New technology and research is helping clinicians avoid multiple visits and long, drawn out endodontic treatment. There is widespread acceptance of single-visit endodontics for vital cases and the trend for nonvital single visits is becoming more widely accepted. I recall, as a young endodontist in the 1960s (ESS), such treatment was considered by most to be below the standard of care. At that time there was neither the research nor the technology to support single visits for nonvital cases. Times have changed and there is new evidence nonvital cases can be treated with quality root canal treatment (RCT) in a single visit, in most cases. This article hopes to provide additional information and encouragement for such change.

The Economics of Single-Visit Endodontics

The financial benefit of a single-visit RCT is significant. A profitable single appointment is reduced dramatically with two visits and becomes a loss when stretched to three (Table 1). Patients, in turn, also benefit greatly. Lost hours of work and needless travel are avoided. Without question, patients prefer single appointments.

The Basis of Single-Visit Endodontics

Validation for one-appointment RCT goes back to ENDO 101. We were told bacteria cause pulpal and periapical problems and treatment required mechanical and chemical disinfection of the root canals – both for vital and nonvital cases. Whether the objective could, or should be obtained in single or multiple visits was open to debate.

Some believe nonvital cases require a medication in the canal between appointments to kill most bacteria, including those in dentin tubules. They correctly believe canal disinfection is important but their expectations of great benefits from intracanal medicaments and second appointments may be exaggerated. There are no assurances the medications will kill bacteria in dentin tubules or bacteria embedded in tissue (inadequate cleaning). For medications to be effective they must make direct contact with bacteria—an unlikely event for those sheltered in tubules and tissue. Also at risk is the increased likelihood of bacteria entering the canal through a temporary barrier between visits.

One must not fall into the trap of expecting that medicating the canal between appointments will effectively substitute for compromised canal cleaning. One who embraces single visit RCT of necrotic cases must strive for meticulous cleaning of the main canal. Otherwise, the concept of single visit RCT cannot be supported by scientific evidence. Therefore, one must make every effort for thorough instrumentation and irrigation to remove as much of the bacteria and tissue as possible in the main canal.

Exceptions to Single-Visit Endodontics

Although we encourage single visits it certainly doesn’t mean we treat all cases that way. Here are our exceptions: (1) cellulitis, (2) acute apical abscess requiring incision and drainage, (3) severe pain when the tooth is lightly touched, (4) a weeping canal that cannot be dried, and (5) difficult cases that extend beyond our allotted time and the patient’s tolerance.

The Concept of Working Width (Apical Enlargement)

Let us now consider the clinical aspects of single-appointment RCT. Recall that thorough disinfection is required for single visits and this requires due importance be given to cleaning the apical third of a canal. Instrumenting to the correct size, a size called working width, or WW, does this. “Working width” is a relatively new term that describes the tip size of the last instrument used to working length (WL). While dentists are very aware of WL, little attention is given to WW. Obviously, just getting the correct WL is not enough. We have to get the correct WW for the apical area. An apex locator makes it easier to get WL, but determining WW has been elusive. Traditional .02 tapered hand files and rotaries with greater tapers are of little value for accurate determination of the correct WW. This is because tapered instruments cut canal walls in several places simultaneously and it is not clear what is happening apically.

Working width is the last instrument used to WL and it is the same as the Master Apical File (MAF) or Master Apical Rotary (MAR). The correct WW correlates closely to the largest diameter of the original canal size in the apical third. Determining the correct WW is as important (arguably even more important) as determining the correct WL. If the apical portion of the canal is large before instrumentation, the WW should be large after instrumentation, and same applies for small canals. An undersized WW, even with a correct WL, compromises cleanliness. An oversized WW compromises root strength.
Three cases illustrate the importance of WW. Figures 1a, 2a and 3a show failed root canals. When retreated to larger WWs the lesions healed, showing the importance of WW for endodontic success (Figs. 1b, 2b and 3b). The larger WW sizes were not determined arbitrarily. They were dictated by the existing canal diameter.

Research reinforces the concept that a WW slightly larger than the original canal size results in better cleaning than a WW smaller than the original canal size (“bigger is better”). Since “bigger is better”, why isn’t the apical canal diameter given the importance it deserves? Because it has been mostly ignored—so much so that apical diameter is called the “forgotten dimension in endodontics”. Why forgotten? Because instruments lose flexibility with increasing sizes and clinicians know larger instruments ledge, zip, perforate and block canals. So, instead of confronting the reality of the forgotten dimension, it is easier to stay with smaller sizes. With time and repetition, a #25 or #30 is perceived as the standard apical preparation size (WW), especially for molars. The problem is that dimensional studies do not support these sizes. If single visit RCT is to be based on science, compromising with smaller WW instruments is not an option. NiTi instruments are more flexible than their stainless-steel counterparts, making larger WW instrument sizes possible. However, they have limitations. The larger sizes are rigid and can cause instrumentation mishaps.

"Bigger is Better"

"Bigger is better” means larger instruments at WL clean better than smaller ones (dictated by original canal size). It also means the size of the apical constriction does not dictate WL. Let’s not confuse the size of the apical constriction with the required size of the apical preparation (WW). The apical constriction is the smallest dimension of the canal (average size = #25 to #30) and does not dictate the size required for apical cleaning. Slightly coronal to the apical constriction (Fig. 4), the canal is usually much larger. Therefore, the final apical instrument size (WW) will have to be compatible with this larger canal dimension and not that of the much smaller constriction size.

Because of advanced technology, the difficulty of instrumenting to larger (but appropriate) WW sizes, even with difficult curvatures, can be overcome by using an instrument with the appropriate design. The LightSpeed, a non-tapered, very short-bladed, NiTi instrument, with superior flexibility and a non-cutting pilot tip (Fig. 5) is designed for this purpose.

Single-Visit Endodontics with Confidence

To be comfortable with single visit RCTs we should be confident that: 1) single visits have scientific support; 2) single visits are routine for vital cases; 3) the essence of single visits is a clean, disinfected canal without compromises; 4) more than one visit will not result in a cleaner canal, and 5) healing is the same for vital and nonvital cases. Success depends on the quality of the RCT and not the number of treatment visits.

We believe a major obstacle of single visit RCT is an unfounded fear it causes more postoperative pain than multiple visits. This is a legitimate concern to those who have to deal with pain and patients who are reluctant to accept it. With this in mind, we strongly suggest routinely warning patients post-treatment pain is not unusual and reassuring them it is not a forecaster of failure. Telling patients what to do if pain occurs is mandatory. The likelihood of pain should be mentioned even for easy cases with
beautiful x-rays. Predicting when pain will or will not occur is pretty much beyond our abilities. You’ve heard this before—explaining pain after the fact is viewed simply as an excuse. How true! Patients will tolerate pain much better if they are warned ahead of time. One predictor of pain we found rather consistently is in patients who have periradicular pain (PDL pain) before treatment. These patients are most likely to have the PDL pain continue after treatment.

If single visits resulted in more postoperative pain than multiple appointments we would not be doing them. But, this is certainly not the case. It is clearly evident (from clinical experience and the scientific literature) that multiple visits have not reduced the incidence of pain. We could find no consistent or irrefutable evidence a single visit, quality RCT of nonvital cases increases the incidence of postoperative pain. In fact, the evidence points in the direction of less pain with single visits. A single treatment gives pain a single opportunity to occur. Multiple visits increase the odds.

**The Essence of Single-Visit Endodontics**

We recognize the essence of a single visit RCT is quality treatment—but how do we get the required quality? Let’s begin by recalling the two essential elements of a RCT; working length (WL) and a working width (WW).

Although disagreement about “ideal” WL exists, most agree it should be close to the apical foramen (most say to, but not through the constriction). Whatever the choice, it’s important to know there is more than ample evidence RCT somewhat short or somewhat long of the ideal (wherever that is) can be successful (Fig. 2a, b).

Therefore, one can conclude there is a biologic tolerance for working length but only if the main canal is clean, disinfected and sealed. When this is accomplished any bacteria remaining in the main canal between the somewhat short root canal filling and the apical foramen (end of canal) are trapped and attacked by the microbidental mechanisms of neutrophils. The necrotic debris is removed by macrophages. These same cells destroy any bacteria and necrotic debris remaining in lateral canals, apical deltas, etc. Bacteria in tubules are isolated by a good root canal filling and denied access to nutrients without which they become inactive or die. A canal cleaned, disinfected and sealed somewhat long (to the foramen or slightly beyond), does not have bacteria remaining in the main canal. It’s important to recall the body’s defense system works against apical infections just as in other locations of the body, given the abundant blood supply of the apical tissues.

There is no convincing evidence treatment will fail just because we instrument a little long or a little short of the “ideal” WL. Modern endodontics should re-examine this outdated belief because accepting long (or short) fills as the cause of failure without considering apical preparation sizes is ignoring a very important (if not the most important) element of RCT. Isn’t it much more likely a dirty, under-prepared canal, rather than a clean canal that is sealed well a little short or long is the real reason for failure? One has to wonder about the scientific value of any research that ignores apical preparation size and judges success and failure based solely on WL. Aren’t we missing the third dimension?
Guest Editorial

Continued from page 46

Discussions about WL raise another interesting question. What about a biologic tolerance for WW? Can the body’s defenses promote healing when a canal is underprepared apically (blade size is too small to clean all walls)—with the likelihood of leaving infected material along side the obturating material? When this happens the bacteria grow and multiply and have easy access to the periapical tissues. A continuous battle between the neutrophils and bacteria ensues. Conversely, canals cleaned with a correct WW instrument and sealed, do not have infected tissue along side the obturating material at WL. This gives the body’s natural defenses a chance to gain the upper hand.

What does research have to say?

Recent studies confirm the idea that larger WW apical preparation sizes, which reflect the diameter of the original canal sizes, remove more bacteria than small apical preparations that do not (Fig. 6). Larger preparations also permit irrigating solutions to be placed closer to working length with easier exchange of irrigant. Since irrigation with pressure should never be used, more canal space is the answer for more efficient irrigation and cleaner canals.

The Hybrid Instrumentation Technique

Single visits should not be excessively long. A “hybrid” technique provides meticulous cleaning in reasonable time by using tapered rotaries for the crown-down preparation of the coronal and middle thirds of the canal and non-tapered LightSpeed rotaries for the apical third.

Technique: After obtaining straight-line access, rotary orifice openers with large tapers are used for coronal shaping. Smaller tapered instruments are used for mid-root shaping and gaining apical access. WL is determined by the dentist in the usual manner, our choice is an apex (foramen) locator.

Apical enlargement to WL and WW is completed with LightSpeed rotary instruments. Their very flexible shaft follows canal curvatures—even when larger WW sizes are required. Since non-tapered LightSpeeds cut only at the tip, the design is ideal for obtaining tactile feedback to accurately determine the apical preparation size (WW at WL). A computer-animated version of the proper technique can be found at http://www.lightspeedusa.com/techniqueguide.html or by calling (800) 817-3636.

Conclusion

More than 25 years ago, research that measured apical canal diameters showed root canals are much larger than once thought. Yet, the myth remains that instrumenting to sizes #20-35 in most molar canals is usually sufficient—a position not supported by science. Research does support the concept that the number of intracanal bacteria decreases as apical enlargement increases and that a single visit with larger apical preparations may substitute for two visits using an intracanal dressing between visits. We cannot over emphasize that single-visit endodontics cannot be justified, nor do we advocate such treatment, when canal cleaning is compromised.

New technology has given us root canal instruments with better designs and materials. Because rotary systems reduce treatment time, single visits are now within the reach of most practitioners. However, speed alone does not justify single visits. It is meticulous canal cleaning and disinfection that does.

We hope this article will encourage you to consider single-visit root canal treatment as an option supported by science. Think about it—and you decide.

Figure 6: Graphical representation of results from two studies indicating fewer bacteria are present in canal when canals are prepared with larger instrument sizes.

E. Steve Senia was granted BS and DDS degrees from Marquette University. After graduation, Dr. Senia re-entered the Air Force (he had served as a pilot from 1953 to 1957) and completed an Air Force GPR residency at Chanute Air Force Hospital. In 1969, he received a Certificate in Endodontics and a Master of Science degree from The Ohio State University.

Dr. Senia retired from the Air force in 1981 as a Colonel and Chairman of Endodontics at Wilford Hall Medical Center. After leaving the Air Force he held the position of Professor and Director of the Endodontic Postdoctoral Program at the University of Texas Dental School at San Antonio until he retired in 1992. He presently holds the title of Clinical Professor at the University.

Dr. Senia is a Diplomate of the American Board of Endodontics, a former member of the Journal of Endodontics Editorial Board and a consultant for the NASA space program. He has lectured extensively around the world, published in national and international journals and is the co-inventor of the LightSpeed root canal instrumentation and SimpliFill obturation systems.

Dr. William Wildey received a BS degree in Physiology from Oklahoma State University in 1972. The first two years of his college education were in Mechanical Engineering. He earned his DDS degree from Georgetown University in 1976 and after graduation served four years as a general dentist in the United States Air Force.

Dr. Wildey was in private practice in Oklahoma from 1980 to 1986. In 1988 he received a Certificate in Endodontics from the University of Texas Dental School at San Antonio.

Dr. Wildey is presently an endodontic practice in the Dallas/Ft. Worth area. He is the co-inventor of the LightSpeed root canal instrument and SimpliFill obturation systems.

The authors want to thank Steven S. Senia, BSIE, MBA, for his contributions to this article.

References