The importance of instrumentation systems hibridization in endodontic treatment: case report

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ABSTRACT

Introduction: The combination of suitable mechanical preparation, root canal disinfection and satisfactory filling is key for a favorable prognosis in endodontic treatment. The anatomical complexity of root canals is a limiting factor in instrumentation, and requires clinicians to carry out different procedures in order to achieve it. **Objective:** The aim of this study was to report a case of endodontic treatment of tooth #47, with complex anatomical traits and double root curvature in a patient with limited mouth opening. **Case report:** Mechanical preparation was performed by means of hybrid instrumentation technique with hand files of different types (Kerr, Hedströen and Flexofile) Gates-Glidden drills and rotary files (ProDesign S system), which were combined in an attempt to increase the effectiveness of cleaning the three canals. Between sessions, calcium hydroxide was used as intracanal dressing and the canals were filled by means of lateral and vertical condensation technique. **Conclusion:** After the study of the pertinent literature and the accomplishment of the clinical case, it was concluded that via hybridization systems it is possible to carry out endodontic treatment with a better prognosis and increased safety. By using the best of each technique, the theory that none of them is fully complete is reinforced. Additionally, hand tools, even with significant advance in automated instruments, still have their value and remain essential in instrumentation protocols.

Keywords: Hybridization. Endodontics. Root canal preparation.

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Introduction

Variations in internal anatomy of tooth exert significant interference in the result of endodontic treatment, since root canals are not only circular, but also oval and flattened, besides having ramifications, recesses and isthmus.[1] Thus, pulp tissue remnants and bacterial contamination may persist even after instrumentation[2] because the irregular shape of root canal leads to deficient instrumentation, mainly in buccal and lingual walls, and particularly in the case of oval canals.[3]

An important factor for favorable prognosis of endodontic treatment is proper biomechanical preparation, consisting in removal of infected dentin and pulpal tissue, thus enabling proper filling.[2] As a result, remaining microorganisms are prevented from finding support for development and proliferation and subsequent recontamination of the root canal.[4]

Instrumentation with automated NiTi files is used primarily in canals with complex anatomical traits due to flexibility and resistance to twisting of these instruments. Files with CM-wire technology represent the last generation of NiTi files, and as the name itself suggests, they have shape memory control, i.e. can be pre-curved, suffer deformation inside the canal during instrumentation and return to their original format after sterilization. Therefore, they present absence of elastic memory and greater resistance to cyclic and torsional fatigue.[5,6]

Yet there is a need for complementation with the manual technique, especially in the apical region, where effectiveness is reduced,[7,8] and due to failures that automated instrumentation presents.[9]

The purpose of this study is to report a case of endodontic treatment in tooth #47 with complex anatomical traits and double curvature in a patient with limited mouth opening.

Case report

A 35-year-old female patient attended a private dental office complaining about spontaneous pain in the lower right region, felt for about a month. The patient was unable to accurately report which tooth caused pain. She claimed to have taken anti-inflammatory drugs and painkillers, which reduced the painful symptoms, but did not eliminate them.

During anamnesis, the patient reported no systemic issues. She only reported having used occlusal splint a few years before, as treatment for temporomandibular disorder. The patient presented severe bruxism and clenching, causing reduction in vertical dimension, which had then been treated with composite resin restorations in posterior and anterior teeth.

Pulp sensitivity thermal tests (Endo-Ice, Maquira, Paraná, Brazil) as well as vertical and horizontal percussion tests were performed. Tooth #46 presented negative response to the tests while #47 was painful throughout. Radiographic analysis (Fig 1) revealed tooth #46 had been subjected to endodontic treatment with filling 3.0 mm from radiographic apex. Tooth #47 showed large pulp chamber and roots with extremely sharp curvature, Schneider class III.[10] Clinical and radiographic diagnoses revealed potential for irreversible symptomatic pulpitis, therefore requiring endodontic treatment.

Thus, crown access was performed, presenting little bleeding, showing damaged pulp. After complete opening, the tooth was sealed with cotton balls soaked in 2% chlorhexidine digluconate (Chlorhexidine, Villevie, Santa Catarina, Brazil) and restored with two kinds of provisional material: provisional filling material (Villevie, Santa Catarina, Brazil) and provisional cement Pulpo San (SS White, Rio de Janeiro, Brazil).

During the next session, crown opening was enlarged to improve crown access to mesial canals, which was hindered by limited mouth opening. The distal canal was wide, being instrumented with Kerr files #15,

Figure 1. Initial radiograph.

#20 and #25 and prepared up to the middle third with GatesGlidden drills #2, #3 and #4 (Dentsply Maillefer, Ballaigues, Switzerland). Electronic odontometry was performed with apical locator Romiapex a-15 (Romibras Ltda., Rio de Janeiro, Brazil). The measure of 21.5 mm up to the foramen was then obtained. The apical third was instrumented with Kerr files from #8 up to #30 (Dentsply Maillefer, Ballaigues, Switzerland).

Mesial canals openings were enlarged with Hedströen files (Dentsply Maillefer, Ballaigues, Switzerland) #20, #25, #30, allowing preparation of cervical and middle thirds with Gates-Glidden drills #2 and #3. They were then accessed with Kerr files #8 and #10 (Dentsply Maillefer, Ballaigues, Switzerland) (Fig 2). Glycerin (Amorável, Biomatika Ind. e Com. de Produtos Naturais, Ceará, Brazil) was used as lubricant agent, so as to facilitate instrumentation. Radiographic analysis showed #10 file access of 17 mm in mesial canals, and distal canal odontometry of 21 mm was then confirmed (Fig 3A).

Root canals were irrigated with 2.5% sodium hypochlorite (Farma Ind. Farmacêutica Ltda, Serrana, Brazil) and eventually with 10 ml sterile saline solution (Samtec, Ribeirão Preto, Brazil). Subsequently, they were filled with calcium hydroxide intracanal dressing (Biodinâmica, Ibiraporã, Brazil) combined with saline solution (Samtec, Ribeirão Preto, Brazil) and provisional double sealing.

After 14 days, mechanical preparation was complemented with rotary system ProDesign S (Easy Equipamentos Odontológicos, Belo Horizonte, Brazil) coupled to VDW Silver Reciproc engine (VDW, Munchen, Germany) operated with speed and torque recommended by the manufacturer. The four system files were used, starting with two Orifice Shapper #30.10 and #25.01 at pre-enlargement stage, an apical patency file (#25.01) and a finishing file (#20.06).

File #25.01 reached patency in the distal canal, while at the mesio-lingual canal it was reached at 19 mm, and at the mesiobuccal, 18 mm. Subsequently, #30.10 file was used. The session ended before the end of complete instrumentation of canals. Final irrigation, intracanal dressing and provisional double sealing were the same as previous sessions.

During the last session, 45 days later, the entire set of ProDesign S-system files was used (Easy) in all three canals, according to the manufacturer's instructions: #30.10 and #25.08 files under 950 rpm speed and torque of 4 N or 400 gcm; #25.01 under 350 rpm speed and 0.5 N. For apical preparation, #20.06 file was used under 350 rpm speed and torque of 1.5 N (Fig 3A). Patency was not reached in mesial canals, thus remaining short of radiographic apex. The distal canal was refined with #30 Flexofile (Dentsply).

Filling was performed by means of lateral and vertical condensation technique using FM main cone (Dentsply) calibrated with the aid of an appropriate rule (Dentsply), as well as zinc oxide-based sealer and eugenol (EndoFill, Dentsply) (Fig 3B). Subsequently, the tooth was restored by means of provisional double sealing.

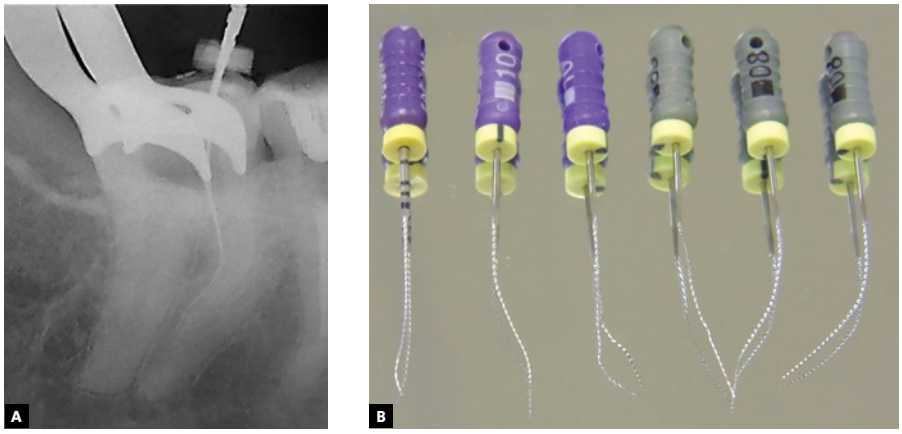

Figure 2. A) Initial inspection radiograph in mesial canals. **B**) Deformation of files used for inspection of mesial canals.

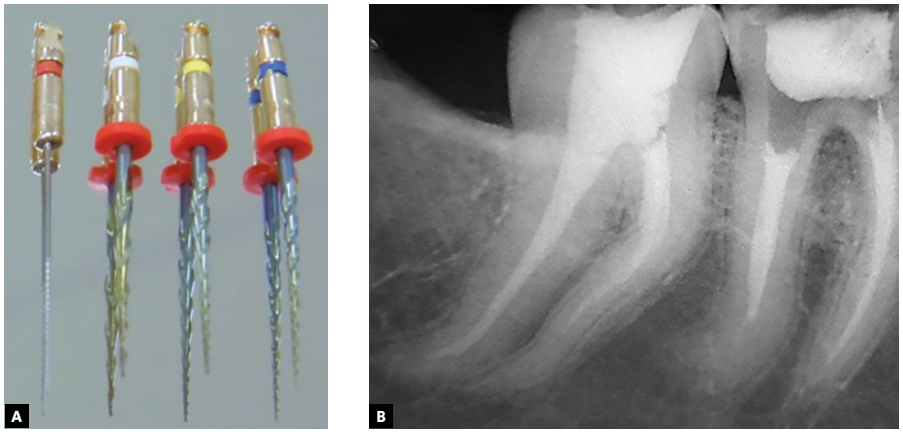

Figure 3. A) ProDesign S system. **B**) Final radiograph.

Discussion

The hybridization of techniques, as reported in the present case, combining manual and automated instrumentation procedures, is a possibility of improving the efficiency of root canal cleaning. This is because it integrates the best of each technique and thereby allows for an increased success rate. The hybrid technique has increased capacity of cleaning the apical third of the root canal system (13.14%) when compared with the rotary technique (18.44%).[2]

The higher the root canal curvature angle, the greater the risk of fracture. Thus, the hybrid technique, although more time consuming, is safer in canals with the curvature angle greater than 25°.[10] The use of rotary technique alone in instrumentation presents a greater number of fractured instruments when compared to the hybrid technique, since the use of a patency file before the rotary instrument minimizes the risk of fracture.[11]

The double curvature existing in the canal and long working length were two major challenges in instrumentation, because the manual files reached total length with great difficulty and suffered constant deformation. Manual files were required to enlarge the cervical third, thus allowing better identification and access with Gates-Glidden drills. After preparation of middle cervical thirds, the root canal was more accessible to the ProDesign S NiTi rotary file (Easy), which due to CM-wire technology was able to go through root canal internal anatomy with lower risk of fracture, given its great flexibility.

In the present case, manual files of different types (Kerr, Hedströen and Flexofile), Gates-Glidden drills and rotary files were associated in an attempt to increase the effectiveness of cleaning the three root canals. The use of various instruments occurred not only due to the complex anatomy of canals, especially of mesial ones, but also due to difficulty of access and identification because the patient had severe mouth opening limitation caused by temporomandibular disorder (TMD).

Silveira et al[12] reported that 50% of the overall population displays some TMD symptoms, such as joint pain, headache, trismus and mouth opening limitation, which imposes difficulty to dental treatment, especially in posterior teeth. In the case reported herein, not only treatment time needed to be changed, with shorter sessions, but also instrumentation protocol and crown access, in which there was the need to remove part of mesial cusps in order to enable more direct access of files. Given the possibility, a microscope is indicated because it facilitates treatment by improving identification of root canal openings via magnification and illumination of surgical site.[13]

In addition to TMD, the patient presented with severe grinding and history of various occlusal adjustments, as well as vertical dimension recovery. Increased cementum thickness and consequent hypercementosis are an

adaptive response of periodontal tissues, which aims at enlarging the support area and improving occlusal force distribution. Functional stress is the most common cause of hypercementosis.[14] In grinding patients also presenting tooth clenching and occlusal trauma, hypercementosis is usually found to a greater or to a lesser degree. It is found in all root surfaces or only one root surface.[14,15] Hypercementosis might often lead to apical deltas, in addition to leading to constricted root canal and changes in root canal original direction at the apical third. This can hinder endodontic instrumentation, in addition to making foramen access impossible, thus affecting endodontic treatment quality.[15] At the present study, hypercementosis jeopardized a more satisfactory filling of mesial canals.

Irrigation was performed manually, although hybrid instrumentation, when associated with ultrasound-based irrigation, presents greater cleanliness, especially in the apical third.[16] Ultrasonic agitation of irrigating solution provides root preparation with significant reduction in the amount of dentin debris, thus enhancing elimination of bacteria and by-products.[16]

Conclusion

After study of relevant literature and clinical case performance it was found that with hybridization of systems it is possible to obtain endodontic treatment with better prognosis and increased safety. By taking advantage of the best in each technique, the theory that none of them is totally complete and manual instruments, even with the breakthrough of automated instruments, still have value and remain essential in instrumentation protocols is confirmed.

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