Use of XP-Endo system to clean the root canal system of a tooth with internal resorption and pulp necrosis: case report

Viviane Loiola Andrade da **ROSA**[1]
Renata Costa Val **RODRIGUES**[2,3]
Carlos Vieira **ANDRADE JUNIOR**[1,3]

DOI: https://doi.org/10.14436/2358-2545.9.1.065-071.oar

ABSTRACT

Objective: This study presented a case of internal root resorption in a tooth with pulp necrosis that was submitted to endodontic treatment. In this treatment, an additional irrigation technique with a XP-Endo Finisher instrument was used during the chemical-mechanical preparation. **Methods:** After radiographic diagnostics and semi-technique tests, instrumentation was performed with Protaper universal system, activation of irrigation solutions, 2% chlorhexidine digluconate with the XP-Endo Finisher file, removal of the smear layer with EDTA 17% activated with the same system, intracanal medication Calen with paramonochlorophenol, temporary sealing of the tooth crown with Coltosol. In the second session, an obturation procedure was performed using the Schilder technique associated with the Tagger hybrid technique. **Conclusions:** The XP-Endo Finisher system was effective as supplementary irrigation technique and it facilitated the cleaning of the root canal system.

Keywords: Dental Pulp Necrosis. Tooth Resorption. Endodontics.

How to cite: Rosa VLA, Rodrigues RCV, Andrade Junior CV. Use of XP-Endo system to clean the root canal system of a tooth with internal resorption and pulp necrosis: case report. Dental Press Endod. 2019 Jan-Apr;9(1):65-71. DOI: https://doi.org/10.14436/2358-2545.9.1.065-071.oar

[1]Universidade Estadual do Sudoeste da Bahia, Departamento de Saúde I, Disciplina de Endodontia (Jequié/BA, Brazil).

[2]Universidade Veiga de Almeida, Disciplina de Endodontia (Rio de Janeiro/RJ, Brazil).

[3]Doctorate degree in Endodontics, Universidade Estácio de Sá (Rio de Janeiro/RJ, Brazil).

» The authors report no commercial, proprietary or financial interest in the products or companies described in this article.

» Patients displayed in this article previously approved the use of their facial and intraoral photographs.

Submitted: 09/11/2017. Revised and accepted: 17/11/2017.

Contact address: Carlos Vieira Andrade Junior
Universidade Estadual do Sudoeste da Bahia. Departamento de Saúde 1
Av. José Moreira Sobrinho, s.n., Jequiezinho – Jequié/BA – CEP: 45.206-510
E-mail: carlos@uesb.edu.br

Introduction

Dental resorption is a process related to a physiological or pathological condition that results in loss of dentin, cementum or bone.[1] Root resorption can be classified as external or internal[2] and it consists of loss of mineralized tissue due to clastic cell activity.[3]

Internal root resorption results from a pathological process that is caused by the action of clastic cells leading to dentin loss.[4] These cells are taken to the pulp chamber by the blood supply, and the process of resorption occurs due to pulpal inflammation.[4] Several etiological factors may cause the reabsorption process, among them, partial pulp removal, caries, trauma, extreme heat, pulp capping with calcium hydroxide and pulpotomy,[5] but the main risk factors are trauma and infection.[6,7]

Clinically, the pathology is usually asymptomatic and a reddish/pink spot may be present due to the presence of granulation tissue in the reabsorbed area[2,8] that can be detected in radiological examinations[1] as a radiolucent area around the pulp cavity, usually affecting incisors and mandibular molars.[8]

The correct procedure for internal root resorption consists of endodontic treatment to remove the blood supply to the resorption cells.[3,9,10]

An essential point for the success of endodontic treatment in these cases is complete cleaning of the resorption space as well as sealing it with adequate material.[8] However, the destruction of the root canal walls forms concave areas which can be a great obstacle and impair treatment since the removal of the granulation tissue in this area is difficult, which could lead to obturation failure of the root canal because the reabsorbed area should be filled completely.[11]

Because the shape of the defect caused by resorption usually makes direct mechanical instrumentation impracticable,[3] sodium hypochlorite solution (NaOCl) has widely been used as it dissolves vital and necrotic pulp tissues,[9] but the use of more effective irrigation techniques is essential to disinfect the root canal.[12,13]

Infection control is imperative to maintain periradicular health,[14] either by using chemical substances such as NaOCl and chlorhexidine digluconate (CHX)[15] or supplementary irrigation protocols, which promote agitation of the irrigation substance, favoring its action in the most remote areas of the root canal system.[13]

Among the irrigation activation techniques, the XP-Endo, which is a disinfection system that has been a recently released on the market, disrupts bacterial biofilm and contributes to the effective cleaning of the root canal system while preserving dentin.[16] Therefore, the aim of this study was to report and discuss the case of a patient with internal root resorption and pulp necrosis who underwent endodontic treatment using a supplementary irrigation technique with the XP-Endo Finisher.

Clinical case report

The 29-year-old female patient, F.A.G.S, presented to the private practice reporting high sensitivity in tooth 12. At radiographic examination, an image suggestive of internal radicular resorption was observed. The patient reported having undergone restorative treatment of the tooth four years ago, but presented no history of trauma to the tooth or region.

No change was observed on the extraoral examination. During inspection, the presence of composite resin restoration (resin facet) was observed in tooth 12. The semi-technical tests yielded the following results: negative response to palpation, percussion, and cold sensitivity test with cold spray at -50°C (Endo-frost, Coltene, Germany). The radiographic examination revealed a radiolucent area within the root canal compatible with internal root resorption and presence of a small radiolucent area in the periapical region suggestive of periradicular lesion (Fig 1). In view of the signs and symptoms, the diagnosis was of pulp necrosis and internal root resorption.

After approval by the Research Ethics Committee (CEP), CAAE 56995416.5.0000.0055, the endodontic treatment of tooth 12 began, which was carried out in 2 sessions. The first session included infiltrative anesthesia, absolute isolation of the operative field, coronary access with a #1014 HL drill (KG Sorensen, São Paulo, Brazil) and Endo-Z drill (Dentsply Maillefer, Ballaigues, Switzerland), establishment of a glide path with #10 K-file (Dentsply Maillefer, Ballaigues, Switzerland) 4 mm short from the apparent tooth length (CAD-4), instrumentation at patency length (CP = 21 mm) using a Protaper Universal® system (Dentsply Maillefer, Ballaigues, Switzerland) coupled to the X Smart® motor (Dentsply Maillefer, Ballaigues, Switzerland) and instrumentation with the F3 instrument. At completion of preparation, the irrigation solution 2% CHX (Marcela Dourada, Jequié, BA) was agitated with XP-Endo Finisher file (FKG, La Chaux-de-Fonds, Switzerland).

The instrument was used in accordance with the manufacturer's protocol, following the steps: 1- the working length (CT) was established using the millimeter plastic tube to adjust the rubber stop; the instrument was cooled inside the tube with application of Endo-frost; 2 - the XP-Endo Finisher file was placed in rotation mode, removing it from the tube by applying lateral movement to ensure that the instrument remained in a straight position, turning off rotation soon after the procedure; the XP-Endo tip was inserted into the root canal, which was previously filled with the irrigation solution, and the motor (VDW Reciproc Gold, VDW, München, Germany) was then activated (800 rpm); the instrument was used for about one minute with gentle in-and-out movements along the entire length of the root canal, allowing it to act also where the resorbed dentin area was located, being withdrawn from the interior of the canal still in rotation (Fig 2).

After final irrigation, the XP-Endo Finisher file was also used to remove the smear layer using 17% EDTA (Marcela Dourada, Jequié, BA) during activation. Finally, the intracanal medication Calen was inserted with PMCC (SS White, Rio de Janeiro, RJ) and temporary sealing of the dental crown was performed with Coltosol (Vigodent, Rio de Janeiro, RJ).

In the second session, 19 days after the first session, after removal of the intracanal medication, the gutta-percha cone M (Odous de Deus, Belo Horizonte, MG) was fitted, the test cone was radiographed (Fig 3), the gutta-percha cones were disinfected with 2% CHX gel (Marcela Dourada, Jequié, BA), the root canal was dried with absorbent paper cones (MetaBiomed, Korea) and the canal was obturated with the gutta-percha (Odous de Deus, Belo Horizonte, MG), and Endomethasone N endodontic cement (Septodonto, France). For the obturation (Fig 4), the Schilder technique was used with the touch'n heat technique (Sybron Dental Specialites, USA) associated with the Tagger hybrid technique using the #50 Mcspadden compactor (Dentsply Maillefer, Ballaigues, Switzerland). The tooth was sealed with Coltosol (Coltene, Brazil) and Riva light-cured glass ionomer cement (SDI, Bayswater, Australia).

Figure 1. Initial X-ray of element #12.

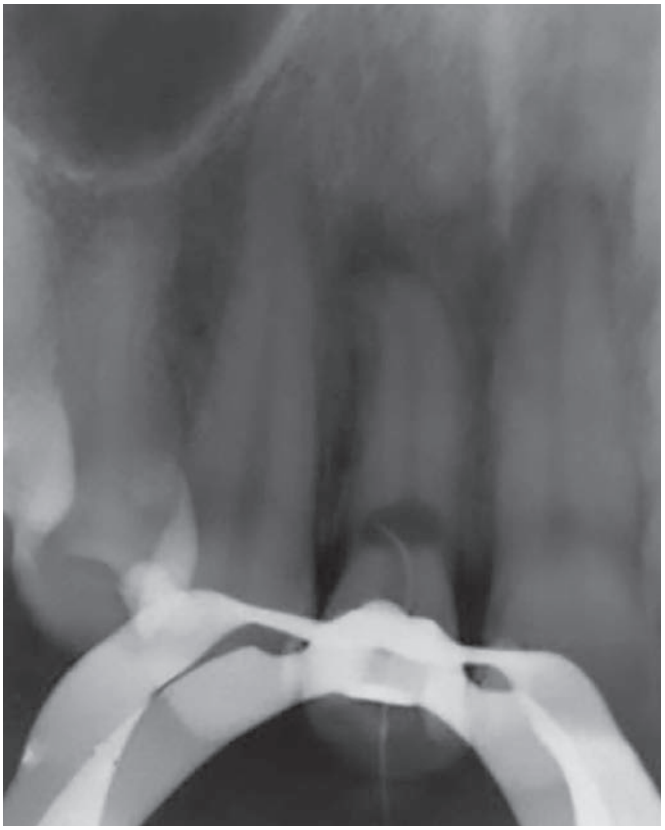

Figure 2. XP-Endo Finisher inside the root canal.

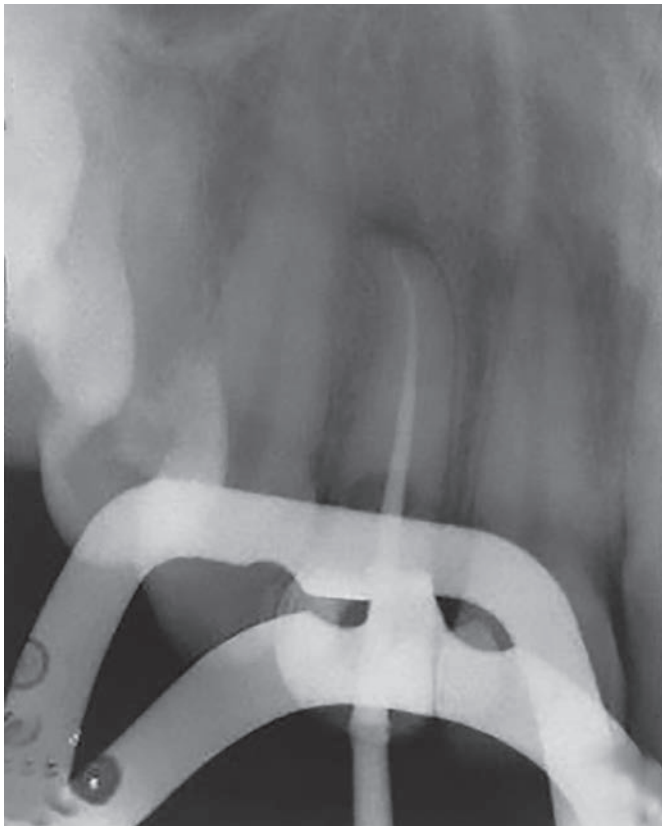

Figure 3. Cone test radiograph.

Figure 4. Final radiograph.

Discussion

In the present report, we discussed a case of internal root resorption in a tooth with pulp necrosis. Internal root resorption is relatively rare and its etiology and pathogenesis have not been fully explained[17]. However, the resorptive process is associated with teeth with pulp vitality whose vital tissue nourishes the clastic cells.[1,2,10,18,19] For this reason, successful endodontic treatment is obtained in these cases as the blood supply and the process resorption is interrupted. However, in the present case, the tooth presented an image suggestive of internal dental resorption and pulp necrosis was confirmed by the semi-technical tests.

Normally in cases of internal root resorption the coronary pulp is necrotic and the destruction of dentin progresses to the root area, so the tooth may present a negative response to the thermal sensitivity test, although the apical pulp is still vital, which is not consistent with the present report, since the radiographic examination shows a small radiolucent area in the periapical region suggestive of periradicular lesion.[21]

The presence of internal tooth resorption associated with pulp necrosis is a challenge for endodontic treatment as the areas of resorbed dentin can serve as niches for the accumulation of dental biofilm. Thus, mechanical instrumentation during the preparation of the root canal does not reach biofilm because the new morphology of the reabsorbed canal hinders the direct action of the instruments.[3,22] Therefore, in the present case, the major challenges were the decontamination of

the root canal system, including areas of resorbed dentin, and adequate root canal obturation.[3,23-25]

The success of endodontic treatment depends on the significant removal of necrotic tissues, microorganisms and their products from the root canal system.[26] Instrumentation along with irrigation procedures by means of chemical-mechanical techniques are essential for the decontamination of the root canal[15] and the use of an irrigation substance with antimicrobial capacity is required to optimize disinfection.[27]

Among the irrigation solutions, the most widely used is NaOCl due to its bactericidal properties and ability to dissolve necrotic tissue.[28] However, the disadvantages of this substance include odor, discoloration, corrosion of instruments, and toxicity.[29] Because of its toxicity, NaOCl is a potential irritant to the periapical tissues, especially at high concentrations,[30] so alternative irrigation solutions with fewer side effects such as CHX have been used[31]. Chlorhexidine does not dissolve the tissue, but its significant antibacterial activity against oral bacteria[32], biocompatibility, absence of toxicity[33] and, its most important characteristic, substantivity,[34] may contribute to prolonged antibacterial effects.[35] In addition, the literature has shown that both NaOCl and CHX are equally effective in fighting root canal infection.[15,31,35-38]

Disinfection carried out by means of chemical substances, in cases where the anatomy of the canal system is more complex, should be potentialized with the aid of instruments that activate the substance,[13] since the conventional syringe and needle irrigation method is ineffective in promoting the cleaning of teeth with anatomical complexities.[39] In cases of internal root resorption, due to restrict access to the resorption cavity, activation of the irrigation substance is needed to improve the effectiveness of disinfection in this area.[40] To help clean the most remote areas of the SCR, different irrigation devices have been developed with the purpose of improving the flow and distribution of irrigation solutions in the root canal[39] as well as maximizing disinfection.[12]

In the present case, 2% CHX was as used, but its main disadvantage in comparison to NaOCl is its inability to dissolve organic matter.[33] To compensate for this limitation, a final supplementary irrigation protocol with the XP-Endo Finisher file was used. This file can promote the agitation of the irrigation solution, favoring the more complex areas of the root canal and cleaning by physical action in these areas.[16]

Among the different activation methods available, the most common are the Self-Adjusting File (SAF), Photon-Induced Photoacoustic Streaming (PIPS), Passive Ultrasonic Irrigation (PUI), EndoActivator, and XP-Endo Finisher.[12,13,41] The XP-Endo Finisher, used in this case report, is a new instrument that is incredibly flexible, highly resistant to cyclic fatigue and zero taper design, that can clean the dentin walls without causing unnecessary removal of dentin, while preserving the original shape of the root canal.[16]

The XP-Endo Finisher is made of an NiTi alloy called MaxWire that reacts to different temperature levels by being highly flexible. In its M-phase (Martensitic), when the instrument is cooled (= 20°C), it is straight; however, when it is introduced into the root canal, the body temperature (= 35°C) causes it to modify its shape, due to its molecular memory, to the A-phase (Austenitic). In the austenitic phase, the XP-Endo Finisher returns to its original shape and thanks to this new shape allied to the flexibility of the alloy, the instrument can reach areas that were previously impossible to be reached, allowing the removal of debris, medication, and even filling residue in cases of retreatment. It is important to note that, according to the manufacturer, the instrument can be used in any root canal that has been enlarged up to diameter 25 (Ø = 25 mm) and it can be used to clean a tooth with up to four root canals.[42]

In a recent study, it was found that the activation of the irrigation solution in curved root canals using XP-Endo Finisher and EndoActivator proved to be more efficient to remove debris and smear layer when compared with the other groups in which the irrigation solution was not activated or it was done with an endodontic file and no significant differences were found between these two methods[43]. Another study showed that PUI and XP-Endo Finisher resulted in lower levels of accumulated dentin debris compared to conventional irrigation and SAF[41]. The XP-Endo Finisher is an excellent complementary method to aid the removal of filling material in curved canals[44] and disinfect root canals.[12]

The irregularity of the internal resorption cavity makes it difficulty not only for instrumentation and disinfection of the reabsorbed area, but also during obtu-

ration.[4,10,23,24,25] Thus, in these cases, the filling material needs to be fluid[45] to be able to seal the resorption failure, and the obturation technique with gutta-percha plasticization is the most indicated because it yields better results.[4,46,47] Thus, in the present case report, the Schilder technique associated with the Tagger hybrid technique was used with the purpose of obtaining improved filling of the resorbed areas, as it was confirmed by the final radiography.

Conclusion

According to the findings, it may be concluded that, after correct diagnosis, endodontic treatment following complete cleaning of the root canal is required to obtain successful treatment. The activation of the irrigation solutions are important auxiliaries for efficient disinfection and the XP-Endo Finisher file proved to be an effective supplementary irrigation step to promote the cleaning of SCR.

References

1. Ne RF, Witherspoon DE, Gutmann JL. Tooth resorption. Quintessence Int. 1999;30(1):9-25.
2. Tronstad L. Root resorption-etiology, terminology and clinical manifestations. Endod Dent Traumatol. 1988 Dec;4(6):241-52.
3. Patel S, Ricucci D, Durak C, Tay F. Internal root resorption: a review. J Endod. 2010;36(7):1107-21.
4. Nilsson E, Bonte E, Bayet F, Lasfargues JJ. Management of internal root resorption on permanent teeth. Int J Dent. 2013;2013:929486.
5. Yadav P, Rao Y, Jain A, Relhan N, Gupta S. Treatment of internal resorption with mineral trioxide aggregates: a case report. J Clin Diagn Res. 2013;7(10):2400-1.
6. Wedenberg C, Lindskog S. Experimental internal resorption in monkey teeth. Endod Dent Traumatol. 1985 Dec;1(6):221-7.
7. Prata MIA, Villa N, Rodrigues HA, Cardoso RJA. Avaliação da reabsorção radicular apical externa e interna, em dentes com lesões periapicais. JBE. 2002;3(10):222-8.
8. Silveira FF, Nunes E, Soares JA, Ferreira CL, Rotstein I. Double 'pink tooth' associated with extensive internal root resorption after orthodontic treatment: a case report. Dent Traumatol. 2009 June;25(3):e43-7.
9. Haapasalo M, Endal U. "Internal inflammatory root resorption: the unknown resorption of the tooth," Endod Topics. 2006;14(1):60-79.
10. Mohammadi Z, Yazdizadeh M, Shalavi S. Non-surgical repair of internal resorption with MTA: a case report. Iran Endod J. 2012;7(4):211-4.
11. Barbizam JVB, Paranhos MPG, Tonomaru Filho M. Reabsorção dentária interna: obturação do canal radicular pela técnica termoplástica híbrida. Rev Fac Odontol Lins. 2003;15(1):7-10.
12. Azim AA, Aksel H, Zhuang T, Mashtare T, Babu JP, Huang GT. Efficacy of 4 irrigation protocols in killing bacteria colonized in dentinal tubules examined by a novel confocal laser scanning microscope analysis. J Endod. 2016;42(6):928-34.
13. Topçuoglu HS, Düzgün S, Ceyhanli KT, Akti A, Pala K, Kesim B. Efficacy of different irrigation techniques in the removal of calcium hydroxide from a simulated internal root resorption cavity. Int Endod J. 2015;48(4):309-16.
14. Siqueira JF Jr, Rôças IN. Clinical implications and microbiology of bacterial persistence after treatment procedures. J Endod. 2008 Nov;34(11):1291-1301.e3.
15. Ercan E, Ozekinci T, Atakul F, Gül K. Antibacterial activity of 2% chlorhexidine gluconate and 5.25% sodium hypochlorite in infected root canal: in vivo study. J Endod. 2004 Feb;30(2):84-7.
16. Trope M, Debelian G. XP-3D FinisherTM file-the next step in restorative endodontics. Endod Pract US. 2015;8:22-4.
17. Levin L, Trope M. Root resorption. In: Hargreaves KM, Goodis HE, eds. Seltzer and Bender's dental pulp. Chicago, IL: Quintessence; 2002. p. 425-48.
18. Bakland L. Root resorption. Dent Clin North Am. 1992;36(2):491-507.
19. Mittal S, Kumar T, Mittal S, Sharma J. "Internal root resorption: An endodontic challenge": A case series. J Conserv Dent. 2014;17(6):590-3.
20. Lopes HP, Rôças, IN. Siqueira Junior JR. Reabsorção Dentária. In: Lopes HP, Siqueira Junior JF. Endodontia- Biologia e Técnica. 2a ed. Rio de Janeiro: Guanabara Koogan; 2004. p. 837-70.
21. Castellucci A. Root resorption. In: Castellucci A, editor. Endodontics. Firenze: Tridente; 2009. p. 868-903.
22. Trope M. Root resorption due to dental trauma. Endod Topics. 2002;1(1):79-100.
23. Meire M, De Moor R. Mineral trioxide aggregate repair of a perforating internal resorption in a mandibular molar. J Endod. 2008 Feb;34(2):220-3.
24. Andreasen JO, Andreasen FM. Textbook and color atlas of traumatic injuries to the teeth. 3th ed. St. Louis: Munksgaard & Mosby; 1994. p. 370-2.
25. Keinan D, Heling I, Stabholtz A, Moshonov J. Rapidly progressive internal root resorption: a case report. Dent Traumatol. 2008 Oct;24(5):546-9.
26. Gu LS, Kim JR, Ling J, Choi KK, Pashley DH, Tay FR. Review of contemporary irrigant agitation techniques and devices. J Endod. 2009 June;35(6):791-804.
27. Siqueira Junior JF, Rôças IN, Favieri A, Lima KC. Chemomechanical reduction of the bacterial population in the root canal after instrumentation and irrigation with 1%, 2.5%, and 5.25% sodium hypochlorite. J Endod. 2000 June;26(6):331-4.
28. Michelotto ALC, Andrade BM, Silva Júnior JA, Sydney GB. Clorexidina na terapia endodôntica. RSBO. 2008;5(1):125-39.

29. Weber CD, McClanahan SB, Miller GA, Diener-West M, Johnson JD. The effect of passive ultrasonic activation of 2% chlorhexidine or 5.25% sodium hypochlorite irrigant on residual antimicrobial activity in root canals. J Endod. 2003;29(9):562-4.
30. Gernhardt CR, Eppendorf K, Kozlowski A, Brandt M. Toxicity of concentrated sodium hypochlorite used as an endodontic irrigant. Int Endod J. 2004 Apr;37(4):272-80.
31. Gonçalves LS, Rodrigues RC, Andrade Junior CV, Soares RG, Vettore MV. The effect of sodium hypochlorite and chlorhexidine as irrigant solutions for root canal disinfection: a systematic review of clinical trials. J Endod. 2016;42(4):527-32.
32. Batista MM, Fraga RC, de Uzeda M. Antibacterial effects of endodontic irrigants on black-pigmented gram-negative anaerobes and facultative bacteria. J Endod. 1998;24(6):414-6.
33. Marion J, Pavan K, Arruda MEBF, Nakashima L, Morais CAH. Chlorhexidine and its applications in Endodontics: a literature review. Dental Press Endod. 2013;3(3):36-54.
34. Rosenthal S, Spangberg L, Safavi K. Chlorhexidine substantivity in root canal dentin. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2004 Oct;98(4):488-92.
35. Rôças IN, Provenzano JC, Neves MA, Siqueira Junior JF. Disinfecting effects of rotary instrumentation with either 2.5% sodium hypochlorite or 2% chlorhexidine as the main irrigant: a randomized clinical study. J Endod. 2016 June;42(6):943-7.
36. Siqueira Junior JF, Rôças IN, Paiva SS, Guimarães-Pinto T, Magalhães KM, Lima KC. Bacteriologic investigation of the effects of sodium hypochlorite and chlorhexidine during the endodontic treatment of teeth with apical periodontitis. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2007;104(1):122-30.
37. Rico-Romano C, Zubizarreta-Macho A, Baquero-Artigao MR, Mena-Álvarez J. An analysis in vivo of intracanal bacterial load before and after chemo-mechanical preparation: A comparative analysis of two irrigants and two activation techniques. J Clin Exp Dent. 2016;8(1):e9-13.
38. Rôças IN, Siqueira Junior JF. Comparison of the in vivo antimicrobial effectiveness of sodium hypochlorite and chlorhexidine used as root canal irrigants: a molecular microbiology study. J Endod. 2011;37(2):143-50.
39. Mancini M, Cerroni L, Iorio L, Armellin E, Conte G, Cianconi L. Smear layer removal and canal cleanliness using different irrigation systems (EndoActivator, EndoVac, and passive ultrasonic irrigation): field emission scanning electron microscopic evaluation in an in vitro study. J Endod. 2013 Nov;39(11):1456-60.
40. Tasdemir T, Celik D, Er K, Yildirim T, Ceyhanli KT, Yesilyurt C. Efficacy of several techniques for the removal of calcium hydroxide medicament from root canals. Int Endod J. 2011 June;44(6):505-9.
41. Leoni GB, Versiani MA, Silva-Sousa YT, Bruniera JFB, Pecora JD, Sousa-Neto MD. Ex vivo evaluation of four final irrigation protocols on the removal of hard-tissue debris from the mesial root canal system of mandibular first molars. Int Endod J. 2017 Apr;50(4):398-406.
42. FKG Dentaire SA The XP-endo Finisher file Brochure. Available from: http://www.fkg.ch/sites/default/files/fkg_xp_endo_brochure_en_vb.pdf
43. Elnaghy AM, Mandorah A, Elsaka SE. Effectiveness of XP-endo Finisher, EndoActivator, and File agitation on debris and smear layer removal in curved root canals: a comparative study. Odontology. 2017 Apr;105(2):178-183.
44. Alves FR, Marceliano-Alves MF, Sousa JC, Silveira SB, Provenzano JC, Siqueira Junior JF. Removal of root canal fillings in curved canals using either reciprocating single- or rotary multi-instrument systems and a supplementary step with the XP-Endo Finisher. J Endod. 2016;42(7):1114-9.
45. Gencoglu N, Yildirim T, Garip Y, Karagenc B, Yilmaz H. Effectiveness of different gutta-percha techniques when filling experimental internal resorptive cavities. Int Endod J. 2008;41(10):836-42.
46. DuLac KA, Nielsen CJ, Tomazic TJ, Ferrillo Junior PJ, Hatton JF. Comparison of the obturation of lateral canals by six techniques. J Endod. 1999;25(5):376-80.
47. Wu MK, Kast'áková A, Wesselink PR. Quality of cold and warm gutta-percha fillings in oval canals in mandibular premolars. Int Endod J. 2001;34(6):485-91.