sealers:

Pulp Canal Sealer EWT (KERR Sealer)

Advantages: Tried and True and supported by literature. Adequately seals the foramen. Majority of endodontists use Kerr EWT or Thermaseal Plus Ribbon Sealer (AH Plus). One of the first sealers to come out and has been used for 65+ years. Mix it thicker or thinner to maintain great apical control. This sealer is antibacterial, fairly biocompatible, and an abundant (pain reliever).

1 WEEK GLASS SLAB SEALER TEST: Set up rock hard on a glass slab when tested in my office and I was unable to pull the encased gutta percha cone free.

Disadvantages: You have to mix it (powder/liquid), Strong potent smell when heated (make sure your assistant is suctioning the smoke so that the patient will not inhale it through the nose), Hydrophobic (may not set in the presence of water). Only acts as a sealer and not a filler.

BOTTOM LINE: I have completed 6000-8000 cases with this sealer and have VERY GOOD SUCCESS. This is "Tried and True" and it is considered a great sealer. This has been my go to sealer for years. My opinion is that Pulp Canal Sealer EWT and Thermaseal Plus Ribbon sealer are still the best sealers on the market!

Thermaseal Plus Ribbon Sealer (AH Plus)

Advantages: Tried and True and supported by literature. Adequately seals the foramen. Many endodontists use this as their main sealer. Antibacterial and fairly biocompatible. Easy to mix because it comes in a mixing cartridge.

1 WEEK GLASS SLAB SEALER TEST: IT HAS NOT BEEN PERFORMED YET.

Disadvantages: Potent smell, Hydrophobic (may not set in the presence of water), only acts as a sealer and not a filler.

BOTTOM LINE: This sealer does VERY WELL in studies. Many reputable endodontists use this sealer.

BioCeramic Sealer

Advantages: Calcium silicate sealer, Easy to dispense (comes in a tube), Osteogenic, Very Biocompatible, High pH, Antibacterial, Forms Hydroxyapatite, serves as a SEALER and a FILLER (I always recommend using a GP cone just in case Re-Tx is needed), BC sealer bonds chemically to the dentinal wall and BC cone. Hydrophilic (can set in the presence of water), Single cone obturation technique so very efficient (BIGGEST ADVANTAGE!) Disadvantages: ***HIGH SOLUBILITY AND DOES NOT ALWAYS SET!*** May not resorb in periapical tissue (overfill), BC coated GP cones are 0.90 Cents a cone. Single cone technique sometimes leaves lateral voids in large canals and the obturation does not always look dense. Some BC tubes also have a runnier mix.

1 WEEK GLASS SLAB SEALER TEST: BC sealer did not set up rock hard and was still slightly runny. This may not be an adequate test because BC sealer needs moisture to set, but I did place some moisture on the top of the sealer to enhance setting.

BOTTOM LINE: Calcium silicate sealer. Efficient and Easy: single cone double butter technique. I have performed over 2000 cases with this sealer and have had mixed success. It is retreatable if you use a gutta percha cone (I NO LONGER USE THIS SEALER).

BioRoot Sealer (Septodont)

Advantages: Calcium silicate sealer, Osteogenic, Biocompatible, Forms Hydroxyapatite, Serves as a ***SEALER*** and a ***FILLER*** (Again always use a GP cone in case you have to Re-Tx), Can use any gutta percha cone (bonds chemically and mechanically?) to the cone and dentinal wall). Can mix it thin or thick. Single cone obturation technique so very efficient! (***BIGGEST ADVANTAGE***) or can perform warm vertical obturation.

1 WEEK GLASS SLAB SEALER TEST: Set up rock hard on a glass slab when tested in my office and I was unable to pull the encased gutta percha cone free. In fact I cut my finger on a jagged portion of the set sealer when my associate jokingly pushed my hand down on it.

Disadvantages: ***HIGH SOLUBILITY AND DOES NOT ALWAYS SET!*** Have to mix it and it sets very fast when mixed. Wait to mix this sealer until right before obturating and leave a little dot of the calcium chloride liquid that comes with the package near the mixed sealer. This way if it sets up too fast your assistant can add more liquid. Another disadvantage is there is not enough vials of the calcium chloride liquid that comes with BioRoot (not sure if you can use saline or distilled water to replace calcium chloride vials). Not a lot of research to support the set and seal.

BOTTOM LINE: Calcium Silicate Sealer. Don't use a full scoop and waste the sealer. Use 1/4 to 1/2 a scoop for a 4 canal molar. Wait to mix BioRoot until you are ready to fill. Can use any GP cone. I have had mixed success with this sealer.
(I NO LONGER USE THIS SEALER!)

ProRoot Sealer (Dentspy Sirona)
BEEN TAKEN OFF THE MARKET

Advantages: Calcium silicate sealer, osteogenic, very Biocompatible, causes very little periodical inflammation, very minimal post-operative sensitivity, forms hydroxyapatite, and has an hour working time. Serves as a **SEALER** and a **FILLER** (Again always use a GP cone in case you have to Re-Tx), **Can use any gutta percha cone** (bonds chemically and mechanically? to the cone and dentinal wall). Can mix it thin or thick. Use this sealer in a **DOUBLE BUTTER** Single cone obturation technique so very efficient! **(BIGGEST ADVANTAGE)** or can perform warm vertical obturation.

1 WEEK GLASS SLAB SEALER TEST: IT HAS NOT BEEN PERFORMED YET (NEW SEALER)

Disadvantages: Poor packaging: the sealer powder comes in MTA like packets and needs to be mixed with gel. Sometimes the mix is too sticky and it is hard to butter the apical 1/3 of the GP cone. THIS SEALER WAS TAKEN OFF THE MARKET FOR VARIOUS REASONS!

EndoRez (Ultradent)

Advantages: resin methacrylate sealer. Meant to be used in a single cone technique. Efficient. Bonds to the canal wall and the EndoRez coated gutta percha points.

Disadvantage: It will not set in the presence of oxygen. Very touchy sealer that does not always set up. I performed 300-400 cases with this sealer back in 2012 and so far have seen **100 plus** failures with it.

BOTTOM LINE: In my opinion, this sealer often does not set inside the canals and can lead to failure. I will not use this sealer again in my practice. DO NOT USE!

MTA Fillapex

Advantages: 13% MTA filler but still part resin sealer.

Disadvantages: Studies state this sealer leaks more than AH Plus, etc. In my opinion, I do not recommend this sealer at this time.

BOTTOM LINE: Wait for more studies. Will this sealer formulation be improved?

What happens when the gutta percha cone just doesn't fit?

Unfortunately, this is not an uncommon problem. At one point in my practice I felt lucky if the matching rotary system gutta percha cone actually fit to working length. It seemed to be about a 50/50 chance that the corresponding rotary/reciprocation finisher and matching gutta percha cone would slide to working length. Now with the new Dentsply gutta percha cones that match the ProTaper Gold, WaveOne Gold, ProTaper Next, Vortex Blue, TruShape, and TruNatomy shapes, this is not such a big problem anymore because the cones are nearly exact dimensions of the matching NiTi file. But what happens when these cones won't even fit to working length?

The first thing I do when the matching cone does not fit is select another one of the same size. Cones have an error rate. If this still doesn't work then I select the next smaller cone of that system and fit it to the foramen. In other words if the cone is long by a 1/2 mm, trim it back so it fits with tugback (ideal) at working length and ideally the width of the foramen.

If the next corresponding cone doesn't fit in the system then I either go back and check my shape by running the last rotary/reciprocation file to length and/or checking my apical shape with the K or NiTi hand files #25 and #30. I can also select a smaller tapered cone (.04) but same tip size and fit it to the foramen. Remember, ***sometimes you do not have defective cones you have a defective shape.*** Make sure Quarter 3 of the Root Canal Game is fully completed (Full canal shape + Deep apical shape with hand files) before you move to Quarter 4 Obturation.

Cold Lateral Obturation

I can't speak as an expert on cold lateral condensation because I have only performed 5

cases in my entire life using this technique. I have seen some "older" endodontists use this technique to obturate and they have had great success and beautiful cases. With the advent of heat devices like System B, GuttaSmart (DentsplySirona), EndoPro 270 (Brassler), and many other cordless heat devices (just look in your Henry Schein or Patterson catalog), warm vertical is relatively quick and simple to perform. Cold lateral condensation is an "older" or "out dated" technique and is not taught as much anymore due to the higher incidence of root fracture from lateral spreader forces. My advice is to use warm vertical condensation or GuttaCore to obturate your cases.

Warm Vertical Obturation (MY PERSONAL FAVORITE)

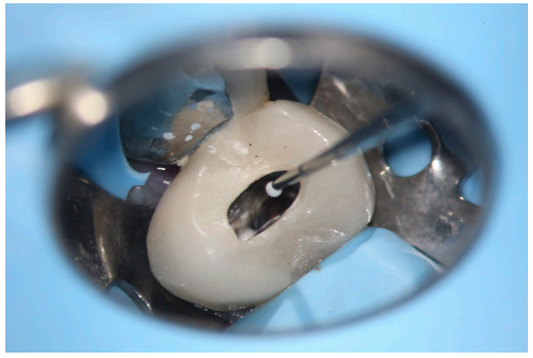
GOAL: The goal of this technique is to gently move the tip of the heat source through the gutta percha to within 4-5mm of the apex or working length, leaving 4-5mm of heated gutta percha behind in the apical 1/3.

Studies show that the heat from the heat source can travel 4-5 mm down through the gutta percha softening and molding the apical gutta percha to form into and help seal the foramen (along with sealer of course). After removing the heat source and the coronal/middle 2/3's of the gutta percha, use a fitted plugger to gently push the heated gutta percha thus molding it into the shape of the foramen.

TECHNIQUE: The technique is as follows: butter the apical 5-7mm of the gutta percha cone with sealer and place into the canal slowly. Use the heat source of choice to sear the gutta percha cone off at the orifice or 3-5mm down into the canal. I use the EndoPro 270, Heat Tip of the GuttaSmart, System B or Calamus heat source to do this. There are many comparable cordless heat devices on the market. I prefer cordless endo motors, heat devices and Obtura because they are easier to pass. I still use the the Obtura with a cord or the cordless Diagun backfill device, but ***I LOVE THE NEW GUTTASMART OBTURATION SYSTEM!***

After searing the cone off at the orifice or slightly down in the canal, use an appropriate sized plugger and gently compress or vertically downpack the gutta percha. The vertical pressure placed on the gutta percha is equal to the force that you would press down on a PEN when you write. So not too much force but enough to compress the gutta percha and start the molding process to the canal walls and foramen. Note I didn't say the force that you would press down with a PENCIL but a PEN because you can use more force on a pen. Compress the gutta percha with a larger plugger (you are more coronal) for 2 seconds and then go back in with the heat source.

You can also perform ***CONTINOUS WAVE*** heat condensation where the tip of the heat device is slowly placed into the gutta percha while heated within 5mm of working length (place a stopper on the tip of the heat device so you know where you are at) and then hold it there a few seconds with the heat off. After a few seconds, activate the heat again for 1 second and pull out the coronal gutta percha. It will come out with the heat source and



ADD A TEARDROP OF SEALER ON TOP OF THE GP AND TO COAT THE CANAL WALLS

the apical gutta percha will remain intact. This is why it is important to have tugback with your gutta percha cone so that when warm vertical is performed you don't pull out the whole gutta percha cone. Unfortunately, tugback does not always occur and then you have to slightly change your obturation game plan. In some cases, when I am worried about pulling my cone out and do not have perfect gutta percha tugback, I do a "normal" slower warm vertical technique where I remove 4-5mm of gutta percha at a time with my heat source and then gently compress the gutta percha with my pluggers. I will do this technique until I get down to within 5mm of working length or until I am unable to advance. ***It is just not always possible on some of these curved, long canals to heat up the gutta percha to within 5mm of working length.*** If you are unable to do this do not stress and definitely do not force the heat tip deeper into a long, narrow, curved canal and cause a root fracture. I have completed thousands of cases successfully where I was unable to get the heat source to within 5mm of the working length. You take what the canals will give you and you don't stress. Be excellent but know that perfect dentistry is not always attainable. So if you are unable to get the heat source to within 5mm of the working length, then theoretically you are performing a single cone obturation (like the BC sealer technique). Somehow these cases still often work quite well but are not ideal.

Once you have removed the gutta percha to within 5mm of working length and have compacted it with a smaller plugger, then it is time to back fill the rest of the canal with warm gutta percha. I use the GuttaSmart (also Obtura or Calamus) and place the 25 gauge needle (smaller the diameter the better) right on top of the gutta percha in the canal. Wait a few seconds for the GuttaSmart needle to heat up the gutta percha in the canal and the canal walls and then slowly extrude the gutta percha. Allow the extruded gutta percha to push the GuttaSmart backfill, Obtura or Calamus backfill out of the canal. Sometimes I only extrude 3-5mm of gutta percha and then compact it with a plugger and sometimes I slowly fill the entire canal. If the canal is long (24mm+) then I usually perform an incremental backfill. Also, if I am having trouble with access or getting the GuttaSmart needle to the right spot (sitting on top of the gutta percha in the canal) then I will perform an incremental backfill. I am careful here to extrude gutta percha slowly when backfilling because I want to avoid the ugly voids. Nothing kills a root canal mood like a big void. By waiting 5 seconds prior to backfilling the canal and executing it slowly, the void can be avoided.

Which heat device do I recommend?

I love the ***cordless*** Endo Pro 270 (Brassler). This is one of the best heat devices on the market. The advantage of this heat device is two fold: cordless and it can be set from 150 to 270 degrees celsius in increments of 20 degrees. The 270 setting is needed if you use BC sealer and cones. The BC cones do not

melt as well as regular gutta percha and a higher heat is needed. Brassler recently came out with BC 150 cones which melt at 150 degrees celsius and can be used in a Warm Vertical Condensation technique. I like the #45/04 taper Tips for molars and #55/06 Taper Tips for Anterior/ Premolars. Cost per tip is unfortunately $130 but you are able to get 100's of uses out of them. The GuttaSmart heat tip is also excellent and is cordless. My favorite tip is the black one. I have 3 GuttaSmarts in my office and use them all the time.

Do I recommend the Obtura or Calamus?

They are both great devices. The benefit of the Obtura device is that it holds a fairly large gutta percha pellet and you can backfill 3-5 teeth with one pellet. The disadvantage with Obtura is that is bulky and sometimes difficult to place in tight access' without touching and burning the patients

lip. Over the years, the Obtura plastic shield end has come into contact with the patient lip or cheek a few times resulting in the patient jumping out of the chair because suddenly they feel a burning sensation. Also, the Obtura can get messy and has to be cleaned often. If you have a lazy assistant and she doesn't follow instructions and forces another gutta percha pellet in the chamber of the Obtura instead of extruding out the last bit of remaining

gutta percha, the gutta percha will sometimes extend out of the main holding chamber and make a mess. The Obtura also has a cord.

The Calamus is a great device because it comes with a heat source on one side (like a System B) and a gutta percha backfill device on the other. So it is all inclusive for all of your warm vertical obturation needs. It also stays pretty clean because it comes with a gutta percha cartridge and needle that is recommended for single patient use. We wipe the needle and use it until the gutta percha runs out. Typically I can backfill 1-2 molars with one cartridge. Another great advantage of the Calamus, is the backfill device looks like a supersized pen and it fits very well into tight spaces in the mouth, especially when using a pen grasp. The needle can also swivel around freely. I place the Calamus needle onto the gutta percha in the canal and wait a few seconds and then activate the button on top of the Calamus handle and after 1-2 seconds the gutta percha slowly extrudes out and into the canal. Another great feature is upon removal of pressure from the activating button the device actually sucks in a little gutta percha that had been extruded thus cutting down on your excess. The disadvantage to this advantage is that there is a small learning curve of 10 cases to get comfortable with this device verses the Obtura which has virtually no learning curve: point and shoot. I have noticed that the Calamus is a more refined gutta percha backfiller and sometimes takes more time to backfill a canal (due to the gutta percha suck back). Another disadvantage to the Calamus is cost. The initial cost of the Calmus is around $2300 which is not terrible considering it's a heat device like System B and a gutta percha backfiller. I tend to use the Calamus on the tougher cases that have longer canals and a tighter access. It is a great device and will definitely take care of both of your heat source and backfill needs.

In my private practice I have had the pleasure to try the majority of heat tips and backfill devices. The two that have come out on top are the GuttaSmart (heat tip and backfill) and the EndoPro 270 (heat tip only).

GuttaSmart: The new gold obturation standard

I have been using the new GuttaSmart system from DentsplySirona for over 2 years and it has become my main obturation system. With the GuttaSmart there are two cordless devices that sit on one charger with two charging slots. One side contains the heat tip device and the other is the gutta percha backfill unit. The cordless heat tip comes with 3 electric heat pluggers of various sizes. There is the small (black = 40/0.025), the medium (yellow - 50/0.05), and the large (blue-60/0.06). I mainly use the small black plugger at 200 degrees Celsius to remove the coronal/middle third gutta percha. I then use the Dovgan plugger (green/white) to gently compress the gutta percha in the apical 1/3. This pushes the heated gutta percha and sealer into the irregularities of the canal and foramen obtaining a fluid tight hermetic seal. The gutta percha backfill cordless device can be used with a 20, 23 or 25 gauge needles with gutta percha cartridges. The needle and cartridge come as one piece and I recommend using mainly the 25 gauge (smallest). I place the tip of the 25 gauge into the canal and onto the apical plug of gutta percha. Depress the button and backfill the entire canal. The device will slowly back you out of the canal as it filling it with gutta percha. I will fill the entire canal all at one time and then use a Dovgan plugger (blue or black end) to compress the gutta percha at the orifice level. If I have a case with 3 or 4 canals I will backfill all 4 canals in a row and then use the plugger to compress the coronal gutta percha. I backfill all canals at one time because the gutta percha stays hot and I able to still compress it with a plugger.

The advantages to this system is that both the heat tip and backfill handpieces are cordless and are easy to use. Warm vertical obturation is very efficient with the GuttaSmart system and only takes me 2-3 minutes longer than if I use the single cone obturation technique with BC sealer. The backfill device can also be held with a pen grasp and is much more ergonomic than the conventional Obtura gun. I am able to easily insert the needle into the canal and down to the gutta percha plug and backfill the entire canal. The only disadvantage is that the unit costs around $2300. This obturation system will also be slightly more expensive to use because you have to buy refill gutta percha cartridges/needles instead of pellets (Obtura gun). Each cartridge lasts for about 2-3 cases.

In my opinion the slight extra cost is well worth the investment. I am able to quickly obturate and achieve dense fills with very few voids with the GuttaSmart system. I do think it is the best obturation device on the market (only the Elements IC from Kerr is comparable and it is still not as good). I now exclusively use the GuttaSmart obturation system in my office to backfill all of my canals.

What pluggers do I recommend in the warm vertical technique?

Remember, we use pluggers to condense down the warmed gutta percha so that a better seal is formed between the sealer, gutta percha and the canal walls and foramen. This is more personal choice. I like the Dovgan Pluggers and really need only two double ended pluggers. The larger plugger has tip sizes of #60 and #80 and I use these to push (condense) the gutta percha in the coronal canal. The smaller plugger has a tip size #35 on one end and a #45 on the other. I use the #45 95% of the time when I am GENTLY condensing the gutta percha near the apical 1/3 of the canal. There are many other excellent pluggers on the market. For years I used the double ended Buchanan pluggers and they are excellent and probably the most well known. The Dovgan pluggers were made by the late Dr. Joseph Dovgan, endodontist. I feel that he improved on the design of the Buchanan Pluggers with the tip sizes and NiTi ends, but in the end both sets of pluggers are excellent. One of my endodontic friends who performs beautiful work uses the Obtura Spartan Pluggers called Kondensers for her warm vertical condensation.

Scenario #1 - You have just completed shaping #29 (lower right 2nd premolar) with the WaveOne Primary file or the ProTaper F2 (last rotary file used) and have apical gauged to a #25. It is a pretty standard case. *What gutta percha and sealer are you going to use?*

Game Plan #1 with Variations

Use the corresponding ***WaveOne Gold Primary Gutta Percha*** or **ProTaper Gold F2 Gutta Percha with Pulp Canal Sealer EWT** (also known as Kerr sealer=This is a zinc oxide eugenol sealer) from Kerr Endodontics or ***AH-Plus/Thermaseal Plus Ribbon sealer*** (Epoxy amine resin sealer) from DentsplySirona. Try the corresponding gutta percha into the canal and if your working length is 21mm and the cone slides to 22mm then trim off 1 mm and try it into the canal again. Ideally, you want some tug back telling you that you have a nice fit and seal at the foramen (not always the case) and that the cone is most likely not going to slide long because there is a nice well tapered prep (ice cream cone shape). Take a cone fit to verify that perfect fit that exists only in your mind. The goal is to fit

the cone as intimately with the apical foramen and with the canal (take up as much space as possible) and to be at the correct length (right at the apical minor constriction- more theoretical), not top short and not too long.

What if the WaveOne Gold or ProTaper Gold F2 gutta perch cone fits 1/2mm short of the working length?

If the gutta percha cone fits within 1/2 mm of your working length then I would take a cone fit radiograph. If the radiograph verifies that the cone is actually 1/2 mm away from the foramen then I would obturate. That 1/2 mm will be sealed with the warm vertical condensation forces and most likely the gutta percha cone will be pushed that last 1/2mm.

What if the WaveOne Gold or ProTaper Gold F2 gutta percha cone fits 1mm short of the working length?

(***I DO THIS FIRST***) Sometimes I also go back irrigate and re-hand file the apical 1/3 and make sure I am patent and that there is not any debris in the canal that could be holding up the gutta percha cone. Remember to always use plenty of sodium hypochlorite irrigation. Always irrigation whenever you file with mechanical (rotary/reciprocation) or hand files and alway checking patency. In some cases, if I had finished with a #25 MAF file, I may hand file to a 25 or 30 just to get a little more apical shape and a better cone fit. Just remember to be ***GENTLE*** (ZenEndo) with the apex and don't rough it up, or for lack of a better term, violate it (not my term, but I have often heard this term thrown out by endodontists when they see a canal filed long with a "blown" apex).

In this case, I can also select a new WaveOne Gold/ ProTaper Gold F2 cone or pick a smaller gutta percha cone and attempt to fit it to the foramen. (Remember, that most of the traditional gutta percha points have a slight error rate. A 30/06 cone could actually be a 35/06 or 25/06 cone. This is why I often select 1 cone size smaller and then fit it to the foramen). The new Gutta Percha that DentsplySirona sells has much less of an error rate, if any, and fits to working length exceptionally well. I recommend the ProTaper Next X2, WaveOne Gold, and ProTaper Gold gutta percha (DentsplySirona).

What if the WaveOne Gold, ProTaper Gold or ProTaper Next gutta percha cone still fits 1mm short and you have already gone back and re-hand filed the apical 1/3?

Basically, this sucks when this happens. Four things could be going on: 1) Your working length is off and short (re-check with the Root ZX), 2) You are not patent, 3) There is still debris in the canal holding the cone up, 4) There is not adequate canal shape and you are trying to "force" the obturation (come on, admit it, we have all done this, particularly on a patient we hope to never see again). I'm assuming that the reason you are reading this right now is that you sometimes have this very problem. Well, don't stress, it sometimes happens to me. I know how to fix it and I want you to know how to!!! Now go back and re-shape to working length with the last NiTi file that you used. Most likely WaveOne Gold Primary, ProTaper Gold, ProTaper Next or Vortex Blue 25/06 or 30/04, 35/04. Work the file to working length 3-4 times and gently brush to the outer wall when disengaging the file. Make sure you have plenty of adequate shape. Irrigate, check patency with a #10 file and re-fit the corresponding gutta percha point. Usually it will fit to working length after re-shaping.

What if you have tried all the above mentioned techniques and the cone still doesn't fit?

By now you are probably getting stressed and pressed for time and may even be 30 minutes late for your next patient who is sitting in the next treatment room looking at his watch. So what do you do? Rather than let the whole day unravel into a time disaster where you are late for the rest of your patients, its time to punt! It's 4th and long and its time to bring in the punt team. I don't mean punt the case to an endodontist, I mean punt by checking patency, drying the canal and placing calcium hydroxide. This is a good idea because 1) Ca(OH)2 is never a bad idea to place in the canal to continue the disinfection, and 2) It seems to really help "soften" the canal walls or any leftover apical tissue. I'm not sure if what I am saying is scientific, but by experience I am able to achieve patency in a majority of the teeth I work on after placing CaOH2 and allowing it to sit in the canals for 1-2 weeks.

Another option is to obturate the canal even though you are 1mm short. Look, we have all done this and this may be an option when you are working on a jerk patient or a patient that drives an hour and a half to your office. This is not ideal, but real life is not always ideal. It may or may not be a good idea to have a discussion with your patient after you obturated 1mm short that the canal is clean, but you had difficulty sealing the last 1mm. I am not sure this is warranted (it is if you are 2mm short), but you could mention that this was a tough one to fill. Thankfully, a lot of times the sealer and cone will run at least 1/2-1 mm if you are using warm vertical or GuttaCore and if you correctly shaped the canal and are patent. Even BC sealer will sometimes fill in that last 1mm if you are truly patent and not blocked out. On some multi-rooted cases, I will sometimes place sealer with a hand file to working length first in that "tough" canal to make sure that I have at least some possibility of a seal. In truth, most of the time when we are 1mm short in obturation, it is operator error. We were going to fast and didn't shape well enough either with rotary/reciprocation or apical hand filing or selected an incorrect gutta percha cone.

Scenario #2 - You have just completed shaping a four canal tooth #3 (upper right 1st molar) with Vortex Blue 25/06 or ProTaper Next X2 (25/06v) or WaveOne Gold Primary (25/08v) or ProTaper Gold Finisher 2 (25/08v). You have apical gauged to #25 on the MB1 and DB and #30 on the Palatal canal. The MB2 meets the MB1 about 1/2 way down the MB root. What gutta percha and sealer are you going to use?
Note: These are all comparable file systems and are great to use in longer, tighter, curvier canals. My 2 favorite file systems to use in these cases are the ProTaper Gold or the WaveOne Gold. If its an access issue (limited opening or tough area to get to) I tend to migrate toward the PT Gold or WaveOne Gold because they have a shortened handle and cut great shapes.

Game Plan #2 with Variations

Option 1: Use the Vortex Bluer 06 taper gutta percha cones or the WaveOne Gold Primary gutta percha cone or the ProTaper Gold F2 gutta percha cone with either Kerr or Thermaseal Plus Ribbon sealer in a warm vertical technique You could also use GuttaCore #25 and #30 (red or blue - MAF) obturator with any of the above mentioned sealers. So you have plenty of options.

Option 2 (FOR BC SEALER USERS ONLY): BC sealer with 20/06 BC cones for the MB1, MB2, and DB canals and 25/06 for the palatal canals. The older BC cones do not fit as well as the regular gutta percha cones so I always select 1 size down from my MAF (master apical file) (I believe the newer BC cones fit better- I STOPPED USING BC SEALER). The one big disadvantage to BC cones is that each cone costs about $1, so I always select a smaller cone that is most likely to fit to working length and then trim back the tip to fit the foramen. The problem arises when 2 or 3 BC cones do not fit a canal and now you have wasted $2-3. I always try to use the BC cones on other canals. I will pick a smaller cone, say a 25/06 and try it in to the palatal first and if its just getting to working length then I know that it probably won't fit in the MB or DB canals (although I remove the cone from the palatal and see if it will fit into those canals). Be smart on cone selection and try to use one cone that doesn't fit one canal in another. That is why I always start smaller and trim the tip of the cone to fit the foramen. You could also use a 25/04 BC gutta percha cone. I typicaly try and use 06 taper BC cones because the 04 taper look very wimpy when filled. I also feel that I am heavily relying on the BC sealer to seal a large part of the canal space and foramen when I use 04 taper BC cones. I still do you use 04 taper BC cones but mainly on the long, tight, curvy canals. Use the BC cones to first place the sealer to working length and then go back and rebutter the BC cones with BC sealer and SLOWLY insert into each canal. Sear at the orifice level and condense with a plugger.

I have had mixed success with BC sealer but I have noticed that I have very little post-operative pain compared to the other sealers (I know this because I call all of my patients 1-2 days after

the root canal). I stopped using BC sealer about two years ago because I was having an increased number of long-term post-operative symptoms. I believe that the sealer is more soluble and does not always set in the the canal).

Keep in mind that this technique is a single cone technique (Brassler calls it "Hydraulic wave condensation") so we are relying on the BC sealer and BC cone to set up and bond to each other and canal walls and apical foramen, hopefully sealing any portal of exit or entry for microbes.

What if a 20/06 BC gutta percha cone does not fit in the MB canal?

Irrigate with 6% bleach, check patency and then re-hand file up to #25 with NiTi hand files. Irrigate, check patency and then if needed go up to #30 NiTI hand file. If they still don't fit, you could try a 25/04 taper cone or switch to micronized gutta percha cones with Pulp Canal Sealer EWT or Thermaseal Plus Ribbon sealer. No harm in switching gears if the BC cones do not fit right.

Scenario #3 - You have just completed shaping a 3 canal tooth #19 (lower left first molar) with WaveOne Gold Primary or ProTaper Gold F2 (last rotary). You have apical gauged to a #25 for the ML canal (MB meets the ML canal) and #30 for the D canal.

Game Plan #3 with Variations

GuttaCore with Pulp Canal Sealer EWT or Thermaseal Plus Ribbon sealer. Remember, the Thermaseal Plus Ribbon sealer (AH-Plus- epoxy amine resin sealer) tends to flow well so you have to be careful not to extrude a large puff out the apex (I have done this a few times). The heated GuttaCore is very effective in pushing the sealer around so you have to be careful and not have excess sealer in the canal. I have only tried Pulp Canal Sealer EWT (Kerr- zinc oxide ACA eugenol) with GuttaCore a few times and I feel that I have better apical control with this sealer.

Follow the GuttaCore steps outlined earlier in this chapter. Select a #25 size verifier for the ML and a #30 for the D canal (remember the MB meets the ML- we know this because we took working length radiographs to check it). Remember there is bleach in the canals during this process and any cone fit process. Make sure that the size verifiers can rotate freely within the canal. If the cone fit radiographs confirm that the size verifiers are at the correct length or 1/2-3/4mm short then its time to obturate with the GuttaCore. Remove size verifiers, irrigate with QMix and check patency. Dry the canals, place sealer with a paper point, wick any excess with a new paper point, and obturate with GuttaCore. Use the measurement lines on the GuttaCore to assist in placing it to the correct working length. Place the GuttaCore to working length SLOWLY!

In this case, I would only use GuttaCore Obturators in the ML and D canal and place a regular gutta percha cone with sealer in the MB (remember it meets the ML canal).

Remove the GuttaCore coronal end with a **NEW SHARP** spoon excavator or move the handle back and forth until it breaks off. Sometimes it breaks off perfectly at the orifice but most times it does not and breaks off higher. I then use a sharp spoon excavator and remove the excess. Be careful in this situation not to pull out the whole GuttaCore while trying to remove the last 2-4mm of the handle excess.

GuttaCore is a great all around obturation system but can be technique sensitive so it is a good idea to have regular gutta percha on hand in case you need to switch gears and do warm vertical obturation.

TIMEOUT
OBTURATION REVIEW

WARM VERTICAL

1. My favorite obturation method is warm vertical obturation with Thermaseal Plus Ribbon or Kerr EWT sealer

2. My second favorite obturation method is GuttaCore with Thermaseal Plus Ribbon or Kerr EWT sealer.

3. Make sure you have adequate apical shape. Once the last shaping file touches the apex (working length) then gently shape the apex by working that file 3-4x back and forth to achieve deep apical shape. If the gutta percha cone or size verifier still will not fit to working length then hand file to a size #25 or #30 K file.

4. Use QMix with the EndoActivator (at least 30 seconds of use per canal) as your last irrigant to remove the smear layer. Let the QMix sit in each canal for at least one minute and then dry with paper points. No need to to rinse it out of the canals. I usually take my cone fit or size verifier fit radiographs with QMix in the canals.

5. Select the gutta percha cone that corresponds with the last shaping file used to length. This is usually the WaveOne Gold Primary, ProTaper Gold F2, Vortex Blue 25/06, ProTaper Next X2, Trushape 25/06, or TruNatomy Prime gutta percha.

6. Place the cones to working length and take straight and angled cone fit radiographs.

7. If you are happy with the placement of the gutta perch cones then dry the canals with a small vacuum and paper points (use the shaping file system paper points).

8. Butter the apical 1/3 of the gutta percha cone and place it to working length. Quick tip: When the gutta percha cone gets to within 5mm of working length, pull back on the cone slightly and then insert all the way down to the apex. This little trick allows the tip of the cone to "grab" a little extra sealer from the canal wall and push it down to the foramen.

9. Use the GuttaSmart black heat tip and place it into the canal and remove the coronal/middle 2/3rd's gutta percha. The goal it to place the heat tip to within 5 mm of the working length, if possible.

10. Take a small ended plugger (Dovgan plugger- white end), dip it into a little sealer and push and mold the heated 5mm apical plug into the foramen. This will create a nice hermetic seal of sealer and gutta percha at the apex. This hermetic seal will prevent microbes from entering or exiting the canal system. "Failure to seal, is a failure to heal." Or to put it in real terms, "Seal to heal so you can get the deal ($) and get your next meal."

11. Use the GuttaSmart obturation side and place the 25 gauge needle on top of the gutta percha in the apical 1/3. Gently and slowly express the gutta percha, allowing it to push the needle slowly out of the canal. Fill the entire canal in one shot.

12. Use a larger plugger (Dovgan plugger- blue/ black end) and condense the coronal gutta percha. This whole process can be quite efficient especially if you incorporate the GuttaSmart in your office.

13. Use an alcohol pellet to remove any excess Thermaseal Plus Ribbon sealer. If you are using Kerr sealer then you will need a small chloroform pellet, followed by an alcohol pellet to remove excess sealer. Restore the tooth.

GUTTACORE REVIEW

1. See steps 3 and 4 above.

2. Select the appropriate size verifier that matches the last shaping file to length (MAF- Master Apical File). If you finished with the WaveOne Gold Primary file than select a WaveOne Gold Primary size verifier (#25 red). If you finish with the ProTaper Gold F3 than select the #30 size verifier (blue). Try the correct size verifier into each canal with QMix.

3. The size verifier must fit to within 0.5mm of working length, FAIRLY PASSIVE and should be able to rotate 360 degrees. Take size verifier fit radiographs.

4. Dry the canals with system based paper points.

5. Place a tear drop of sealer in the coronal 1/3 of each canal orifice with a clean paper point. Use another new paper point to wick any excess sealer.

CHAPTER 11
POST-GAME: POST-OPERATIVE INSTRUCTIONS AND PATIENT MANAGEMENT

PART 1: POST-OPERATIVE INSTRUCTIONS

Post operative instructions are very very important. You, the assistant, and your front office need to communicate clearly to the patient what they will feel post-treatment and what they need to do to stay comfortable. A few minutes of clear post operative instructions will greatly reduce weekend or late night calls from the patient.

We give all of our patients a post operative instruction card and my front office reviews it with them and high lights some of the key points like, "DO NOT CHEW ON THE TREATED TOOTH FOR THE NEXT 3-5 DAYS, take 600mg Advil every six hours for the next two days (about 3 times a day) and then reassess if the Advil is needed for the third day." I tell the patient that we just performed a surgery inside the tooth and that it will be sore for 3-5 days and sometimes up to a week (I see this in bruxers). We give 3 Advil (600mg) after the procedure if the patient has eaten in the last 3-4 hours. If the patient has not eaten then we recommend that the patient eats right away and takes 3 Advil before the numbness wears off. I always tell the patient, "Stay ahead of the pain and take the Advil (if they are healthy enough) prior to the numbness wearing off and then every six waking hours." I like to tell patients, "You take 2 little Advil (200 mg) for a headache and then 3 little Advil for a toothache." I am careful because we have had patients not listen or read the card about dosage and take 3 tablets of 600mg Motrin. Kidneys be damned!

Typically, my assistant reviews post operative instructions right after the post operative radiographs are taken and then finally my front office reviews any relevant points with the patient on the post- operative card. Patients are typically physically and emotionally wasted after a 1 1/2 hour root canal and tend to catch about 15% of what you say. This is why I recommend that you develop a root canal post operative instruction card.

PART 2: PATIENT MANAGEMENT: Simple sayings of the Root Canal

I need to confess. I told a 25 year old patient two days ago that he needs to "man up." What would you say to a 210 pound man who is moaning while I am working but doesn't have any pain? Maybe I am not the best individual to write a chapter on patient management and communication. My two biggest problems: I am too honest and have zero filter. This is a bad combination to have in life ("how do I look in these pants?") and in practice ("I need lots of numby juice!"). Typically, I now run through five or six scenarios in my mind, discarding most, until I settle on one that sounds professional and intelligent. That's when I open my mouth and speak.

Yesterday, I had three crazy patients in a row. The first guy refused to sign the consent forms and would not pay a dime because he claimed his dentist was responsible for all costs. He sat in my reception area (not waiting room) for 30 minutes until he finally decided to sign. He was also exceptionally rude and a major jerk. I ended up deciding not to treat him and asked him to leave (first time I have asked someone to leave).

The second patient was on drugs, had major psychosis and claims that he has MS behind his eyes. Whatever you do, don't make the mistake, as my new assistant did, and ask him how court is going. The third patient was bipolar and irrational and was unable to look at me or talk to me because then, "it was not real." She actually used her hands to cover her eyes and would not move them and would not open her mouth like she was five. I thought about pappoosing her and using the antiquated pedo "hand over mouth" technique when she started crying. Can you imagine what happened when I gave her the palatal injection for #2? She just about flipped out. A small smile may have crossed my face during that injection. Hypothetical of course. I seriously considered closing the office and taking my staff to happy hour. I believe the phrase, "I need alcohol" was mentioned by most of the staff at least four or five times that day.

Thank God the fourth patient was a no BS cop who looked like he was a UFC fighter (and yes wrestled in high school). I definitely would not have told him to "man-up." He turned out to be an excellent patient who fell asleep during the root canal on #15. We kept telling him how grateful we were to have him as a patient. The only mildly disturbing incident that occurred, was that I almost missed the "non-existent" MB2 with its own foramen or POE (portal of exit). In other words, it did not meet the MB1 like the majority of the maxillary 2nd molar MB2's. I was using paper points on the other canals and thankfully happened to look one more time through the scope and the MB2 "dot" was staring at me 3mm from the MB1, and slightly mesial from the MB1/Palatal orifice line. If you see an MB2 more than 2mm from the MB1 it usually has its own foramen or exit. Whoops!

With all that said, I wanted to include a chapter of the greatest hits of one liners and explanations I give to patients during the root canal process. Over the years, I have been able to dial it in on what lines work and impart understanding to the patient and what lines cause confusion.

First off, if possible, have your front office employee address the patient by name when they walk into your office. You want to create a "Cheers" atmosphere, "Where everyone knows your name." People love to hear their name. It makes them feel good and starts a positive office vibe. There are so many lame front office employees in the medical and dental field that it absolutely amazes me. Talk about a way to kill your office productivity potential. I stopped going to my family physician mainly because his office staff sucked and especially his front office. They wouldn't even look up when I walked in and say, "Hi." Instead, while looking down, they would say, "Sign in." I told her she was fired but she didn't hear me and/or she didn't care. So please avoid the sh@#ty front office phenomenon and employ good, happy, joyful, energetic people that smile when they greet the patient by their first name. Amen.

Most patients are busy with work and family and just want the bottom line:

What's wrong?
How do you fix it?
How much is it going to cost?
How long is it going to take?

First off what do you say to a patient who clearly needs a root canal?

The patient interview (S), clinical testing is complete and the radiographs read (O), and your diagnosis (A) is #3 IP-Symptomatic/Symptomatic apical periodontitis. The treatment (P) is a root canal. What do you say?

"This tooth will definitely need a root canal." SAY IT WITH CONFIDENCE. I leave it at that because most patients know that they need one and just felt the percussion, bite stick, and Endo Ice pain. I like the patients to own the tooth so while testing, I always ask is this the one? Most times patients understand that they have a sore tooth and that it needs to be treated so I try to keep it simple. 5-10% of the patients will require more explanation. If you get a 10%er then I explain the "3 pain strikes your tooth is out" rule (percussion (+,++,+++), bite stick (+,++,+++), cold (+,++,++ +)).

Patient: "How did this happen? I always take care of my teeth and floss?" Bacteria. Bacteria walked through the cavity or crack into the inside of the tooth (nerve center) and caused an infection or inflamed nerve. You can just say bacteria walked through the cavity into the nerve center. I keep it as easy as possible and it works.

Scenario - New crown cemented 2 months ago.
Patient: *"I never had pain before you worked on this tooth and did that crown?"*
First of all don't get defensive (I'm really reminding myself this because it always frustrates me to hear this). Usually the patient had a giant cavity right on the nerve and a composite restoration was completed and crown placed. This is failure of ownership and the patient is not taking responsibility, but it does us no good to be defensive. Practice your Zen principles and breathe before responding. I recommend to gently remind

the patient of the large cavity they previously had and to shift the ownership back to the patient.

Scenario - What if there was never a cavity but a crack or large restoration? A full coverage restoration was placed and now the patient has pain and needs a root canal. "This tooth has had multiple fillings (I don't say restorations) and cracks and cavities over the years. Sometimes these teeth just get pushed over the edge and the nerve goes bad." If there is a crack, I stress that bacteria can walk through the crack. Cracks and infection seem to be good buzz words for patient understanding.

Scenario - What if there was no history of prior pain or caries and you replaced an old crown due to esthetics or porcelain fracture?
This one is tougher because everything was truly fine (besides the porcelain fracture) until we intervened. First off it is important to communicate that this is not an anomaly. Patients think that this is the first time this has ever happened in the entire history of the world and that it is a huge injustice. I tell them, "This happens all the time. Teeth are touchy and sometimes they appear normal but when we try to fix a ***PROBLEM*** (shifting responsibility back to the patient) they go south. I wish there was a way to look inside the nerve and tell ahead of time which ones will be fine and which will go bad so we could tell you before we fixed the ***PROBLEM***."

Patient: So my tooth is infected? (Dx: #3 IP-Symptomatic/Symptomatic apical periodontitis) *"No, it is one stage before that, but the nerve is inflamed and swollen inside the tooth. Its similar to when you sprain your ankle and it swells. You have a sprained tooth with swelling inside. The good news is that you are still one stage from the nerve becoming completely* ***infected****"* (this helps motivate them to get the root canal started).

What do you say when the diagnosis is #3 Pulp necrosis/Symptomatic apical periodontitis (with lesion)?

"Your tooth is infected and will need a root canal." I cross my fingers and pray that is the only explanation they need and it usually is. The word "infection" pushes patients into action. Use it, but use it correctly. If the patient requires more explanation, I show them the radiograph and point to the apical lesion or PARL (periapical radiolucency). I tell them the infection and its byproducts has spread from the inside of the tooth to the bone. This is a huge patient motivator and serves two points; one that the inside of the tooth needs to be "cleaned" of infection and, two, that the patient needs get the treatment done ASAP because the bone is involved. Patients hate the words, "bone infection." I always document that I explained to the patient that there is an infection and that I showed the patient the infection on the radiograph. Also document RBA- risks, benefits, and alternatives. DOCUMENT EVERYTHING within reason that you tell the patient. At the end of the appointment I like to show the patient the radiolucent lesion and REMIND them that there is an 80% healing rate, but that sometimes the area does not heal and that the tooth may need to be extracted. I like to say, "80% are pretty good odds but you could be a 20%er". Always tell the patient the diagnosis and prognosis of the root canal procedure and document that you did this. I used to have every patient sign a form stating the diagnosis, procedure and prognosis. I don't do this anymore on every case but recommend it on some of the more guarded root canal cases that you may attempt. Why? The simple reason is ***patients forget and hear what they want to hear***. They will push to try and save a tooth with a large radiolucent lesion and, if so, you will need to explain in great detail all of the treatment options and that the prognosis is somewhat guarded and that they may lose this tooth in the near future.

How do I explain the Cone Beam Computed Tomography (CBCT) and the extra out of pocket cost?

First of all, I require the CBCT on all surgical and most retreatment cases. If the patient does not want to pay the extra cost then I will not treat them. I used to give the CBCT out for free a lot but that's because I didn't know how to communicate the value of the CBCT. Now I tell the patient that the "CT" or "CAT" scan (really CBCT) is a 3-dimensional picture that gives me the most information possible on this tooth and the ***BONE INFECTION***. I tell them that often it gives me the answer that we are seeking. I describe the CBCT quickly in 2 ways: "I can take a journey and walk through your tooth and see every canal, valley and canyon that I need to see." Or, "We can now open the book and look inside. Before with just regular x-rays, we could only look at the front and back cover of the book. Now I can look inside the book (tooth and bone) and read all the information (I usually say this in a faster, excited tone). ***Is there a tooth or bone infection?*** It is a little bit mean, but if you suspect apical periodontitis with a lesion, there is no better way to get a patient motivated then to say the words "bone infection." They hear, "possible cancer" or they think that it can spread to their brain and other parts of their body. Don't be dishonest when throwing this phrase around, but if needed, use it for treatment motivation.

Anesthetic - ***"Our philosophy here, '. .*** is more numb is better than less numb'. Are you okay with that? You may be numb for a while." I tell the patient after the first carpule is injected, "This is 1 of 3 rounds (I don't say injections or carpules)." After I have completed the numbing I tell them I am going to let them "soak" or "marinade" for 10-15 minutes. This gives me some leeway in case I am finishing a patient in another room and I need to buy fifteen or twenty minutes. I always give at least 10 minutes for mandibular blocks (especially on the Gow Gates technique). I will start immediately on any upper tooth if I am ready. If a patient has been "soaking" for 20+ minutes I come in the room and say, "How you doing? You pretty numb? I gave you some extra soak time. These teeth can be pretty hypersensitive."

Palatal anesthesia - This is the most painful injection in the mouth due to the tight mucosa. I give a palatal injection for every maxillary case. For one, the rubber dam clamp can pinch the palatal gingiva and also I need the supplemental or accessory anesthesia. I do not play around with these hot or even necrotic teeth. I don't want the patient to feel pain when I am working on the palatal canal of either a premolar or molar. Early on in my cases, I would not anesthitize the palate (because it hurts!) and invariable the patient would feel some pain during instrumentation on the palatal canals. As I am finishing my 3rd carpule of 2% Lidocaine with 1:100,000 epinephrine, I leave about 1/8 of solution for the palatal injection and tell the patient, "I am going to numb up both sides of the tooth. You are going to feel some cold on your tissue (place the cotton pellet with Endo Ice)", and then immediately give the palatal right in the center of the white circle (frozen tissue). I keep the Endo Ice pellet on the tissue during the injection but move it over slightly. This serves the same purpose as the "Shaky, Shaky" on mandibular blocks: a tissue distractor.

What do I say when a patient has been waiting in the reception area (not lobby) or in the room for greater than 30 minutes?

"So sorry to keep you waiting." I smile and touch their shoulder (if appropriate) and use their name and say, "Bill, so sorry to keep you waiting." I let them respond and then quickly move on, "How has life been treating you? Youv'e been staying out of trouble?" People love to talk about themselves and they love to hear their name. Also, an apology and a little personality goes a looooooooong way. I know its hard for us dentists to have a personality but I know we can do it! I've got faith in you.

Rubber Dam - *"I am placing a barrier called the dental dam over your tooth to keep it clean and dry."* I will tell the patient "You will end up liking this barrier because it keeps the water out of your mouth." Try to spin the rubber dam as a positive (which it is). "This barrier allows me to work safer and more efficiently." About 5-10% of the patients get claustrophobic with the rubber dam and the bite block. Most of these cases end up fine if you allow them to sit up with the rubber dam off, take a break, and ***SWALLOW*** (remove bite block or "resting" block). I then explain, "I see this all the time. It's scary because you feel like you can't swallow or breathe. Here's what we are going to do. I will cut a hole in the rubber dam so you can breathe through your mouth and we won't use the resting block (bite block) as long as you can open when I am working and then you can rest when I am out of your mouth (I then train them and have them go through the motions of opening and closing).

Almost all of my patients that have a hard time get used to the dental dam in a few minutes." Most of the patients are now prepped and know that we care and that they can handle the treatment.

Patient positioning - *"I have to put you pretty far back in the chair so I can see."* Because I use the microscope on all of my cases I place the patients head below their feet on the maxillary cases and supine on mandibular cases. Patients tell me they feel like they may fall out the back of the chair so I try to prepare them for the Trendelenburg position (feet higher than the head). I also have the patient move to the very top of the headrest so I don't have to lean over them and "chase" the tooth. If you are using a microscope or high magnification Loupes with a light, make it easy on yourself and obtain correct patient positioning.

Access - I generally do not say much during the access. I only ask if they are doing okay during the initial access into the tooth and into the pulp chamber. Sometimes my assistant will ask relieving me of the burden. If a tooth is extremely hyperemic I like to take a picture and show the patient later so not only did they "OWN" the tooth during the clinical testing, but now they see the evidence of why it was hurting. If you don't take a picture, no problem, just tell the patient that the nerve was very, "inflamed and angry." Pictures are the best way to communicate, but words also work, as long as the patient trusts us. If a tooth is necrotic, I tell the patient, "Wow, that was pretty infected in there, just like we thought." If a necrotic tooth smells, "Do you smell the infection? Pretty bad in there." This increases patient ownership of their root canal.

If there is purulent exudate (pus) I take pictures and show the patient how bad the infection was.

What do I say to the patient after I have finished the root canal or first appointment on a case that is necrotic or has a lesion?

"I just stuck my hand (files) into the hornets nest (lesion) and stirred up the bees (immune cells). Hopefully, the bees stay put but sometimes they can get angry and you can feel a fair amount of discomfort."
Post operatively I like to tell the patient, "*I just did a minor surgery inside your tooth so it will be sore and please do not chew on it for about a week.*" Patients hear the term *"surgery"* and it helps them understand that there will be discomfort. I like to call this post-operative pain, *"Healing discomfort."* You have to go through some healing discomfort in order to get this tooth healthy again.

What do I tell patients that have an acute apical abscess and are in a lot of pain and are not on antibiotics?

"We are trying to stop the infection train and we are a few days behind. Right now I am standing on the track and holding my hand out and the train is pushing me back. In a day or two, with antibiotics and treatment, we will slow the train down but it will take some time. There is a chance that if the swelling continues to spread you will need to go to the emergency room and receive intravenous antibiotics and pain meds. Please call me on my cell phone if you feel that this is the case." I actually demonstrate what I am saying by holding out my hand pushing the infection train back. I know it sounds cheesy but it works because they understand.

The patient knows that #1 they may need extra medical care to control the spread of infection and #2 that you care and that you are reachable. This provides a small amount of comfort for the patient.

Another way to discuss the acute apical abscess (acute swelling) is to tell the patient that we are swimming upstream against the wave of infection. It's going to take a little time until we and the antibiotics can make some headway but the healing does start today. I also use the "swimming upstream" or "behind the eight ball" analogy on cases that have a large lesion. I want to convey to patients that endodontic treatment doesn't just always solve their problem. This keeps ownership on the patient because they often shift it to us (rightly so in vital cases) once we treat them.

Last night I had a lovely British patient call me at 10pm in excruciating pain from a nasty retreatment that I started a few days prior. I called her back immediately (I don't usually answer the phone unless I know who it is. If it's important they will leave a message) and discussed her options. She ended up at the emergency room at 1 am and they treated her. She was at my office at 7am this morning and I removed the cavit, blue sponge and CaOH2, and left it "open." I will discuss this later. I called the patient later and she was much better but very tired. The patient holds no ill feelings towards me (at least not that I know of) because she understands that the infection arose from the prior inadequate root canal and that I am trying to fix her tooth problem. It's not my problem that the tooth started with an infection, although you do inherit the infection once you start the case. The key is that the patients understand through good communication that you are doing your best to eradicate the infection and that sometimes the bees in the hornet nest go crazy and cause a flare-up. By me being assessible she knows that I care for her well-being and that I want healing as much as she does. It took 3 minutes of my time to talk with her on the phone and to text back a few messages. Not bad for goodwill or to avoid badwill.

How do I discuss 2 visits with necrotic cases?

Clintonian Spin- named after Bill Clinton the greatest spinster of all time (Hillary wasn't bad either). Always tell the truth but use simple words that convey clear objective meaning. *"I have to place an anti-bacterial medicine (Calcium Hydroxide) inside your tooth to help kill the infection. We will bring you back in two weeks once everything has healed and we will finish the root canal."* Now this is all true, but sometimes I would have been able to finish the case if I had another thirty minutes of time. If you want you can say, *"I don't have enough time to complete your root canal,"* or you can say, *"I want to place an anti-bacterial medication inside the tooth."*

Sometimes on difficult hyperemic cases I tell the patient, *"I am placing an anti-bacterial medicine inside your tooth to help kill bacteria and soften the inside of the tooth up. This tooth has some difficult curves (prep them prior to starting that its curvy) and I want to make sure that I do a great job. We are going to bring you back in 1-2 weeks and complete the root canal then."* Patient: *"What will you be doing then doctor?" "More of the same, but we have completed the majority of the work so it will be easier."*

If a case is bleeding and I am unable to finish I say, *"This tooth is continuing to seep a little and I need the inside completely dry in order to finish the root canal. I have placed an anti-bacterial medicine (patients here antibiotic) inside your tooth to stop the seepage and to help with healing."* If they ask for further clarification, and they usually don't, then I explain that the nerve and outside tissue is very inflamed and continues to bleed back into the tooth (just a little) and I need the inside of the tooth to be dry in order to fill and complete the root canal. *"I have placed an anti-bacterial medicine inside your tooth (Calcium Hydroxide) to help kill the inside infection and I am giving you antibiotics to help kill the infection that resides outside of your tooth."* What patients "hear": Anti-bacterial=Antibiotic.

What do I say when my case fails and the diagnosis was IP (irreversible pulpitis), in other words the nerve was vital and it should not have failed?

I tell them that sometimes the root canal does not "take" the first time. " Take" is a great word and one that seems to resonate with most people. I then offer to Re-Tx the tooth in ONE or TWO VISITS at no charge (if it failed within 1-2 years).

What do I say when a case with a lesion is not healing?

I tell patients, " . . . as we discussed before treatment, sometimes the area doesn't heal completely for a lot of reasons: the root could be cracked (the great endodontists' get out of jail free card) or the non-healing area may be an apical cyst. This is not the time to use the word "bone infection." Use the phrase "bone infection" at the initial consult to try and sway the patient into much needed treatment.

What do I say when I perforate?

"I made a pin point hole in the wrong area of the tooth. I repaired in with a hard cement but sometimes this can lower the success of the procedure. This was a very difficult tooth to treat.

What do I say when I separate a file?

First, I use a lot of profanity (all in my head of course) and then I continue with the treatment and inform the patient at the END of the procedure. I don't recommend telling the patient during the visit because some will fret during the entire appointment and may have a lot of unwarranted questions at the end. I tell the patient, "This was a very difficult tooth and a small titanium file separated while cleaning out the nerve. It has become part of the root filling. It usually isn't a problem but, as usual, we will recall you at 6 months.

What do I say when I ledge a canal and can't get patent?

"This was a very difficult tooth", (are you starting to see a pattern?) "and I had trouble getting all the way to the end. I placed an anti-bacterial medicine inside to continue to kill any infection and soften the end of the root up. We will finish the root canal in two weeks."

If you completed the case and the cone is short 2 mm (because you ledged) I would tell the patient, "I completed the root canal today. This was a very difficult tooth and I had trouble getting down to the end of the root. We are going to recall you in 6 months and make sure all is well." If the patient asks, "Could this be a problem?" I respond, "Sometimes they are fine and then sometimes the root canal just doesn't take. Let's recall you in 6 months."

I find that less information is better. This is why I love to use "***one-liners***" that are tried and true and impart simple, but clear understanding to patients.

What do I say when I see a terrible root canal from another dentist?

First of all, I think it is important that we are very careful with the words we use. The tongue can be an evil entity so choose your words carefully. I believe we need to stick together as dentists. Patients can be devisive and attempt to pit dentist against dentist. I don't roll with this and choose my words carefully. "Sometimes root canals just don't take. It is possible that it came unsealed or that we just need to clean the inside out a little more."

Now if it is an awful root canal and they did a poor job then I say, "They did their best and sometimes these teeth can be very difficult to treat. We need to go in and clean everything out and reseal the root canal."

You also have the option of telling the patient that the prior root canal sucks and that the prior dentist did not do a good job and did not clean out the root canal system well. On occasion, on some really awful root canals, I have just laid it out to the patient, "Yeah, this is not a good one. We need to get in there and clean it out all out."

My goal is to discuss the problem or origin of failure and then focus on the solution: Retreatment. I only want to discuss the problem briefly and then spend the majority of the time chatting about the solution and prognosis.

What do I say when I completed a case 3 months ago and now the patient has a sinus tract?

This is a bummer when this happens and is not a good sign. This means that the tooth is not healing and is going in the wrong direction. The first thing I do in these cases is take a N/C (no charge) CBCT. I need to figure out why it is failing. I start my diagnosis over again and figure out the problem. I don't say much until I know the problem. Usually I am able to look at the tooth, talk with the patient and then look at the CBCT last in another room. This gives me time to formulate a plan and statement prior to going back in to see the patient. Either the tooth needs to be retreated for free or referred out to an endodontist (this poses another problem; does the patient pay for retreatment or do you refund the insurance money from the root canal treatment?).

This is where understanding simple retreatment would be a giant bonus for you as a clinician. ***PLEASE SEE: THE 4 QUARTERS OF THE SIMPLE RETREATMENT GAME PLAYBOOK***. If you could figure out the problem (missed canal, poorly obturated, etc.) then you could go in and attempt to fix it for free. All it takes is the knowledge, skill and 1 1/2 hours of your free chair time.

"Well it looks like it is not taking. Sometimes treatment does not work. I am going to refer you to an Endodontist that specializes in retreatment of difficult cases. They will probably take a CBCT and look at the tooth to see if they find the problem. This is a tough one."

OR

"Unfortunately, the tooth is not responding to treatment. We need to go back in and clean everything out and place an antibacterial medicine to see if we can get some healing. If after 2 weeks the pimple on your gum is dissipating then we can reseal the root canal. Remember we talked about the chance of success on these cases. Unfortunately you are currently a 20 percent."

OR

"Well, this is isn't working. The tooth is not responding to treatment. I did everything to try and save it but it will need to be removed. The GOOD NEWS is that the bad tooth can be replaced with a new tooth (implant)."

Cases that fail are always difficult to deal with. This is my least favorite part of private practice; dealing with problem patients and problem teeth. This is why good patient communication is so important. I always prep the patient prior to the root canal procedure on the success and failure rates and that there is a chance that this may not work. The patient MUST HAVE proper expectations on success. If you don't mention it patients will think that all work is 100% successful and will be shocked when it fails and blame you.

What do I say when a case that I treated 6 months ago still has buccal percussion pain but looks WNL on the radiograph?

I tell the patient that some patients have a chronically inflamed periodontal ligament and it sometimes takes a year until the tooth feels "right." I tell them that if it becomes a "problem" we can redo the root canal, but it will take 2 separate visits. I always stress that the radiographs show that everything is "normal" and that there does not appear to be any infection. This alleviates the patients worries.

What do I say when a case fails 2 months later and the patient asks for some of the money back?

Re-Tx - 2 visits - 3 hrs + I located a necrotic MB2. The patient and his wife called at different times and asked if we could refund some money since it failed so soon. I at first told the patient "no" because It took me two visits to retreat his tooth and I located a necrotic MB2. I gave him the crystal ball line and said, "If I had a crystal ball and I could see in the future that this tooth was going to fail I would have never touched it and had it extracted." But after, discussing the case with the patient, and he was very gracious when I explained why I was not going to "help out with the extraction," I decided to give $150 back (my retreat cost is $1550) for goodwill sake. I called the patient the next day and told him and he was exceptionally happy with the $150 refund, which surprised me because it was such a small amount. In the end, I felt like it was the right thing to do because a negative word can spread like wild fire. Lets keep it positive as much as possible.

What do I say when a patient refuses to sign the consent forms?

The patient has to sign the consent forms or you CANNOT treat them. This is a huge red flag when I hear this. I have had this happen twice in the last two weeks and I cannot remember the last time this has happened prior.

Last night I took an emergency at 5pm. I had to pick up my son from baseball at 7pm so I was cutting it close, but if a patient is in pain then I will do my best to accommodate and treat. The patient refused to sign the financial consent form saying he was not responsible for his 20% portion. He had Delta insurance and stated that he wanted to wait until we billed his insurance before he paid his portion. He said that in years past he often over paid his portion and didn't get a refund. He also asked for a discount. Here I am taking this guy on as a late ER, keeping my poor assistant back from seeing her family and this guy won't sign the financial form,

won't pay anything out of pocket, is asking for a discount, and when I did treat him, kept looking at his watch asking how much longer, as if a root canal takes ten minutes. Let's say my blood pressure was starting to increase with every tidbit of information. To top it off, this guy is a successful attorney and has a country club membership. And he asking for a discount and refusing to pay his portion? The draw back of living in Southern California or more specifically Orange County.

So what did I do?

I did something that I never do. As I was finishing another patient, I walked out to the front desk with my gloves and Endo Ring on and talked to the patient about the financial situation. I told him what are policy was and that we bill for service (patient is responsible for his portion) at the time of the appointment. The patient explained why he hates to pay his portion because it is estimated. I finally relented because I could tell he was going to pay his portion and I took a small gamble. He also had served as an officer in the military and was an attorney, and my bet was that he would pay his $238 portion. Keep in mind that we are arguing over $238 and that I took this patient as a late ER and he is in a lot of pain. My first response was anger and I wanted to send him away, but I did not want to lose goodwill. A compromise was reached and we took a credit card number down so in case he didn't pay we could bill his card. We do this anytime a patient is unable to "pay" their portion. Now, if it is a cash patient then we make them pay after treatment is rendered.

Anaheim Ducks Playoff Game

Last week a patient no showed for a prime time appointment. We had booked off an 1 1/2 hours for treatment time and had called the patients cell phone the day prior to remind them of the appointment. I always recommend calling at least one day ahead to confirm appointments, especially the big ticket procedures. The next day (Thursday) the patients mother calls around 3 pm and states that her 16 year old daughter is in great pain and needs another appointment as soon as possible. We offer Friday mid- day but the mother says her daughter can't miss school. We offer Monday at 4 pm (squeezing the patient in a very busy schedule) and the mother says no they are going to the Ducks vs. Kings playoff hockey game so can't do it. They finally schedule for Thursday one week from the initial call. So much for "great pain." When I did finally treat the daughter one week later, she told me that she has some cold and chewing pain and had a medium depth composite restoration placed 3 months ago. The tooth was barely hyperemic.

What do I say when a patient didn't bring his wallet and has no form of payment but is in pain?

This is a tough one. I go on intuition on this one. Have I been burned? Absolutely. Most of the time it seems to work out. If the patient is truly in pain I will at least perform a pulpotomy or pulpectomy and prescribe analgesics and/or antibitoics. What moron doesn't bring his/her wallet to an appointment? What would they say if they were in a supermarket?

What do I say when a patient asks if I'll do it for $1000 cash?

I try to smile and gently tell the patient that this is not a f@#%ing swap meet. Just kidding. I tell them the price of the procedure is fixed. These are the patients that I don't mind not treating because generally they can be a real problem. If they are not happy with our financial policies I am okay showing them the door. DO NOT BARGAIN! THEY WILL TELL THEIR FRIENDS!

What do you say when a patient says just bill my insurance and then I'll pay what they don't pay?

Thankfully, I have my front office assistant handle most of these cases. She gently reminds the patient that our financial policy is to collect the patients "portion" at the time of service (just like most service based industries).

What do you do if a patient has a history of cancelling last minute prime time appointmets (7:30, 8:30 am, 3:30 pm)?

Suddenly we no longer have any prime time appointments available for the next two years. I recommend only appointing this "very busy" patient only in the middle of the day so in case they cancel at the last minute you have an opportunity to work an emergency patient in or move up a later patient.

What do you do if a patient no-shows 2 appointments in a row after being confirmed?

I have had this happen recently with a patient who no showed on her last two scheduled appointments after being confirmed each day prior. After the second no-show, I instructed my staff TO NOT appoint the patient in our office again and to call the referring dentist and let them know the situation. 3 hours of wasted appointment space. Basically, I am divorcing the patient and it's the happiest day of my life.

What do I say when a patient asks for a senior citizen discount?

My standard answer is that we do not give courtesies. By saying this it allows me to give courtesies to patients that really deserve it. With senior citizens I should charge more because typically these teeth are highly calcified and the patient has limited opening. Often they are not able to sit in the chair for very long and this can mean multiple visits which reduces your overall production. If a patient limps in or comes in with a walker and they are cash and very pleasant, than I am more willing to help them out with a small courtesy. Please don't misread me, I have a big heart, and want to help when I can, but somedays it gets ridiculous when 1/2 the patients ask for a discount. I work on their mouth for 1-2 hours (and it took me 11 years of schooling to be able to do that) and all they do is complain about how long it takes and how much it costs.

What do you say when the dentists family is being referred to me for a root canal?

I tend to give a referring dentists IMMEDIATE family 100% off of the root canal. If it is not immediate family then I will typically give 40-50% off of the root canal fee and waive the consult. The problem comes when the patient is "family" of the referring dentist but upon probing you find out he is the 14th distant cousin (is that possible?). I then tend to give a small "courtesy courtesy" of $100-200. I call it the "courtesy courtesy" because I am giving a courtesy so they won't complain to the referring dentist "family" member.

Communication with the patient is of utmost importance. What we say conveys meaning and meaning leads to understanding. Patient understanding of the root canal process and why it may succeed or fail is one of the first steps towards improved root canal treatment. Discussing outcomes with a patient and setting realistic expectations is extremely vital before even the bur touches their tooth.

Research shows that the success rate of root canal treatment in vital cases ranges from 90-95% and 80-85% in necrotic cases with a periodical radiolucency (PARL). So it is of UTMOST importance that we clearly communicate these success rates with patients prior to treatment. Proper expectations may save you a lawsuit or a lot of later stress if the case fails on a difficult patient (I have learned the hard way!!!). I always explain the success rate to the patient but then go beyond that and highlight the chance of failure. Case with a PARL: "There is an 80% chance of success if we treat this tooth. But remember root canal treatment is not perfect and that means that 20% of these, and maybe more, fail and may need to be extracted or treated surgically to scoop out the infection. I'll do the absolute best that I can but some things are out of my hands. Is that pretty clear?"

If one of my vital cases fails I get angry with myself. Often the root canal will be shaped well and obturated to length, yet there is a new lesion or the patient is still symptomatc. So we have to differentiate between true failure (apical lesion pops) and symptomatic failure. In either case, my goal then becomes what happened? Is there something I did that contributed to the failure or did the patient fail to get the final restoration or wait 6 months before it was sealed? Did the restoring dentist leave the cotton/sponge pellet and cavit (yes this happens all the time and is why I now seal 99% of my cases with a pulpal floor bonded composite)? Did I miss a canal (this happened on

one of my good friends and he tells the story to anyone willing to listen- "And he missed a canal!")? Did I go too fast and not achieve adequate shaping and cleaning or allow enough "soak" time of the sodium hypochlorite? Did I obturate while one of the canals was still bleeding or "weeping" serous fluid? Is the patient crazy? Is it psychosomatic, in other words they will never be better no matter what you do?

What do you do when a failed (symptomatic or new apical lesion or existing apical lesion has not reduced in size) case comes back in your office? Hopefully, you educated the patient and they have a very clear understanding of the success of root canal treatment (often times they have no

DX: PULP NECROSIS/SYMPTOMATIC APICAL PERIODONTITIS

recollection of this conversation). I start out with reviewing the prior success/failure discussion we had right before treatment. I then perform a radiographic/clinical exam because often times their chief complaint (CC) is cold pain and so right off the bat we know that another tooth may be in need of treatment. If the tooth we treated is still symptomatic or I suspect a lesion forming or not healing, I will take a CBCT. I will then review and see if I missed any canals or if indeed a lesion appears to be forming. I will then Re-treat the tooth at no charge and usually do this for up to two years after treatment on vital and necrotic teeth. If there is a large non-healing lesion, I usually perform the apicoectomy at full price (don't take on the responsibility of a lesion failing to heal).

A lot of general dentists do not perform retreatments and will then have to refer the patient to an endodontist. This does pose a problem because now the patient pays for the initial treatment and retreatment. Three solutions: ① Learn how to do simple retreatment, ② Refund some of the money if its been under six months. Now I hate doing this and do not recommend you do this often. Reserve this only for the difficult patients and the cases that should have healed (Do the patients ask for a refund when their surgery fails at the hospital?), ③ Tell them you did your best and sometimes root canals fail (refer to success/failure discussion) and refer for a retreatment or extraction (if necessary).

BEST OF THE ONE-LINERS THAT ACTUALLY WORK

Over the years I have used these one-liners to help explain, define and put patients at ease about what we are doing in the practice. They almost always work and help me as much as my patients.

PRE-OPERATIVE

1. Nervous patient - "I'm sorry. Everyone hates to see us. I promise I'll take good care of you or you can punch me."

2. Patient - "Why do I need a root canal?" Lesion present - "You have a bone infection."

3. Pulp necrosis case - "You have an infection inside your tooth and we don't want it to spill out into the bone."

4. Lesion present - "There is a 70-80% success rate on these ones. They are not perfect, but you have good odds. Just don't be a 20%er."

5. Irreversible pulpits case - "You know how your ankle swells when you sprain it, well the tissue in your tooth is swollen. You have a sprained tooth."

6. How do you tell a patient that they need a root canal? "You need a root canal" (say it with confidence. Be bold - you just finished clinical testing on a very sore tooth)

7. Older failing root canal - "Sometimes root canals come unsealed."

8. "Root canals take an hour to an hour and a half and may take two visits" (take the pressure off to complete it in one visit)

9. Patient asks, "What is a root canal?"- "We are going to roto rooter out your canals and then place a root filling."

10. Patient asks, "What is a root canal?"- "Well we are going to remove your nerve and then seal in a new "synthetic" nerve."

11. Patient is swollen and comes into you as an ER- "The train of infection is running down the tracks. We need to stop it with treatment and antibiotics. But the train will still push us down the tracks until we can stop it (hold your hands up like you are trying to stop the train). There is a chance that you may need to go to the ER and get IV antibiotics. If after treatment you keep getting worse (more swollen) and you feel you have trouble breathing then go to the hospital.

12. Patient is swollen and comes into you as an ER. "We are 2 days behind the infection. We need to stop it with treatment and/or antibiotics. You may need to go the hospital for IV antibiotics."

ANESTHESTIC

1. "More numb is better than less numb right"

2. "I'm going to let you marinade for a few minutes." (If you need more time say 10-15 minutes)

3. "I need you numb. I don't want you throwing punches at me."

4. Difficult time getting the patient numb. Blame the tooth not yourself. "This is the perfect storm. A lot of nasty bacteria with lots of inflammation and nerve swelling. We need the storm pass and get some healing." Perform pulpotomy or pulpectomy and place Ca(OH)2. "Let the storm pass" and then bring them back in 1-2 weeks for completion of the root canal.

CBCT

1. We charge $197 per scan ("out of pocket") - "We need a 3-D scan to look at the bone infection and to see where it's at and how big it is."

CLINICAL PROCEDURE

1. "I am placing a dental dam to keep your tooth clean and dry."

2. After rubber dam placed - "If you need anything let me know. You are in control bud. Restroom? No problem. Suction? No problem. Just let us know."

3. "Here is a small resting block. This will help you rest your jaw during treatment."

4. If you don't want the resting block (bite block)

no problem. Just open wide when I'm working and relax when I'm out." Have them practice this prior to access.

5. If you need 10-15 minutes of time to evaluate or start another patient - "I am going to let this tooth soak with anti-bacterial solution to help kill the infection. Be back in about 10-15minutes."

6. Cone Fit Radiographs - "Okay we are almost done. I have cleaned out the tooth and we are just about ready to seal it. We are going to take a few digital pictures now (never say x-rays)."

7. Running out of time and need another appointment to finish - "I am now placing an antibacterial paste (Calcium Hydroxide) to help to continue to kill the infection. We will bring you back in 1-2 weeks and then seal the tooth." I say all of this with the rubber dam still on.

POST-OPERATIVE

1. "Don't chew on the tooth for 4-5 days. Let it heal."

2. "I did a surgery inside your tooth so it's going to be sore. Just be easy and let it heal."

3. "I put medicine (Calcium Hydroxide- recommend Ultracal XS from Ultradent) inside the tooth to help kill the inside infection and I'm giving you antibiotics to help kill the outside the tooth infection."

4. "I feel good about this tooth healing, but sometimes the tooth doesn't case how I feel and things just don't heal."

POST-OPERATIVE PROBLEMS

1. Patient - "Why does my tooth still hurt when I touch it with my finger or tongue. It's sore when I floss. I though root canals meant the nerve is gone?" My response - Use profanity (in head), "Can you chew on it? Yes. Okay the ligament (PDL) surrounding the tooth may still be healing. Let's give it more time. Sometimes it takes up to 6 months for things to calm down."

2. Patient - "Why does my tooth still have feeling? I thought the nerve was gone." My response- Root canal treatment is not a natural process. We are removing the nerve inside a canal in a tooth that is sitting in bone in your jaw. Its not a perfect process and sometimes we have to give the tooth time to heal and sometimes we have to Retreat the root canal so we can reseal it."

3. Symptomatic failure of my RCT (biting and percussion pain and/or aching)- "Sometimes the first root canal doesn't take. I will clean it out again and re-seal it and this usually does the trick."

4. Failed RCT (apical lesion is not healing) that I did- "Sometimes treatment doesn't work. I cleaned out the tooth but the bone didn't heal. Time to remove the tooth and think about replacing it with an implant."

MISTAKES

1. Separated file - "The small end of a file separated inside your tooth. It has become part off the filling."

2. Perforation - "While looking for your calcified canals a small perforation occurred. This is a small hole the size of a period. I sealed it back up and I recommend that we watch this tooth."

LECTURE- PROCEDURAL UNDERSTANDING

1. Coronal flare first and then negotiation to patency - "When you open the top it makes it easier to get to the bottom."

2. Negotiation to patency - "Walk the apex"- "Take the file (with a small apical curve) on a walk around the apex" and try to find where the canal curves. Once it drops in do not remove, instead perform 25-50 microsmoothies (push/pull)

3. "Don't just peck the apex on the cheek with your shaping file but gently make out with it 3-4 times". In other words, once your shaping file reaches working length, don't remove it instead shape the apex with 3-4 gentle up and down strokes. This helps achieve deep apical shape.

CHAPTER 12
INCISION AND DRAINAGE AND MANAGEMENT OF A SODIUM HYPOCHLORITE ACCIDENT

What is a flare-up?

A flare-up occurs when root canal treatment has been either initiated or completed and the patient presents back usually 2-3 days later with swelling and pain.

The other day I performed a beautiful apicoectomy on tooth #10. Really it was not that difficult but still challenging enough to warrant great concentration. Four days later the patient calls me and tells me she is suddenly swollen. My first thought is did I leave a racelet (epinephrine impregnated green cotton pellet) in the crypt and I immediately blamed myself, but then I got smart and switched my train of thought over and started to blame the patient. I though for sure the patient was not rinsing with Peridex and had been rough with the sutures and possibly impacted food under the flap. When the patient arrived, I gently probed the patient with questions and found that none of the prior thoughts were true. I knew there was not a racelet because we did not need or use any during that surgery and the patient was following all prescribed post operative instructions. So what happened? Four days later the patient gets an infection? It doesn't make sense, but the puss or purulent exudate was pouring out of one spot where the suture had come loose (so I guess it was my fault after all). Thankfully I did not have to perform an incision and drainage (I and D) because drainage had been established naturally.

Flare-ups will occur approximately 5% of the time after root canal treatment. Bottom line: if you perform root canals in your practice you will have a flare-up and you need to know how to handle them.

First of all, don't panic and stop blaming yourself. I have trained my mind to blame the microbes (or with patients I say bacteria). Some cases are bound for flare-ups and whether we encouraged it or not it doesn't matter. I call these cases "the perfect storm." And I tell the patient this. They know what it means from the movie. All variables came together at just the "perfect" time to cause a giant pus wave of swelling and infection.

Before I discuss how to deal with a flare-up lets talk about ways to avoid it.

How to avoid a flare-up (of course this does not always work)

1 Do not over-instrument and blast through the foramen

2 Do not shoot calcium hydroxide out the foramen into the lesion (this can cause significant pain)

3 When in doubt prescribe antibiotics after initiating or completing endodontic treatment- this is a bit controversial but I sometimes prescribe antibiotics based on a gut feeling and not always because swelling, fever, redness (rudor), inflammation, and pain (dolor) are present. If a certain tooth is very necrotic, and the patient is in great pain, and it is a Friday and Christmas is in two days, you can bet your sweet ass that I am prescribing either Amoxicillin 500mg, TID for 7 days, or Clindamycin 150mg or 300mg TID or QID for 7 days. And the majority of the time you will want to start with a loading dose of 1 gram for Amoxicillin and either 300mg or 600mg for Clindamycin.

4 Try not to push debris (gutta percha, silver point crud, necrotic debris, sealer) out the apex. This can push microbes and/or their by-products out into the apical tissues causing an immune response.

What cases have a higher flare-up potential?

① Necrotic cases

② Re-Tx cases with a lesion (I personally think any symptomatic Re-Tx case)

③ Patients with moderate to severe pain prior

to endodontic treatment (the infection has been brewing for a few days).

④ Middle aged females with health problems (fibromyalgia, immune compromised or over-reactive immune systems, etc.) I rarely see flare-ups in vital cases (IP- Irreversible Pulpitis/ Symptomatic = remember this? If this is fuzzy, please go back and review the AAE pulpal and periapical diagnosis' in the first quarter of this book. This is very important to have down and is not hard to learn).

Yes, I have seen a few flare-ups in vital cases and its quite baffling to me. I may have been too aggressive on my apical filing and pushed microbes into the apical tissues and the patient may have had certain health issues (compromised immune system or over - reactive immune system) and not able to combat the microbial assault. Or, it could be that one canal in a multi-canaled system was partially necrotic and I failed to notice in my great desire to stick files in the holes.

How do you treat a flare-up?

① Antibiotics with a loading dose. I usually start with Amoxicillin 500mg, TID for 7 days, and give a 1 gram loading dose. If its a bad one, I start with Clindamycin 300mg, TID for 7 days and give a 600mg loading dose. I always tell the patient to take Clindamycin with food and if you start having diarrhea to stop the antibiotic and call me and we will prescribe a different one. I also tell them this is a very good and strong antibiotic and works extremely well. Discuss the negative side effect of the medication, but then conclude with the positive so that their mind is ready to receive the meds and heal. I don't want to set up the patient for failure by telling them this antibiotic can hurt the stomach and may be hard to take.

② If the swelling is diffuse than it less likely you will establish drainage with an incision. If you had only started the root canal and placed calcium hydroxide then you can anesthetize and go back in, remove the calcium hydroxide and attempt to achieve drainage by filing 1mm long with a #20 or #25 K hand file. Diffuse swellings are more difficult to deal with because it is much harder to get drainage. Another option is to give Clindamycin 300mg with a 600mg loading dose without going back in the tooth. If you have completed the root canal, I do not recommend going back in and removing the gutta percha just because the patient has a flare-up. Attempt antibiotics first and if the root canal was well done it can still be successful. Augmentin (Amoxicillin with Clauvulonic Acid) is also an excellent antibiotic.

③ Establish Drainage - LOCALIZED SWELLING= If there is a localized swelling (medium to large bump) adjacent to the treated tooth, than this is the perfect case to perform incision and drainage. (Fee Note- There is an Incision and Drainage fee), but I typically do not charge the patient especially if I did

the endodontic treatment. Sometimes I will charge the patient if the patient has come from another office with a flare-up, but even then I don't always charge. This is a touchy time because the patient is in great pain with swelling and typically worried

about their health. If you are going to charge, wait until the pain and swelling have subsided and then bill them. Your call on this.

④ Follow-up daily: Phone call and office appt.

How do you manage a sudden sodium hypochlorite accident?

Obviously this is a horrible thing to happen to your patient and we want to avoid this at all costs. Keep in mind correct irrigation principles with a 25, 27, or 30 gauge needle. First, make sure you are using a side vented irrigation needle and preferably a needle with a side port and end cap. Second, keep the irrigation needle ***loose*** in the canal and ***never allow it to bind.*** Third, ***irrigate slowly and gently.*** Never force the syringe top down. Fourth, there is no need to place the needle near the working length. My recommendation is to not go any deeper than half the canal working length. If a sodium hypochlorite does occur you will immediately know. Usually it comes right after irrigating with bleach and there is a sudden pain reaction by the patient. They will be in great pain, sometimes moaning and trying to hold their face. The patients face will feel like it is on fire. At this point irrigate aggressively with saline (bind the needle) and try to dilute some of the bleach that has entered the periapical tissue. Administer a long acting anesthetic (Marcaine) and cease the endodontic procedure immediately (place sponge and cavit). Place an ice pack on the patients face and prescribe an antibiotic to prevent any tissue infection from the necrotic damage that the bleach may have caused and a heavy narcotic (Vicodin or Percocet). It is also recommended that the patient takes an anti-inflammatory (Advil or Alleve). Explain to the patient what happened and that it is likely that the area will become black and blue. It is recommended to recall the patient daily and to call and check on the patient. It is also recommended to call your lawyer.

CHAPTER 13
CONCLUSION

EXPAND?

Root canal treatment can be a difficult process if you are not confident in your technique. My goal for you is to have a root canal playbook that you can follow for every treatment and that this playbook will provide you with consistent results. The 4 quarters of the root canal game provides a game plan that you can follow and feel confident that you can achieve efficient, effective, and excellent endodontics. My sincere desire is that your technique will improve greatly from reading and studying this playbook and that you will be **BETTER TOMORROW.** Many blessings to you, your patient's and your treatment. Happy root canal my friends!

APPENDIX
ONE MORE THING

BUT WHY CAN'T WE FINISH THIS TODAY?
(The story of my witch patient)

In a perfect world we would finish all of our root canals in one visit, prep the tooth, and cement the crown an hour later. It would be seamless and effortless and everything would succeed. Unfortunately, life is not ideal and endodontics is not perfect, patients can be a pain in the rear, and sometimes it takes two visits to finish root canal treatment.

So how do we manage patient expectations prior to the start of the root canal process? How do we communicate the reason why we are needing two visits to complete the endo? How do we make sure the patient comes back for completion and does not get lost in the sauce?

In the Army, I performed root canal treatment on a real live WITCH. She was a wife of an American soldier who happened to be a Wicca leader for the military in Germany. She came in one day on an emergency basis in a great deal of pain. I performed a pulpectomy (cleaned out the majority of the nerve to the apex at least up to a #25 hand file- ideal pulpectomy) and placed calcium hydroxide. I informed her that she needs to come back so we can complete the root canal treatment and restoration. I then promptly forgot about her except the witch part.

One year later she comes back to the clinic swollen and in pain. I look back in the records and see that she never came back for the completion of the root canal treatment or restoration and that we never called to re-appoint. Now I'm nervous because she's a witch and what if she puts a spell on me (she told me she is a good witch and only practices white magic and doesn't really place spells on people- Yes I asked her!)?

Again I perform a pulpectomy and place new calcium hydroxide and place her on antibiotics (I routinely give Amoxicillin 500mg, 1 g loading dose and then Tid for one week or for serious infections or an allergy to Penicillin, Clindamycin 300mg, 600mg loading dose, Tid for one week). This time she comes back in a week and I complete root canal treatment and the restoration and it was a success because I exited the Army 8 months later (geographic success!).

I have learned a lot since the early days and now I have communication procedures for everything I do in my practice. My goal is to manage patient expectations right out of the gate. Fist off, I tell my patients that, "This root canal will take an hour to an hour and a half and it may take 2 visits". I have said this phrase ~8000 times and it works. If it takes two visits, I tell them, "We had to place an antibacterial medicine inside the tooth to help kill the infection." If its vital (Irreversible pulpitis) then I say, "We had to place an antibacterial medicine inside the tooth to help kill the bacteria (because the tooth is not infected)". I have said this ~3000 times and patients accept it for the most part because you are placing medicine to help kill the infection and in their mind prevent it from spreading.

The last step is to have good recall and re-appoint systems so that the patient does not get "lost in the sauce." Make sure that your front office appoints the patient for the completion appointment prior to them leaving and to call and remind them of their next appointment.

I hope this helps. Please visit RootCanalAcademy.com for more patient one-liners. Happy Endo my friends.

APPENDIX
LASER ENDODONTICS

Photon Induced Photoacoustic Streaming (PIPS): Chemical Debridement at its Best

INTRODUCTION

The evolution of enododontics has been drastic over the last thirty years. Specifically, the introduction and improvement of nickel titanium rotary and reciprocation files, sealer, and CBCT imaging has improved the mechanical shaping, cleaning, sealing and visual ability of the root canal procedure. It is important to remember that endodontics consists of a two part process: the mechanical shaping and the chemical cleaning of the canal system known as chemomechanical debridement or disinfection. The introduction of newer irrigation techniques or systems has just started to improve significantly over the last few years. Some new and improved chemical debridement techniques are the EndoVac (Kerr Endodontics), EndoActivator (Dentsply Tulsa), Ultrasonic activation, multi-sonic, soundwave technology called GentleWave (SonEndo), and laser activated irrigation.

Laser activated irrigation (LAI) is a technique used in endodontics to improve chemical debridement of the root canal system. This is a technique in which an Er:YAG laser is used and emits a wavelength of 2940 nm and that is strongly absorbed by water. The erbium: Yttrium Aluminum Garnet (Er: Y3I5012) laser provides an aggressive photoacoustic streaming of water, sodium hypochlorite, EDTA or Chlorhexidine inside the root canal system by using laser-emitted photons from a quartz, radially firing tip that induces tens of thousands of microbubbles to form and quickly collapse. The collapse of thousands of microbubbles at any given time causes a sonic boom effect that is effective is loosening and removing pupal tissue, removing the smear layer and biofilm, and lysing bacterial cell walls. This "irrigation on steroids" pushes a tidal wave of antibacterial solution into the isthmuses, lateral and secondary canals, apical deltas, anastomosis, and can enhance disinfection of the deep complex apical anatomy or the apical "redzone."

The author has been using LAI in his private endodontic practice since 2012 and has completed over 4000 cases with this technique. The authors technique of choice is Photon Induced Photoacoustic Streaming (PIPS) using the Lightwalker laser from Fotona. The purpose of this article is to answer four questions: What is laser activated irrigation?, Why use this technique?, How do you use laser activated irrigation? and When is this technique incorporated in the root canal process? and to discuss tips and slips associated with laser-activated irrigation.

WHAT IS LAI?

LAI, or more specifically, Photon Induced Photoacoustic Streaming (PIPS) was introduced in 2004 and is used in the root canal procedure to loosen and remove pulpal tissue, remove separated files, remove loose pulp stones and pulp stones wedged into the canal orifice, remove pulpal debris during shaping, remove biofilm and the smear layer formed from mechanical filing, lyse bacterial cell walls, and kill fungal and viral entities (bodies). LAI is a low-energy technique (50 microsecond pulse, 20 mJ, 15 Hz, 0.3 W) based on a Er:Y AG laser that emits photons into an irrigation solution causing an irrigant shockwave. A quartz radially firing tip is used in the root canal procedure to emit short photons into the irrigation solution sitting in the canal system, which absorbs the laser energy, causing vapor bubbles to form and collapse within the solution. Debridement occurs through acoustic streaming and cavitation caused by the collapse of thousands of vapor bubbles which creates a sonic boom effect that travels down the canal system. It is important to remember that this low energy photon release does not create heat that could damage the periradicular tissue. In a study, where thermocouplers were connected to the radicular apical 1/3 there was only a 1.5 degree celsius increase after 40 seconds of irradiation (1). The LAI tip is ONLY placed in the access of the tooth and not into the canals. The tip does not need to be placed directly over each canal but just into the pulp chamber. The photo acoustic streaming of solution from the pulp chamber will spread through a tidal wave effect through multiple canals and deep into the root canal system.

WHY LAI?

LAI is an effective irrigation technique. But does it work and is it worth integrating a laser assisted irrigation technique into the already complicated root canal procedure? Tay et al. (2) showed the presence of trapped air in the apical 1/3 resulting in a vapor lock. Because of this vapor lock, non-activated irrigants are not as effective in the apical 1/3. An article in 2011 showed that the PIPS technique, used for 60 seconds for each tooth, was superior in removing bacteria when compared to standard needle irrigation and passive ultrasonic irrigation (3). Another article in 2012 shows 100 percent inhibition of regrowth of Enterococcus faecalis after using the PIPS irrigation technique for 20 seconds with 6 percent sodium hypochlorite in 24 single rooted tooth. All 24 teeth were inoculated and allowed to soak in a Enterococcus faecalis broth for 4 weeks (4). PIPS has also been shown to remove biofilm from the root canal system. In a bovine study model, PIPS outperformed standard needle irrigation, the EndoActivator, and passive ultrasonic irrigation in removing biofilm from infected bovine dentin (5). PIPS is also effective in removing the smear layer. Pedulla et al (6) and Zhu et al (7) showed that PIPS was significantly more effective at removing the smear layer. In an article published in 2014, PIPS was shown to remove canal debris and increase canal space 2.6 times greater than standard needle irrigation in 14 mandibular molars shaped to a size 30 foramen and 06 taper. It was also noted that PIPS was more effective in removing debris from "complex canal spaces," read isthmus, compared to standard needle irrigation.

HOW DO YOU USE LAI?

There are a few requirements prior to using LAI clinically. First, a rubber dam, which is the standard of care, must be placed and the dam needs to be completely sealed. Secondly, once the tooth has been properly accessed a four wall reservoir or "swimming pool" must be established. If accessing through a crown or a tooth with four walls than the reservoir is naturally created. If there is an interproximal wall missing than a four wall reservoir needs to be artificially created. The clinician can either place a piece of sponge or cotton pellet in the pulp chamber and build-up the tooth with a bonded composite or can temporarily create an interproximal wall with a light curable rubber dam sealing material. It is important to build a four wall reservoir because during the LAI technique the assistant will be continually applying irrigation solution into the pulp chamber and simultaneously suctioning any excess runoff. It should not take anymore than 30 seconds to seal the rubber dam and create a four wall reservoir with light curable rubber dam sealer.

Anterior teeth are slightly more difficult to use LAI because the pulp chamber is smaller and the laser tip must not be placed inside the canal. The best method is to create a reservoir on the lingual side using a rubber dam sealing material. After a reservoir is created, the dental assistant loads a 12cc syringe with a 23 or 25 gauge needle (any gauge can be used but smaller gauges can make it difficult to PIPS because the solution comes out of the needle at a slower rate) and bends the needle at 90 degrees or close to it. The author recommends allowing the assistant to enter first and get set in the mouth by "hooking" the 23 gauge needle on a wall of the access chamber. This provides a purchase point and prevents "free PIPSing" which can lead to bleach spraying all over the rubber dam. Once they have hooked the access wall with the needle than the assistant will place the surgical suction perpendicular (if possible) to the buccal or lingual wall depending on the tooth and which side the assistant is sitting on. The suction will float about 5mm from the tooth and will suction any irrigation runoff. There is a target point that an experienced assistant will find quickly during PIPSing in which the irrigation solution fills the pulp chamber and any runoff is quickly suctioned prior to leaking into the rubber dam. Often times the simple command to the dental assistant "back" or "closer" during the PIPS process will tell them to move the suction a few millimeters in either direction in able to locate that sweet spot where enough irrigation solution is deposited into the pulp chamber for the PIPS technique and yet not getting removed by a suction that is too close. Setting up the PIPS technique may sound complicated, but on the contrary it is very easy and the author is able to teach any new assistant how to assist the PIPS technique within ten minutes. The author was even able to teach his 17 year old son to help assist in PIPS during a weekend emergency. He became an experienced PIPS assistant in just 2 cases.

Once the assistant is ready to irrigate into the pulp chamber and suction any run-off, the clinician can carefully place the quartz tip into the pulp chamber. The goal is to have a portion of the tip submerged in irrigation solution. The unsheathed, tapered portion of the tip fires photons radially into

the irrigation solution providing the LAI effect. The tip can be placed anywhere in the pulp chamber as long as a portion is submerged in irrigation solution. The LAI effect will travel throughout the entire root canal system.

Activate the laser and start the procedure as soon as the assistant has filled the pulp chamber up with irrigation solution. If the laser is activated early as the assistant is filling up the pulp chamber it can "throw" solution (sodium hypochlorite) out of the mouth and onto the patients or assistants clothes. It is recommended to place a full body towel over the patient to protect their clothes prior to the first LAI cycle.

WHEN DO YOU PIPS?

The LAI technique is a dynamic, open system. In other words, the clinician can use LAI at any time during the root canal procedure. It is dynamic, because If deemed clinically necessary, extra LAI cycles can be added or subtracted depending on the complexity of the case.

There is a specific final LAI protocol but as discussed LAI can be used to improve and quicken the root canal procedure during negotiation and canal shaping. Remember this is an open and dynamic technique. On any multi-rooted posterior case, the author will perform an LAI cycle with sodium hypochlorite after he has located the canals and performed a coronal flare. The goal is to start to loosen and dissolve any pulpal tissue and to push sodium hypochlorite down into the root canal system. Clinically, this makes negotiation to patency much more efficient. Anecdotally, the author feels that an LAI cycle after coronal flare drastically improves success in obtaining full negotiation and an accurate working length. Who doesn't want that?

Once negotiation to patency, an accurate working length and an open glide path has been obtained, than NiTi shaping commences. During the shaping procedure it is recommended, but not necessary, to use LAI one to two cycles. The author usually performs LAI one cycle in between NiTi shaping passes to encourage debris and tissue removal. If the case has long, complex anatomy than the author will often use LAI in 2 separate cycles in between NiTi shaping passes. In this case, measure the #10 hand file length in which it moves freely down the canal and then gently shape to that length, not going past any area of the canal that has not been explored and secured. When using this technique, and then using LAI cycle's, patency is often achieved. The idea behind LAI is that it enhances chemical debridement allowing for cleaner canals. Cleaner canals equals less microbes, better obturation, improved seal, less lingering post-operative pain and a higher success rate.

Once shaping is complete and the clinician is ready to obturate the canal system than the final LAI protocol is initiated. The final LAI protocol consists of multiple cycles of sodium hypochlorite, water and EDTA. Once the final LAI cycle is complete, dry the canals and obturate. The overall time it takes to perform the final LAI protocol in a standard molar case is around four minutes.

LAI TIPS

There are a number of tips that will make any clinician better at using the LAI technique. It is imperative that prior to any LAI cycle that a rubber dam is placed and sealed with a rubber dam sealer. The author prefers a light cure rubber dam sealer because it takes approximately 30 seconds or less to seal the rubber dam. Incidentally, it should only take 30 seconds to place a rubber dam and it is considered the standard of care. Make sure that there is not an open crown margin or inter proximal caries prior to using the LAI technique. LAI works so well that sodium hypochlorite will leak out the access and through the open crown margin if they are connected. Second, cover the patients clothes with a full body towel or shield to prevent any splatter of sodium hypochlorite when using LAI.

When ready to use LAI, allow the dental assistant to place the irrigation needle into the access, hooking a wall for a purchase point (bend the 23 or 25 gauge irrigation needle at almost a 90 degree angle), and place the surgical suction next to the tooth. Once the assistant is situated than go in with the laser tip, place it into the access and commence LAI. Allowing the dental assistant to get ready first prevents mishaps like breaking the laser tip or not being in the correct position and having to reset during the LAI cycle. Make sure that the assistant does not place the needle across the access. This can block the access and make it much harder to place the laser tip in the access. Bending the needle at a ninety degree angle and hooking a buccal or lingual wall will prevent this.

The author recommends to use LAI with sodium hypochlorite one cycle prior to attempting to negotiate and one or two cycles during Nickel Titanium shaping. This helps clean out the debris and pulp tissue as the clinician is progressing though the root canal. It is believed this increases efficiency and makes the entire procedure more effective.

LAI can also be very effective in removing calcium hydroxide from the canal. Typically a clinician will place calcium hydroxide as an intracanal medicament in cases that need more disinfection or cases where blood, purulent or serous fluid continues to "weep" into the canals from the periodical tissues during treatment. The best way to remove the calcium hydroxide at the second appointment is to first irrigate out the majority of the calcium hydroxide with standard needle irrigation using bleach. Then take a #10 Kor C hand file and re-establish patency and then use the LAI technqiue.

In instances where a hand or nickel titanium file separates in the canal LAI can sometimes remove a loosened file. The author has not seen LAI remove a bound separated file. Once a file separates, use an ultrasonic tip to loosen the file and then use LAI with water or sodium hypochlorite. Most cases will take multiple LAI cycles and ultrasonic loosening to achieve file removal. The author has removed 4 separated files with the LAI technique.

LAI can also help anesthetize inflamed pulpal tissue. In a few cases patients have complained of discomfort after locating a second canal in a lower premolar. These forked canals can be difficult to locate, much less negotiate with hand files. In these cases, the author used LAI with 1 carpule of 2% Lidocaine with 1: 100,000 epinephrine and was able to achieve full pulpal anesthesia.

There are cases where the final LAI protocol is adjusted. This can be done in three different ways: use lower milliJoules, use LAI for less time, and/or use less sodium hypochlorite at the final protocol. If a tooth has an open apex, a resorbed apex from a large periodical radiolucency, is short in length, or if the canals are shaped to a large foramen (#35 and bigger) then it is recommended to either reduce the final protocol initial sodium hypochlorite cycles to just one or two or turn down the unit to 1 0mJ and perform the normal protocol. The author finds the easiest way is to turn down the power to 1 0mJ and perform the recommended final LAI protocol. In doing this, it will help prevent apical bleeding.

Another clinical situation that LAI can be effective is in treating calcified canals. LAI does not necessarily help locate calcified canals, but does clean and remove all the debris from the pulp chamber allowing better visualization of the pulpal floor color. Once calcified canals are located they can sometimes be difficult to completely negotiate. In some cases the author has been able to place a #10 C file about 10mm into the canal but unable to advance. In this case, if a slight stick is felt than immediately proceed with LAI with a water cycle. Continue to GENTLY pick with an #8 or #10 C file with file lubricant. Usually the author is able to advance another few millimeters, then continue to use LAI with water and then attempt to negotiate farther down the canal. Each time the author is able to advance deeper into the canal until finally achieving patency. In these cases It usually takes an average of 3-5 LAI cycles. This tip was taught to the author by Dr. Bryan Beebe and it works well most of the time.

Often the author fields a question regarding LAI and retreatment and can LAI remove gutta percha from the canals. LAI biggest benefit is the aggressive acoustic streaming and sonic boom effect followed by a tidal wave of irrigant flooding the canal system. This irrigation on steroids in incredibly beneficial in removing pulpal debris and loosened gutta percha. The authors recommendation is to remove the majority of gutta percha with a solvent and then use LAI (water and sodium hypochlorite) to clean out the remaining loose gutta percha, pulpal debris and microbes. Do not use LAI with chloroform (CHCl3) which is a carcinogen.

The last LAI tip involves the "PIPS" power effect. If a clinician wants to "feel" the PIPS power effect just place the mirror head against the outside of the buccal wall of a molar tooth when using LAI. The "PIPS" power effect or vibration will travel through the mirror head, down the handle and to the clinician's fingers.

PIPS SLIPS

There are a few negative outcomes that can occur

with LAI if the clinician is not careful. All of these events are rare but deserve discussion so as to prevent future problems. It is important to learn from your mistakes, but it is even better when you learn from other clinicians mistakes. The author wants to highlight some mistakes that he has run across in private practice over these last four years and discuss how to correct them.

The author has noted that some clinicians have attempted to use LAI with sodium hypochlorite without a rubber dam. This can be dangerous and could cause a chemical burn in the throat. DO NOT use the LAI technique without a rubber dam. In one early case, the author did not adequately seal the rubber dam and during LAI, bleach leaked out into the mouth and down the throat. This caused a chemical burn and led to an angry patient. The chemical burn did heal but only after the patient experienced a sore throat for a few days.

Over the years, the author has learned the hard way that LAI works well and if applied incorrectly can splatter and stain clothes. So cover the patients clothes with a large towel to prevent splatter and staining and don't activate LAI early. Allow the dental assistant to fill the entire chamber with irrigation solution and submerge the laser tip in the solution prior to activating so as not to "throw off' irrigation solution onto the clothes. Again this is an extremely rare event but it is a possibility (this has occurred in 20 out of 4000 cases).

Because LAI works so well, in some cases the patient will feel discomfort during the final protocol. Since the root canal procedure can often take an hour to an hour and a half to complete often the patient is not fully anesthetized at the time the final LAI protocol is performed. The recommendation is to give another carpule of anesthetic, wait a few minutes and then proceed finishing the LAI protocol.

Remember that the LAI technique is open and dynamic and can be adjusted at any point throughout the protocol. There are cases where the author will only use LAI with sodium hypochlorite for a shortened cycle during the final protocol because the canal is only 15mm in length. Shorten the final protocol or reduce the power of the mJ in certain cases in order to prevent apical bleeding. Since LAI creates an aggressive acoustic streaming of sodium hypochlorite, if it comes into contact with inflamed apical tissue or exposed interproximal gingiva it can cause bleeding. The good news is the apical bleeding usually subsides within 5 minutes. Even without LAI, apical bleeding can occur just from shaping canals and cleaning inflamed pulpal tissue or touching inflamed periapical tissue with hand or rotary files. There are a few cases early on where the author was too aggressive and did not follow protocol and used too much LAI In these cases there was apical bleeding that lasted for ten- fifteen minutes. If apical bleeding does occur during an LAI cycle, stop and proceed with hand irrigation for the remaining appointment.

CONCLUSION

Photon induced Photoacoustic Streaming is a laser assisted irrigation method that improves chemical debridement through aggressive acoustic streaming of irrigant inside the root canal system. This method is worth continued investigation and discussion and has shown to be clinically effective at removing pulpal tissue, pulpal debris, loosened separated files, microbes, biofilm and smear layer. LAI allows the clinician to practice effective., efficient, and excellent endodontics. This is called E3 Endodontics, and if practiced consistently, provides the patient with the best possible root canal treatment available. LAI also increases efficiency by loosening·and removing pulpal tissue and allowing for quicker negotiation to patency. This early stage of the root canal game is of utmost importance because everything follows successful negotiation to patency. LAI also removes pulp tissue and debris and provides cleaner canals. Cleaner canals allow for more area to be packed and sealed. This in turn should allow for better root canal success. In conclusion, LAI gives the clinician confidence that they are doing the best possible treatment for their patient and providing an E3 endodontic experience.

APPENDIX
OFF-SEASON TRAINING

GENTLEWAVE TECHNIQUE

Rubber dam isolation. I extend the dam 1 tooth mesial so I can see contours while accessing. Access and locate all canals. I perform coronal negotiation with #10 C 21mm about 10-15mm into the canal to make sure the coronal 1/3 is open. I then use a ProTaper Gold SX and obtain coronal flare. I use a #8 or #10 K file to negotiate to patency. If patent, I use my ProMark apex locator and get a working length. If not patent I may take a working length film and if its 1-2mm from the radiographic apex, I'll finish shaping to the length that the #10 K file reaches. After I obtain a working length I use the ProTaper Gold S1, S2 (I brush to the outer wall) and then F1 to finish all 1mm back from working length (I shape almost all my cases with this system). I still irrigate in between shaping files with 6% NaOCL and check patency between each file.

Once shaping is complete I immediately place Soundseal or Kool Dam in the embrasures and B and L and around all restorative margins to prevent leakage. My assistant cures for 20 seconds. I then try in the occlusal matrix into the access to make sure the access is large enough and the clamp is not in the way. This is my dry run. I then remove the tip from the Soundseal syringe and quickly place a generous portion of it onto the bottom of the occlusal matrix leaving just the tip exposed. I use my Endo explorer to smooth out any excess. I place the occlusal matrix with Soundseal into the access and my assistant cures for 20 seconds and then I remove the occlusal matrix carefully with an Endo explorer. They cure another 20 seconds right on top of the occlusal access and distal. If it's an anterior or premolar than I check for any internal bubbles or holes under the microscope. If all is sealed then my assistant hands me the anterior/premolar procedure instrument and it's then 8 minutes of pure ecstasy as I run GentleWave.

If it is a molar I remove the occlusal matrix with an Endo explorer and then I use a Diamond bur with water and carefully remove any excess or access overhang of Soundseal. Some people use an Endo Z bur. I then inspect (under the microscope) for any internal holes that will lead to a leak (this is where I see the most leakes). If there is a hole I place a small amount of sound seal in the hole, smooth it out with an Endo explorer and cure for ten seconds. I then try in the depth gauges and usually start with the Red (8mm) and if it's hitting the pulpal floor, move to the blue (7mm) depth gauge. About 90% of the cases I use the red or blue procedure instrument. I find this step very subjective (even after 1000 cases) and can't always tell the which depth gauge is the right one but always error on the smaller one so I'm not hitting the pulpal floor. Even if the procedure instrument is 2mm away from the pulpal floor it still works. 1-2mm is the optimal range. I then have my assistant hand me the molar procedure instrument and I run the magic mist (GentleWave) for 7-8 of the longest minutes of my life.

Once GentleWave is completed I usually see some bleeding and have grown to be comforted by it. I know that the entire canal is clean all the way to the PA tissue. This is a huge paradigm shift because we were taught that bleeding from the PA tissues meant that we either instrumented long or were too aggressive and did something wrong, or finally, there is just too much inflammation.

I immediately place ProTaper Gold F1 cones into each canal and directly into the bleeding. I walk away and perform a consult or anesthetize the next patient. About 5 minutes later I'm back and in about 90% of the cases the bleeding has stopped or close to it. I remove the cones, rinse them with NaOCL and then use QMix (EDTA + Chlorhexidine) from Dentsply and rinse out the blood. I use the Macrocannula EndoVac and suck out the QMix and any blood and then use 1 coarse paper point per canal (most of the time) and then 1 medium paper point per canal. I butter the apical end of the GP cone with Thermaseal Plus Ribbon Sealer (AH-Plus) from DentsplySirona and place the cone to working length. As I approach working length I pull the cone back a little (hoping to collect more sealer at the tip) and then place to working length. I use the smallest tip on either the heat tip end

of the GuttaSmart (black tip) or the Endo Pro 270 (yellow tip) (cordless heat tip) and remove the coronal/middle 1/3 GP. I am often not within 5mm of working length but try when I can. I use Dovgan Pluggers (usually white and blue ends) to help pack the GP. I then backfill with the GuttaSmart obturation system from Dentsply. I didn't like the GuttaSmart at first but now love it. This shaping technique gives me balance shapes (not too small not too big) and I also see more anatomy and cooler stuff with Thermaseal Ribbon sealer. I have also had very good results with this technique and have had very good healing with very few post-op problems. When I was using BC sealer I had much more post-operative problems (the tooth still hurts or I still feel pressure or it hurts to bite).

Problems - On maxillary molars if 2 minutes into the bleach cycle you suddenly get a geyser of air bubbles running through the window of the molar procedure instrument abort immediately. It could be a platform leak but most likely bleach is going into the sinus (usually the palatal canal). This has happened to me 2x and my associate one time. We had this problem occur within the first month of using it and have not had it since. Generally, this is not a big problem but it is a possibility so I would be a little more focused when running GW on max. Molars. It's highly recommended to take a CBCT on all maxillary molars.

Sometimes I will get a little leak somewhere in the platform. If it's 1/2 way through or near the end of the cycle, and it is small in one area, I just have my assistant suction right at the leak and keep running GW. It is my understanding that GW still works and the canal system still appears cleaned out and I still get some bleeding.

If bleeding continues into the ten minute range, first use profanity and then use cold saline or 3% Hypertonic saline (boundtree.com). If you inject 3% hypertonic saline into the canal forcefully this can stop the bleeding almost immediately.

GW is a huge paradigm shift and can be frustrating the first 100 cases. It took me over a year and I finally found my groove with it and use it on as many cases as I can. **For a while I was using it about 50% of my cases but the last 6 months I have been using it about 70% or higher of my cases.** Don't feel that you have to use it 100% of the time but I do notice the more I use it the more my cases look pretty good and appear to be very clean inside. Good luck and stay with it because the magic mist is the gift that keeps on giving.

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