“Endodontic treatment is just a space maintainer for implants.”

This joke, often told by implant surgeons and implant salespeople, dramatically illustrates the current and very serious challenge to endodontic therapy remaining as a respected method of saving our patient’s teeth. Ironically, while many endodontists think of this as an us vs. them conflict, I would argue otherwise and point out that much of this threat has grown out of the seeds of our success. The pendulum of change swings, but it always swings too far before it returns closer to a state of equilibrium.

So how have we come to this state of affairs? Well, back in the dark ages of dentistry, the focal infection era, teeth with endodontic pathoses were blamed for the medical profession’s failures until the courageous fathers of modern endodontics said “enough, we can save our patient’s teeth by eliminating the disease within them rather than by ripping them out”. And people of all developed nations learned that they no longer had to expect to be wearing dentures by the time they were forty years old. I have often had a laugh when I consider that we convinced the physicians that it was OK to save teeth by doing aerobic culturing of root canals, a nearly useless method, to prove that we had sterilized root canals during our preparation procedures. Nevertheless, they fell for it and we then saved millions and millions of teeth and in this case the end really did justify the means.

However, as we treated a greater number of cases, we found that our success rates were not predictable. It was really Dr. Herbert Schilder—defining the objective of RCT as consistency of long-term outcomes or “predictability”—who began the next chapter of endodontic therapy when he stated and taught that our success was wholly dependent on our ability to treat root canal systems to their full apical and lateral extents. Granted, that wasn’t easy at the time, but technological developments have since made those definitive outcomes accessible to any dentist who understands the precursors to that result and was willing to do the work necessary to achieve success at that level.

So, what are the issues that threaten the credibility of endodontic therapy as the first choice when pulpal pathosis or persistent infection occurs in a root canal system? There are actually a fair number of them, some very obvious and some a bit more obscure. The following are the factors I have seen in my own practice as well as those I have become aware of in my educational pursuits both domestically and internationally.

**Needlessly Weakened Teeth**

This first topic of discussion may be a surprise to many endodontists in terms of its priority in the list, however, I am starting here because this is one we are totally in control of, and which were are definitely accountable for.

With all of those fantastic conceptual and procedural advances that came from Dr. Schilder’s paradigm shifts in root canal therapy, a negative that haunts us still today is that of over-enlargement of the spaces we work through. At that time, without magnification or the hyper-flexible nickel titanium shaping files we have today, it became clear that we needed larger access cavities to better find and treat canals and larger coronal shapes to allow for ideal management of tortuous apical regions of canals. And for the tools we had at our disposal in that era these convenience forms were necessary—the larger view of the edict to conserve of tooth structure meant that if we were to save the whole tooth, we needed to sacrifice some of that tooth’s structure to enable a predictable endodontic treatment result. Unfortunately, the pendulum always swings too far...

Sadly, despite advances that allowed us to be more conservative in our preparations and still achieve consistent outcomes, many endodontists and general dentists are still working for that full-bodied “look” at the end of the case because it became associated with better treatment results. However, one of the primary concerns that prosthodontists and enlightened endodontists have about the long-term prognosis of endodontically-treated abutments is their propensity to come apart under chewing forces—to vertically fracture. Indeed, the primary reason I have for considering a tooth unworthy of retreatment is when it’s structural integrity is gone.

I can fix most problems present in a root canal, but I cannot re-establish strength in the crown or root structure—so when I see that teeth have been needlessly weakened by previous treatment I feel sickened at the missed opportunity by the previous practitioner to do no harm in this respect (Figs. 1 and 2).

Dentists who do endodontic procedures should consider my definition of success—seeing my patient’s name...
in the obituary before they need a retreat or implant—
and cut tooth structure with that in mind. After coronal
leakage, the most common reason for long-term failure
of endodontically-treated teeth is vertical root fracture.
As an aside, any tooth with a vertically-directed
coronal fracture that extends even one millimeter
into the soft tissue attachment must be extracted.

Really the only rational but misguided reason to over-shape
root canals, now that we have nickel titanium shaping
files and flexible gutta percha condensers, is to create
enough coronal space in a root canal to do cold lateral
condensation. Herb Schilder used to joke that cold lateral
condensation of gutta percha was like filling a room with
telephone poles, and while that is a funny overstatement,
I care less about the quality of the resulting fill than I
do about the over-enlargement needed to wedge 3-5
accessory cones next to a cold hard master cone. Why not
keep the coronal shape smaller and use a narrow posterior
heat spreader powered by a Touch ‘n Heat or System-B
Heat Source instead (Sybron Endo)? A single warm lateral
condensation stroke followed by a single Autofit backfill
cone (Sybron Endo) will actually create a small hydraulic
wave through the softened master cone that can fill lateral
anatomy with the smaller coronal shape that is required the
structural integrity of the root is maintained. Better, no?

The fact is that there are many ways to obdurate root
canal systems that don’t require over-enlarging the canal
space, the most effective being centered-condensation

warm gutta percha methods such as the Continuous Wave
Technique or carrier-based filling using a Thermfil or GT
Obturator (Dentsply Tulsa). Regardless of which of these
filling techniques one chooses, long-term prognoses will
be enhanced when we quit weakening root structure, and
then perhaps restorative dentists will come to have greater
confidence in endodontically-treated teeth as crown and
bridge abutments.

Abandonment of Surgical Retreatment
Alternatives
Another milestone in our endodontic capabilities came
with the introduction of operating microscopes and ul-
trasonic instrumentation to our procedures by Dr. Gary
Carr. Initially, these devices were used to better our
surgical outcomes but then morphed into tools that pro-
vide greater possibilities for conventional retreatment.
We found that with better vision and tiny ultrasonic tips
we could remove posts and broken files as well as find
previously undiscoverable canals. Great huh? Yes of
course, however the pendulum always swings too far…

The new dogma of retreatment became that non-surgical
approaches were always done first, even when the coro-
nal seal was intact. Mostly this was very good because in
cases that failed due to coronal leakage, our retreatment
success increased significantly. However the law of unin-
tended consequences is real, and after this change in treat-
ment planning post-graduate students in many residencies
left school without enough surgical training to feel con-

Figure 1. Endodontically treated maxillary molar with vertical
root fracture in mesio-buccal root. While the endodontic therapy
was quite good in the apical regions (note the apical accuracy of
filling and the significant lateral canal in the mesio-buccal root)
the unnecessary over-enlargement of the coronal regions of the
canals resulted in a loss of structural integrity and the splitting
of the MB root within five years of treatment.

Figure 2. Maxillary premolar with narrow root structure and
proportionately narrow coronal preparation, enhancing its long-
term prognosis. Note the subtle curvatures that were maintained
due to the landed blades and the maximum flute diameter
limitation of the single 20-.06 GTX File used to cut the shape.
dent with that retreatment approach for failed endodontic treatment in molars. Remarkably, I have heard of incoming residents at some programs being informed that they will probably do fewer than ten surgical cases during their term in grad school! Something to consider for dentists applying to post-graduate endodontic programs.

Second, when under-trained in this respect, endodontists are limited to non-surgical retreatment options resulting, on occasion, in the destruction of well-done restorative work during the disassembly procedures required for non-surgical retreatment. This means spending many difficult hours retreatring these teeth with new post/cores and crowns needed afterwards. It is a general truism that dentists are more likely to treatment plan procedures that they are capable of providing and limited training will inevitably limit the treatment alternatives discussed with the patient.

We know that a great number of endodontic failures occur because the coronal seal has been lost and conventional retreatment is, of course, necessary in those cases, but surgery, in my opinion, has been poorly described as a “non-conservative” treatment approach. I think Dr. Donald Arens, one of the great surgical endodontists of the previous generation wrote that taking a surgical approach to resolve endodontic failures can often be more conservative than a non-surgical approach. To the endodontists who have good surgical skills, consider as I do, that sometimes surgery can the quickest, least expensive way to save a failing endo case, all things considered.

While most endodontists will inform their patients that a non-surgical treatment plan should be pursued first and that surgery may be necessary if success is not achieved, I am suggesting that in certain cases it should be the opposite. When a surgical retrograde procedure is simpler, it should be done first with the caveat that if it is unsuccessful, the more expensive, time-consuming coronally-directed treatment will follow. It is unarguable in my mind that the surgical approach, in many situations, is more definitive. Consider these facts—a retrograde approach will never be hampered by a broken file that cannot be removed, or an apical blockage or ledge that cannot be bypassed, and the terminal point of an illusive fourth canal in an MB root of an upper molar is always found when you take a retro-grade approach.

In fact, the increasing loss of surgical skills in the specialty is greatly threatening our claim to be specialists, if not due to the unpredictable conventional retreatment results that implant surgeons see so often, then because it begs the question of what separates an endodontists from a skilled and well-trained general dentist who does a wide range of non-surgical endodontic procedures? To the endodontists who were undertrained in this procedure, do not despair. Surgical techniques have also advanced - surgical retreatment is now a very straightforward procedure if one knows how to micro-surgically raise and suture flaps, achieve perfect hemostasis in every case, to find and retrofill apices in just a few minutes regardless of the tooth position.

In specialty group practices where at least one of the partners is a competent surgeon, and in regions where oral surgeons have trained up to actually treat root canal systems from a surgical approach, instead of extract and implant, it is not necessary for individual endodontists to do surgical retreatment. However, in practices or areas without these alternatives, it will become increasingly important for endodontists to attain or refine these skills. Fortunately, there are many excellent training centers around the US where this can be accomplished.

**Inadequate Treatment Results**

It is embarrassing to say this, but there are still many schools that are teaching, at undergraduate as well as graduate programs, endodontic techniques that are inefficient and ineffective. Believe it or not, there are still educators who inculcate their students with a phobia about going to and through the ends of root canals during treatment—without one shred of scientific evidence that there is any lessening of prognosis results. And in fact, the greatest number of failures (aside from missed canals and coronal leakage situations) occur because treatment was short of the full apical and lateral extents of root canals. HELLO? That is where the bugs are! That is where the severely inflamed tissue, close to a rich blood supply, will remain alive and angry (Figs. 3 and 4)!

When and if we ever figure out how to predictably sterilize these internal spaces, we won’t even need to fill the primary canals; we’ll just provide a perfect coronal seal to the CEJ level and be done with it. Until then, we must shape and clean to the apical and lateral termini of root canal systems—where the inside of the root becomes the outside of the root, where a limited immunologic response changes to a hemispheric capability. This means full treatment of all primary canals, irrigating with hypochlorite as effectively as possible, and then filling three-dimensionally to the fullest apical and lateral extents of these systems so that we can entomb any bacteria we didn’t kill during our cleaning procedures.

Now that I do implant surgery, I am even more amazed at the paranoia that some of my colleagues in the specialty have about taking a K-file that is .1 mm wide just a milli-
meter through the end of primary canals to clear their apical regions. When we do implant surgery, we take a drill that is 5 mm’s wide and 13 mm’s long and we use it to core through the center of our patient’s jaw, place a like-sized foreign body into that space and it’s OK. Actually it’s more than OK, it’s great! But to peek through the end of a root canal with a tiny root canal file and, God forbid, leave a small button of biocompatible sealer there—HORRORS!

My advice is that for any of you out there who still feel nervous or guilty about treating the whole root canal—either get some psychotherapy or quit doing root canal therapy if you are unwilling to do what you are paid for. To date, I have never had a patient tell me to intentionally leave parts of their root canal untreated. Ironically, one of the other threats to endodontics is the wing-nut health paranoids who are informing our patients that root canals are very complex, and that persistent infections can reside in these spaces. Jeez, I hate it when I agree with these guys, but isn’t it a better thing to explain to these concerned patients that we agree and that is why we are so committed to thorough treatment?

There are also CE educators who recommend substandard procedures, such as single-cone filling methods because it helps them sell rotary files—this in an era where three-dimensional filling results can be accomplished in less than a minute. If you ever hear of a CE course advertised claiming that you can do any molar in 30 minutes—run away! This is the lowest form of ethics in education and does nothing but truly promote endodontic therapy as a space maintainer for an implant. Personally, I would rather have a nice tooth replaced with a well-done implant than pay good money, put up with the hassle and discomfort of a use-less procedure, and then have my tooth extracted anyway.

Most embarrassing for the specialty are endodontists who have sold out. I can more readily forgive clinicians for their failures who were inadequately trained, than I can endodontists who know better but have entered the specialty to retire early. Any diligent endodontist who cares about providing state of the art treatment results, with today’s technology, will do very well by retirement age. Any endodontist who thinks that the meaning of specialty practice is to do 10 one-shot molars a day is victimizing their patients, destroying the hard-won confidence in endodontics as a predictable procedure, and ultimately destroying themselves, as expedient treatment can never be more than a short term strategy for success. The thing that hacks me off is that when an endodontist does a poor job, uninformed dentists will often assume that since a specialist treated it, root canal treatment just couldn’t save that tooth. And we all get a black eye.

Restorative dentists who have access to well-trained, conscientious endodontists know from long experience that endodontic therapy is a very consistently successful procedure. They know that it is the least costly, least time consuming approach to resolving endodontic pathosis, and that a successfully treated tooth is the most consistently-esthetic abutment to restore.

**Figure 3.** Mandibular molar with over-extended fill in the distal canal and the under-extended treatment in the mesio-lingual canal. The patient had significant pain referred over the upper and lower teeth on the side of his face for over 18 months. The common treatment plan for this case would be apicoectomy of the distal root.

**Figure 4.** Post-operative radiograph shows mesio-lingual canal after conventional retreatment (of only that canal) revealing previously untreated 3 mm long accessory canal in addition to the apical segment of the primary canal. All of the patient’s referred pain was resolved in spite of the distal canal, left in its original state.
It's a bit different when a general dentist does a case that fails. The perception about the relative success of endodontic therapy in these cases will depend on whom the dentist refers that patient to after the failure becomes apparent, and here lies the sticky wicket for endodontists.

If the general dentist refers the patient to an endodontic specialist and he or she even hints that the previous treatment was sub-standard, the narced-on dentist will be asked to refund their fee at the minimum, or worse, will lose the patient and all their friends and relatives in that practice. Conversely, if the dentist refers the patient to an implant surgeon, the implant surgeon doesn’t have to say “your dentist botched the case,” they can say “oh, root canal treatment really isn’t very predictable” (Figs. 5 and 6). Just something to think about if you are an endodontist. Finking out general dentists will not convince them to quit doing root canals, it will just convince them to cut out the endodontist as an option when the case fails. When the pendulum swings….

Retreatment of Teeth with Poor Prognoses
This one is for the endodontists, and I have been guilty of this in the early part of my career. I’m so old that I practiced before implants worked, and back in the day when extracting a distal abutment meant the patient would have to put up with a partial denture to replace the chewing function or just live without that replacement, we did a lot of weird dentistry we called “heroic”. That’s funny, in a pathetic way, because the term heroic was a self-reference when it more accurately described the patient undergoing treatment approaches with poor prognoses.

The list of heroic endodontic procedures included repairs of perforations before MTA, hemi-sections or root amputations of teeth with vertical fractures, forced eruption of teeth having sub-crestal caries, cervical resorption, or oblique fractures, and my favorite—internal bonding of root fractures. Not to mention doing root canal therapy on teeth that periodontists were ineffectually treating. That pendulum swung way too far—thank God we don’t have to do that anymore.

However, as much as it hurts to say it, we as endodontists are still retreating teeth with poor prognoses, for the same reasons that there are implant surgeons that are extracting teeth that could be saved—to a hammer, everything looks like a nail. Despite my best intentions, I have done this—fortunately for my self-esteem—mostly in cases that I now understand to have less than excellent long-term restorability prognoses.

Anterior teeth that are broken or decayed below the gum line have, as I have been educated by prosthodontists, a very mediocre long-term prognosis. While we can often restore these teeth with post/core build-ups, unless a significant ferrule can be placed 360° around the tooth, they are ticking time bombs for vertical fracture under side-loading forces. While these situations must be evaluated on a cases-by-case basis, in general, patients with this problem will be better served with an implant.

Figure 5. Maxillary molar after treatment by general dentist. When this case failed (a mysterious failure to be sure) the patient was referred to an implant surgeon who recommended extraction with implant placement. Only because the patient sought a second opinion, from a different general dentist, was the tooth saved.

Figure 6. Post-op radiograph after retreatment in a single 2-hour visit.
Fortunately, due to the more vertical loading and because we no longer have to stress posterior abutments with bridges (yah for implants!) many of these can be salvaged when they have lost tooth structure to cervical levels. Again, these cases must be treatment planned on a case-by-case basis.

Beyond issues of restorability, there are still cases being retreated after two, three, and even four failed retreatments. These are probably the most difficult judgment calls I make and they require communication with the restorative dentist, the patient, and often another endodontist (in my case, my partner, Jack Sturm).

To all of my specialist colleagues, please be aware that when endodontists retreat loser teeth, our collective success rate becomes lower as does the confidence other dentists have in endodontic therapy as a predictable way to save teeth. My worst experiences in pursuing implant training have been when an implant surgeon pulls out yet another case they implanted after one or a number of endodontists treated, retreated, and retreated it to death. Implant surgeons don’t see the retreatment cases that work; they see the ones that don’t, so their viewpoint of the success of retreatment is very skewed already.

The issues I consider in treatment planning an endodontic failure, in order of importance, are the structural integrity of the tooth, the periodontal supporting structures around the tooth, and finally the challenges of retreatment.

First, as mentioned above, the best retreatment in the world is not going to provide a long-term prognosis for a weak tooth. One of the challenging decision points, in terms of structural integrity, is what to do about a tooth having a vertical fracture that just barely reaches the soft tissue attachment. My experiences have taught me that these cases usually fail in the short or mid-term, and that they always fail in the long-term. Early in my practice career I have said (and have heard every new associate in my office say) to a patient with this condition, “we will save your tooth for as long as we can”. This gives me the dumb-chills now to remember my well-intentioned mistakes in this regard, a fantasy that lasted about 18 months into my practice experience. My advice to dentists young in their experience is to be ruthless in extracting these teeth, unless the patient makes a decision in their own worst interest. This recommendation, of course, applies to vertically-fractured virgin teeth as well.

Diagnosis of the apical extent of vertically-fractured teeth requires at least 10X magnification for internal access cavity wall examination, breaking the contact to see if there is a narrow increase in pocket depth on the outside of the tooth opposing the fracture line seen from within the pulp chamber, and careful viewing of a well-angulated radiograph for crestal breakdown in that area.

Second, as to the periodontal factors influencing prognosis determination, even periodontists have given up on periodontally compromised teeth—they just place implants now as they realize all those years of bone grafting next to natural tooth structure did not yield predictable long-term results or even worse, that we should never remove healthy periodontal tissues around good teeth to reduce pocket depths around adjacent loser teeth.

Last, I consider the issue of retreatability. In my mind this is a bit like the current concept of criminal justice, three strikes and it’s out. If the tooth has a perforation that needs to be repaired, three posts that must be removed, coronal leakage and also apical damage that will require surgery after an extensive disassembly and removal of a broken file—get it out of that patient’s head! These decisions are best made with the patient’s best interest in mind—not just in a physiologic sense but in a financial one too.

Consider the costs and time required for each treatment alternative, explain it to the patient as best you can, and let them inform you of their priorities. I have had patients who would walk through nine miles of broken glass on their knees to save a tooth with a guarded prognosis. It’s their tooth, and unless it just has no chance of being saved, I will accede to their wishes and retreat it if that is what they desire. The key issue for endodontists is to charge for the time it will take to do the procedures, not what the insurance company will pay (typically $100-200 more than standard treatment).

Also, the relative difficulties, time, and costs of implant replacement must be considered. In a patient who has taken IV bisphosphonates, who has a very low sinus floor, and had a previous implant failure, the equation would favor retreatment of even a challenging case. Conversely, if the patient could walk out in one visit with an immediate implant placed in the extraction socket with an esthetic provisional crown on it, for God’s sake, do the implant. Which brings us to the latest trend in the specialty of endodontics—that of root canal specialists training up to do implant surgery.

Why is your local endodontist doing implant surgery?
My favorite reason for placing implants is because I heard the endo/space maintainer joke once too often
(and my converse joke for implant surgeons is, “all miss-positioned implants integrate perfectly”). Seriously, I started training up to do implant surgery because I saw the specialty threatened by implant surgeons who had learned to disrespect the possibilities of endodontic therapy, whether their experiences were our fault or theirs. I saw my colleagues, myself included, opting out or being cut out of treatment planning consultations and I knew it was time for endodontists to break out of the in and out “mow, blow, and go” concept of multidisciplinary practice. And how has my experience as an endodontists/implant surgeon been? Fascinating and very satisfying.

Do I think that the majority of endodontists will eventually become implant surgeons? No. Those endodontists who practice in less competitive regions of our country will see little reason to add complexity to their day when they are already overwhelmed with endodontic referrals. In those areas periodontists and oral surgeons still refer cases for retreatment and it would often be counter-productive to jeopardize those healthy relationships. And obviously, endodontists who do not enjoy doing surgery in their original area of expertise will not enjoy doing other types of surgery. But for those who are seeing eminently-salvageable teeth extracted without an endodontist’s opinion, there is but one alternative—becoming the best, least-biased treatment planning opinion because, unlike implant surgeons who cannot do RCT, we can do either procedure.

What have I learned? I have learned many things about delivering better care to my patients, among them: I understand prosthodontist’s treatment planning process better, I make better decisions about which teeth to retreat and which to extract, and I have learned that I don’t have to be as sad when I cannot save a patient’s tooth. I have been received with grace and generosity by other implant surgeons—most of whom realize that we are not fighting for implant vs. endo, but are fighting to save teeth from being needlessly prepped to be bridge abutments, for our patient’s well-being, and for a growing perception by the public at large that dentists learn from their failures and become more adept at providing treatment that will stand the test of time. And I have learned that you can teach an old dog new tricks.

The future of Endodontics

Despite all of the issues mentioned above, the future of endodontics as a respected treatment for saving teeth is very bright. While the pendulum always swings too far during change, it always returns. Simple regression to the mean is a very serious force in the universe and it is no different in dentistry. Just as improved technology in endodontic procedures has increased the number of general dentists doing those procedures, and has attracted a greater number of dentists to the specialty, so it will go in the implant field.

Implant surgery is no more immune to failure than endo,
and as the number of dentists doing implant placement increases, the high rates of success will inevitably drop. And when an implant fails, it is a fairly expensive, 1-2 year process to reconstruct the bone that has been lost as a result (Figs. 7 and 8). Implant surgery, like endo, is not a panacea, when the best implant surgeons are famous for recreating an appearance that is very similar to a tooth. Implants are still not a tooth although they are fairly miraculous. When I think about the turnaround time needed to complete treatment on a pulpally-diseased tooth—about 2-4 weeks from the start of the RCT to the cementation of the permanent restoration, implants cannot compare (Figs. 9 and 10).

The future of Endodontics as practiced by specialists is in question for all of the reasons mentions above. The days of nearly instant practice success after residency are gone for those of limited skill or conscience. But for those who continue to learn, who get better every year of their practice career, who are curious and passionate about their chosen field of expertise, the future has never been brighter. The pendulum always swings too far but it’s cool to see that it is coming back to center…

**Figures 9 and 10.** Maxillary molar with long narrow, highly curved roots treated with GTX Files. Note the exceptional apical control and the three-dimensional result in spite of limited coronal enlargement (courtesy of Dr. David Rosenberg).