CLINICAL ARTICLE

The standardized-taper root canal preparation – Part 4. GT file technique in Large Root canals with large apical diameters

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Abstract

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Aim To describe the GT file shaping steps required to create apical resistance in the presence of a wide root apex.

Summary Canals are occasionally encountered with apices wider than 0.25 mm. These can be some of the most difficult to manage with conventional instruments, and overfills are common. Shaping such canals with GT files requires a paradigm shift of thinking, extending tapered files through the apex to create linear resistance in the apical few mm of the canal. GT standard and accessory files allow canals with apices up to around 0.7 mm to be prepared for tapered gutta percha cone-fit. Apices larger than this should be considered too large for further shaping, and repaired with MTA before filling.

Key learning points

- Tapered apical preparations offer optimal resistance form for obturation.
- Tapered apical preparations can be prepared in most roots with wide apices by extending GT files and GT accessory files to or through the apex.
- Apices wider than 0.7 mm should be repaired with MTA prior to filling.

Keywords: apical control, GT files, root canal preparation, wide apices.

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Introduction

Ten years ago, when my sister Jennifer was in dental school, she asked me a remarkable question about endodontic therapy. Jen had been to a national meeting of her dental fraternity and had discussed endodontics with a student from another dental school. Bob Rosenberg was running the University of California, San Francisco's Endondontic

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Department at the time and, being a Boston University alumnus, he and his faculty taught my sister and the rest of the undergraduate class Dr Herbert Schilder's warm gutta percha obturation technique.

Jennifer said, 'Steve, I was talking to a dental student from another school who had been taught a very different root canal filling technique from the one we learned at UC.' She said that this technique entailed the cementation of the master gutta percha cone in the canal and then, *without warming and softening the gutta percha*, they wedged an instrument into the canal between the cone and the canal wall. Even weirder (to my sister), after taking this instrument out, they put other cold, unsoftened gutta percha cones into the space vacated by the 'spreader'.

Her classic question was, 'Steve, are there any other schools that teach this filling technique?'

The irony was that almost *all* of the other dental schools taught this lateral condensation obturation technique and most of the general dentists and endodontists throughout the world at that time used it as well. To Jennifer, who had no prior-knowledge barriers, hydraulically moving warm gutta percha and sealer into lateral and accessory canals was a very logical concept that made much more sense to her than the most popular root canal filling technique in dentistry at that time.

If you get this story, it is obvious that the clinical belief systems we carry through our practices of dentistry are more arbitrary than most of us realize. Sam Seltzer, one of my heroes in endodontics, told his postgraduate endo students, 'We don't change the test questions from year to year, we just change which answers are correct.' Unfortunately, dentists, who are an extremely well-intended group, often feel guilt or fear when they challenge traditional dogma. Testament to this fact is the sad reality that when I teach practising dentists, I spend at least one-third of my time releasing them from erroneous or ineffective technique rules they were given in dental school.

Of course, most of the rules we were given in school were very appropriate, with the materials, instruments, and concepts available at that time. However, dental science marches on and technique strategies continually develop, so you must keep an open mind to more effective procedures, even if they seem counter to your previous viewpoint.

Thinking GT concepts

Many of the concepts and techniques associated with variably tapered rotary GT files are different than or opposite to what we have done in the past. If aspects of predefined shaping seem counter-intuitive to you, you are not the Lone Ranger. This is a distinctly different approach to the shaping of root canals.

However, if you can understand the conceptual and procedural basis for the GT technique, you will gain all of the advantages of the predetermined shape, including enhanced irrigation efficacy, elimination of strip perforations through controlled coronal enlargement, confirmed deep shape in every prep, and totally dependable apical resistance form.

All of these clinical advantages accrue to a technique that requires fewer instruments, fewer procedural steps, and dramatically less of a learning curve to competence. We have proved the effectiveness of this new technology over six years of successfully teaching its use to a wide range of dentists, from 2nd year dental students to clinicians with 35 years of practice behind them.

Predefined shapes in canals with large apical diameters

To successfully use the variably tapered GT files, clinicians must understand the primary objective of tapered canal preparations. When I shape a root canal during endodontic therapy, my ultimate goal (after carving coronal-to-apical shape in a canal) is to determine the

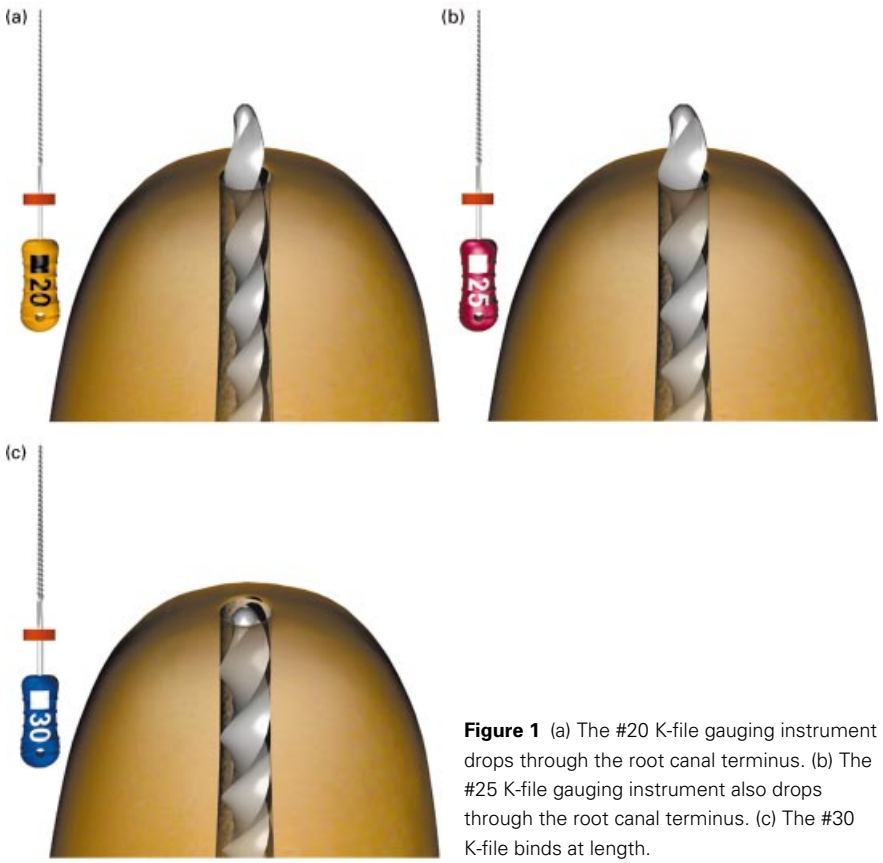

Figure 1 (a) The #20 K-file gauging instrument drops through the root canal terminus. (b) The #25 K-file gauging instrument also drops through the root canal terminus. (c) The #30 K-file binds at length.

apical diameter of the canal, and to confirm that there is continuity of shape coronal to that terminal point or to create it if discontinuity exists. Obviously, the smaller the terminal diameter of the canal, the easier it is to create apical continuity of taper.

So it is fortunate that the terminal diameters of most root canals are 0.2–0.25 mm. However, in perhaps 5% of the canals you will encounter in practice, the terminal diameter of the canal being prepared will be *larger* than 0.25 mm. Whilst most of these teeth appear to be very straightforward endodontic cases, they can be serious trouble because of the excellent opportunity they provide of sliding a gutta percha cone out the end of the canal.

When I still used serial step-back shaping with traditional K-files, these cases were fairly anxiety-provoking because the step-back intervals had to be exact and the cone-fit had to be exact to avoid the humiliation of uncontrolled overfills. With the introduction of variably tapered GT files, this problem has been eliminated.

When a GT file in the standard series is cut to length in a canal with large apical diameter, the apical taper may be discontinuous. This is discovered during the 'apical gauging' subroutine described in the previous article (Buchanan 2001), where measurement of the terminal diameter of the canal is passively accomplished with standard K-files after crown-down shaping has been carved to at least a 0.06 taper.

These conventional K-files have 0.02 tapers, so they usually bind at their tips in a canal that has a 0.06 or greater taper. These instruments are being used as feeler gauges, so they must *not* be rotated at all. They are pushed straight into the canal to se if they bind at or short of the terminus. In the scenario of the canal with a moderately large terminal diameter, the #20 and #25 K-files drop through the root canal terminus during the apical gauging routine, and the #30 binds at length (Fig. 1a–c).

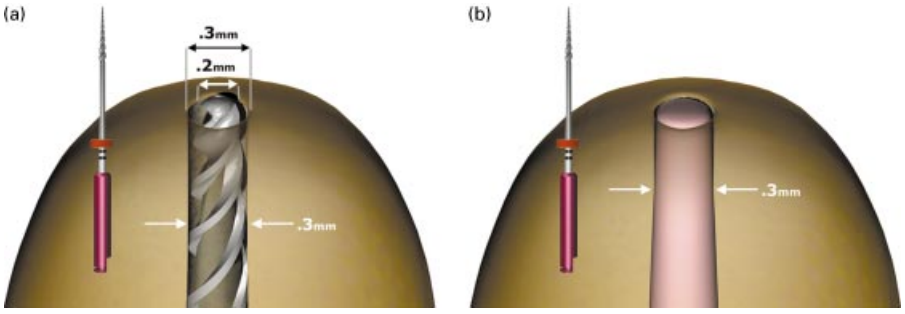

Figure 2 (a) This canal with a terminal diameter 0.30 mm has discontinuity of taper, because the tip diameter of a standard 0.10 GT file is 0.2 mm. (b) Tapered gutta percha cone-fit to full length in same canal, showing that it is binding short of its tip, a set up for over-extension.

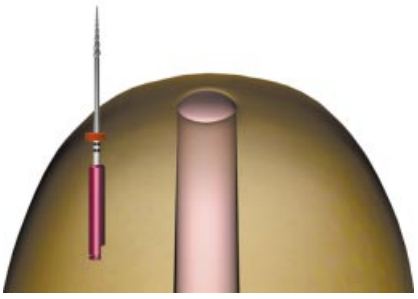

Figure 3 Gutta percha cone binding exactly at its tip in a canal preparation evidencing apical continuity of shape.

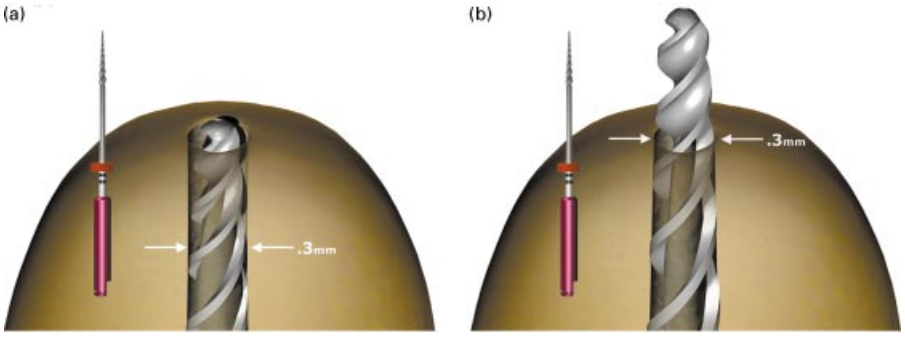

Figure 4 (a) A 0.10 GT file with arrows indicating where the file is 0.3 mm in diameter. On this file that would be 1 mm back from the tip. (b) When the 0.10 GT file is taken 1 mm long, the part of the file that is 0.3 mm in diameter intersects the terminus of the canal, which was also of that diameter. Thus, apical continuity of taper is confirmed.

A 0.10 GT file in the standard series has a tip diameter of 0.2 mm and the canal, as gauged, is 0.3 mm at its terminus. This reflects apical discontinuity of taper (Fig. 2a), a set-up for cone-fit prematurity (Fig. 2b). When a gutta percha cone is fit in a preparation with apical discontinuity, it is a set-up for apical obturation inaccuracy. Conversely, when a gutta percha cone binds at its tip, it will move only about 0.5 mm into the canal, even in the presence of excessive apical condensation forces (Fig. 3).

Suspension of disbelief

So what is the easiest way to eliminate this discontinuity of shape? Take the GT file long! Because these instruments are 0.2 mm in diameter at their tips and 0.10 mm mm^{-1} in taper, their diameter 1 mm back from the tip is 0.3 mm (Fig. 4a). By extending this file 1 mm past the canal terminus, the portion of the file that is 0.3 mm intersects the terminus of the canal, which is 0.3 mm (Fig. 4b).

To dentists who were trained to never take any files through the terminus, this may sound like fingernails on a chalkboard. However, research done by Torabinejad *et al*. (1988) showed no increase in postoperative pain when instruments were taken beyond the root canal terminus. Furthermore, with GT files there is no ripping of the apical constricture, even when they are taken long, beyond severe apical curvatures.

We have intentionally taken GT files out of the end of root canals for years, with excellent results. The marketing professionals at Tulsa/Dentsply are concerned about this part of the GT technique, because they do not think dentists can wrap their minds around the paradigm shift this technique requires. I know you can and will overcome this challenge, primarily because everything gets simpler afterwards.

Shaping canals with wide apices

The GT method of shaping canals with larger apical diameters is to cut one of the 0.12 accessory GT files to length and to gauge again. Be certain that the root in question is large enough in diameter to safely accept the 1.5 mm maximum flute diameters (MFD) of the 0.12 accessory GT files. If you are in a distal root of a lower molar, which is long, thin and curved, and you find out the terminal diameter of the canal is 0.35 mm, I would choose to take the 0.10 GT file 1.5 mm long rather than risk perforation with the size 35-0.12 accessory GT file in that particular root.

In Fig. 5(a) we see the #30 K-file drop past the large apical terminus with the #35 K-file binding at length (Fig. 5b). The 35-0.12 accessory GT file is cut to length at 500 r.p.m. (Fig. 5c), and gauging is repeated. In this case the #35 K-file binds at length and the #40 file steps back 0.25 mm from the terminus (Fig. 5d,e), confirming continuity of apical taper. A medium-large nonstandardized gutta percha cone will ideally fit all of the 0.12 accessory GT shapes.

If a #50 K-file binds at length during gauging, a 50-0.12 accessory GT file would be cut to length, with repeated gauging confirming continuity of shape (Fig. 6a–c). Larger terminal diameters may require the 70-0.12 accessory GT file be brought to bear, but larger than that is considered an open apex case, which is best treated with ProRoo-MTA (Tulsa/Dentsply).

Conclusion

The payoff of understanding this new paradigm-shift is fewer instruments, fewer steps, more consistent shapes, easier fills, and total forgiveness of length determination errors. With that said, if you still feel anxious about this new variably tapered shaping technique,

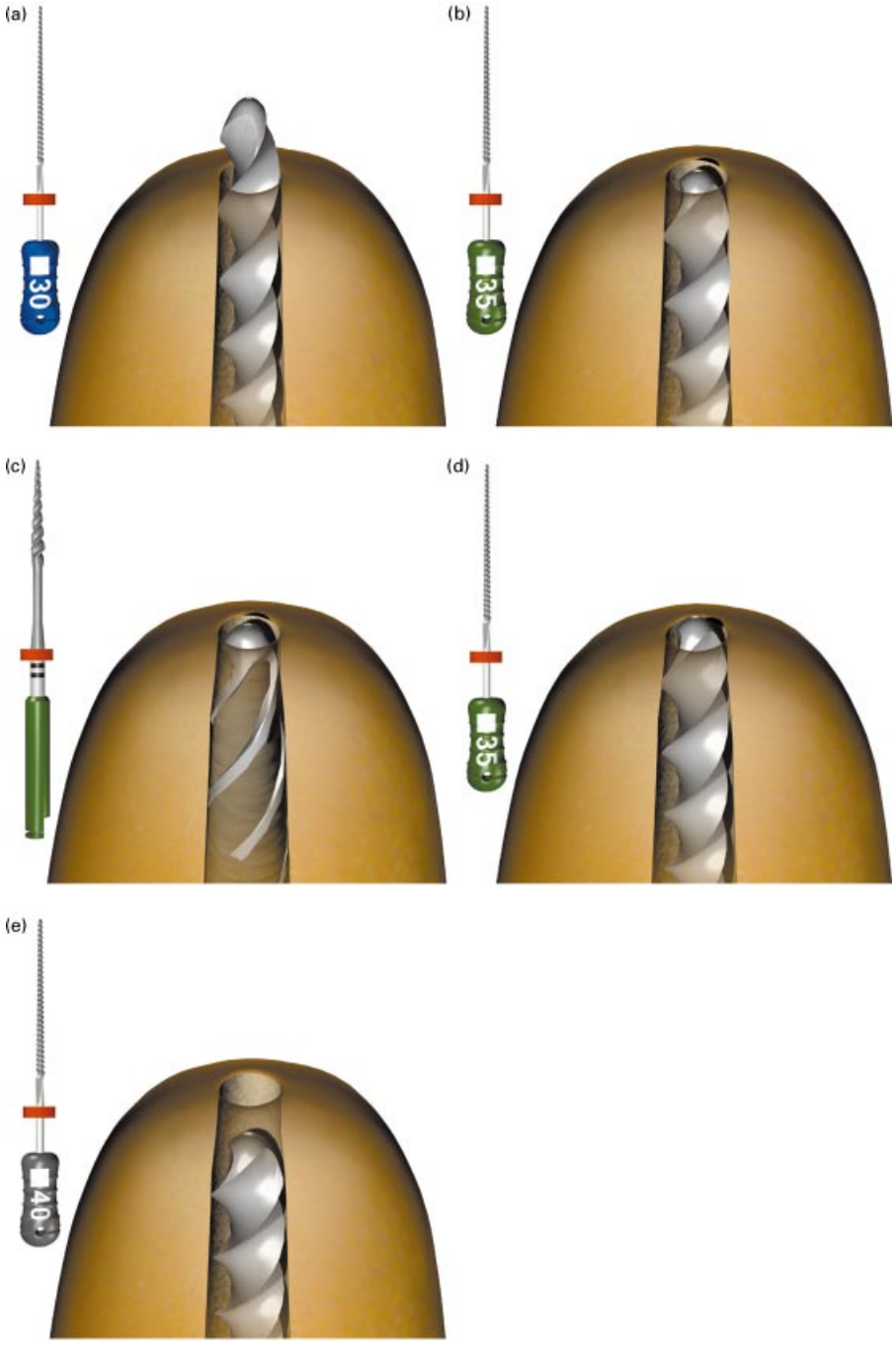

Figure 5 (a) #30 K-file free-falls through the root canal terminus. (b) A #35 K-file binds at length. (c) The 35-0.12 accessory GT file is cut to length at 500 r.p.m. (d) The #35 K-file still binds at length confirming the diameter of the end of the canal. (e) The #40 K-file steps back, confirming that there is taper coronal to the terminus.

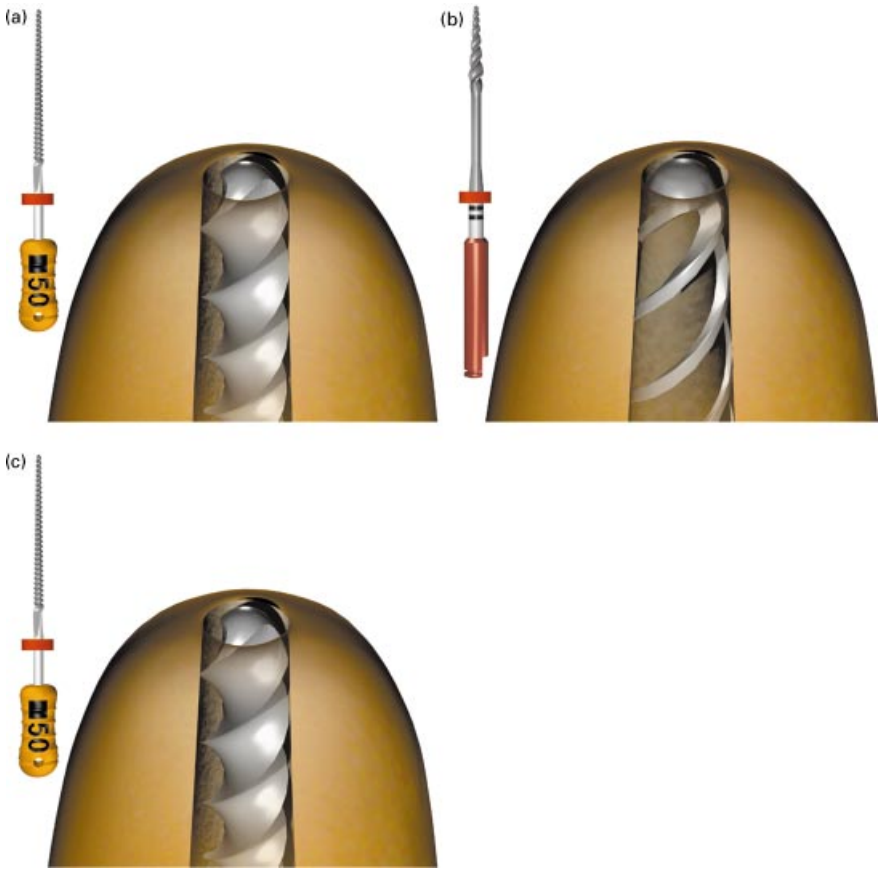

Figure 6 (a) A #50 K-file binds at length. (b) The 50-0.12 GT file is cut to length. (c) The #50 K-file still binds at length, confirming the integrity of the apical shape.

remember that undergraduate dental students at the University of the Pacific showed exceptional results the first time they used GT files. Also remember that eventually, one of these students will hear that another school teaches the use of 18 instruments, each fitting to a different length in the canal, in a 45-step hand file shaping technique, and that student will think,

> 'I wonder if there are any other schools who teach this bizarre and difficult method of shaping root canals?'

In the 5th article of this series, I will move to the issue of Small Root canals, and the GT shaping strategies effective for their management.

Acknowledgement

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