CLINICAL ARTICLE

The standardized-taper root canal preparation – Part 3. GT file technique in Large Root canals with small apical diameters

L. S. Buchanan
Dental Education Laboratories, Santa Barbara, CA, USA

Abstract

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Aim To describe the preparation of Large Root canals with small apical diameters by the GT file technique.

Summary Large Root canals with small apical diameters can usually be prepared with one to three GT files; one to nine clinical steps, and one to five minutes of clinical time.

Following proper access, pulp tissue should be removed, and lubricant applied to prevent pulp compaction and blockage. Initial crown-down enlargement is accomplished with up to three standard GT rotary files 0.10, 0.08 and 0.06 taper, running at 300 r.p.m., and with light touch. Care should be taken not to overload instruments, and they should be withdrawn, cleaned and inspected whenever they bind. Sometimes, the shaping objective is achieved with a single instrument; often waves of instrumentation are required before the shaping objective file cuts to length. Prior to cone-fit, the apical resistance form is confirmed with conventional files, employed as feeler gauges of the tapering form created at the canal terminus. Regardless of the shaping time, canals should be soaked with sodium hypochlorite solution for at least 30 min for effective cleaning.

Key learning points

- Large Root canals with small apical diameters should be prepared to shaping objectives 0.08 or 0.10 taper.
- Compacted pulp tissue causes many canal blockages. It should be removed early, and canals should be well lubricated.
- Large Root canals with small apical diameters should be prepared in crown-down sequence, with recapitulation of steps until the shaping objective is achieved.
- Apical resistance form should always be confirmed before cone-fit.
- Canals should be exposed to sodium hypochlorite for at least 30 min for effective cleaning.

Keywords: Large Root canals, root canal preparation, variable taper files.

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Correspondence: Dr L. S. Buchanan, Dental Education Laboratories, 1515 State Street, Suite 16, Santa Barbara, CA 93101, USA (fax: + 805 963 0946; e-mail: info@endobuchanan.com)

Introduction

The preparation of Large Root canals with small apical diameters (Fig. 1), needs between one and three variably tapered rotary GT files (Dentsply, Ballaigues, Switzerland), between one and nine steps, and about one to five minutes of clinical time to create a perfect, predefined, standardized taper in most canals. No Gates Glidden Burs are needed in the canals, so coronal enlargement is perfectly adequate. This eliminates the risk of strip perforation or coronal overenlargement. The predefined taper delivers the most predictable, the most forgiving type of apical resistance form, *linear* resistance form.

The predefined taper created by these GT Files makes cone-fit a snap, because you never need to worry about which size cone to fit in a tapered canal prep. If you choose the 0.10 taper GT file as your final shaping objective, you know, before the shaping procedure is done, that a 0.10 Autofit gutta percha cone (Analytic Endodontics, Orange, CA, USA) will bind perfectly at its tip in the preparation result to come. Cone-fit used to be the most difficult aspect of using tapered canal preparations, 'which cone to fit afterwards?… the medium or the fine-medium …. hmmm'. With predefined tapers, there is no controversy.

When you shape root canals with GT files, you pick the cone when you pick the file which represents the ideal shaping objective for that root (Buchanan 2001). Because GT files create a predefined taper every time they are used, the filling materials, the paper points, the condensation devices, the backfilling materials, and the restorative systems that follow are all predetermined when the shaping objective file is chosen at the start of the case.

And while I no longer advocate a one-file technique as a clinical expectation, we should graciously accept gifts when they are presented. In big canals it is not uncommon for a single 0.10 GT file to cut the full shape in a Large Root canal in about 90 s. In the first of four short articles on GT file technique, let us look at the procedure required in a Large Root case with a small canal and a small apical terminus (Fig. 1).

Creating the shape: initial crown-down enlargement

The concept of creating shape in a root canal from the orifice to the terminus, 'Crown-Down' shaping, was developed at Oregon Health Sciences University under F. James Marshall. There are many advantages of this concept, amongst them, less infected debris is pushed through the canal terminus, dramatically less breakage of rotary instruments, and better control of instruments in the tortuous apical regions of the canal because their shank ends are freed up by the early coronal enlargement.

Crown-down shaping cannot commence until the orifice has been flared into the access cavity (Fig. 2), the canal has been negotiated, length has been determined, and the pulp in each primary canal has been removed (Fig. 3). If this is not done first, crown-down shaping, carving shape coronal to apical using larger to smaller tapers of files, will tend to push the pulp ahead of the instruments, creating an unacceptable number of irreversible apical blockages (actually, one is too many). Remember to have a lubricant filling the pulp chamber during negotiation procedures; this will predictably eliminate early apical blockage.

The initial crown-down enlargement routine is accomplished with the three GT rotary files in the standard set, from largest to smallest tapers (Figs 4–6). The 0.10, the 0.08, and finally the 0.06 taper GT file, is used; each of them cutting deeper. At 300 r.p.m. these files cut dentine very effectively, without threading into the canal, as they rapidly cut to their 'stalling point'.

This stalling point is simply when the file stops cutting further apically, and the files

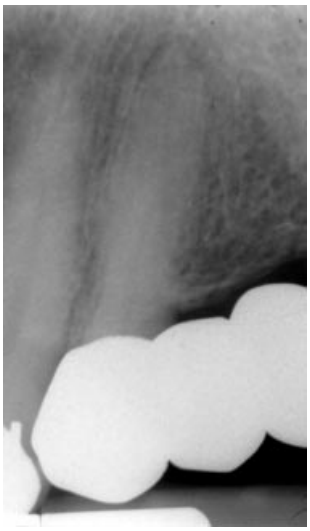

Figure 1 Preoperative radiograph of a premolar with a necrotic pulp with periapical extension of the disease process. This would be considered a Large Root canal that requires a 0.10 or 0.12 mm mm^{-1} taper shaping objective.

Figure 2 A #35-0.12 GT accessory file, used at full slow speed r.p.m. to flare the orifice and to smooth the transition between the line angle of the access preparation and the canal. This creates straight-line access, critical to rotary instrumentation.

Figure 3 #15 K-file or larger negotiated to length in canal. All pulp tissue in the primary canal must be confirmed to have been removed.

Figure 4 The 0.10 GT file starts the crown-down shaping procedure. Check where the debris packs in the flute spaces of the file, that is where the file is cutting. In a larger canal you can keep on cleaning and cutting with the 0.10 GT Files to the terminus.

Figure 5 The 0.08 GT file continues more apically. Stepping down in GT taper size is done when cleaning and reusing the larger file yields little progress.

Figure 6 The 0.06 GT file quickly cuts to length.

Figure 7 Then the 0.08 GT file easily cuts to length because all of these files have the same tip diameters.

Figure 8 Then the 0.10 GT file will cut to length in a Large Root case as it is the final shaping objective.

stall out for one of two reasons. After the flute spaces fill with debris, the file will cut no further into the canal, as the mounded debris physically holds the cutting flutes away from the canal walls. For this reason, if the file stops cutting apically and, upon withdrawal, the flute spaces are seen to be packed with debris, simply clean the file and it

will usually cut deeper into the canal. If the file in use *is* the shaping objective for this particular canal, the clinician should continue to cut with that file until it will not cut further without additional apical pressure. Adding pressure to a file that stalls out, for whatever reason, is the worst possible procedural strategy.

If the file stops advancing apically but is not packed with debris, it is either binding along too much of its length or it is too stiff to bend around a given canal curvature. Either way, this indicates that it is time to go to the next lesser-taper GT file in the series. These files have radiused, non-cutting tips to eliminate apical ledging and perforation, and the variable-pitch flute angles become more passive at the file tips, so when GT files bind at their tips, they are usually not going to cut deeper into the canal.

Handpiece-driven files, like hand files, break when they are leaned on, so when the file stops cutting apically, again, the worst choice would be to push on it. Handpiece power obviates the need for putting dangerous apical forces on these files. In the worst cases, recapitulating a second time through the series of files will do more to develop the desired shape than jamming a balky file into the canal and risking breakage.

Again, in Large Roots, it is not uncommon for the first file to cut to length. Most often, several files are needed to safely cut to the canal terminus in Large Roots with small canals. If the first file that goes to length is less than the shaping objective, for instance a 0.06 or 0.08 taper GT file in a Large Root (Fig. 7), just take each successively larger taper GT file to length until the appropriate shape is achieved. This would be a 0.10 GT file in a typical Large Root case (Fig. 8). Once one of the GT files cuts to length, the larger taper GTs will easily cut to the same length in a straight canal because the three GT files in the standard series all have the same tip diameters.

Following the crown-down finale, it is imperative that clinicians gauge the diameter of the apical terminus of the prepared canal (Fig. 9) to confirm that there is an apical constricture and that we have created tapered shape coronal to that end-point. In other words, to prove the presence of continuously tapered apical resistance form.

Without this apical gauging routine, it is possible to seat a GT file to final position in a root canal with a large apical canal diameter and end up with apical discontinuity of taper. In this case, the shaping result would be a tapered preparation that ends short of the canal terminus, leaving the last 1–2 mm of the canal parallel instead of tapered, a set-up for overfill. This will be considered further in the next article of this series, where the GT file technique is described for canals with large apical diameters – one of the most challenging canal forms to shape, in terms of creating adequate apical resistance form.

Guageing apical resistance form

This gauging procedure (Figs 9–12), done with standard ISO-tapered K-files, is simple and quick. If you use 17% aqueous EDTA as irrigant (Roth Chemical, Chicago, IL, USA) during this subroutine, you can simultaneously remove the smear layer. The 3–4 files used for this routine are *not* supposed to cut dentine, rather, they are to be used as 'feeler gauges'; just like the feeler gauges that are used to determine the gap between electrodes in a spark plug. As such, they are pushed straight into the canal *without even a watch-winding rotational motion.* If you think a file binding at length could be pushed on through the terminus, you are right, it could. But cutting dentine is not the point of this procedural subroutine, the irrigants will clean the dentine walls. Rather, the objective here is to passively measure the apical diameter of the canal without enlarging it.

Starting with a 15 K-file, which should now slide though the terminus, place successively larger files in the preparation until one of them binds at length or nearly at length. In a typical canal with a small terminal diameter this will be a #20 or #25 file. After a given file has bound at the terminus, the next 2–3 larger instruments should each bind

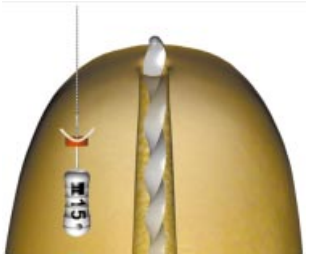

Figure 9 Apical gauging *must* be done to determine the apical diameter of the canal and to confirm that there is shape coronal to that point. Typically, the 15 K-File, which bound tightly during the initial negotiation and length determination phase of treatment, now passively drops through the terminus of the canal, not because the canal's terminal diameter was enlarged but because coronal shaping freed up the shank end of the #15 K-file.

Figure 10 We see that the #20 K-file binds at length in this case. This is good news.

Figure 11 The #25 K-file binds $^{1}/_{4}$ mm short of full length. Excellent.

Figure 12 The #30 K-file binds 1/2 mm short of full length, confirming that there is an apical constricture and that there is shape coronal that point. We are done with the shape in less than three minutes.

progressively shorter than their predecessor, confirming the presence of apical taper (linear resistance form).

Usually, the total shaping time will be under five minutes per canal, less time than it takes sodium hypochlorite to clean root canals. In single or two-canal cases, you will need to continue to soak the canal with NaOCl after shaping is completed, to make a total irrigation time of >30 min.

Remember, when tapered root canal preparations are created, the last thing you find out is the terminal diameter of the canal. Apical gauging is that final discovery process that confirms that the preparation has an apical constricture and that there is continuity of taper (apical resistance form) coronal to it. Cone-fit in this preparation shape should take less than 20 s (Figs 13–15).

If this apical preparation philosophy seems foreign to you, it is. In fact, the creation of tapered linear resistance form is the antithesis of the apical stop preparation. With the apical stop preparation, there is no leeway for length determination error. Slightly long in a curved canal and you have no apical resistance form. And then GP cones start flying past the canal terminus, with lateral condensation!

I tell students that if they get confused with this new apical preparation paradigm, just do the intuitive opposite of what we have all been taught and you will be on track. However, if you can make this significant conceptual leap, *everything* gets easier. Fewer instruments, fewer steps, unbelievable leeway in length determination, and remarkably precise length control of obturation materials.

Figure 13 A 0.10 'Autofit' gutta percha point binding at its perfect position in the root canal preparation, exactly at the terminus of the canal. This GP point has a taper 0.09 mm mm^{-1}, one degree less than the preparation shape, ensuring that it binds at the terminal point of the root canal.

Figure 14 The same 0.10 autofit gutta percha point trimmed to be $^1/_2$ mm short of full length in the canal, as the cone will snug into the canal by that amount during condensation procedures.

Figure 15 Postoperative film of Large Root canal shaped with only three GT files. Do not let anyone tell you that you need seven or eight shaping files, they are still using the apical stop preparation, a less effective shaping objective.

Conclusion

Large Root canals can be prepared predictably and rapidly to shaping objective with standard GT files in a crown-down sequence. For effective cleaning, canals should be soaked with sodium hypochlorite for at least 30 min.

In Part 4 of this series, I will explain the simple shaping routines necessary when apical gauging reveals that the terminus of the canal has a diameter larger than 0.2 mm.

Acknowledgement

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Reference

Buchanan LS (2001) The standardised-taper root canal preparation – Part 2. GT file selection and safe handpiece-driven file use. *International Endodontic Journal* **34**, 63–71.

