

One- versus Two-visit Endodontic Treatment of Teeth with Apical Periodontitis: A Histobacteriologic Study

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Abstract

Introduction: This study analyzed the *in vivo* microbiological status of the root canal systems of mesial roots of mandibular molars with primary apical periodontitis after 1- or 2-visit endodontic treatment.

Methods: Mesial root canals were instrumented by using either a combination of K3 and LightSpeed instruments (mesiobuccal canals) or the ProTaper system (mesiolingual canals), with 5% NaOCl irrigation. Patency files were used. Smear layer was removed, and a final rinse with 5 mL of 2% chlorhexidine was performed. In the 2-visit group (7 roots, 14 canals), canals were medicated with calcium hydroxide for 1 week and then obturated by using the continuous wave of compaction technique. In the 1-visit group (6 roots, 12 canals), canals were immediately obturated after chemomechanical procedures. Teeth were extracted 1 week after root canal instrumentation and processed for histobacteriologic analysis. **Results:** In the 1-visit group, no case was completely free of bacteria; residual bacteria occurred in the main root canal (5 of 6 cases), isthmus (5 of 6), apical ramifications (4 of 6), and dentinal tubules (5 of 6). In the 2-visit group, 2 cases were rendered bacteria-free; residual bacteria were found in the main canal only in 2 cases (none of them with persistent dentinal tubule infection), in the isthmus (4 of 7 cases), and in ramifications (2 of 7). The 2 instrumentation techniques performed similarly. When filling material was observed in ramifications, it was usually intermixed with necrotic tissue, debris, and bacteria. **Conclusions:** The 2-visit protocol by using an interappointment medication with calcium hydroxide resulted in improved microbiological status of the root canal system when compared with the 1-visit protocol. Residual bacteria were more frequent and abundant in ramifications, isthmuses, and dentinal tubules when root canals were treated without an interappointment medication. Apical ramifications and isthmuses were never completely filled. The use of

an antibacterial interappointment agent is necessary to maximize bacterial reduction before filling. (*J Endod* 2012;38:1040–1052)

Key Words

Calcium hydroxide, endodontic infection, endodontic treatment, 1-visit endodontics, sodium hypochlorite

The microbiological goals of the endodontic treatment of teeth with apical periodontitis are to reduce the microbial bioburden to levels compatible with periradicular tissue healing and to prevent microbial recolonization of the treated canal. The former can be attained by antimicrobial measures involving chemomechanical procedures and intracanal medication, whereas the latter is a role for root canal obturation. One of the most controversial issues in endodontics is whether an interappointment medication is really needed to improve disinfection and then enhance treatment outcome (1).

Several clinical studies have evaluated the intracanal antimicrobial activity of chemomechanical preparation by using NaOCl as the irrigant in concentrations ranging from 0.5%–5%, but most of them demonstrated that 40%–60% of the canals still exhibit detectable cultivable bacteria (2–12). Because residual bacteria have been shown to adversely affect treatment outcome (4, 13), the use of an interappointment intracanal medication has been recommended to supplement the antibacterial effects of chemomechanical procedures and maximize bacterial reduction (3, 5, 7, 9, 10, 14). Calcium hydroxide is arguably the most commonly used intracanal medication, but its effectiveness in significantly increasing the number of culture-negative root canals after chemomechanical preparation has been demonstrated to be inconsistent (3, 5, 15).

There are many studies showing that root canals that cultured negative before filling have a greater potential of improved outcome (4, 16, 17). Thus, the choice for clinical protocols that predictably lead to negative cultures as demonstrated by the literature has been recommended (18). Nevertheless, culture has limitations, because it has low sensitivity, many endodontic bacterial species remain to be cultivated, and the method used for sampling only shows the microbiological conditions of the main canal (19). The histobacteriologic approach used in previous studies (20–22) has the great advantage of providing information about the spatial location of residual bacteria, including those present in areas distant from the main canal, such as tubules, isthmuses, and ramifications, which are difficult to treat and sample. Therefore, this method has great potential to provide information about clinical protocols that are better suited to control the infection in the root canal system.

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doi:10.1016/j.joen.2012.04.010

The present histobacteriologic study was undertaken to analyze the *in vivo* microbial status of the middle and apical segments of the root canal system of mesial roots of human mandibular molars with primary apical periodontitis after 1- or 2-visit endodontic treatment. Two different nickel-titanium rotary instrumentation techniques were used for both groups, and calcium hydroxide was used in the 2-visit treatment protocol.

Materials and Methods

Clinical Procedures

Teeth selected for this study were human mandibular molars with necrotic pulps and radiographic evidence of apical periodontitis that were extracted for reasons not related to this study (nonrestorability because of extensive caries/crown fractures or periodontal disease). The study protocol was approved by the institutional review board of Tlaxcala University, Mexico, and informed consent was obtained from the individuals participating in the study after the clinical procedures were thoroughly explained. Thirteen teeth were selected and randomly assigned to either of 2 experimental groups by using a coin toss. Only the 2 mesial canals were included in the

experiment. All clinical procedures were carried out by 1 experienced endodontist (J.V.).

2-visit Group

This group included the mesial canals of 7 mandibular molars. After local anesthesia, the cusps were cut down, carious dentin was excavated, and the tooth was isolated with a rubber dam. Thorough disinfection of the tooth and the rubber dam was done by using 5% NaOCl, and the endodontic access cavity was prepared with sterile high-speed carbide burs. Next, the access cavity and the distal canal were profusely irrigated with 5% NaOCl, calcium hydroxide was placed at the entrance of the distal canal, and the distal aspect of the access cavity was separated from the mesial one by building a mechanical barrier with LC Block-out resin (Ultradent, South Jordan, UT).

After exploration with a scouting #10 K-file, the 2 separate mesial canals were coronally flared by using Gates-Glidden burs sizes 3 and 2, along with copious irrigation with 5% NaOCl. The working length (WL) was determined with the aid of an electronic apex locator (Elements Diagnostic Unit; Sybron Endo, Orange County, CA) at the 0.0 reading of the device with a #10 K-file. Mesio-angled and/or disto-angled

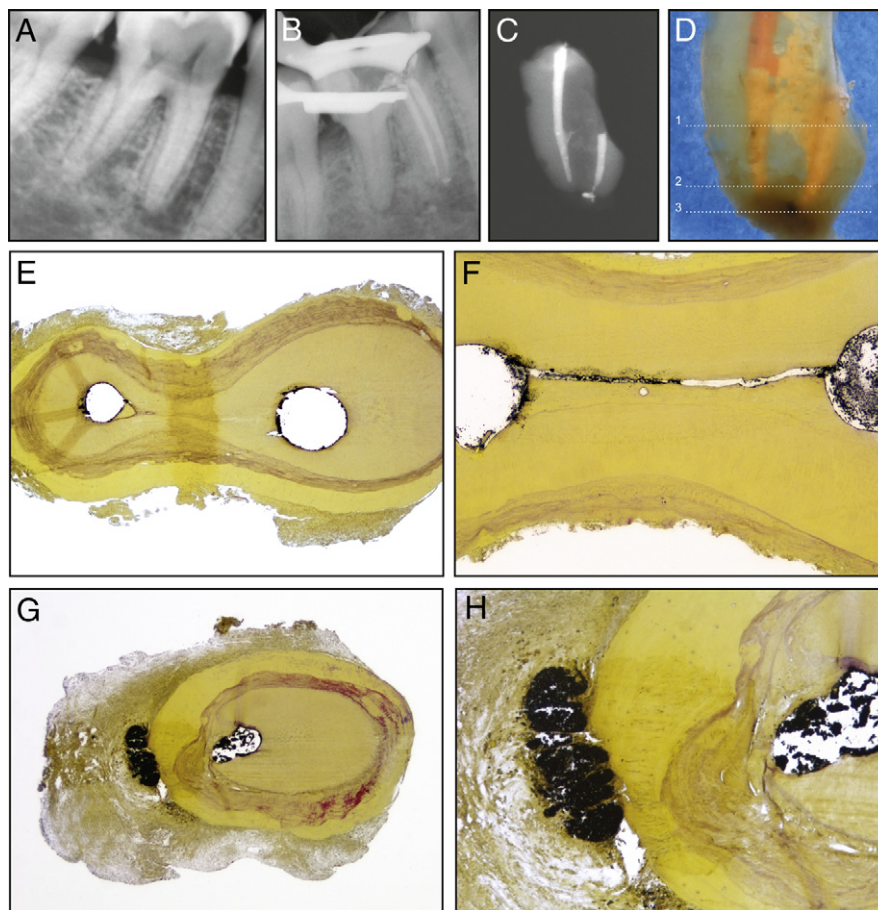


Figure 1. Two-visit group. (A) Tooth #30 with massive buccal carious lesion involving the pulp chamber floor in 56-year-old woman. (B) Postobturation radiograph taken with mesiodistal angulation. Note the excess material extruded from the lingual canal. (C) Radiograph of mesial root taken at 90° angle. The root fractured obliquely during extraction. (D) Mesial root in the clearing agent. Obturation material is visible in a space connecting the 2 canals. The pathologic periapical tissue remained attached to the root tip at extraction. (E) Cross-cut section taken from the middle third at the level of line 2 in (D). No isthmus is present at this level between the 2 canals (Taylor modified Brown & Brenn stain; original magnification, $\times 16$). (F) Section taken from the apical third at the level of line 1 in (D). An isthmus containing obturation material (black) and connecting uninterruptedly the 2 mesial canals is now visible. Presence of particles of obturation material on the cut dentin is artifactual, as these float in the Canada balsam and are displaced from the root canal space (original magnification, $\times 25$). (G) Section taken at the level of line 3 in (D), encompassing only the lingual root tip and canal. A moderate quantity of filling material has been forced into the periapical pathologic tissue (original magnification, $\times 16$). (H) Detail from (G) (original magnification, $\times 50$). Note: no bacteria were found at any level in this specimen.

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