A new instrument for root canal system finishing after chemomechanical preparation: XP-Endo Finisher

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• Conflicts of interest: none declared.

Abstract

Objective: the objective of this paper is to present a literature review on XP-endo Finisher, addressing the results of studies that evaluated this new endodontic instrument. **Material and Methods:** a search was undertaken in PubMed and Bireme databases between 2015 (when the instrument was launched to the market) and 2017 using the following descriptors: XP-endo Finisher. **Results:** eighteen papers were retrieved and divided into categories according to the type of evaluation: Removal of calcium hydroxide paste; Removal of triple antibiotic paste; Removal of filling material; Extrusion of sodium hypochlorite during instrumentation; Extrusion of dentin debris during instrumentation; Antimicrobial and antibiofilm action; and removal of smear layer and debris. **Conclusion:** according to the papers reviewed in this study, it may be concluded that XP-endo Finisher may have a positive impact on the endodontic treatment. This instrument showed promising results for intracanal medication removal; filling material removal during endodontic retreatment; smear layer and debris removal; enhance of the antimicrobial action of irrigants; and improvement of biofilm removal.

Keywords: Endodontic treatment; XP-endo finisher; Root canal instrumentation.

Introduction

The root canal system (RCS) has a variable anatomy and zones of anatomical complexities such as lateral canals, C-shaped canals, irregularities and isthmuses. Although the advent of nickel-titanium (NiTi) endodontic instruments has enabled an advance in root canal cleaning and shaping, studies have shown that, in general, the currently available instruments reach only 45-55% of the canal walls, leaving untouched areas after endodontic treatment.[1-3]

XP-endo Finisher (FKG Dentaire, La Chaux-de-Fonds, Switzerland; Figure 1) has recently been introduced in Endodontics as a new concept of anatomical instrument, originally designed to be used following RCS preparation to enhance cleaning. The XP-endo Finisher has a small core size (ISO 25 in diameter), zero taper (25/.00) and triangular cross section. It is produced using an exclusive, patented NiTi MaxWire alloy (Martensite-Austenite Electropolish Flex FKG Dentaire), which reacts differently at different temperature levels. The shape-memory principles of this alloy resulted in a highly flexible instrument that changes its shape according to the temperature at which it comes into contact. The file is straight (Figure 1A) in its martensitic phase (M phase) at room temperature (25°C). When the file is exposed to the body temperature (37°C inside the canal), it changes its shape due to its molecular memory to the austenitic phase (A-phase), expanding within the root canal and assuming a convex shape with a 1.5 mm depth in the final 10 mm of its length (Figure 1B). According to the manufacturer, the A-phase shape in the rotation mode (800 rpm 1N.cm^{-1}) allows the file to access and clean areas that are otherwise impossible to reach with standard instruments, preserving dentin and canal morphology.

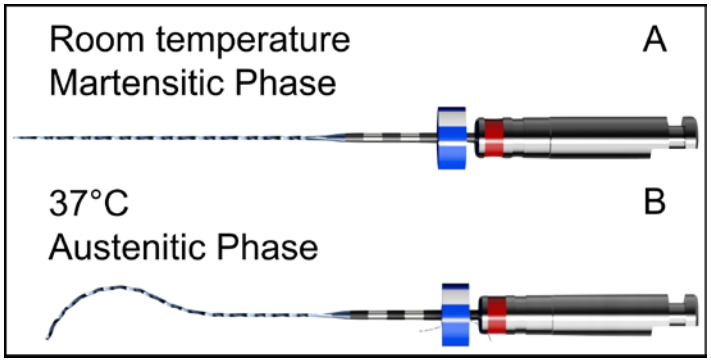

Figure 1. XP-endo Finisher instrument

A number of studies have been conducted to evaluate the performance of this instrument.[1,4-20] The objective of this paper is to present a literature review on XP-endo Finisher, addressing the results of studies that evaluated this new endodontic instrument.

Material and Methods

This study is a literature review designed to assess the forms of use and the main outcomes in the literature regarding the XP-endo Finisher. A search was undertaken in PubMed and Bireme electronic databases between 2015 (when the instrument was launched to the endodontic market) and 2017 using the following descriptors: XP-endo Finisher.

Results

Eighteen papers that met the inclusion criteria were selected and divided into categories according to the type of evaluation of XP-endo Finisher for the following purposes:

Removal of calcium hydroxide paste; Removal of triple antibiotic paste; Removal of filling material; Extrusion of sodium hypochlorite during instrumentation; Extrusion of dentin debris during instrumentation; Antimicrobial and antibiofilm action; and removal of smear layer and debris.

Literature Review

Removal of Calcium Hydroxide Intracanal Medication

Several studies have assessed the capacity of Endo XP-Finisher for removing calcium hydroxide from the RCS. In general, the studies have shown that this new instrument is more efficient in promoting greater removal of calcium hydroxide than the conventional needle and syringe irrigation (CNI)[4-8] When the XP-Endo Finisher was compared with passive ultrasonic irrigation (PUI), the results were conflicting. Hamdan *et al*.[9] was the only published study that found a better result for calcium hydroxide removal with XP-Endo Finisher. All other studies[4-8] showed similar efficiency of XP-Endo Finisher and PUI and both provided greater removal of calcium hydroxide from the RCS than CNI. In all these studies cavities were prepared inside the main canal simulating an area of resorption and, in all of them, the mechanized instruments promoted a better removal of intracanal medication from canal irregularities.

Other calcium hydroxide removal protocols have also been evaluated in comparison with the XP-Endo Finisher. Gokturk *et al*.[4] compared XP-Endo Finisher with laser- activated irrigation, Canal Brush, Vibringe, PUI, beveled needle conventional irrigation and double side-vented needle conventional irrigation. The laser-activated irrigation and PUI removed more calcium hydroxide in all root thirds; there was no statistically significant difference between PUI and XP-endo Finisher in the cervical third. Kfir *et al*.[5] evaluated the effectiveness of XP-endo Finisher, self-adjusting file (SAF) system, PUI and CNI in the removal of calcium hydroxide from irregularities simulated in maxillary central incisors. In that work no significant difference was found between XP-Endo Finisher, SAF and IUP, and all tested systems provided greater removal than CNI. Keskin *et al*.[6] prepared cavities inside the main canal of single-rooted teeth to simulate resorption and evaluated the removal of intracanal medication from this region with XP-endo Finisher, PUI, Endo-activator and Canal Brush. The authors found that Endo XP-Finisher and PUI were the most efficient of all techniques. Uygun *et al*.[7] compared the efficacy of XP-Endo Finisher, 3D TRU Shape instrumentation system, PUI and CNI for calcium hydroxide removal from artificial cavities. All tested systems removed more calcium hydroxide than the CNI. It is important to mention that in none of the studies, XP-Endo Finisher or any other irrigation or irrigant activation method was capable to remove completely the calcium hydroxide paste from the root canals.

Removal of Triple Antibiotic Paste

The use of pastes containing antimicrobial agents is indicated in cases of revascularization in immature teeth with an open apex and its removal is important for the correct revascularization protocol. Two studies were conducted to evaluate the use of XP-endo Finisher for triple antibiotic paste removal from root canals. Turkaydin *et al*.[10] compared XP-endo Finisher with PUI and CNI and found that XP-endo Finisher was more efficient in all three root thirds. In contrast, Gokturk *et al*.[11] observed a similar performance for paste removal in the cervical third comparing XP-endo Finisher, PUI, Vibringe device and CNI. In both studies, none of the techniques was capable to remove completely the triple antibiotic paste from the root canals.

Removal of the Filling Material

Several studies have evaluated the efficiency of XP-endo Finisher for removing filling material from the RCS following endodontic retreatment.[1,2-14.] The studies are unanimous in stating that the use of XP-endo Finisher improves considerably the removal of residual filling material. However, even after use of XP-endo Finisher, filling material remnants were observed inside the RCS, demonstrating that its use improves cleaning but does not eliminate completely the filling material.

Sodium Hypochlorite Extrusion During Instrumentation with XP-endo Finisher

A recent study[15] compared the volumes of sodium hypochlorite apically extruded by five irrigant activation systems: XP-endo Finisher, negative pressure irrigation (Endovac), PIPs, Endoactivator and CNI. Endovac resulted in the lowest extrusion of sodium hypochlorite, while PIPs was associated with the highest extrusion of irrigant. There were no differences between XP-endo Finisher, Endoactivator and CNI.

Dentin Debris Extrusion During Instrumentation with XP-endo Finisher

During the chemomechanical preparation of the RCS, dentin debris, microorganisms and irrigating solutions can be extruded into periradicular tissue. Apical extrusion of dentin debris was evaluated by Kfir *et al*.[16] comparing two instrumentation techniques: SAF system and ProTaper Next plus XP-endo Finisher. The results showed that the although SAF system produced less apical extrusion, all techniques were associated with extrusion of dentin debris into the periapical region.

Antimicrobial and Antibiofilm Action Associated with the use of XP-endo Finisher

lves *et al*.[1] evaluated the capacity of XP-endo Finisher to

cleanse root canals contaminated with *Enterococcus faecalis* and found it more efficient in reducing microorganisms counts than PUI. However, none of the techniques was able to properly disinfect the isthmus areas.

The efficiency of XP-endo Finisher for radicular biofilm removal was compared with PUI and CNI.[17] The results showed that the use of XP-endo Finisher provided the best results, followed by PUI and CNI.

Azim *et al.*[18] evaluated the efficacy of four irrigation protocols in killing bacterial colonies in dentinal tubules: XP-endo Finisher, PIPs, EndoActivator and CNI. XP-endo Finisher showed the best cleansing in all root thirds compared with CNI and EndoActivator and PIPs, at 50 µm depth. At a greater depth (150 µm), PIPs was more efficient than all other techniques.

Removal of Smear Layer and Debris

Elnaghy *et al.*[19] evaluated the capacity of XP-endo Finisher to be used as an additional tool for removing smear layer in curved canals. This instrument was compared with EndoVac, CNI and manual agitation of endodontic instruments. The results showed that XP-endo Finisher was more efficient in removing smear layer than CNI and manual agitation, but no significant difference was observed between XP-endo Finisher and EndoVac.

In another study,[20] XP-endo Finisher and PUI were more efficient than CNI and SAF system for removing debris from the mesial root of mandibular molars.

Conclusion

According to the outcomes of the studies retrieved in this literature review, it may be concluded that the instrument XP-endo Finisher can have a positive impact on the endodontic treatment. This instrument showed promising results regarding removal of intracanal medication, removal of filling material during endodontic retreatment; removal of smear layer and dentin debris; enhancement of the antimicrobial action of irrigants and improvement of biofilm removal.

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Mini Curriculum and Author's Contribution

1. Nathália Faria Valente – DDS. Contribution: bibliographical research, manuscript writing.
2. Juliana Zumpichiatti Paredes de Oliveira – DDS. Contribution: bibliographical research, manuscript writing.
3. Ana Vitória Moura de Carvalho Valoura – DDS. Contribution: bibliographical research, manuscript writing.
4. Fernanda Hecksher – DDS and MSc. Contribution: manuscript writing, manuscript review.
5. Edson Jorge Lima Moreira – DDS and PhD. Contribution: manuscript writing, manuscript review.
6. Emmanuel João Nogueira Leal da Silva – DDS and PhD. Contribution: manuscript writing, manuscript review, work supervisor and paper submission.

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