Clinical

Creating a glide path for rotary NiTi instruments: part two

Peet van der Vyver[1]

Introduction

In part one of this series the author discussed the rationale for the preparation of a glide path prior to the use of NiTi rotary instruments and illustrated the clinical technique when using a reciprocating handpiece (M4, Kerr) in combination with stainless steel K-Files to facilitate glide path preparation.

The lack of glide path establishment and glide path enlargement is often the cause of ledge formation, transportation, blockage of root canals followed by obturation short of the apical constricture. Figure 1 illustrates a case where poor root canal treatments were performed on the lower right second premolar, first and second molars. Figure 2 depicts the same case after gutta-percha removal and the location of the missed canals. Glide paths were established and enlarged with PathFiles (Dentsply/Maillefer) in all the root canals, canal preparation was done with ProTaper Universal (Dentsply/Maillefer) and the root canals obturated with RealSeal (Sybron Endo).

PathFile number 1 (purple marking) has an ISO 13 tip size, PathFile number 2 (white marking) has an ISO 16 tip size and PathFile number 3 (yellow marking) has an ISO 19 tip size. The taper of the nickel titanium files are only 2% which guarantees high flexibility and enables the files to follow complex anatomical root canal configurations during glide path enlargement. According to the manufacturer's the files can be used at a speed of 300 rpm and torque setting of between 3-5 N/cm.

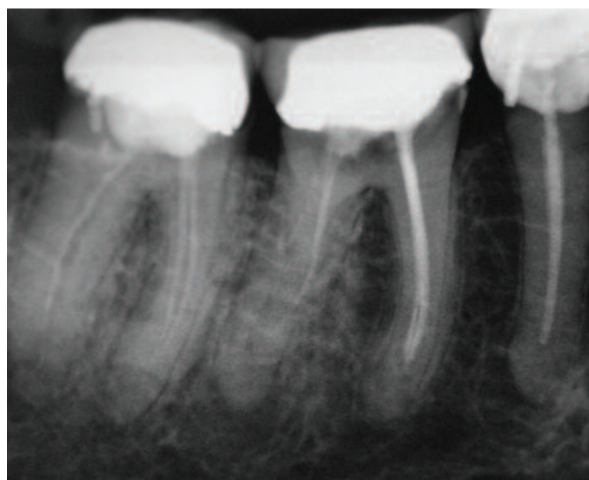

Figure 1

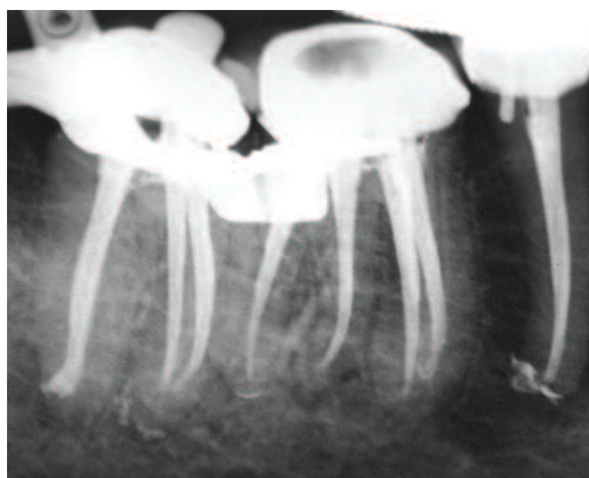

Figure 2

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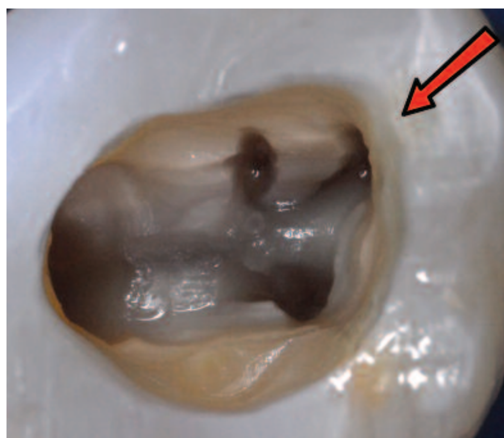


Figure 3

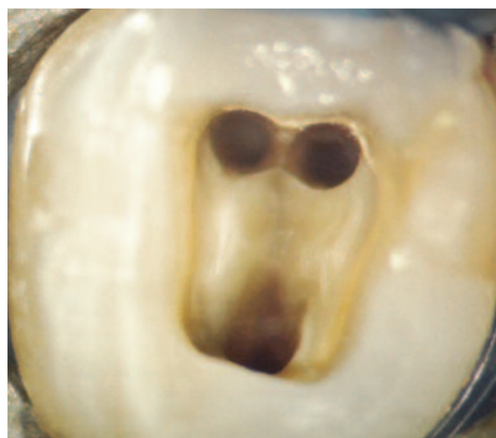


Figure 4

PathFile: Clinical Considerations and Instrument Sequence

- Prepare an access cavity that will ensure straight-line access into all the root canals. Figure 3 depicts an access cavity that was prepared on an upper first molar. Note the lack of straight-line access into the first mesio-buccal root canal (arrow). Figure 4 demonstrates a case where an access cavity was prepared on a lower fist molar. It is evident that the preparation allows for straight-line access into all the root canals.

- Remove any coronal interference, eliminating any obstruction or accentuated curvatures in the coronal third of the root canal. Figure 5 shows a radiograph of a lower second molar where a coronal interference is clearly visible (arrow), obstructing the entrance of the mesial root canal. This triangle of dentine was removed with an ultrasonic tip (Start-X no 2, Dentsply/Maillefer) (Figure 6) before the canal could be located. Figure 7 illustrates the final result after the canals were prepared with ProTaper Universal (Dentsply/Maillefer) rotary files, irrigated with the SAF System (Redent Nova) using sodium hypochlorite and EDTA and obturated with System B (Sybron Endo) / Obtura II (Obtura Spartan).

- Negotiate the root canal up to working length (established with apex locator or radiograph) and establish patency with a pre-curved stainless steel K-File (size 06, 08 or 10) (Figure 8).

- Establish an initial glide path with the K-files by using a "watch-wind" or "in-and-out movements" by hand or by attaching a reciprocating handpiece (M4 (Kerr) (Figure 9) or NSK Tep-E10R (NSK)) to the files and using the technique described in part one of this series (Van der Vyver, 2011).

- Do not proceed with the PathFiles (Dentsply/Maillefer) before an initial glide path has been established up to a size 10 K-File. To verify this, a size 10 K-File must be placed at working length, withdrawn 1.5 mm by hand from the root canal and pushed back to working length without any difficulty. The above procedure is then repeated but the file is respectively

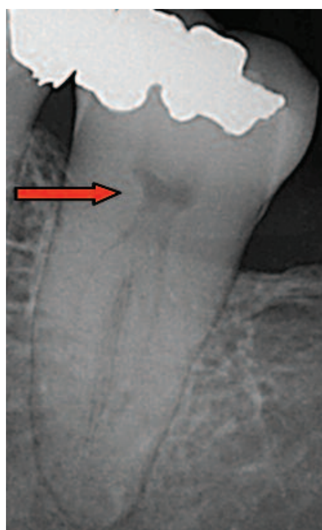


Figure 5

Figure 6

Figure 7

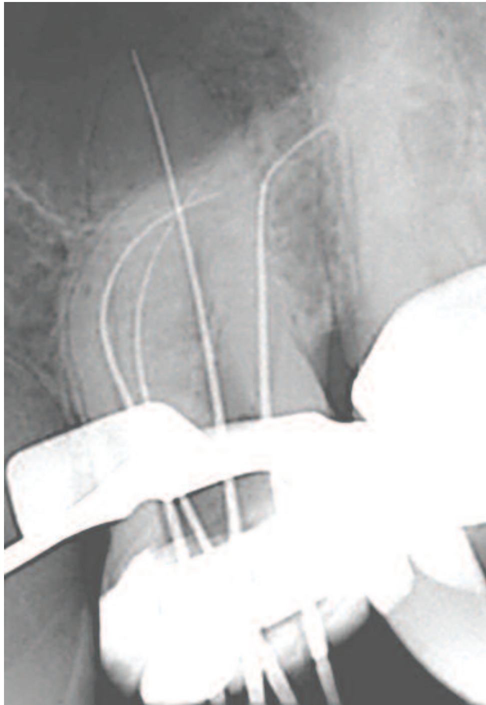


Figure 8

Figure 9

withdrawn up to 3 and 5mm from the root canal. When the file can travel 5mm from working length up to the established working length in the root canal, a successful glide path has been established.

- PathFile no. 1 (0.13 mm) (Figure 10) is introduced into the root canal at a rotation speed of 300 rpm in a delicate in and out movement until working length is reached (3-5 seconds). The instrument is then removed from the canal. It is important to note that the PathFiles must not be kept rotating in a stationary position in the root canal, especially in severely curved root canals due to the increase in metal fatigue on the instrument.

- Irrigation after each PathFile is recommended to remove dislodged debris from the root canal. In canals that demonstrate accentuated curves in the apical third of the root canal system it is also recommended by the author to recapitulate with the size 10 K-File by hand to ensure complete patency of the root canal.
- PathFile no 2 (0.16 mm) (Figure 11) is then introduced

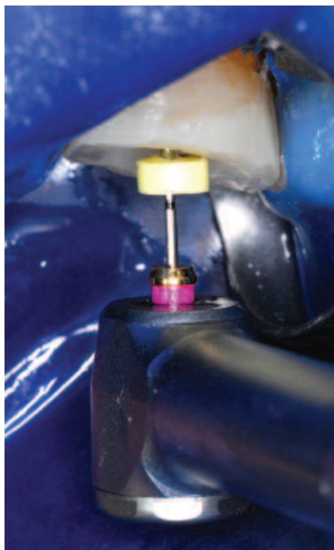


Figure 10

Figure 11

Figure 12

followed by PathFile no 3 (0.19 mm) (Figure 12) following the same protocol as described above.
- Start preparing the root canal with NiTi rotary instruments of choice.

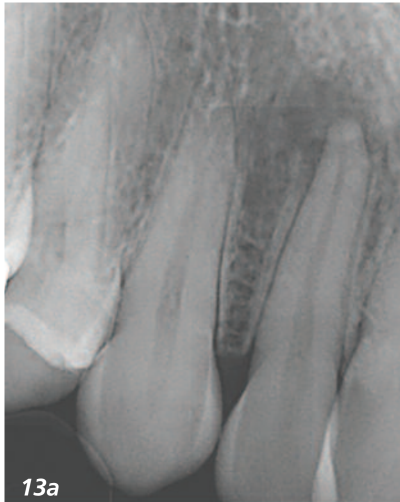
Clinical Case Reports

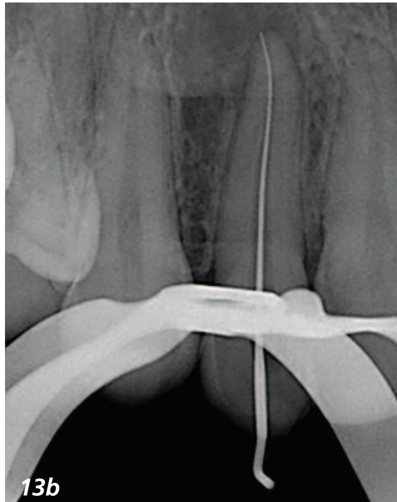
Case Report 1

Figures 13a illustrates a case where a 30 year old female presented with a peri-apical area around her non-vital, upper right central incisor. After access cavity preparation, length determination and patency was established using an electronic apex locator (Raypex 5, VDW) and a size 15 K-File (Figure 13b).

A glide path was established using PathFiles no. 2 (0.16mm) and no. 3 (0.19mm) (Dentsply/Maillefer) and root canal preparation was done with a size 025.08 single-use WaveOne Primary Reciprocating File (Dentsply/Maillefer) (Figure 13c) driven by a WaveOne Electric Motor (Dentsply/Maillefer) (Figure 13d) and 6:1 reducing handpiece (Sirona). The WaveOne Primary file was used with a progressive up and down motion, engaging the dentine with light force 3-4 times before the file was removed from the root canal. The flutes of the file were cleaned and the root canal irrigated with 3.5% sodium hypochlorite. Recapitulation was achieved with a size 0.10 K-File to length. This process was repeated until working length was reached with the reciprocating file. Smear layer removal was achieved with a rinse of 17% EDTA for 1 minute.

A master cone, WaveOne Gutta Percha Point Primary (Dentsply/Maillefer) was fitted (Figure 13e) and the cone-fit confirmed with a radiograph (Figure 13f). The root canal was obturated (Figure 13g) using AH Plus Root Canal Cement (Dentsply/Maillefer) and System B (Sybron Endo) and Obtura II (Obtura Spartan).





Figures 13a and 13b

Figure 13c

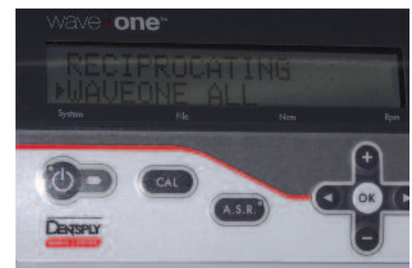


Figure 13d

Figure 13e

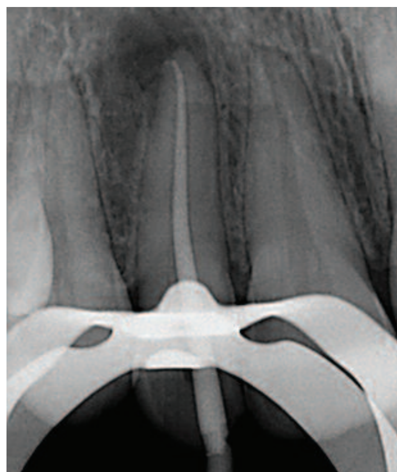


Figure 13f

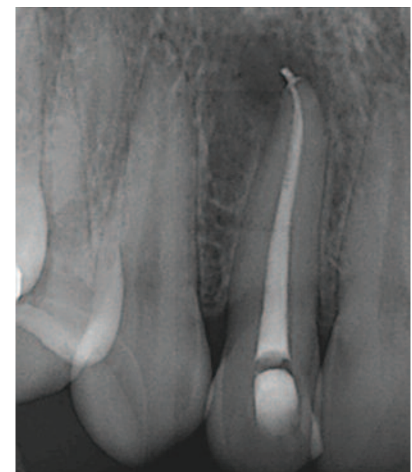


Figure 13g

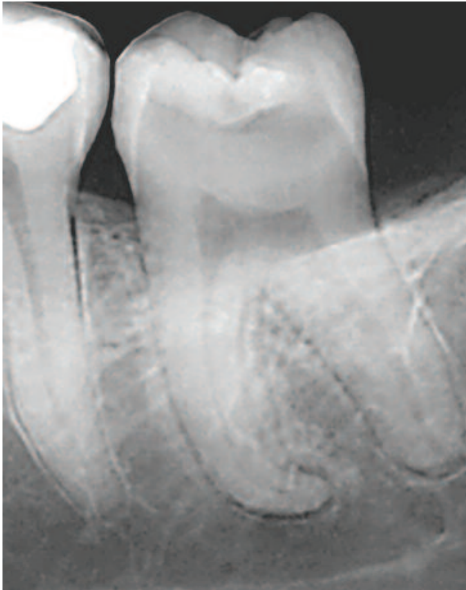


Figure 14a

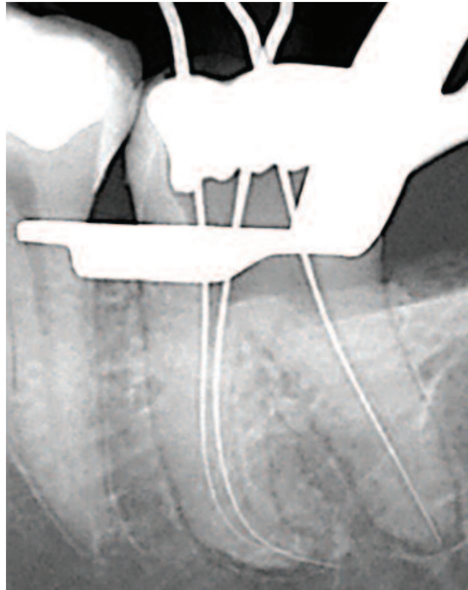


Figure 14b

Figure 14c

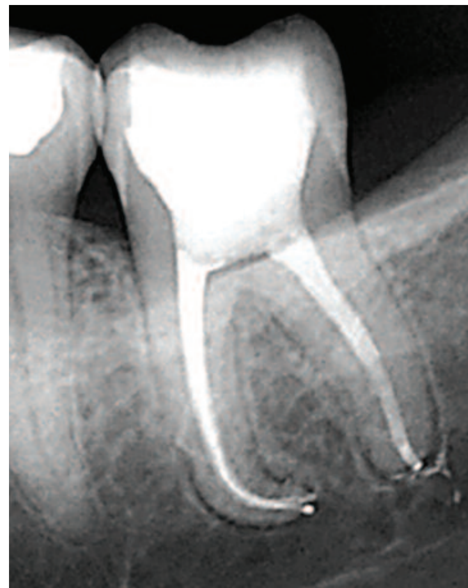


Figure 14d

Case Report 2

The patient, a 30 year old male presented with irreversible pulpitis on his lower left first molar. Radiographic examination revealed a large carious lesion on the occlusal surface of the tooth (Figure 14a). Note the close proximity of the apices of the roots to the inferior alveolar nerve canal. After removal of the caries and access cavity preparation, root canal patency and length determination was established (Figure 14b). A glide path was established by first using a size 10 K-File in a reciprocating handpiece followed by PathFiles. Root canal preparation was done using ProTaper Universal rotary instruments (Dentsply/Maillefer) and obturation was done with AH Plus Root Canal Cement (Dentsply/Maillefer) in conjuction with F2 ProTaper Obturators (Dentsply/Mailllefer) (Figure 14c) in the mesial canals. The distal canal was obturated with a F3 ProTaper Universal Gutta Percha Point using System B (Sybron Endo) and Obtura II (Obtura Spartan). Note how the original canal anatomy was maintained without ledge formation or transportation of the root canals. (Figures 14a, b, d: Courtesy of Dr C van der Merwe).

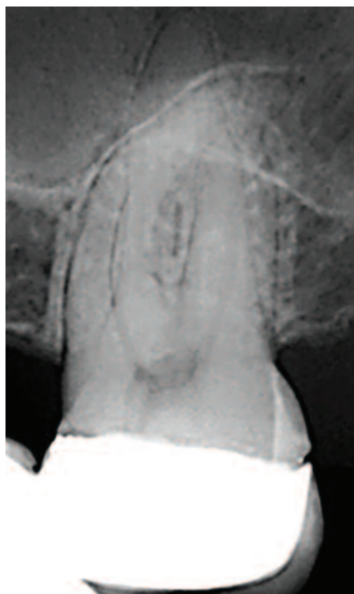


Figure 15a

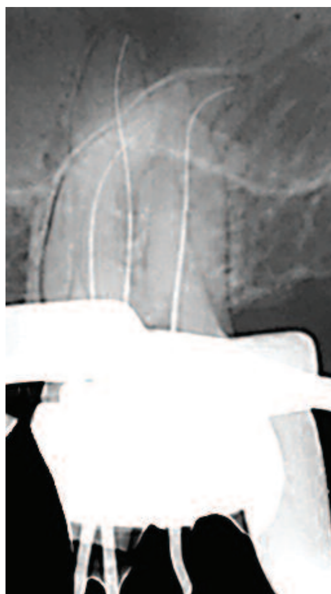


Figure 15b

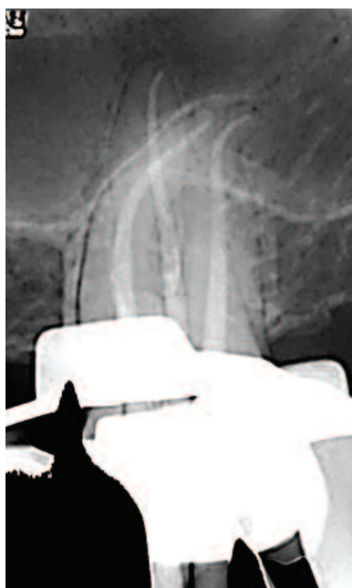


Figure 15c

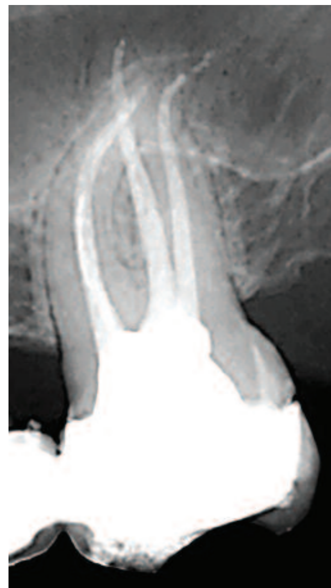


Figure 15d

Case Report 3

Figure 15a demonstrates a case where a 50 year old male presented with pain and discomfort on his upper left second molar which was one of the abutments of a four unit bridge. A length determination radiograph (Figure 15b) revealed a curvature in the middle third of the mesio-buccal root canal, a small curvature in the apical 2mm of the palatal root canal and a sharp curvature towards the distal aspect of the disto-buccal root canal.

Glide path preparation was done with a size 10 K-File in a reciprocating handpiece followed by 0.13, 0.16 and 0.19mm PathFiles respectively. Root canal preparation was done with ProTaper Universal (Dentsply/Maillefer) rotary instruments and obturation completed with AH Plus Root Canal Cement (Dentsply/Maillefer) and System B (Sybron Endo) and Obtura II (Obtura Spartan). Clearly visible on the gutta-percha conefit (Figure 15c) and post-operative radiograph (Figure 15d) is that the different curvatures in the three root canals were maintained during canal preparation. (Figures 15a-d: Courtesy of Dr C van der Merwe).

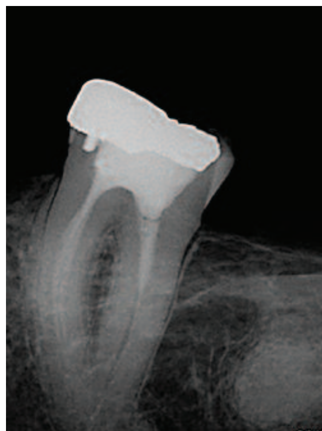


Figure 16a

Figure 16b

Figure 16c

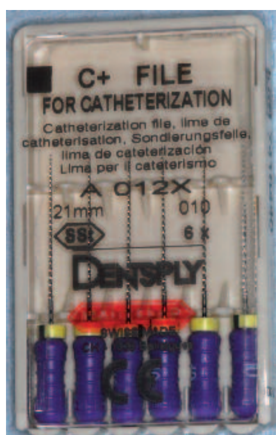


Figure 16d

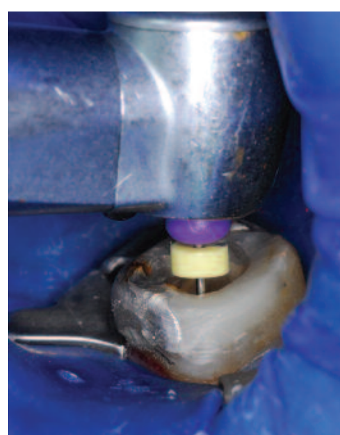


Figure 16e

Figure 16f

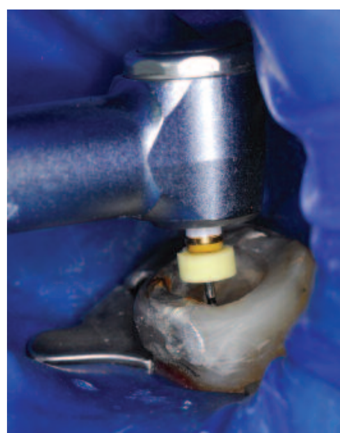


Figure 16g

Figure 16h

Case Report 4

The patient, a 60 year old female presented with discomfort when chewing on her lower left second molar. A pre-operative radiograph (Figure 16a) revealed a previous root canal treatment. Mesio-buccal and mesio-lingual canals were poorly instrumented and obturated approximately 5-7mm short of the radiographic apices. The distal root canal was obturated short of the radiographic apex, leaving approximately 10-12mm of visible root canal space untreated.

Figure 16b illustrates the initial negotiation of the root canals with hand files after removal of the obturation

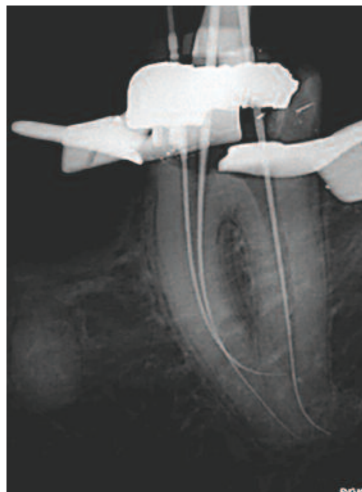


Figure 16i

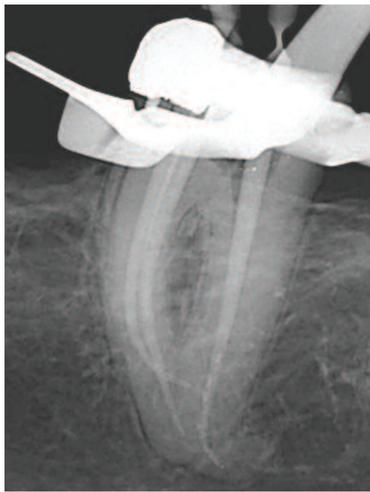


Figure 16j

Figure 16k

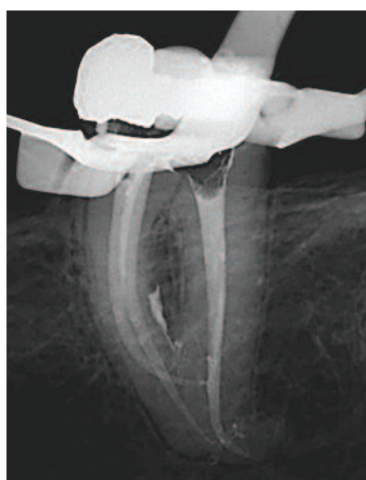


Figure 16l

materials from the root canals with ProTaper Universal Retreatment Files (D1, D2 and D3) (Dentsply/Maillefer) (Figure 16c), Hedstrom files and Endosolv E (Septodont). Clearly visible on this radiograph is that the mesial canals appear sclerosed in the apical parts and that full working length was achieved in the distal root canal. C+ Files (Dentsply/Maillefer), size 08 and 10 (Figure 16d) in conjunction with size 08 K-Files were used to negotiate the mesial root canals until the apex locator reported that apical patency was achieved in the mesial root canals.

Glide path preparation was accomplished by first using a size 10 K-File in a reciprocating handpiece up to the predetermined working lengths ensuring initial glide paths up to a size 10 (Figure 16e). PathFile no. 1 (0.13 mm)(Figure 16f) was introduced into the root canals with a delicate in and out movement until working length was reached ensuring not to keep the file rotating in a stationary position in the curved part of any of the root canals. All the canals were irrigated with sodium hypochlorite and a patency file (pre-curved 08 K-File) was taken up to the working length in each root canal to ensure the absence of any debris in the root canals and to reconfirm working length.

PathFile no. 2 (0.16 mm) (Figure 16g) was then introduced followed by PathFile no. 3 (0.19 mm) (Figure 16h) following the same protocol as described above. Figure 16i depicts a radiograph with PathFiles placed into the root canals up to the predetermined working length. It is evident that all the canal curvatures were maintained during glide path preparation.

Root canal preparation was done with ProTaper Universal rotary instruments and irrigation by alternating 3.5% sodium hypochlorite and 17% EDTA. A Protaper F2 Universal Gutta-Percha Points (Dentsply/Maillefer) were fitted into the prepared mesial root canals and a F3 Protaper Universal Gutta-Percha Point (Dentsply/Maillefer) was fitted into the prepared distal root canal (Figure 16j). The root canals were obturated with Calamus Dual 3-D Obturation System (Figure 16k). Figure 16l demonstrates the post-operative result. Note the excellent maintenance of the root canal anatomy. Visible on the radiograph is an apical lateral canal in the distal root canal as well as a midroot lateral canal branching off from the mesio-lingual root canal system that was obturated with the warm vertical condensation technique.

Conclusions

Several studies advocate glide path preparation to a minimum of 0.20 mm before the use of rotary nickel titanium instruments (Berutti et al., 2004; Varela Patino et al., 2005). After the establishment of an initial glide path with a size 10 K-File (by hand or in a reciprocating

handpiece) followed by the use of PathFiles (Dentsply/Maillefer) for glide path enlargement this objective is achieved. The clinician will have the following advantages when using this technique:

- The mechanical enlargement of the glide path with rotary instruments instead of creating it with stainless steel files by hand, results in less hand fatigue and saves the clinician valuable chair time.
- The high flexibility of the 2% tapered instruments enables the clinician to follow the original canal anatomy and to maintain it during glide path enlargement without ledge formation or transportation of the root canal.
- Removes pulp tissue and debris from canal allowing the operator to maintain working length and patency in the root canals.
- An increased flow of irrigation solutions into the middle and apical thirds of root canals (Greco and Cantatore, 2008).
- A glide path established to a size 0.19 mm (PathFile no. 3) ensures a reduction in torsional stress and thereby increasing the lifespan of the rotary instrument that will be used for canal preparation. According to Berutti et al. (2004) the canal diameter should be at least one size larger as the tip of the first rotary instrument. A size 0.20 mm glide path guarantees this protocol if the clinician uses the S1 file of the ProTaper Universal System (Dentsply/Maillefer) that has a tip of 0.18mm. Routine glide path establishment and enlargement with PathFiles (Dentsply/Maillefer) can increase the lifespan of rotary instruments with a reduced risk of instrument fracture.
- Provides the clinician with more confidence to prepare more complex and challenging endodontic cases.

References

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