Clinical Comparison of the Effectiveness of Single-file Reciprocating Systems and Rotary Systems for Removal of Endotoxins and Cultivable Bacteria from Primarily Infected Root Canals

Frederico C. Martinho, DDS, MSc, PhD, Ana P.M. Gomes, DDS, MSc, PhD,* Aletéia M.M. Fernandes, DDS, MSc,* Nádia S. Ferreira, DDS, MSc,* Marcos S. Endo, DDS, MSc, PhD,* Lilian F. Freitas, DDS, MSc, PhD,* and Izabel C.G. Camões, DDS, MSc, PhD†*

Abstract

Introduction: This clinical study was conducted to compare the effectiveness of single-file reciprocating systems and rotary systems in removing endotoxins and cultivable bacteria from primarily infected root canals. **Methods:** Forty-eight primarily infected root canals were selected and randomly divided into 4 groups: WaveOne (Dentsply Maillefer, Ballaigues, Switzerland) (n = 12); Reciproc (VDW, Munich, Germany) (n = 12), ProTaper (Dentsply Maillefer) (n = 12), and Mtwo (VDW) (n = 12). Samples were collected before and after chemomechanical preparation. The irrigation was performed by using 2.5% sodium hypochlorite. A chromogenic limulus amebocyte lysate assay test was used to quantify endotoxins. Culture techniques were used to determine bacterial colony-forming unit counts. **Results:** In the baseline samples (ie, samples collected before chemomechanical preparation), endotoxins and cultivable bacteria were recovered from 100% of the root canal samples. No differences were found in the median percentage values of endotoxin reduction achieved with reciprocating systems (ie, WaveOne [95.15%] and Reciproc [96.21%]) and with rotary systems (ie, ProTaper [97.98%] and Mtwo [96.34%]) ($P < .05$). Both single-file reciprocating systems (ie, WaveOne [99.45%] and Reciproc [99.93%]) and rotary systems (ProTaper [99.85%] and Mtwo [99.41%]) were effective in reducing the cultivable bacteria (all $P < .05$). Moreover, the culture analysis revealed no differences in bacterial load reduction ($P > .05$). **Conclusions:** Both single-file reciprocating systems (ie, WaveOne and Reciproc instruments) and rotary systems (ie, ProTaper and Mtwo instruments) showed similar effectiveness in reducing endotoxins and cultivable bacteria from primarily infected root canals, but they were not able to eliminate them from all root canals analyzed. *(J Endod 2014;40:625–629)*

Key Words

Bacteria, disinfection, endodontics, endotoxin, root canal

One of the main goals of root canal treatment is to reduce the amount of bacteria as well as their byproducts, all contributing to the perpetuation of apical periodontitis (1–3). Lipopolysaccharides, one of the most important byproducts present on the outer layer of the membrane of gram-negative bacterial species (4–6), have been detected in 100% of the root canals with primary endodontic infection (1, 7, 8) with high levels closely related to severe inflammatory responses (7–10).

Although practitioners commonly use manual instrumentation, the use of nickel-titanium (NiTi) rotary files has become a standard technique because of their more rapid procedures (2, 3, 11, 12), more centered preparations (11–13), and less apical extrusion of debris (14, 15). Although ProTaper (Dentsply Maillefer, Ballaigues, Switzerland) and Mtwo (VDW, Munich, Germany) rotary systems have provided significant bacterial/endotoxin reductions (1, 3, 16, 17), no instrument can optimally make root canal systems free of bacteria (16, 18–21) and endotoxins (1, 7, 10, 22).

A new concept has recently proposed the use of a single-file system to shape the root canal completely from start to finish (2, 3, 23, 24), particularly the Reciproc (VDW) and WaveOne (Dentsply Maillefer) systems, which are 2 M-wire reciprocating systems (24). However, evidence on their cleaning and disinfecting abilities is only incipient.

Previous *in vitro* studies have evaluated the ability of single-file systems in shaping root canals regarding anatomy preservation (25), debris removal (26), apical extrusion of debris (27), cyclic fatigue resistance (23, 27, 28), cleaning effectiveness (24), and bacterial reduction/elimination (2, 3). However, no clinical study has compared the effectiveness of single-file reciprocating systems and rotary instrumentation in removing endotoxins from primarily infected root canals. Therefore, this clinical study was conducted to compare the effectiveness of single-file reciprocating systems

From the *Endodontic Division, Department of Restorative Dentistry, São José dos Campos Dental School, State University of São Paulo, UNESP, São Paulo, Brazil; and †Endodontic Division, Department of Restorative Dentistry, Fluminense Federal University, Niteroi, Rio de Janeiro, Brazil.

Address requests for reprints to Dr Frederico C. Martinho, Endodontic Division, Department of Restorative Dentistry, São José dos Campos Dental School, State University of São Paulo, UNESP, Eng Francisco José Longo, 777 São José dos Campos, São Paulo, SP, Brazil, CEP 12245-000. E-mail address: Frederico.martinho@fosjc.unesp.br

0099-2399/$ - see front matter

Copyright © 2014 American Association of Endodontists.

http://dx.doi.org/10.1016/j.joen.2013.12.006

and rotary systems in removing endotoxins and cultivable bacteria from primarily infected root canals.

Materials and Methods

Forty-eight patients requiring primary endodontic treatment were included in the present study. A detailed dental history was obtained from each patient. Those who had received antibiotic treatment during the last 3 months or who had any general disease were excluded. The Human Research Ethics Committee of the São José dos Campos Dental School approved the research protocol describing the sample collection for this investigation, and all volunteer patients signed an informed consent form.

All the selected teeth were single rooted with a primary endodontic infection showing the presence of 1 root canal and the absence of periodontal pockets deeper than 4 mm. None of the patients reported spontaneous pain. Teeth that could not be isolated with a rubber dam were excluded. The following clinical/radiographic features were found in root canals with primary endodontic infections investigated: pain on palpation (12/48), tenderness to percussion (16/48), and a radiolucent area greater than 3 mm in size (36/48).

Files, instruments, and all materials used in this study were treated with Co^{60} gamma radiation (20 kGy for 6 hours) for sterilization and the elimination of pre-existing endotoxins (EMBRARAD; Empresa Brasileira de Radiação, Cotia, SP, Brazil). The method used for disinfection of the operative field was previously described elsewhere (1, 7). Briefly, the teeth were isolated with a rubber dam. The crown and surrounding structures were disinfected with 30% hydrogen peroxide (volume/volume for 30 seconds) followed by 2.5% sodium hypochlorite (NaOCl) for the same period of time and then inactivated with 5% sodium thiosulfate. The sterility of the external surfaces of the crown was checked by taking a swab sample from the crown surface and streaking it onto blood agar plates, which were then incubated both aerobically and anaerobically.

A 2-stage access cavity preparation was made without the use of water spray but under manual irrigation with sterile/apyrogenic saline solution and using a sterile/apyrogenic high-speed diamond bur. The first stage was performed to promote a major removal of contaminants, including carious lesions and restoration. In the second stage, before entering the pulp chamber, the access cavity was disinfected according to the protocol described previously. Sterility of the internal surface of the access cavity was checked as previously described, and all procedures were performed aseptically. The first endotoxin sampling was taken by introducing sterile/apyrogenic paper points (size #15, Dentsply Maillefer) into the full length of the canal, which was determined radiographically and retained in position for 60 seconds for sampling. Immediately afterward, the sample was placed in a pyrogen-free glass and immediately suspended in 1 mL limulus amebocyte lysate (LAL) water according to the endotoxin dosage by using a kinetic chromogenic LAL (Lonza, Walkersville, MD) assay. This sampling procedure was repeated with 3 paper points that were pooled in a sterile tube containing 1 mL Viability Medium Göteborg Agar III (VMGA III) transport medium (29) for microbial cultivation.

After accessing the pulp chamber and subsequent first endotoxin sampling, teeth were randomly divided into 4 groups: WaveOne (n = 12), Reciproc (n = 12), ProTaper (n = 12), and Mtwo (n = 12). After the first sampling, the root canal length was determined from the preoperative radiograph and confirmed using an apex locator (Novapex; Forum Technologies, Rishon le-Zion, Israel). The root canals were then prepared according to the group selection.

All instruments were set into permanent rotation with a 6:1 contra-angle handpiece (Sirona, Bensheim, Germany) powered by a torque-limited electric motor (VDW.Silver Reciproc motor, VDW). For each Mtwo and ProTaper file, individual torque limit and rotational speed programmed in the file library of the motor were used, whereas Reciproc and WaveOne were used in a reciprocating working motion generated by the motor. The preparation sequences were as follows.

Group WaveOne

The WaveOne instruments were used according to the manufacturer's instructions. A size #25 WaveOne file with a 0.08 taper (Dentsply Maillefer) was used in a reciprocating motion. The instrument was used in an in-an-out pecking motion of about 3 mm in amplitude with apical pressure. After 3 pecking motions, the instrument was removed from the canal and cleaned. Next, a size #15 K-type file was taken to the working length (WL) to check whether the canal was patent. These procedures were repeated until the WaveOne instrument reached the WL (−1 mm).

Group Reciproc

The Reciproc R40 instruments were used according to the manufacturer's instructions. The Reciproc R40 instrument was introduced into the canal until resistance was felt and then activated in a reciprocating motion. The instrument was used in an in-an-out pecking motion of about 3 mm in amplitude with apical pressure. After 3 pecking motions, the instrument was removed from the canal and cleaned. Next, a size #15 K-type file was taken to the WL (−1 mm) to check whether the canal was patent. These procedures were repeated until the Reciproc instrument reached the WL.

Group ProTaper

ProTaper instruments were used according to the manufacturer's instructions in a gentle in-and-out motion. Afterward, the instrument was removed from the canal and cleaned. Next, a size #15 K-type file was taken to the WL (−1 mm) to check whether the canal was patent. The instrumentation sequence was as follows: SX instrument at two thirds of the WL, S1 instrument at the WL (−1 mm) (taper = 0.02–0.11, size #17), S2 instrument at the WL (−1 mm) (taper = 0.04–0.115, size #20), F1 at the WL (−1 mm) (taper = 0.055–0.07, size #20), F2 instrument at the WL (−1 mm) (taper = 0.055–0.08, size #25), and F3 instrument at the WL (taper = 0.05–0.09, size #30).

Group Mtwo

All Mtwo instruments were used to the full length of the canals (single length technique) according to the manufacturer's instructions in a gentle in-and-out motion. Next, the instrument was removed from the canal and cleaned. Next, a size #15 K-type file was taken to the WL (−1 mm) to check whether the canal was patent. The instrumentation sequence was as follows: a 0.04 taper size 10 instrument, a 0.05 taper size #15 instrument, a 0.06 taper size #20 instrument, a 0.06 taper size #25 instrument, and a 0.05 taper size #30 instrument.

Irrigation was performed with disposable syringes and 30-G NaviTip needles (Ultradent, South Jordan, UT) by using 5 mL 2.5% NaOCl solution between the pecking sequences (groups 1 and 2) and between files (groups 3 and 4). Before the second sampling after instrumentation, NaOCl was inactivated with 5 mL sterile 0.5% sodium thiosulfate during a 1-minute period, which was then removed with 5 mL sterile/apyrogenic water.

Before the second sampling (s2) after instrumentation, NaOCl was inactivated with 5 mL sterile 0.5% sodium thiosulfate during a 1-minute period, which was then removed with 5 mL sterile/apyrogenic water. Next, a new sampling procedure was performed as described previously at s1.

Download English Version:

https://daneshyari.com/en/article/3147892

Download Persian Version:

https://daneshyari.com/article/3147892

Daneshyari.com