Clinical guidelines for the use of ProTaper Next instruments (Part II)

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Recently, the ProTaper Next system (DENTSPLY Maillefer) was launched into the dental market. In part 1 of this series, published in the July/August edition of Dental Tribune Asia Pacific, the authors outlined the clinical guidelines for the use of the ProTaper Next instruments. There are five instruments in the system but most canals can be prepared by using only the first two instruments. The first instrument in the system is the ProTaper Next X1, with a tip size of 0.17 mm and a 4% taper. This instrument is used after creation of a reproducible glide path by means of hand instruments or rotary Pathfiles (DENTSPLY Maillefer).

The ProTaper Next X1 is always followed by the ProTaper Next X2 (0.25 mm tip and 6% taper). This instrument can be regarded as the first finishing file in the system, as it leaves the prepared root canal with adequate shape and taper for optimal irrigation and root canal obturation. The ProTaper Next X1 and X2 are an increasing and decreasing percentage tapered design over the active portion of the instruments.

The last three finishing instruments are the ProTaper Next X3 (0.30 mm tip with 8% taper), ProTaper Next X4 (0.40 mm tip with 9% taper) and the ProTaper Next X5 (0.50 mm tip with 6% taper). These instruments have a decreasing percentage taper from the tip to the shank. The ProTaper Next X3, X4 and X5 should be used to either create more taper in a root canal or to prepare larger root canal systems.

There are several advantages related to the ProTaper Next system:

- The instruments are manufactured from M-Wire that contains a second metal, providing more flexibility, increased safety and protection against instrument fracture, allowing the clinician to treat more complex root canal systems with a high level of success.
- The instruments have a bilateral symmetrical rectangular cross section with an offset from the central axis of rotation (except in the last 5 mm of the instrument, DO5) creating an asymmetric rotary motion. The exception is the ProTaper X1, which has a square cross section in the last 5 mm to give the instruments a bit more core strength in the narrow apical part. The asymmetric rotary motion allows the instrument to experience a rotational phenomenon known as precession or swagger. According to Van der Veen and Scannapieco, the benefits of this design characteristic include that it further reduces (in addition to the progressive tapered design) the engagement between the instrument and the dentine walls because only two cutting points make contact with the canal wall at any time. This will contribute to a reduction in taper lock, screw-in effect and stress on the file. It also ensures debris removal in a coronal direction because the off-center cross-section allows for more space around the flutes of the instrument. This will lead to improved cutting efficiency, as the blades will stay in contact with the surrounding dentine walls. Root canal preparation is done in a very fast and effortless manner.

- Furthermore, the swagging (asymmetric) rotary motion of the instrument initiates activation of the irrigation solution during canal preparation, improving debris removal. The design also reduces the risk of instrument fracture because there is less stress on the file and more efficient debris removal. Every instrument is capable of cutting a larger envelope of motion (larger canal preparation size) compared to a similarly-sized instrument with a symmetrical mass and axis of rotation. This allows the clinician to use fewer instruments to prepare a root canal to the adequate shape and taper to allow for optimal irrigation and obturation. Finally, there is a smooth transition between the different sizes of instruments because the design ensures that the instrument sequence itself expands exponentially.

The aim of this article is to illustrate the use of ProTaper Next instruments in complex and challenging endodontic cases. The preparation technique for minimally invasive root canal preparation with ProTaper Next instruments will also be discussed.

'S'-shaped root canals

A major challenge in endodontic treatment is the treatment of ‘S’-shaped or bayonet-shaped root canals. This type of root canal configuration can be present in root canal systems of maxillary laterals, canines and premolars, as well as mandibular molars. The authors would recommend using Pathfile no. 5 (ISO tip 0.85 mm) after Pathfiles X1 and X2 in these challenging root canal systems as the final glide path preparation. This will increase the glide path size before introducing the ProTaper Next X1, resulting in less engagement as the file travels down the canal curvatures.

Case report one

The patient, a 41-year-old female, presented with irreversible pulpitis on her maxillary right second premolar (Fig. 1a). The length determination radiograph revealed an ‘S’-shaped canal configuration (Fig. 1b). The canal was negotiated and glide path enlarged using Pathfiles no. 1, 2 and 3. Canal preparation was done with ProTaper Next X1 and X2.

In this case, emphasis was placed on using a backtrack, outwards brushing motion with the ProTaper Next instruments to remove restorative dentine in the canal, allowing the instruments to progress apically. The canal was obturated (Fig. 1c) with a size 20 Guttacore obturator to working length followed by another X2 Guttacore obturator to ensure adequate obturation of the oval coronal part of the root canal system.

Case report two

A 45-year-old male patient presented with severe pain on his maxillary right first molar. A preoperative periapical radiograph revealed placement of a deep amalgam restoration (Fig. 2a). The length determination radiograph revealed an ‘S’-shaped configuration in the distobuccal root canal (Fig. 2b). The root canals were negotiated to working length and the glide paths enlarged using Pathfiles no. 1 and no. 2. Pathfile no. 5 was used in the distobuccal root canal. Canal preparation was done with ProTaper Next X1 and X2 in all three root canals.

It is very important to identify canal curvatures during initial canal negotiation in order to avoid the above mentioned preparation errors. The greater the angle of curvature and the smaller the radius of curvature, the more complex the management and treatment will be.

Again, the authors would recommend using all three Pathfiles in these challenging root canal systems to enlarge the glide path prior to canal preparation. It is also important to note that the reduced apical tapers of the ProTaper Next instruments (compared to ProTaper Universal) are ideal for maintaining apical curvatures or ‘S’-shaped root canals.

Case report

The patient, a 27-year-old male, presented with a non-vital mandibular premolar.

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The coronal two thirds of the canals were prepared with Protaper Next X1 and X2 using a backstroke, outward pushing motion to remove restrictive dentine in the canals, allowing the instruments to progress towards the apical third. The apical third of the root canals were prepared with a controlled push-pull motion, allowing the instruments to progress up to working length.

The prepared root canals were gauged with a size 25 nickel titanium hand file. The file was snugged at working length except in the distal canal of the lower first molar. This canal was enlarged with a Protaper Next X5 instrument. Figure 3e illustrates radiographic confirmation of the working length and the fit of the plastic carriers of size 25 Protaper obturators (without gutta percha). All the canals were obturated (Fig. 3d) with size 25 Protaper obturators, except the distal root canal in the lower first molar that received a size 50 Protaper obturator. Figure 3e demonstrates the final result after obturation and Figure 3f illustrates healing of the periapical pathology around the roots on a six-month postoperative radiograph.

Minimally invasive canal preparation

According to Gutmann’s minimally invasive endodontic (MIE) procedures, the root canals can be prepared with the instruments rather than focusing on improving the conditions of access cavity preparation, followed by mechanically enlarging the glide paths in all four root canals using Pathfiles no. 1, 2, and 3. All four root canals were prepared with Protaper Next using the following technique, resulting in minimally invasive canal preparations. In order to explain the technique, we will outline the preparation steps for one of the mesiobuccal root canals.

Protaper Next X1 was introduced into the canal and used in a push-pull motion. Restrictive dentine was removed on the substroke, pulling motion. The push-pull motion was repeated a few times until the instrument progressed approximately one-third of the canal length. The instrument was removed from the root canal, the flutes cleaned and the canal irrigated, recapitulated and re-irrigated. The file was re-introduced into the root canal and the same protocol repeated (Fig. 3b). After three cutting cycles of 4 mm each, the full working length was reached (Fig. 3c).

Protaper Next X2 was introduced into the canal and used in a push-pull motion. Restrictive dentine was removed on the substroke, pulling motion. The push-pull motion was repeated a few times until the instrument progressed approximately one-third of the canal length. The instrument was removed from the root canal, the flutes cleaned and the canal irrigated, recapitulated and re-irrigated. The file was re-introduced into the root canal and the same protocol repeated (Fig. 3b). After three cutting cycles of 4 mm each, the full working length was reached (Fig. 3c).
Minimally invasive, maximally effective

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The palatal canal was obturated with a ProTaper Next X3 gutta percha cone using the Calamus Dual Obturation Unit (DENTSPLY Maillefer). It was decided to obturate the two mesiobuccal and distobuccal canals with Guttacore crosslinked gutta percha carriers.

It must be noted that because of the more conservative canal preparations obtained with the push-pull preparation protocol it was not possible to passively fit a size X2 Guttacore verifier (size 025) up to working length in the prepared root canals. Only size 20 Guttacore verifiers fitted passively, without resistance to working length (Fig. 6a).

The selected root canals were then obturated using three size 20 Guttacore obturators. Figure 6b shows the final result after obturation. Carrier-based obturation also forms part of the MIE concept due to the minimal amount of application forces involved during the obturation process onto the remaining root structure.

Editorial note: A complete list of references is available from the publisher.

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