Adapting to the anatomy, guided by the canal

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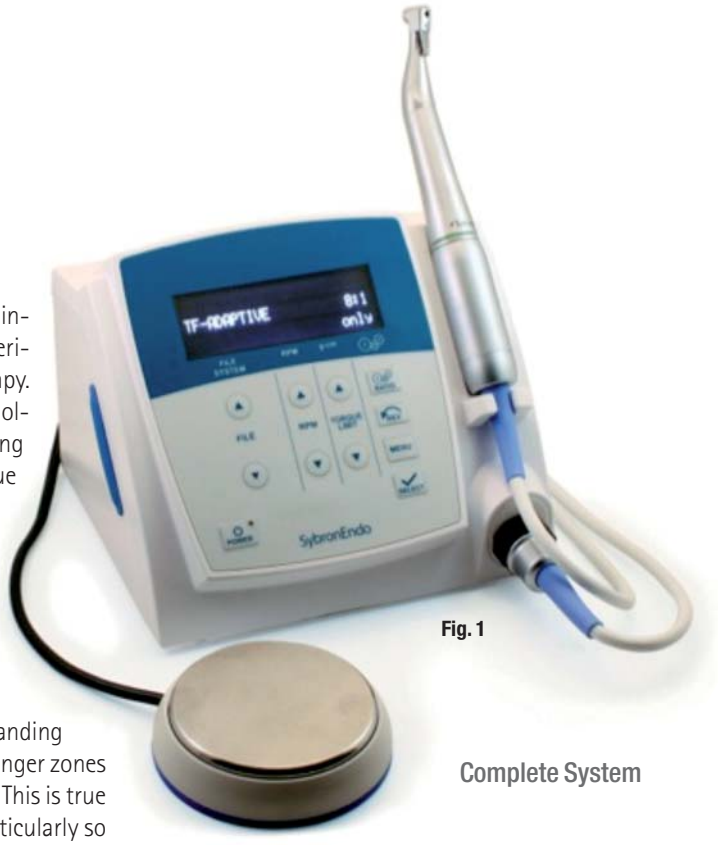

Fig. 1 Complete System

_Root-canal anatomy with all of its inherent complexity still represents a very serious challenge to modern root-canal therapy. Even with many breakthroughs in technology, we are still not capable of fully cleaning and shaping the root-canal system. It is true that rotary NiTi files are a very helpful treatment tool, yet we are still learning and discovering how to use them effectively to achieve the best possible clinical result with respect to the existing biology and anatomy.

The anatomy often looks seems demanding because it represents several traps and danger zones during the shaping and cleaning process. This is true for the entire length of the canal, but particularly so in the apical region. Stainless-steel files are still the first files to be used, in small sizes, usually no more than #15, in order to avoid failures caused by apical transportation. Rotary files can shape better and faster than stainless-steel hand files can, but depending on their design and the alloy used they may also lead to deformation or straightening of the canal. For this reason, it is crucial to understand both the design of the instrument and the alloy.

According to multiple studies, ground triangular cross-section instruments often modify the existing shape of canals by straightening them in the middle third. This type of instrument in a mesial canal will often lead to a strip perforation due to the instrument's tendency to lean on the internal portion of the canal wall. Using this instrument in a reciprocating motion with fixed angles of rotation has been shown to push debris forward and out of the root-canal system by packing the debris internally.

The canal itself is what should lead you down; it determines how it must be negotiated and shaped. What I mean is that the curves of a root canal are not regular, nor are they recurring. Each canal has its own unique anatomy and curves; therefore, it determines both the rotational speed and the angle of engagement between the file and the dentine. Each canal guides the files down the canal safely and preserves the initial shape of the root-canal system.

The most recent innovation from Axis | SybronEndo, TF Adaptive (Fig. 1), allows for complete flexibility of rotation angle, and therefore the speed and power required to prepare the canal. The primary forces leading to canal separation are torsional and cyclic fatigue. When these are combined, there is a substantial amount of stress on the file during the shaping procedure. Since the anatomy of each canal is different, we sometimes encounter difficulty using

files in continuous rotation. In these situations, Adaptive Motion may be of great assistance in shaping the canals safely, respecting the original anatomy. In a more difficult curve, the angles of rotation are smaller and change according to the stress applied to the instrument. Clinically, it is very difficult to feel these changes, but we can determine from the sound that the file is progressing more slowly or at a lower angle of engagement. This automatically provides the balanced force required by the instrument to adapt to the canal in order to provide the optimal shape for cleaning of the root-canal system. This is best described as interrupted but continuous rotation with variable reciprocation according to resistance.

_Case 1

"Spooked" is the right word to describe my feelings when I first saw this X-ray (Fig. 2). The patient and I were both concerned about the treatment of this mandibular molar. It took 18 months for the patient to return to the office. Fortunately, a mix of double-antibiotic paste and a small amount of steroid had been placed in her canals to maintain some stability during this long period. As the temporary paste's effectiveness had diminished, the patient was motivated to request an appointment.

Once the patient was in the chair, the other dentists in my clinic seemed even more excited by this case than I was because they kept visiting my operatory. After several seconds of EndoVac usage, I checked the patency of the canals with a nicely precurved #10 K-file. The distal roots captured my attention because the preoperative X-ray showed very peculiar anatomy. With very careful scouting of the canal, I was able to determine that a single opening led to this very complex root-canal system of multiple canals.

Starting with the M4 Safety Handpiece (SybronEndo) and a #10 K-file, I established patency and created a path of lower tension for the NiTi files to follow. I used a sequence of irrigants to prevent the smear layer from blocking access to the rest of the root-canal system. Shaping of the canal was a challenge, and then the moment everyone was waiting for had arrived.

Adaptive Motion was selected on the Elements Motor (Axis | SybronEndo), and the golden rule of less taper behind the curve was on my mind. Since it was a very unusual case, I chose to approach it in a different way. I first used the #25.08 Twisted File (SybronEndo) for only a few millimetres at the orifice of the canal to facilitate the access of other files and to have a stable working length. I then used a #10 K-file to establish working length. I performed shaping and cleaning first with a TF Adaptive S2 instrument (#20.04) by taking it as deep as it would go with a few strokes in the Adaptive Motion mode. It was interesting to feel and hear the various sounds and the speed changing each time the file went into a canal or upon repeated insertion in the same canal. This file was followed by a #25.04 TF Adaptive file and it was able to reach working length in all the canals after just a few seconds of instrumentation.


Fig. 2

Apical enlargement of the last 3 mm in my opinion is essential to success in endodontics. Therefore, I decided to finish with 0.2 taper K3 files (SybronEndo) because taper is not as important as tip size with regard to apical enlargement.

The sequence of irrigants used was effective in preventing the smear layer from blocking the root-


Fig. 3


Fig. 4

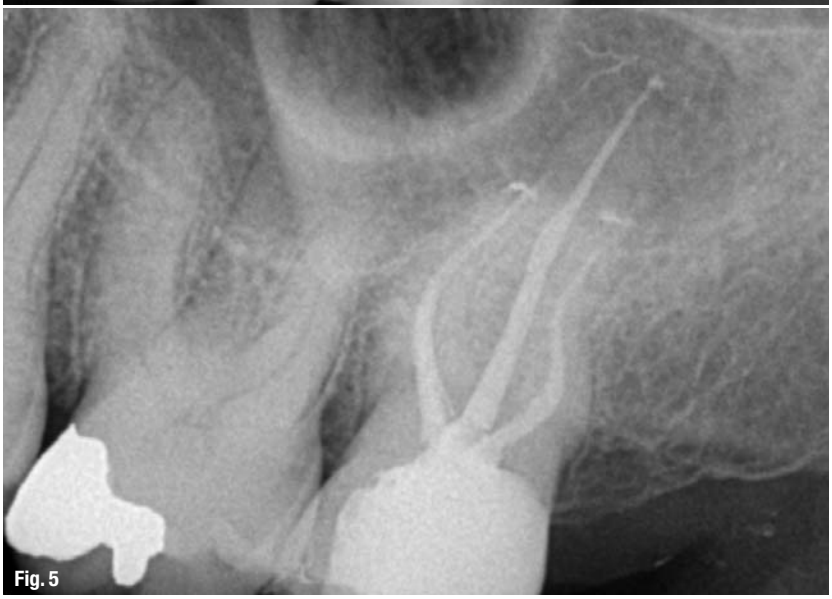
Fig. 5

canal system by using the irrigants with the EndoVac (SybronEndo). The negative apical pressure delivered the irrigants in a very safe, efficient, and effective manner. The EndoVac is a superb way to dry the canal by removing the majority of the liquids from the root-canal system, thereby preventing them from blocking the obturation material compacted using a modified warm condensation technique to seal the root-canal system.

The post-operative X-ray (Fig. 3) showed that this complex had been properly cleaned and shaped, and verified the necessity of the irrigation protocol, the choice of files, and the method of rotation, which prevented debris from being packed into the isthmus. The middle canal of the distal root was not touched with an instrument. Although the X-ray cannot fully reveal the complexity and shape of the anatomy and curves of this molar, the patient left the office more than happy that she was able to retain her natural molar.

_Case 2

Maxillary second molars are usually tricky and they sometimes have a strange access cavity. In addition, the patient is very rarely able to open his or her mouth wide enough for the dentist to be able to work properly and comfortably.

On the preoperative X-ray (Fig. 4), a nicely shaped distal canal was evident, as well as some periapical problems. Finding the second mesial canal was very difficult owing to the angulation of the coronal third, and establishing straight-line access required removal of a great deal of tooth structure, thereby making the molar vulnerable to fracture.

The small TF Adaptive pack was chosen, and after checking patency and using the M4 Safety Handpiece for 10–15 seconds per canal, the first file (green) was taken to working length.

I established that the rotary file had prepared the canal sufficiently to maintain a stable working length. This was followed by the second file (yellow) to working length, and the final file (red) was taken to working length too, using just a few strokes in the Adaptive Motion mode.

Shaping the distal canal was not a problem and I could unmistakably feel that the files were changing and adapting to the specific clinical situation each time they were in contact with the dentine. The post-operative X-ray (Fig. 5) shows the shape of the distal canal, and the access to the mesial canals can be assessed._

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