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CASE REPORT

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Endodontic management of a mandibular incisor with severe canal obliteration: a case report

Henry Paul Valverde Haro[1, 2, a],
Adriana Denisse Erazo Conde[2, b]

[1] Universidad Hemisferios. Quito, Ecuador.
[2] ENDOsolutions Research Group. Riobamba, Ecuador.
[a] Master's Degree in Endodontics.
[b] Second professional specialty in Dental Prosthetics.

ABSTRACT

One of the physiological procedures associated with injuries to the dental pulp is root canal obliteration, characterized by partial or total narrowing of the canal, making its access or localization challenging. With today's technology, digital planning of the access cavity, using minimally invasive techniques through CBCT and intraoral scanning of the patient's mouth, improves this complex clinical situation. This case involves a 66-year-old patient with dyschromia of the lower central incisor, a history of dental trauma, and a positive response to percussion testing, with pulp necrosis and symptomatic apical periodontitis. A three-dimensional impression of an endodontic access guide was made. The root canal was then permeabilized in a controlled manner and the canal was located using a minimally invasive approach. The root canal was treated conventionally. Clinical and radiographic follow-up after one year demonstrated the effectiveness of using a static guide for endodontic treatment in cases of severe obliteration.

Keywords: dental calcification; access cavity preparation; cone beam computed tomography; three-dimensional impression; dental trauma.

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INTRODUCTION

One of the physiological processes associated with damage to the dental pulp is root canal obliteration, where partial or total narrowing of the canal is observed, making it difficult to access or locate (1, 2). Many of these cases are asymptomatic and are detected by routine auxiliary imaging, such as periapical radiographs, panoramic radiographs, and cone beam computed tomography (CBCT) (3).

When pulp or periapical pathology is present in teeth with root canal obliteration, the degree of complexity increases to the point of becoming a challenge for the clinician. Therefore, there is a high risk of procedural error in the effort to locate the root canal (4). With current technology, the ideal approach is to perform digital planning using an intraoral scan of the patient's mouth and CBCT, in order to achieve conservative access, locating the root canal in a minimally invasive manner (5). This procedure is called guided endodontics and is presented as a treatment alternative for obliterated teeth, reducing treatment time and significantly decreasing procedural errors (6, 7).

Today, 3D printing in dentistry is widely used in endodontics for the production of static guides, surgical guides, and three-dimensional replication of teeth for dental autotransplantation procedures, providing a fast, accurate, safe, and increasingly inexpensive alternative in the manufacturing process (8).

This case report presents a guided endodontic treatment of a severely obliterated lower central incisor with periapical pathology.

CASE PRESENTATION

A 66-year-old male patient attended an endodontic consultation due to constant pain during chewing and palpation in a lower central incisor with dental discoloration. The patient's medical history included controlled hypertension, and his dental history included dental trauma more than three years prior.

The mandibular central incisor showed a positive response to both vertical and horizontal percussion tests and no response to the thermal pulp vitality test. The initial periapical radiograph (Figure 1A) showed severe obliteration of the root canal at the level of the pulp chamber and root, compared to the adjacent central and lateral incisors. Tooth #41 showed radiographic evidence of apical periodontitis. A maxillary CBCT scan with a 16×18 cm FOV was performed using a tomograph (GIANO HR, NewTom®, Imola, Italy). The tomographic images confirmed the presence of severe canal calcification and periapical pathology (Figure 2).

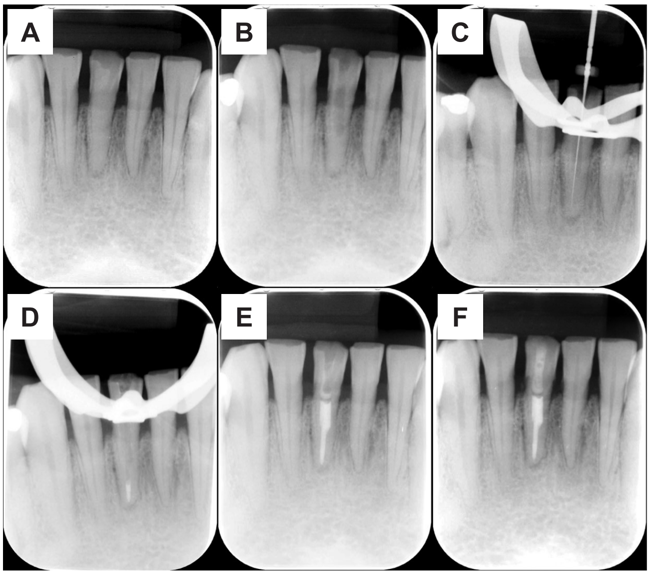

Figure 1. Radiographic control: A) Initial periapical radiograph showing complete obliteration of the canal; B) Control radiograph of endodontic access with ATEC bur to the middle third; C) Control radiograph of conductometry with K10 file; D) Control radiograph of continuous wave heat technique conometry; E) Control radiograph of root canal filling; F) Control periapical radiograph one year after treatment.

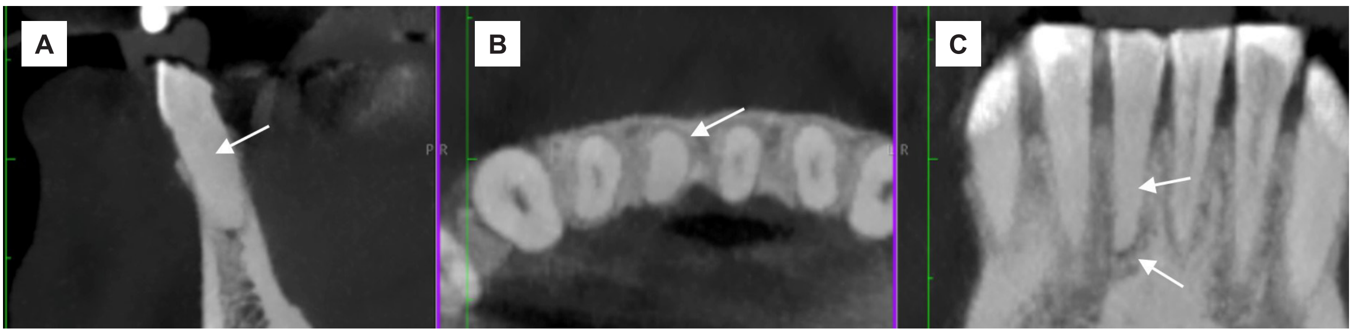

Figure 2. Observation of severe obliteration and periapical pathology in CBCT: A) Observation of severe obliteration in the sagittal section; B) Observation of severe obliteration in the axial section; C) Observation of severe obliteration in the transaxial section and presence of periapical pathology.

The definitive pulp diagnosis was pulp necrosis and the periapical diagnosis was symptomatic apical periodontitis. Root canal treatment was proposed using a static endodontic guide to reduce the risk of procedural error. As an alternative contingency treatment, the patient was informed of the possibility of tooth extraction. The patient opted for the first proposal to preserve his permanent tooth.

Using an intraoral scanner (Helios 600, Eighteeth®, Changzhou, China), a digital model of the patient's dental arch was created and exported as an STL file. The two files (CBCT and STL) were processed with software (Romexis® 3D implantology, Planmeca, Helsinki, Finland), then aligned and the access planned with a 1.0 mm diameter and 21 mm long ATEC bur (Endoseal®, Steco, Hamburg, Germany). The bur was superimposed on the middle third of the root. The guide was designed with a hole for inserting a 5 mm titanium sleeve and a 1 mm entry hole diameter (Endo Sleeve, Steco®, Hamburg, Germany) and exported as an STL file for reproduction on a 3D printer (Figure 3A).

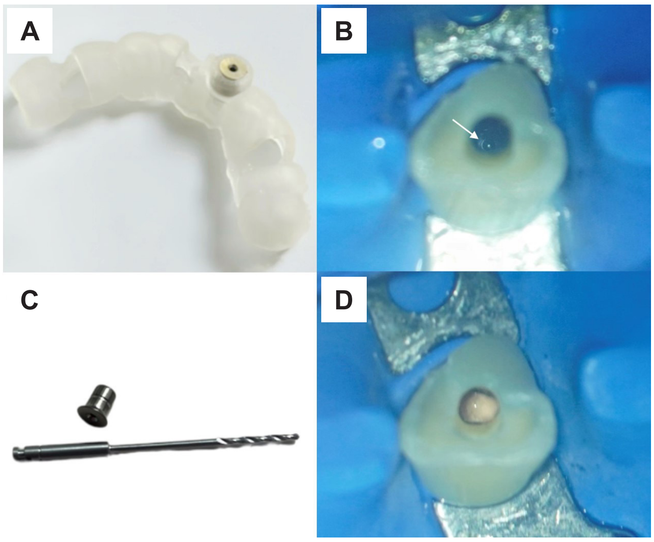

Figure 3. Clinical images of the procedure and endodontic guide: A) Static endodontic guide with titanium cap installed; B) Location of the root canal; C) ATEC 28 mm bur and 5 mm titanium cap; D) Three-dimensional filling of the root canal.

Informed consent was obtained from the patient, and the guide was tested to verify its correct fit on the incisal surfaces of the mandibular anterior teeth. Local infiltrative anesthesia with a vasoconstrictor was administered, and a mark was made through the guide to identify the access point with a pencil lead. The enamel was removed in a minimally invasive manner until the dentin was exposed, using a round diamond bur (1014, Microdont®, Sao Paulo, Brazil). Next, the ATEC bur (Figure 3C) was fitted to an endodontic motor with a rotation speed of 1000 rpm and 2.5 Ncm of torque; and access was gained to the middle third of the root, with abundant irrigation and inward and outward movements, until the reference point marked on the ATEC bur was reached. A control radiograph of the access was taken (Figure 1B).

Preparation of the access took approximately 10 minutes. The tooth was then completely isolated for conventional endodontic treatment (Figure 3B). Using 1.6x magnification with a surgical microscope (RM-2000 Plus, Rogin Dental®, Shenzhen, China), the canal was located using a DG16 endodontic explorer and 25 mm preserie files (K08 and K10, Maillefer®, Ballaigues, Switzerland). A periapical conductometry radiograph was taken to verify access to the root canal (Figure 1C). Subsequently, it was irrigated with 5.25% sodium hypochlorite and instrumented with a reciprocating system up to an R40 (Reciproc, VDW®, Munich, Germany). A final sonic activation was performed with the tip (Eddy, VDW, Munich, Germany) with 5 one-minute intervals of 5.25% sodium hypochlorite, irrigation with 5 mL of saline solution, and a one-minute interval of ethylenediaminetetraacetic acid solution (EDTA 18%, Ultradent®, South Jordan, USA).

Next, a final irrigation with 5 mL of saline solution was performed. The procedure was completed using sterile cones (Reciproc, VDW ®, Munich, Germany) for drying. The filling was performed with a 40/04 master cone (gutta-percha points; Coltene®, Langenau, Germany) using epoxy amino resin-based root canal sealing cement (AH Plus, Dentsply®, Erlangen, Germany). A control radiograph of the filling was taken at the apical third (Figure 1D) and, using the continuous wave heat technique (Beefill 2 in 1; VDW®, Munich, Germany), the filling was completed up to the chamber third of the root canal. The access cavity was cleaned with cotton moistened with ethanol, and the endodontic filling was sealed with flowable resin (Figure 3D).

Radiographic checks were performed during all phases of treatment, carried out in a single session, observing adequate three-dimensional filling up to the working length (Figure 1E). Follow-up was performed one year after endodontic treatment, with the result being the absence of symptoms and periapical bone neoformation (Figure 1F).

DISCUSSION

The diagnosis and individualization of endodontic treatments are essential for the healing and prevention of pulp and periapical pathologies (9). Although most mandibular incisors tend to have internal morphological symmetries and few anatomical variations, they continue to pose a challenge for root canal treatment (10).

In the case of a tooth with an obliterated canal, its longitudinal axis serves as a reference for accessing the root canal (6). Attempts have been made to perform this type of procedure conventionally using ultrasound and a dental surgical microscope (11). In this type of therapeutic approach, due to the high risk of procedural errors and the internal anatomical complexity of obliterated canals, the use of CBCT during endodontic treatment planning is justified, providing more benefits than risks in terms of increased patient exposure to radiation, compared to periapical radiographs (12-15).

Guided endodontics minimizes dentin wear and reduces the potential risk of procedural errors, while preserving as much healthy dental tissue as possible (16). In the present case report, there were limitations due to severe canal obliteration; therefore, wear was performed on the mesial wall of the root canal during the procedure due to the lack of a precise reference to determine where the canal could be located at the apical third of the root during digital planning of the static guide. However, this limitation was overcome with the help of magnification achieved with the microscope, which allowed observation of the canal entrance prior to the removal of dentin debris with irrigating solutions. The apical third of the root canal was accessed using pre-series files. Therefore, it is recommended to use guided endodontic burs and a titanium cap inserted into the three-dimensional impression of the guide to avoid unwanted movements during treatment (17).

When the tooth to be treated has no adjacent teeth, it is recommended to stabilize the guide with bone anchors (15, 17, 18); however, in this case, it was not necessary because good stability was observed at the level of the adjacent teeth, which reduced the likelihood of unwanted movements during the procedure. Therefore, guided endodontics is a novel procedure for the treatment of obliterated teeth. Further research and innovation are needed in access burs, reducing their diameters and resistance during preparation, as limitations can cause alterations in the original shape of the root canal (19).

CONCLUSION

This case report demonstrated the effectiveness of using a static guide for endodontic treatment of a canal with severe obliteration.

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Ethics approval:
Informed consent was obtained from the patient.

Author contributions:
HPVH: conceptualization, methodology, original draft writing.
ADEC: research, software, visualization, writing (review and editing).

Corresponding author:
Henry Paul Valverde Haro
Henry.valverde@upch.pe

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