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 work together in an increasing and decreasing percentage tapered design over the active portion of the instruments.

The last three finishing instruments are the ProTaper Next X3 (0.50 mm tip with 7% taper), ProTaper Next X4 (0.80 mm tip with 8% taper) and the ProTaper Next X5 (0.55 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 are 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 higher percentage of flexible instruments, increased safety and protection against instrument fractures,
- 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, D0–D3 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.2 According to Van der Vyver and Scianamblo,3 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 offset 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 site 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 endodontics is the treatment of 'S-shaped' or haywire-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.4 The authors would recommend using Pathfile no. 5 (ISO tip 0.19 mm) after Pathfiles 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 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 5. Canal preparation was done with ProTaper Next X1 and X2.

In this case, emphasis was placed on using a backstroke, 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 GuttaCore obturators 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 radiograph revealed an ‘S-shaped’ canal configuration (Fig. 2a). The length determination radiograph revealed an ‘S-shaped’ canal configuration in the distobuccal root canal (Fig. 2b).

After gauging with a size 25 nickel titanium hand instrument, it was decided to enlarge the palatal root canal to a ProTaper Next X3. All three root canals were obturated and Pathfiles 1 and 2 GuttaCore percha cones using the Calamus Dual Obturation kit (Fig. 2c). Note the maintenance of the ‘S-shaped’ curvature in obturated distobuccal root canal system.

Challenging curvatures in the apical third of root canals

Apical root canal curvatures must always be respected and never straightened. According to Catel- luci,5 straightening these curves would mean displacing the apical foramen from its original position, which can lead to treatment failure. Other problems that can be encountered when treating curved canals include ledge formation, perforation, zip formation and file separation.6

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.7

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 mandi
The coronal two thirds of the canals were prepared with ProTaper Next X1 and X2 using a backstroke, outward swirling motion to remove restrictive dentine in the canals, allowing the instruments to progress toward 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 snug at working length except in the distal canal of the lower first molar. This canal was enlarged with a ProTaper Next X3 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 30 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 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 cervical tooth structure 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, predispensing 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 39-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 Propepx apex locator (IDENTIPS3 Maillefer).

Reproducible glide paths were established by using a size 10K-file by hand, followed by mechanically enlarging the glide path 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 outstroke, pulling motion. The push-pull motion was repeated a few times until the instrument progressed approximately 1 mm in each cycle, reaching a total of 4 mm each, the full working length was reached (Fig. 3e).

ProTaper Next X2 was introduced and used following the same protocol. After two cutting cycles of 4 mm each, full working length was reached. A size 25/20 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 (≤>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.
Minimally invasive, maximally effective

The new Piezomed offers extremely high performance, yet is gentle on soft tissue. In addition, it includes automatic instrument recognition and LED handpiece illumination. The handpiece with the cable is thermo washer disinfectable and sterilizable!
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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