Root canal therapy with a modular NiTi system: A case report

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Fig. 1: Pre-op radiographic image of tooth #46. **Fig. 2:** Mesioangular radiograph with five root canals visible.

Once in a while, some cases bring something extra to the operating table: unusual anatomical structures, such as a kind of additional main root canal, can add an incalculable variable to an already challenging 3D structure in the root canal system. The radiographic image in the following case revealed a rare specimen that almost resembled an octopus and required a special treatment with a modular, flexible nickel-titanium (NiTi) system.

Case report: More canals in the pipeline

A 42-year-old female patient presented to our dental clinic reporting problems affecting the mandibular right first molar. A standard cold test of tooth #46 showed a delayed reaction. In the preoperative radiograph, the diagnosis and the amazing anatomy of the tooth became apparent. Although human anatomy differs a great deal from case to case, the typical molar usually has no more than four main canals in its root canal system. However, the mesial root canal pattern of the molar in question showed some substantial side structures. The radiograph almost resembled an image of an octopus with many arms attached to the body (Fig. 1). Acute pulpitis was diagnosed, and the patient consequently agreed to a non-surgical root canal therapy.

Fig. 3a

Fig. 3b

Fig. 3c

Figs. 3a–c: CM-treated NiTi files: new **(a)**; save for reuse **(b)**; and unwound **(c)**.

According to our standard approach, the endodontic treatment naturally started with the isolation of tooth #46. We thus applied the mandatory dental dam to create a clean operating field, before gaining access. The first step then was to remove all caries from the affected tooth. Entering the pulp chamber gave us an idea of the true dimensions of the problem: the mesial canals were totally necrosed. Besides that, it was interesting to discover the unusual root pattern we suspected based on the radiographic images. The mesioangular radiograph showed how important it is to capture radiographs from different angles: it clarified the separate mesiolingual root and helped us to prepare the access properly (Fig. 2). In an unusual, winding root canal system, in general, the greatest challenge would be thorough canal preparation. We opted for flexible NiTi files that would allow for safe and efficient cleaning of the main canals.

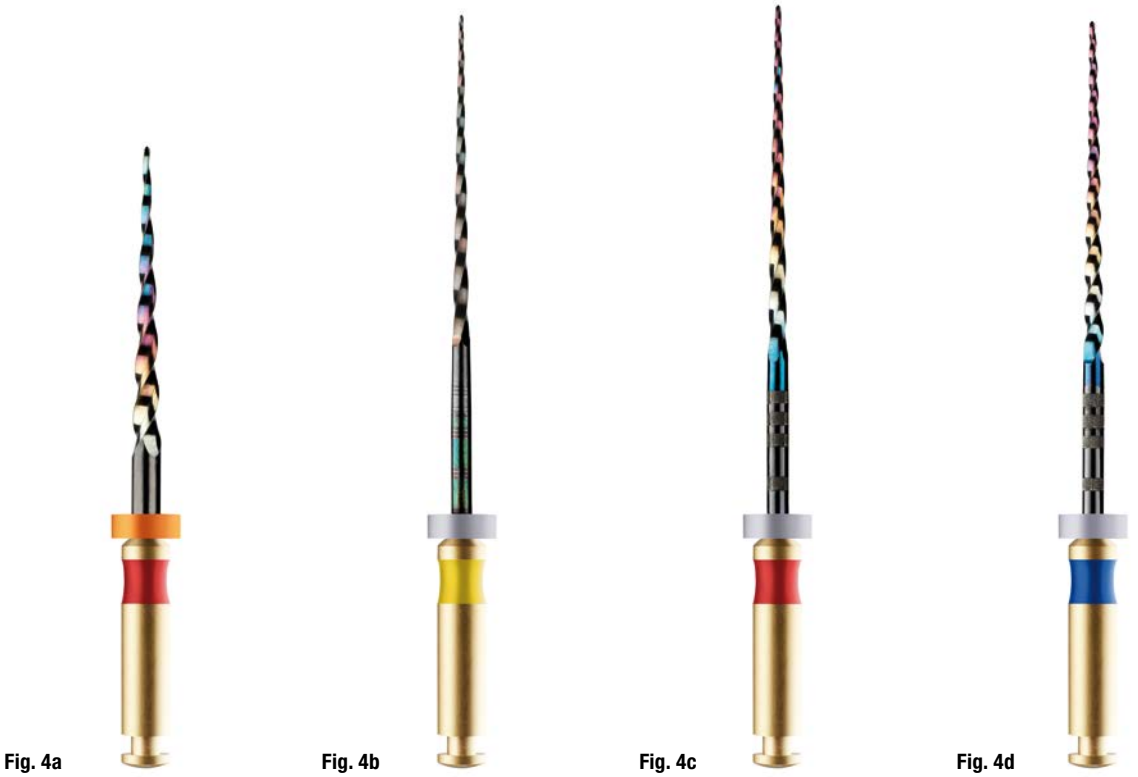

Fig. 4a Fig. 4b Fig. 4c Fig. 4d

Fig. 4a: HyFlex CM 25/.08 orifice opener. **Fig. 4b–d:** HyFlex CM sequence: 20/.04 **(b)**; 25/.04 **(c)**; and 30/.04 **(d)**.

Very early on, international dental specialist COLTENE was one of the first suppliers of fracture-resistant NiTi files with the so-called controlled memory (CM) effect. CM-treated NiTi files are prebendable, but unlike conventional NiTi files, they do not bounce back. Owing to the special production process, certain physical qualities of the alloy are strengthened, making the files both flexible and very fracture-resistant. The practice team can even see with naked eye whether the files can be reused without any problems: CM-treated NiTi files automatically resume their original shape when heated during sterilisation. Coming out of the autoclave, they should look like new with their characteristic winded shape. If they appear to be unwound and sporting an unregular form, they have reached the end of their life cycles and should be discarded immediately (Figs. 3a–c).

Best-fit NiTi files for every canal

Modular NiTi file systems like the HyFlex allow experts as well as beginners to compose their own set of instruments. Depending on their favourite working method and the given anatomical structures, they can choose from a wide range of special and universal files. In the case described in this article, we were able to use an almost identical sequence of HyFlex CM files to prepare all five main canals. To begin with, all the canals were scouted with a size 10 hand file, until a manual glide path was established. Then the actual preparation took place.

For pre-flaring, a HyFlex CM 25/.08 orifice opener (COLTENE) was used (Fig. 4a). Next, the HyFlex CM 15/.04 was inserted into the canal. With a gentle pecking motion, we proceeded up to working length. We then switched to the corresponding size 20 file with the same taper of .04 to approach the apex. The fine-tuning in the three mesial canals was achieved with the help of a HyFlex CM 25/.04. In the distolingual and distobuccal canals, the final instruments in the sequence were a HyFlex CM 25/.04 and the 30/.04 (Figs. 4b–d). The files moved smoothly through the centre of the canal and

Fig. 5: GuttaFlow bioseal automix syringe, 5 ml.

Fig. 6: Post-op radiographic image with visible obturation.

did not become blocked at any point. The high flexibility helped us to gain a good feel of the exact curvature of the canal, as we used the tactile approach to scout the path one third by one third.

It goes without saying that thorough rinsing following a strict cleaning protocol between instrument changes was crucial for a reliable overall result as well. For the chemical irrigation between the mechanical preparation, 5.25 % sodium hypochlorite and 17 % EDTA were used. This procedure also helps to reach side structures that cannot be cleared of debris and bacteria by file preparation alone. In this case, there was a substantial coronal isthmus between two mesial canals, whereas in other patients, lateral canals are far more delicate and particularly difficult to reach.

Different anatomical challenges

The last step was to create a proper seal to prevent microorganisms from re-entering the root canal system and to protect the root from future recontamination. For an efficient and durable obturation, we chose GuttaFlow bioseal (COLTENE; Fig. 5) for the hydraulic condensation technique. The three-in-one obturation material combines fluid gutta-percha with a suitable sealer at room temperature and bioceramics in an automix syringe. This composition results in an easy-to-handle material with excellent flow properties and a working time of ten to fifteen minutes. The gutta-percha is warmed and can be pushed down with a plugger if it has not already begun flowing into all (possibly hidden) the canals itself. After polymerisation, the bioactive material forms hydroxyapatite crystals on the surface, significantly improving adhesion and actively encouraging the regeneration of bone and dentine. Almost like a traditional Indian healer, you thus do your magic and wait for the result to show in the final radiograph. The postoperative radiograph depicts the mighty octopus with its clearly recognisable arms, all reliably filled with gutta-percha (Fig. 6). The long-term documentation will confirm whether we were able to create a durable seal.

At international meetings, my international colleagues and I often observe that the different shapes of root canals never cease to amaze the endodontic expert. No matter how many lateral canals, isthmuses and side structures you have seen in your career, there is always that one case that brings a special challenge to the treatment. On the one hand, such anatomical structures need flexible instruments. On the other hand, such root canals need a reliable obturation material that fills even remote areas and flows into parts of the 3D root canal system that cannot be reached otherwise. In India, many patients wait until the dentinal decay is already far advanced and a major part of the root canal system is necrosed. Sound, revision-safe root canal therapy helps to encourage people to seek treatment at an earlier point, when many conditions can even be resolved or managed far better.

Conclusion

Varying anatomical structures require flexible instruments that adapt to the individual situation in the root canal and move reliably in the centre of the canal. A modular NiTi system like HyFlex CM or EDM files allows endodontic specialists to choose from a range of special files, from glide path files and orifice openers up to finishing files of different sizes and tapers. A bioactive obturation material moreover flows into all kinds of lateral canals and promotes healing.

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

This article is part of a three-part series titled So Many Roots to Travel *and developed by COLTENE. In the series, endodontic specialists around the world discuss their most spectacular cases and show how they met the treatment challenge using modern NiTi instruments.*

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