Matching Gutta-percha cones with TF/TF Adaptive Instruments

By Prof. Gianluca Gamburini, Italy

Introduction
With the widespread use of the rotary NiTi instruments, matched taper gutta-percha (GP) cones (of greater tapers) were developed to make root canal obturation techniques easier, more predictable and improve quality. Nowadays many manufacturers commercialise matched taper GP cones that must be used with a specific instrumentation technique. As a consequence, not only the single cone technique regained popularity due to the fact that single matched cones could now produce a satisfactory three-dimensional fill; also warm vertical condensation gained advantages from the use of a matched master cone, by reducing the risk of voids or gaps inside the filled endodontic space.

However, the greater amount and variability in design and dimensions of commercially available NiTi instruments and GP cones of greater tapers can easily create confusion among practitioners usually if they use instruments and cones of different brands. If selected gutta-percha cones do not precisely match the used NiTi instruments, the whole concept fails and non-standardized gutta-percha cones of greater tapers do not reach the desired working length and/or don’t fill the apical preparation precisely.

In order to appreciate how matched GP cones should work, clinicians need to understand the differences in sizes, tapers, designs and manufacturing processes of these products. Even if these factors are usually taken into account when a manufacturer produces matched GP cones to be used with a specific instrumentation technique, the goal of the present paper is to discuss all these variables and give clinicians a better understanding of the possible clinical problems they may encounter in the cone fitting and practical solutions to solve them.

Sizes, tolerance and manufacturing of gutta-percha cones
Traditionally, GP cones are hand rolled, a manufacturing process that is not very precise and consistent. Therefore, according to ISO standards the tolerance allowed for GP cones is 0.05 mm, much bigger than the tolerance allowed for endodontic instruments produced by grinding or twisting (0.02 mm). This has always been a problem in endodontics and it explains why correct fitting of the master cones in all techniques (single-cone, lateral condensation, warm vertical condensation, System B lateral condensation, warm lateral condensation, warm vertical condensation) is always described as a fundamental step in the procedure.

With the traditional ISO .02 tapers, the problem mainly related to the lack of precision of tip of the GP cones. Therefore GP tips needed to be manually adjusted to fit the apical preparation with a good retention (“tug-back”), to avoid under-filling and/or overextension of cones through the apical foramen.

The same procedure was needed for non-standardised gutta-percha cones with feathered tips. This is why calipers or specific instruments to precisely cut gutta-percha cones were invented and commercialised (Fig. 1). With the introduction of gutta-percha cones of greater tapers the problem is not only related to the tip sizes, but also to the taper.

Therefore, these GP cones can be divided in two categories: uniform and non-uniform taper. The first ones are commercially as .04 or .06 tapered cones, while the second ones are usually commercialised with a brand name related to a specific instrumentation technique (i.e. TF cones, TFA cones, etc.).

Tip sizes and tapers of NiTi instruments
Even if some instruments have a non-uniform taper, the great majority of endodontic NiTi rotary instruments have a uniform taper, and techniques are designed to create at least a .04/.06 tapered preparation.

This is why GP cones of greater tapers are usually commercialised in .04 and .06 tapers. However, NiTi instruments having the same nominal size and taper may not have the same dimensions and consequently not create an identical root canal preparation. Therefore, clinicians to understand problems in matching instruments and cones.

Therefore, the best and easiest solution is to choose TF/TFA gutta-percha cones that precisely fit the root canal preparation achieved by the TF/TFA instruments and allow ideal three-dimensional filling and good apical back-fill. In the alternative, a K3XF user could use both types of cones (the .04-.06 cones and TF/TFA) because they will both nicely fit the root canal preparation in the apical and middle thirds.

Additional clinical tips for TF/TFA users
So far, dimensions and sizes have been discussed to help clinicians to understand problems in matching instruments and cones.

However, there are also clinical ways to try to solve problems that can be encountered during these procedures. These are tips that can be useful not only with TF/TFA but with many instrumentation techniques.

Create more coronal flaring. TF/TFA are very efficient instruments and very good at lateral cutting. They are ideal instruments for all techniques that require breaking and/or circumferential filling.

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The full list of references is available from the publisher.

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nal preparation by not reaching the working length, one possible solution is to increase coronal flaring by brushing with the last instrument. By doing so a TF/TFA instrument will increase the dimensions of the prepared canal in the coronal part, solving the problem related of “GP Taper-lock”.

Correct apical fitting. Clinicians may experience two different clinical problems in the apical fitting: the need for a better apical tug-back, which may require slightly cutting the tip of the master cone, and the fitting related to the amount of canal transportation.

The first case may happen due to the different dimensions; tolerance of a GP cone may be slightly smaller than the nominal size, increasing the risk of overfilling during obturation. In such cases, the advice is to slightly increase the dimensions of the master cone by cutting 0.5/1 mm off the tip, or ideally to precisely recalibrate the master cone using a tip-snip device. This can also happen if a canal is iatrogenically slightly over-instrumented (due to a mistake in the working length determination or in the position of the rubber stop on the file); the apical constriction is now modified and the cone fitting must try to accommodate this mistake by increasing the tip size of GP master cone.

TF/TFA are significantly more flexible than the majority of competitor NiTi rotary instruments. As a consequence they tend to follow more precisely and maintain the original trajectory of root canals, minimizing canal transportation. Canal transportation is a mistake that frequently occurs when a rigid file is inserted into a curvature, and tends to straighten it by cutting more in the inner part of the curvature coronally and in the outer part apically. However, this mistake, which can affect quality of debridement, makes insertion of master GP cone easier, especially when complex, double or triple curvatures are present.

This is why the TF/TFA user may clinically experiment with a slightly more difficult insertion of the master GP cone to the working length. If this problem occurs, once again slightly increasing circumferential filing can help.

Conclusions
Hence we may conclude that TF/TFA users should preferably use TF/TFA cones that perfectly match the prepared canals. By doing so, fitting the master GP cone becomes much easier and more predictable, and in the very few cases where some problems can still be found, the provided clinical tips may help clinicians in understanding problems and finding proper solutions.

References