

CLINICAL ARTICLE

# Part 2: "I would Rather have a Root Canal than..."

## Francis W Allen discusses the challenges of cleaning the canal thoroughly to minimize pain and ensure long-term success



Francis W Allen

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ABSTRACT

The primary objective of root canal therapy is retention of pulpless or pulpally involved tooth with its associated periapical tissues in a healthy state. Achievement of this objective requires that the pulpal spaces and contents be eliminated as sources of infection. No instrumentation technique can be 100% effective in removing debris all the time. Although with Light speed technique we can achieve 95% removal of debris, introduction of an antimicrobial endodontic irrigant plays vital role in cleaning up any remaining debris and bacteria that can lead to pain and failure during root canal treatment. With traditional positive pressure irrigation technique getting an adequate amount of irrigant to flow into the last 1mm is not safe and easy. Additionally, techniques recommend 30 or 45 minutes of soaking, which is time consuming. These difficulties can be avoided by novel idea of reversing the irrigation process with EndoVac (discus) by using negative apical pressure for irrigation. SMART endo using light speed technique and endovac irrigation is faster, easier, safer, and can remove 99+% of the debris and bacteria in the critical apical region of the canal. That means less painful, better and more successful root canal treatment.

**Keywords:** Light speed LSX, Endovac, Balanced force technique, CEJ.

In part 1 (Vol 3, No 2), I referenced a study showing that when cleaned to the proper working width (WW), 100% of the canals were free of debris.<sup>1</sup> What about those large oval-shaped canals, fins, cul-de-sacs and other parts of the root system that an instrument cannot touch? We know that no instrumentation technique can be 100% effective in removing 100% of the debris 100% of the time. LightSpeedLSX™ (Discus) gets you really close (95%), but even it cannot be perfect every time.<sup>2</sup>

This is where irrigation comes in—cleaning up any remaining debris and bacteria that can lead to pain and failure! But, Chow’s research<sup>3</sup> in 1983 shows that for an irrigant to be effective it has to: (a) reach the end of the canal; (b) create a current flow to replenish irrigant; and (c) remove the debris from the canal (Table 1). There is not a single *in vivo* type of study that shows irrigants can meet “Chow’s paradigm” in the critical apical region of the canal. Getting an adequate amount of irrigant to flow into the last 1 mm is not as safe or as easy as it sounds. Additionally, techniques recommending 30 or 45 minutes of soaking are way too time consuming and yet still cannot completely resolve Chow’s paradigm.

**Table 1:** Chow’s paradigm—For an irrigant to be effective, it has to:

1. Reach working length (WL)
2. Create a current flow at WL
3. Remove the debris at WL

To avoid an irrigation accident, we are constantly warned against taking the irrigation needle closer than 2 mm from the working length (WL), to prevent the needle from getting stuck in the canal and avoid applying too much pressure. The “perfect storm” is where you violate one of the above guidelines and inject sodium hypochlorite (NaOCl) into an open venule creating a catastrophic, potentially life-altering situation (Fig. 1). In my opinion, a fair amount of our patient’s postoperative pain comes from a miniscule amount of NaOCl seeping into the periodontal tissues.



**Fig. 1:** Example of an irrigation accident

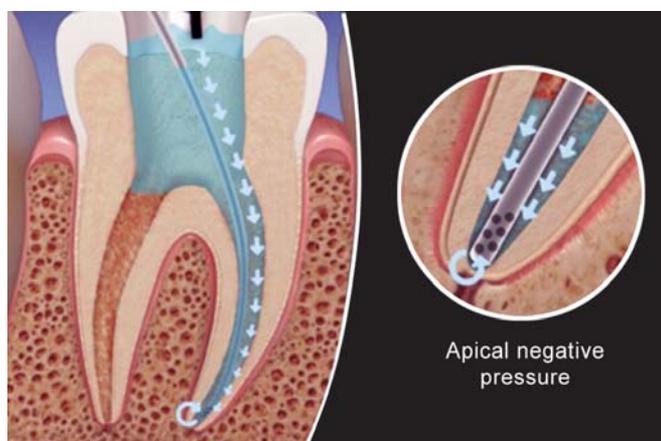
## Thinking Outside the Box

Dr John Schoeffel has solved the irrigation dilemma of Chow's paradigm by thinking outside the box and completely reversing the irrigation process with EndoVac® (Discus) (Fig. 2). Instead of pressing on a syringe plunger, dangerously delivering irrigant into the canal short of WL with positive pressure, EndoVac uses negative apical pressure. A cannula is hooked up to your Hi-Vac system and placed into the canal. It pulls irrigant down from a reservoir in the pulp chamber, into the canal and then suctions it out of the canal through the cannula Hi-Vac connection. It is an extremely safe apical "sump pump;" irrigant simply cannot go beyond the end of the cannula, virtually eliminating the risk of an irrigation accident while fulfilling Chow's paradigm.

Once instrumentation is complete and before obturation begins, the larger MacroCannula is first used as far as it will go down the canal (usually about half way) for the purpose of killing bacteria and dissolving the bulk of residual canal debris. The smaller MicroCannula (0.32 mm diameter) is then taken to full WL for the purpose of killing bacteria and dissolving the smaller remnants of any remaining canal debris. Yes, to full WL—because all studies show it is totally safe and effective. This action safely creates a current flow all the way to WL while dissolving and suctioning out the debris and bacteria. Recent research indicates that when EndoVac is coupled with LightSpeedLSX, it results in 99+% debris removal in the canal.<sup>2</sup> To borrow a Discus phrase, that is SMART Endodontics.<sup>4</sup>

## Sucking Out the Bad Stuff and Pain

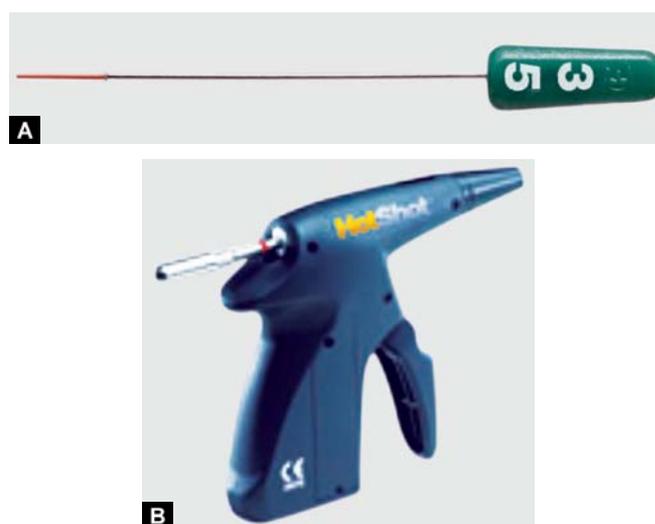
In my practice, I take the EndoVac one step further, meaning that I routinely take the MicroCannula beyond the WL and out the end of larger foramen when possible. I do this to suck out purulent exudate, hemorrhage and debris. A great example of that is tooth No. 9 in Figure 3. This patient came in for a traditional emergency pulpectomy to a size #20 file. The canal was necrotic without any exudate. The pain got worse and was referred to me for treatment the next day.



**Fig. 2:** EndoVac safely goes to WL with negative apical pressure acting like a sump pump for the purpose of removing any residual, painful, inflammatory debris



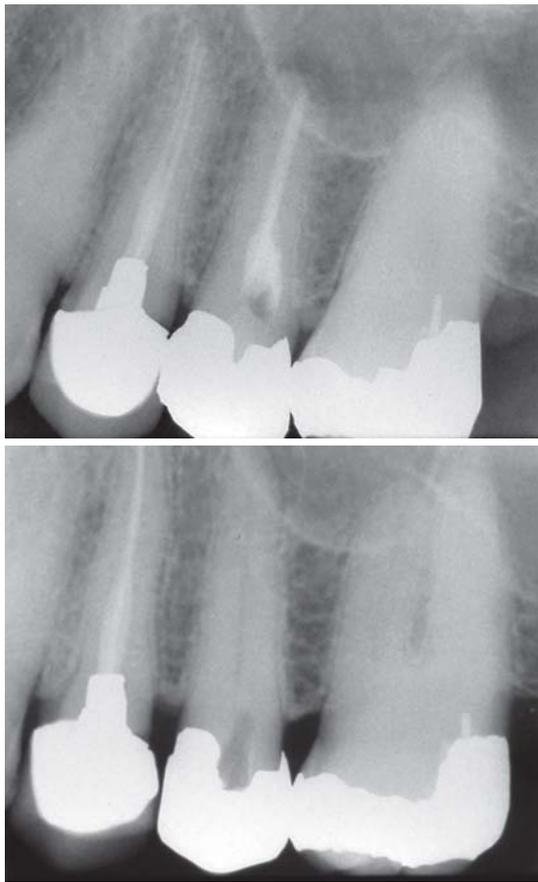
**Fig. 3:** Tooth No. 9. After using EndoVac, the patient said the pain was gone. An extremely appreciated transition from severe to no pain



**Figs 4A and B:** Simplifill apical plug and hotshot backfill gun

I used the LightSpeedLSX technique to determine that the proper WW was of a size #90. The tooth had extensive external resorption allowing the MacroCannula to be taken out the end of the canal. Suctioning of the lesion resulted in purulent and hemorrhagic exudate. I kept this up for about 12 minutes until I was able to dry the canal. Next, the apical canal was obturated with a matching size #90 SimpliFill gutta-percha Apical Plug (Discus) and backfilled with the HotShot Gun (Discus) (Figs 4A and B). When I called that evening, the patient told me "all the pain is gone." An extremely grateful patient appreciated the quick transition from severe pain to no pain! Complete cleaning of the canal resulted in pain reduction and justified one-appointment endodontics.

Another example of this occurred the same week (Fig. 5). A dentist tried to find the canal in tooth No. 13 about 3 years previously, and now the patient shows up as an emergency with severe pain radiating to the top of his head. Using a microscope and ultrasonics, it took me 1 hour to find a necrotic canal 16 mm down the canal (WL of 20 mm). Once the canal was found, a #25 hand file slid to WL without resistance. This is so



**Fig. 5:** The patient said "wonderful" after rubber dam was removed—the severe radiating pain to the top of his head was eliminated upon EndoVac use



**Fig. 6:** After a second pulpectomy, this time with EndoVac, the patient is able to eat and get a good night's sleep

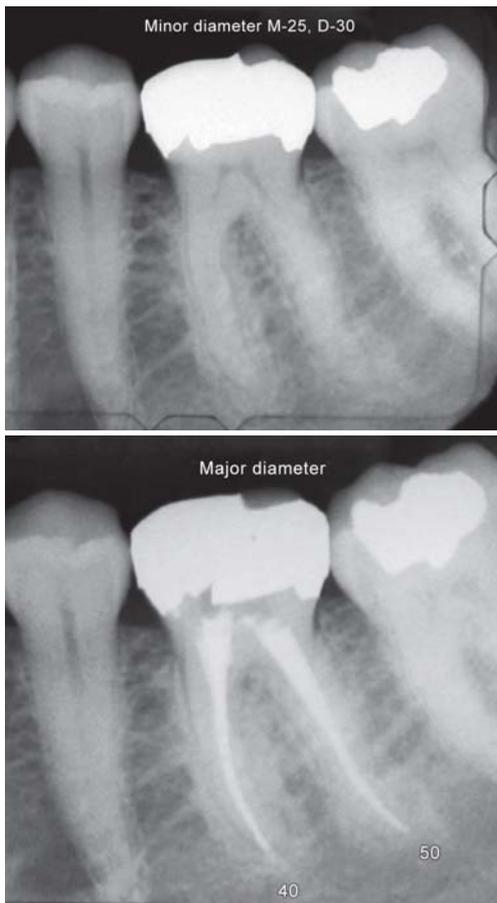
typical. Sclerotic dentin usually forms coronally to apically. Once I worked through the sclerotic dentin, the canal itself was quite large. The canal's WW was determined to be a LightSpeedLSX #80, but the great thing for him was that when I started using the EndoVac, he said "Wonderful!" He felt

immediate elimination of "pressure pain" all the way to the top of his head even under anesthesia. Again, complete removal of debris and bacteria allowed me to eliminate the acute pain and justified one-appointment root canal treatment (RCT).

The third case, in the same week, started as a traditional emergency pulpectomy on tooth No. 30, but the pain got worse (Fig. 6). The patient could not eat or sleep and was referred to me for treatment two days later. These canals were smaller, and I could not get a cannula to the inflamed tissue, so I enlarged the apical constriction just slightly to a size #40 with LightSpeedLSX so that I could extend the MicroCannula out the foramen to decompress the painful lesion. I medicated the canals with calcium hydroxide and called her that evening. She said she was asymptomatic—she could eat and didn't need any pain medications, it felt so much better. She was looking forward to a good night's sleep. She was one happy patient! These cases demonstrate that not only can EndoVac do a great job of killing bacteria and removing debris from within the canal space, but it can also act as a sump pump removing inflammatory periradicular tissue, thereby reducing postoperative pain.

### The "1-hour" Molar depends on Case Selection and Blind Luck

"I would rather have a root canal than" – what about negatives such as: it takes too long, it costs too much, and it doesn't always work. Speed (which translates into profit), and patient time in the chair (which translates into patient and doctor comfort) are dependent on how long it takes to establish a good glide path. Once a glide path is established, rotary instrumentation should be completed in minutes. The 1-hour molar depends on case selection and blind luck. When I find all the canals and can make good glide paths in the first 15 minutes, I know I will finish in less than 1 hour. That's how predictable the technique is for me. But, there are cases when it can take me a couple of hours just to finish the access and establish a good glide path to WL. A great example of this is figure 7. I have been using LightSpeed for about 11 years, and I am still amazed how it can accurately measure canal sizes in the apical third. In this case, I was optimistic and scheduled 2 hours because the canals were very sclerotic. I was not able to reach WL in the first 2 hours, so I rescheduled her for another hour and a half. It took another hour just to establish WL with a #6 hand file, and when I finally got to a size #10, it fit amazingly loose in the canal! I was running out of time and started with the LightSpeed technique and believe it or not, the very first LightSpeed to meet any kind of resistance (the minor diameter) was a #25 in the mesials and a #30 in the distal canal. Instrumentation continued with the LightSpeed, working up in sequence until I measured the WW (major diameter) as sizes #40 and #50 for the mesials and distal, respectively. Had I been using tapered instruments, I would have finished instrumentation prematurely because of the binding that I would have been feeling in the coronal, not apical, part of the canal. And that is just how canals are—sclerotic dentin forms coronally to apically, but you still

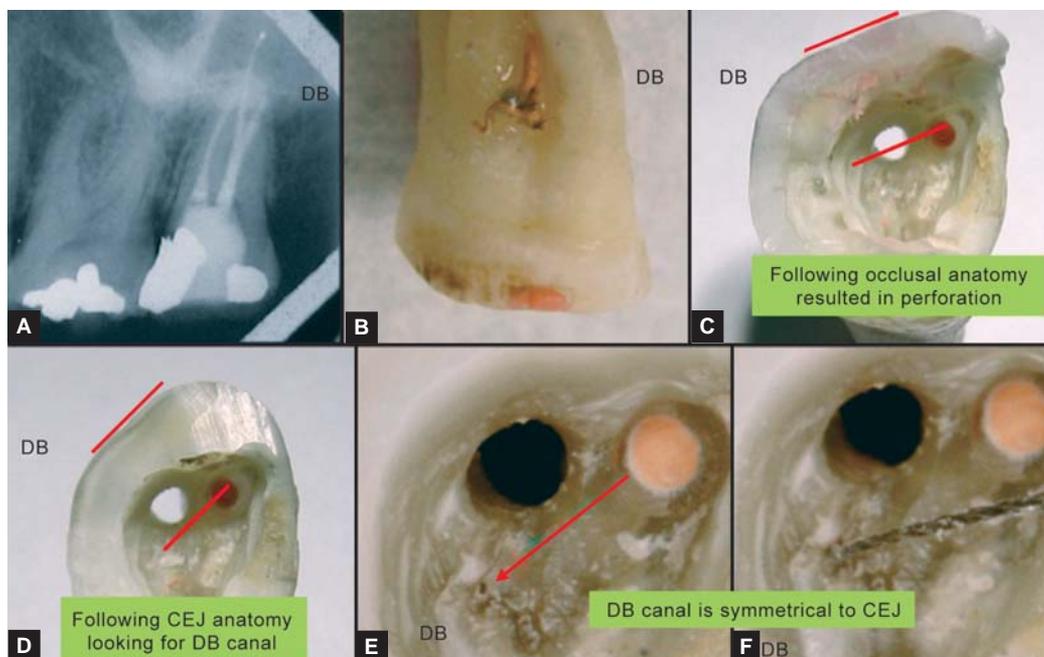


**Fig. 7:** Even though it took 3 hours to establish a glide path with # 10 file, the first Lightspeed to blind in the canal (measuring the minor diameter) were sizes 25 and 30 and the WW (major diameter) were sizes 40 and 50. Once gaining access, getting the canals really clean using a safe, conservative technique and accurately gauging the apical width is the easy part

need to safely clean to the correct WW apically, or you will leave debris behind and increase the risk of postoperative pain and failure down the road.

### Working Blind

The American Association of Endodontists (AAE) has a great chart to assist in case selection that can be found at <http://www.aae.org/dentalpro/CaseAssmtReferral.htm>. The more difficult the case, the greater magnification you will need to quickly find and negotiate the canals. One thing commonly overlooked—magnification eats up light! With the additional magnification and light (especially with a microscope), you are better equipped to take advantage of anatomical clues to find and negotiate canals. The cementoenamel junction (CEJ) is a very important landmark. The pulpal floor and canals are normally symmetrical with CEJ. Canal orifices are typically found at the junction of the wall and floor; the floor is darker than the walls (sclerotic dentin is usually lighter, but the floor itself is usually darker than the walls), and fusion lines lead to canal orifices. Figure 8 is a great example of the importance of following the CEJ. After RCT, the patient was referred to me for build-up and a crown. It was about two weeks after RCT, and the tooth was still a bit sensitive. The postoperative radiograph (Fig. 8A) looks good, but take a close look at the distal buccal (DB) canal. Upon opening into the chamber, I noticed hemorrhage and a large pulpal floor perforation filled with gutta-percha in the furca between the mesial buccal (MB) and DB canals (Fig. 8B). The patient elected to have the tooth extracted. I had already started the occlusal reduction before removing the temporary restoration, but you can still see that



**Figs 8A to F:** Pulp chambers and canals are symmetrical to the CEJ. The dentist followed the occlusal table rather than the CEJ and ended up with a DB perforation

the dentist followed the occlusal plane while looking for the DB canal (red lines) (Fig. 8C). In Figure 8D, I reduced the occlusal table to the CEJ to use as reference to look for the real DB canal. As you can see in Figures 8E and F, the DB canal was indeed symmetrical to CEJ.

By using the AAE case difficulty form and factoring in your experience level, you will be better at deciding when to hold'em and when to fold'em.

### One-appointment Endo

Now, what about the one-appointment RCT? One-appointment RCT on vital cases is pretty much accepted by all, but when you have a necrotic stump and especially in an infected canal, one-appointment RCT is highly debated. If you are able to remove all the debris and bacteria in the first visit, it justifies one-appointment RCT.<sup>5</sup> Research indicates that SMART Endodontics can achieve this at a 99+% rate when both LightSpeedLSX and EndoVac are properly used together.<sup>2</sup> For me, one-appointment RCT is now justified with SMART Endodontics. The only time I don't do one-appointment RCT is when it takes way too long to establish the glide path, I cannot dry the canal, or the patient is in just too much pain for an extended appointment.

### Tips for Saving Time when Establishing the Glide Path

Some personal favorites in establishing WL are the balanced force technique, the "C" files (Dentsply), and the M4 handpiece (Sybron Endo). The balanced force technique can be found at <http://www.healthmantra.com/rotary/tech.shtml>, which also has a link to the original techniques and simplified/modified techniques. When I give presentations, I find that many dentists are unaware of or haven't tried this technique in sclerotic cases and curved canals to establish WL. The general concept is to take a small bite of the canal and then shear off the dentin. It takes a bit of patience and time but definitely will reduce your instrument separation rate while achieving WL in those more difficult cases. This is achieved by advancing the K-type hand

file until it meets resistance. With continued, light, apical pressure, turn the file clockwise ¼ turn to dig into the dentin. Then with continued apical pressure, turn the file counterclockwise ½ turn. This shears off the dentin just engaged. Depending on the level of sclerosis, it may be performed a couple of times before removing the file to bring up debris and check for damage to the file (Fig. 9). This is where the Lexicon C file<sup>6</sup> (Dentsply/Tulsa Dental) comes in handy. The C file is a bit more expensive, but more durable and can be shaped to negotiate difficult canals.

### The M4 Saves both your Hands and Time

The M4 Safety Handpiece<sup>7</sup> reduces the repetitive stress issues of the "endo dance" and saves time. The endo dance is where you have spent a great deal of time establishing WL in a sclerotic canal using the balanced force technique then enlarge the canal to a size #20 with a K-file before beginning rotary instrumentation. The M4 safely does that tedious, potentially painful, repetitive job of dancing/rotating the file only a few degrees back and forth while you move the file up and down 1 mm. After I have a small K-file to WL, I place the M4 contra-angle head over the top of the K-file's handle and slowly activate the foot pedal. Running at about quarter speed, I will move the M4 up and down, 0.5 mm to 1 mm. Then I increase to full speed and continue the 0.5 mm to 1 mm up-and-down motion. When the file feels very loose, I move the file up and down about 3 mm. This technique easily and safely knocks off about 20 minutes for me on very sclerotic canals. The M4 is also great for anticurvature filing with Hedstrom files to move the coronal 4 mm of the canal away from the curvature and furca danger areas to help establish straight-line access.

### Cost

There is a big push toward implants. In spite of numbers given for RCT success, there is an underlying turbulence about success rates. So many variables to take into account! We recently published an article concluding that "a high percentage of cases confirmed as healthy by radiographs revealed apical periodontitis on cone beam computed tomography and by histology."<sup>8</sup> It was suggested that success rates could be off by 30% and more!

Now that we have the technology to rise above the 20% cleaning rate and approach 99% debris and bacteria removal, one-appointment RCT is now justified in my opinion, as demonstrated in Figures 2 and 3. Confidence in RCT outcome should be restored as the treatment of choice. Implants are rarely covered by insurance, and the cost of implants as well as the ability to clean a bridge must be carefully considered. How do RCT overhead and material costs compare to implants? Clearly, when RCT treatment is completed successfully, it is more cost effective than implants for both the patient and the dentist—in my mind that settles the cost issue.

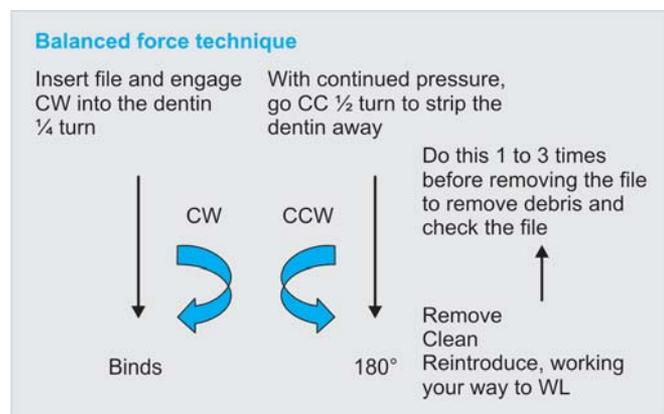


Fig. 9: Balanced force technique takes patience and time but helps safely reach WL in sclerotic canals

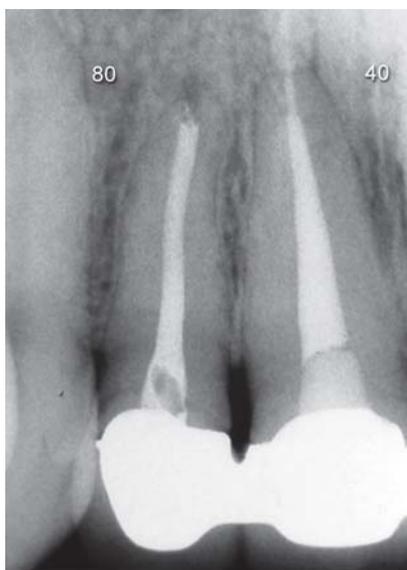
## Bigger is Better?

Another major component affecting success is the fracture rate of RCT. Koch writes about how the advent of tapered rotary instruments has caused excessive coronal enlargement and weakening of the tooth.<sup>9</sup> He advocates less taper, but let's go one step further with that idea. Because canal walls are basically parallel, why not eliminate the taper altogether? Figure 10 is a great example of that. The central incisor was prepared with rotary NiTi tapered instruments then finished with hand files to a size #40. The lateral incisor was completed during a 25-minute walk-in emergency appointment to a size #80 with LightSpeedLSX and filled with a SimpliFill gutta-percha Plug (Discus).

Which is more conservative in the coronal region? What about weakening the root in bone? Would you think that cleaning to WW weakens the root? Lam reported that teeth prepared with LightSpeed to WW were more resistant to root fracture than roots prepared with hand files or with greater taper rotary files. He postulated that creating perfectly round canals leads to reduced areas of stress concentration.<sup>10</sup> Bigger is better (cleaner) in the apical root while being more conservative in the mid-root and coronal aspects of the root at the same time, a win-win situation.

## Separation Anxiety

A major reason that, for me, RCT stood for "Refer Canal Treatment" was the fear of a broken instrument. I call it *separation anxiety*. Obviously, operator experience should reduce the chances of separation, but here are some numbers that make me very comfortable doing RCT myself. A study of endodontists using crown-down NiTi tapered rotary techniques showed a separation rate of 5%.<sup>11</sup> Another study of endodontic residents using the same techniques showed separation rates of 3 to 23%, depending on the instrument used.<sup>12</sup> Because I am presenting rates in a decreasing order of experience, let's look



**Fig. 10:** Tooth no. 8 was treated crown down with NiTi tapered rotaries, then finished to a size #40 with hand files. Tooth no. 7 was performed with LightSpeedLSX to size #80. The apical region is cleaned to the correct WW with conservative removal of dentin coronally. The most conservative approach is to take just enough dentin, in all the right places

at the ultimate sample—undergraduate dental students. Preliminary data from a Creighton University study involving 3,100 canals treated with LightSpeedLSX shows an irretrievable separation rate with LightSpeedLSX of 0.37%, easily 10 times better (Unpublished data, Dr Thomas J Beeson, January 2009). I borrow again, and add to Discus' phrase: that is SMART and Safe Endodontics.

## CONCLUSION

It was not that long ago that for me, treating root canals was the last thing in dentistry I wanted to do. Now I have a passion for endodontics that resulted in me being an area endodontic referral source for my group practice, writing articles on conservative endodontics, and traveling around the world lecturing on evidence-based endodontics. The bottom line for me is that SMART Endo is faster, easier, safer, and can remove 99+% of the debris and bacteria in the critical apical region of the canal. That means less painful, better, and more cost-effective RCT for me and the patient, thus reversing the adage, "I would rather have a root canal than...". Patients routinely state that their root canal was nothing like what they thought it would be. This has turned endodontics into a passion for me, and I often joke that I would rather do a root canal than go fishing!

## ACKNOWLEDGMENT

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