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

The ProTaper Next X1 is always followed by the ProTaper Next X2 (0.25 mm tip and 6 % taper). The 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 obturation. The ProTaper Next 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 Vyver and Swainambolo, 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-centre 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 swaggering (asymmetry) 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 similar-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 endodontics 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 Pathfiles no. 5 (ISGLO tip 0.19 mm) after Pathfiles no. 1 and 2 in these challenging root canal systems as the final glide path preparation file. 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 pulps and periradicular pain in the maxillary right first molar. A preoperative periapical radiograph revealed an 'S-shaped' canal configuration (Fig. 1b). 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, outward brushing motion with the ProTaper Next instruments to remove restrictive dentine in the canal, allowing the instruments to progress apically. The canal was obturated (Fig. 1c) with a size 20 Gutta-core obturator to working length followed by another X2 Gutta-core 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' canal 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. Pathfiles 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 mandible...
The coronal two thirds of the canals were prepared with ProTaper Next X1 and X2 using a backstroke, outward-rounding motion to remove restrictive dentine in the canals, 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 snug 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 shows 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 can range from diagnosis to making a decision to treat (or not to treat) the case. They also include:

- Minimal removal of dentine during access cavity preparation, enlarging and shaping of the root canal system to retain as much as sound dentine as possible.
- Retention of tooth structure during disassembly and retreatment procedures.

We have to accept that if access openings are too restricted it can impact on the final result of treatment. Gutmann further suggests that efforts should be made to minimise the excess removal of dental tissue and in the canal orifice through the use of Peeso reamers, Gates Glidden burs and orifice opening instruments. These instruments tend to straighten the canal and weaken the root canal walls, predisposing them to cracks and, in some cases, can even lead to root canal wall stripping defects. For some clinicians, it might be an option not to brush excessively with ProTaper Next instruments but to rather use the ‘push-pull’ preparation technique.

Case report

The patient, a 59-year-old male, presented with non-vital maxillary first and second molars (Fig. 4a). He also reported that his previous dentist, for pain relief, did emergency root canal treatments on both teeth.

The temporary filling on the upper first molar was removed and four root canal orifices located and explored (mesiobuccal, mesiobuccal 2, distobuccal and palatal). Figure 4b shows a periapical radiograph confirming the working lengths that were electronically measured with the Propex 3 apex locator (DENTSPLY Maillefer).

Reproducible glide paths were established by using a size 10/k-file by hand, followed by mechanically enlarging the glide paths in all four root canals using Pathfiles nos. 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 4mm each. 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 4mm each, the full working length was reached (Fig. 3c).

ProTaper Next X2 was introduced and used following the same protocol. After two cutting cycles of 4mm each, full working length was reached. A size 25/02 nickel titanium hand file was used to gauge the apical foramen. The file fitted snug at working length and shaping was complete.

The mesiobuccal, mesiobuccal 2, and distobuccal canals were prepared up to ProTaper Next X2 and the palatal canal was prepared up to ProTaper Next X3. Because the instruments were used in a push-pull motion instead of a deliberate brushing motion, the canal shapes were generally smaller in size and more conservative. The concept of larger apical sizes has been advocated to improve bacterial reduction. However, maintaining smaller sizes (r<20/40) would seem desirable for the preservation of radicular dentine in the majority of cases and to rather focus on improved methods for cleaning and disinfecting root canal systems.8
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 0.25) 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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