References

1. Occhi IGP, Souza AA, Rodrigues V, Tomazinho LF. Avaliação de sucesso e insucesso dos tratamentos endodônticos realizados na clínica odontológica da UNIPAR. UNINGÁ Review. 2011;8(2):39-46.
2. Gabardo MCL, Dufloth F, Sartoretto J, Hirai V, Oliveira DC, Rosa EAR. Microbiologia do insucesso do tratamento endodôntico. Rev Gestão Saúde. 2009;1(1):11-7.
3. Espíndola ACS, Passos CO, Souza EDA, Santos RA. Avaliação do grau de sucesso e insucesso no tratamento endodôntico em dentes uni-radiculares. Rev Gaúcha Odontol. 2002;50(3):164-6.
4. Tang L, Sun TQ, Gao XJ, Zhou XD, Huang DM. Tooth anatomy risk factors influencing root canal working length accessibility. Int J Oral Sci. 2011 July;3(3):135-40.
5. Lovdahl PE, Gutmann JL. Problems in locating and negotiating fine and calcified canals. In: Gutmann JL, Dumsha TC, Lovdahl PE, Hovland EJ, editors. Problems solving in endodontics: prevention, identification and management. 3rd ed. St. Loius: Mosby Tear Book; 1997. p. 69-89.
6. Haque S, Hossain Z. Pulp Calcification: Case reports with difficult Endodontic Problem. City Dent Coll J. 2010;9(1):19-22.
7. McCabe PS, Dummer PM. Pulp Canal obliteration: an endodontic diagnosis and treatment challenge. Int Endod J. 2012 Feb;45(2):177-97.
8. Leonardi D, Giovanini IF, Almeida S, Schramm CA, Baratto-Filho F. Alterações pulpares e periapicais. Rev Sul-Bras Odontol. 2011;8(4):47-61.
9. Kim S, Baek S. The microscope and endodontics. Dent Clin North Am. 2004 Jan;48(1):11-8.
10. Selden S. The role of dental operating microscope in improved nonsurgical treatment of “calcified” canals. Oral Surg Oral Med Oral Pathol. 1989 July;68(1):93-8.
11. Patel S, Durack C, Abella F, Shemesh H, Roig M, Lemberg K. Cone beam computed tomography in Endodontics - a review. Int Endod J. 2015 Jan;48(1):3-15.
12. McCabe PS, Dummer PM. Pulp canal obliteration: and endodontic diagnosis and treatment challenge. Int Endod J. 2012 Feb;45(2):177-97.
13. Kühl S, Payer M, Zitzmann NU, Lambrecht JT, Filippi A. Technical accuracy of printed surgical templates for guided implant surgery with the coDiagnostiXTM software. Clin Implant Dent Relat Res. 2015 Jan;17 Suppl 1:e177-82.
14. Neelakantan P1, Subbarao C, Subbarao CV. Comparative evaluation of modified canal staining and clearing technique, cone-beam computed tomography, peripheral quantitative computed tomography, spiral computed tomography, and plain and contrast medium-enhanced digital radiography in studying root canal morphology. J Endod. 2010 Sept;36(9):1547-51.
15. Patel S, Mannocci F, Shemesh H, Wu MK, Wesselink P, Lambrechts P. Radiographs and CBCT-time for a reassessment? Int Endod J. 2011 Oct;44(10):887-8.
16. van der Meer WJ, Vissink A, Ng YL, Gulabivala K. 3D Computer aided treatment planning in endodontics. J Dent. 2016 Feb;45:67-72.
17. Amir FA, Gutmann JL, Witherspoon DE. Calcific metamorphosis: a challenge in endodontic diagnosis and treatment. Quintessence Int. 2001 June;32(6):447-55.
18. Dula K, Bornstein mm, Buser D, Dagassan-Berndt D, Ettlin DA, Filippi A, et al. SADMFR guidelines for the use of cone-beam computed tomography/digital volume tomography. Swiss Dent J. 2014;124(11):1169-83.
19. Cunha FM, Souza IM, Monneral J. Pulp canal obliteration subsequent to trauma: perforation management with MTA followed by canal localization and obturation. Braz J Dent Traumatol. 2009;1(2):64-8.
20. Shah P, Chong BS. 3D imaging, 3D printing and 3D virtual planning in Endodontics. Clin Oral Investig. 2018 Mar;22(2):641-54.
21. Saunders WP, Saunders EM. Conventional endodontics and the operating microscope. Dent Clin North Am. 1997 July;41(3):415-28.
22. West JD. The role of the microscope in 21st century endodontics: visions of a new frontier. Dent Today. 2000 Dec;19(12):62-4, 66-9.
23. Patel S, Kanagasingam S, Mannocci F. Cone beam computed tomography (CBCT) in endodontics. Dent Update. 2010 July-Aug;37(6):373-9.
24. Sheehy EC, Roberts GJ. Use of calcium hydroxide for apical barrier formation and healing in non-vital immature permanent teeth: a review. Br Dent J. 1997 Oct 11;183(7):241-6.
25. Connert T, Zehnder MS, Amato M, Weiger R, Kühl S, Krastl G. Microguided endodontics: a method to achieve minimally invasive access cavity preparation and root canal location in mandibular incisors using a novel computer-guided technique. Int Endod J. 2018 Feb;51(2):247-55.
26. Krastl G, Zehnder MS, Connert T, Weiger R, Kühl S. Guided endodontics: a novel treatment approach for teeth with pulp canal calcification and apical pathology. Dent Traumatol. 2016 June;32(3):240-6.

Use of ultrasonics to optimize endodontic treatment: case report

Murilo Priori **ALCALDE**[1]
Rodrigo Ricci **VIVAN**[1]
Paulo Henrique **WECKWERTH**[2]
Guilherme Ferreira da **SILVA**[2]
Marco Antonio Hungaro **DUARTE**[1]

DOI: https://doi.org/10.14436/2358-2545.9.3.075-081.cre

ABSTRACT

The aim of this case report was to describe the use of ultrasonic in several endodontics steps during root canal treatment of second C-shaped mandibular molar, favoring more predictable outcome of endodontic treatment of teeth with complex anatomy. A male patient reported painful symptoms on the right and lower side of the face. Clinical examination revealed absence of pulp vitality of tooth 47 and the radiographic examination showed carious lesion, apical periodontitis and C-shaped anatomy. Therefore, the necropulpectomy treatment was selected. After the coronal access, an ultrasonic tip was used to remove the irregularities of the pulp chamber. The root canal preparation was performed using Reciproc 25.08 and Mtwo 40.04 and a final passive ultrasonic irrigation of the sodium hypochlorite and EDTA was performed with Irrisonic tip. Calcium hydroxide paste was used as intracanal dressing, which was introduced by Lentulo #40 and ultrasonic agitated. After 15 days, a passive ultrasonic irrigation was performed to remove the intracanal dressing and the canals were dried with sterilized paper points. The root filling was performed with AH Plus sealer, which was introduced by Lentulo #40 in a electric motor at 350 rpm and ultrasonic agitated during 1 minute. Then, the hybrid Tagger technique was performed to root canal filling. The radiographic examination showed the suitable isthmus and lateral canals filling. After 1 year and 8 months, the radiographic examination revealed complete apical healing, showing that the use of ultrasonic in several steps of endodontic treatment can favor a more predictable outcomes.

Keywords: Endodontics. Ultrasonics. Periapical Periodontitis.

How to cite: Alcalde MP, Vivan RR, Weckwerth PH, Silva GF, Duarte MAH. Use of ultrasonics to optimize endodontic treatment: case report. Dental Press Endod. 2019 Sept-Dec;9(3):75-81.
DOI: https://doi.org/10.14436/2358-2545.9.3.075-081.cre

[1] Universidade de São Paulo, Departamento de Dentística, Endodontia e Materiais Odontológicos (Bauru/SP, Brazil).

[2] Universidade do Sagrado Coração, Departamento de Biologia Oral (Bauru/SP, 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: May 02, 2018. Revised and accepted: April 16, 2018.

Contact address: Murilo Priori Alcalde
Rua Dr. Servio Túlio Carrijo Coube, 3-33, ap. 22B
Jardim Infante Dom Henrique – CEP: 17.012.632 – Bauru/SP
E-mail: murilo_alcalde@hotmail.com

Introduction

The biomechanical preparation and intracanal dressing has a key role effect to achieve the antisepsis of the root canal system in cases of necrotic pulp, reducing the number of microorgnisms and favoring a suitable condition for tissues healing.[1] However, the irrigating solution and intracanal dressing can present a limited effect inside the anatomical complexities (isthmuses, lateral canals, apical delta and etc), which can harbor microorganisms and cause the failure of root canal treatment.[2,3]

The mandibular molars present a complex internal root canal anatomy with isthmuses, apical delta and/or flattened canals on the mesial roots.[4,5] In addition, a anatomical variation can be present ,which is named C-shaped root canals[6,7]. This anatomical variation is more common in the second mandibular molar and in the asian population, with prevalence varying 33 until 44%.[7] The C-Shaped mandibular molars are characterized by a fusion of either the buccal or lingual aspect of the mesial and distal roots occurs and a radicular groove throughout the length of the root.[6,8] Melton et al.[6] showed that some anatomical variations can occur on the C-Shaped mandibular molars. Previous studies showed that most part of the isthmuses areas are not touch by the endodontic instruments, favoring the debris and pulp tissues accumaltion, which could compromise the treatment outcome.[9-11]

Currently, the ultrasonic have been widely used in several steps of endodontic treatment. [12,13] The passive ultrasonic irrigation is worldwide used due to improves the cleanness and smear layer removal of anatomical complexity than conventional irrigation[12,14-17] In addition, the ultrasonic agitation of calcium hydroxide paste[18,19] and root canal sealer[20-22] favor greater penetration inside the dentinal tubules, increasing the antimicrobial effect of intracanal dressing[19] and endodontic obturation[22]. Furthermore, the ultrasonic agitation increases the quality of endodontic obturation.[22] Therefore, it is an indispensable tool to perform the endodontic therapy.

Considering the negative impact of the anatomical complexities on the quality of the endodontic treatment,[2,3] it is important to use protocols that optimizes the root canal cleanness and antisepsis for treatment of teeth with necrotic pulp. Therefore, the aim of this case report was describe the use of ultrasonic in several endodontic steps during the root canal treatment of C-Shaped second mandibular molar, increasing the predictability of the endodontic treatment of teeth with anatomical complexity.

Case report

Male patient, 49 years old, attended the clinic of Endodontics at the Bauru School of Dentistry, reporting painful symptoms on the lower right side of the face. During the intraoral examination, a possible carious lesion was detected on the tooth 47. In addition, the patient reported painful symptoms during vertical percussion and apical palpation. The pulp sensitivity test was performed using EndoIce (Maquira Indústria de Produtos Odontológicos S.A, Maringá, PR, Brazil), which indicated a possible pulp necrosis. Therefore, the treatment indicated for this case was Necropulpectomy.

The radiographic examination detected a carious lesion on the tooth 47, presence of a chronic apical periodontitis and the fusioneted roots, which could indicate a C-shaped anatomy (Figure 1A). The anesthesia of the inferior alveolar nerve was performed using articaine (DFL, Indústria e Comércio Ltda., Jacarepaguá, RJ, Brazil), the coronal access was performed with 1014 spherical diamond tip and inactive tip 3080 (KG Sorensen, Cotia, SP, Brazil) and absolute insulation was performed. After this step, it was possible to confirm the presence of a type 2 C-shaped anatomy, according to Melton et al.[7]

The coronal access was optimized using a ultrasonic diamond tip ED2 (Helse Ultrasonic, Santa Rosa do Vitrbio, SP, Brazil). Then, the root canal preparation was starded. The root canals was explored with a file of type K # 10 and 15 (Dentsply Maillefer, Rio de Janeiro, RJ, Brazil) up to 2/3 of the work length. The

instrumens was inserted along the C-shaped anatomy to optimize the preparation of areas of anatomical complexity. Then, cervical flaring was performed using a R25 Reciproc instrument (VDW, Munich, Germany) at the same working length of the manuals files (Fig 2A and B). In addition, a ultrasonic tip (E18) (Helse Ultrasonic, Santa Rosa do Vitrbio, SP, Brazil) was used to improve the cleaness of the isthmuses areas at cervical portion (Fig 2C and C). Finally, the working length was determined using an electronic foraminal locator (Propex II, Dentsply Maillefer, United States) The apical root canal preparation was performed with instrument R25 and Mtwo 40.04 rotary instrument (VDW, Munich, Germany). During the root canal preparation was used 2.5% sodium hypochlorite and 2 ml irrigation solution was used after each instrument used.

After the biomechanical preparation, the passive ultrasonic irrigation of 2.5% sodium hypochlorite and EDTA was performed using the Irrisonic tip (E1) (Ultrasonic Helse, Santa Rosa do Viterbio, SP, Brazil), which was repeated at 3 times during 20 seconds.[23] A final irrigaiton with 10 ml of saline solution was performed and the canal were dried with sterilized absorbent paper (Dentsply Maillefer, Petrópolis, RJ, Brazil).

The calcium hydroide paste was used as intracanal dressing, which was inserted with Lentulo spiral and agitated with an ultrasonic tip E1 during one minute.[19] The double coronary sealing was performed with a layer of Cotosol (Vigodent, Bonsucesso, RJ, Brazil) and Maxxion R glass ionomer (FGM, Joinville, SC, Brazil).

After 15 days, the patient returned to the obturation procedure. The calcium hydroide paste was removed by the passive ultrasonic irrigation using saline solution and the root canal was dried with absorbent paper tips. After master cone radiograph, the endodontic sealer AH Plus (Dentsply Maillefer, USA) was manipulated and inserted into the root canal by a # 40 Lentulo spiral fitted on a Silver Reciproc electric motor (VDW, Munich, Germany at 350 rpm). Then, the endodontic sealer was agititaded during 1 minute using the ultrasonic tip E1, which was directed to the mesiodistal and buccolingual face.[20,22] Then the master cones (VDW, Munich, Germany) were inserted and the Taggers hybrid technique was performed with a #55 McSpadden compactor.

The radiographic assessment of the endodontic obturation (Fig 1B) showed a suitable filling of isthmuses areas and lateral canals. Before the coronal sealing, the pulp chamber was cleaned with 70% alcohol solution and a double coronary sealing was performed with a layer of Cotosol (Vigodent, Bonsucesso, RJ, Brazil) and Maxxion R glass ionomer (FGM, Joinville, SC, Brazil) (Fig 1C).

On examinaiton at 1 year after the endodontic treatment showed a complete hard tissue formation; however, the tooth still presented the provisional sealing (Fig 1D). Clinical and radiographic examination at 1 year and 8 months showed healty tissues and the teeth was finally rehabilitated (Fig 1E).

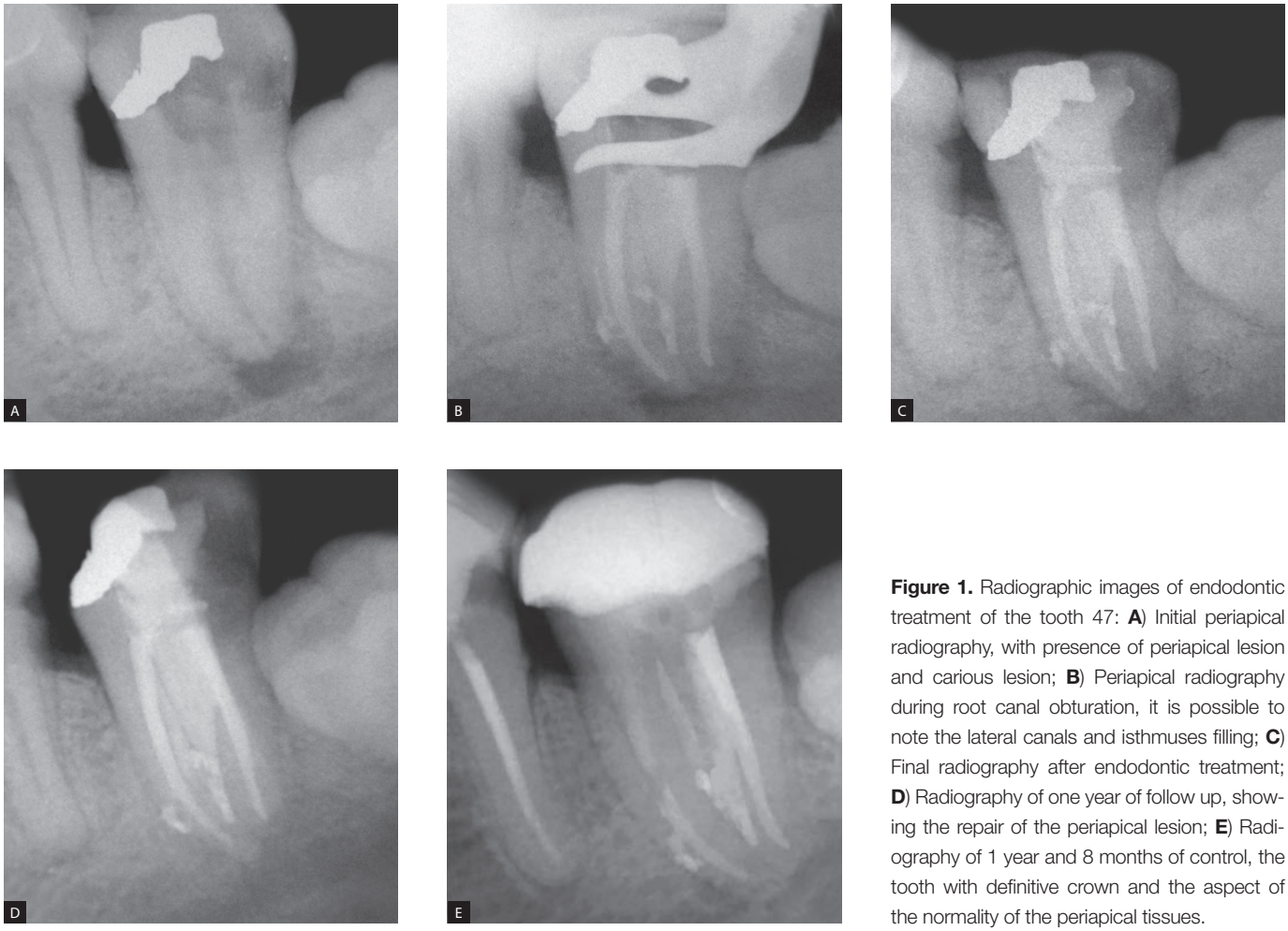

Figure 1. Radiographic images of endodontic treatment of the tooth 47: **A**) Initial periapical radiography, with presence of periapical lesion and carious lesion; **B**) Periapical radiography during root canal obturation, it is possible to note the lateral canals and isthmuses filling; **C**) Final radiography after endodontic treatment; **D**) Radiography of one year of follow up, showing the repair of the periapical lesion; **E**) Radiography of 1 year and 8 months of control, the tooth with definitive crown and the aspect of the normality of the periapical tissues.

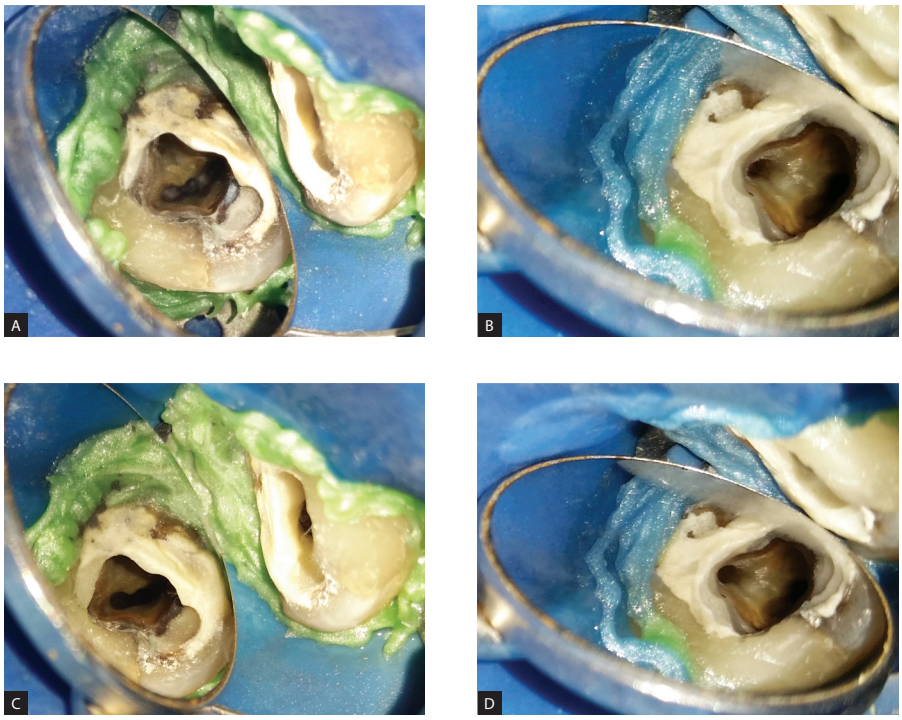

Figure 2. Clinical images of the pulp chamber: **A** e **B**) Root canal orifices view previously the use of ultrasonic tips; **C** e **D**) Root canal view after use of ultrasonic tips and passive ultrasonic irrigation, it is possible to note the better cleanness e quality of root canal preparation.

Discussion

The C-Shaped anatomy has high prevalence on second mandibular molars.[6-8] The C-Shaped mandibular molars are characterized by a fusion of either the buccal or lingual aspect of the mesial and distal roots occurs and a radicular groove throughout the length of the root.[6,8] In addition, a complex internal anatomy can be present with anastomeses, flattening and isthmuses along the root canal, wich could difficult the root canal preparation and cleanness.[6-10]

Previous studies showed a high percentage of root canal walls are not touched by the endodontic instruments.[9-11,25] Solomov et al.[10] showed that SAF(ReDent Nova, HaTaasiya, Israel) promoted greater root canal preparation than NiTi rotary system in C-Shaped mandibular molars, preserving more dentin walls and reducing untouched root canal walls. However, Amoroso-Silva et al.[11] showed that Reciproc R25 and SAF promoted similar percentage of untouchaed root canal walls. However, the authors showed that oscilatory instrumentation using #25 hand NiTi file promoted a significant reduciton of untouched areas. In this case, we opted to complement the intrumentaiton using a ultrasonic tip (E18; Helse Ultrasonic, Santa Rosa do Vitérbio, SP, Brazil) due to is a conservative method and probably greater debriment isthmuses areas.

The apical preparation size during root canal treatment has a key role effect on the microbial reduction.[25,28] Somes authors showed that the apical preparation size should be #35 or 40 and taper 0.04 favored a better irrigation, reduced number of the microorganisms and debris accumulation.[25-28] Additionally, the anatomical root canal diameter should be taken into account because the anatomical diameter of C-Shaped molar ranges from 0.20 to 0.39 mm.

The elimination of remaining pulp tissues and biofilm are important for the sucess of endodontic therapy and for suitable root canal obturation.[1,14,15] In addition, the calcium hydroxide paste as favors the antisepsis and the apical healing due to he high alkaline pH and calcium ions release.[29,30] However, the antimicrobial activity of calcium hydroxide paste is reduced in contact with organic matter.[1,30] Therefore, the passive ultrasonic irrigation of the sodium hypochlorite and EDTA was performed to promote a better root canal cleanness, smear layer removal and bacterial reduction than conventional irrigation[12-16], which favor the antimicrobial effect of intracanal dressing.

The calcium hydroxide paste has antimicrobial effect only in contact with the microrganisms.[30] Vera et al.[3] showed remaining microorganisms inside the dentinal tubules and isthmuses areas after 15 days of intracanal dressing with calcium hydroxide paste. Therefore, some authors have been proposal the ultrasonic agitation of calcium hydroxide paste.[18,19] Duarte et al.[18] showed that ultrasonic agitation of calcium hydroxide paste increases the pH level and greater calcium ions release in simulated external root resorption. In addition, Arias et al.[19] showed that the ultrasonic agitation of the calcium hydroxide paste increases the penetrability of the paste inside the dentinal tubules and its antimicrobial action againts Entereococcus faecalis. Therefore, the ultrasonic agitation of calcium hydroxide paste was performed in this case.

After 15 days the calcium hydroxide paste was removed using passive ultrasonic irrigation.[31] During root canal obturation the AH Plus sealer was inserted using a #40 Lentulo spiral and ultrasonic agitated using the ultrasonic tip E1 during 1 minute.[20,22] The ultrasonic agitation of the sealer was performed because promotes greater penetrability of the inside the dentinal tubules[20-22], reduces the gaps[20-22] and better isthmuses filling[22]. The Tagger's hybrid technique was used because favors better obturation quality and isthmuses filling than lateral cold condensation technique.[32]

After 1 year of the endodontic treatment there was complete hard tissue formation; however, the tooth still presented the provisional sealing (Fig 1D). Clinical and radiographic examination at 1 year and 8 months showed health tissues and the teeth was finally rehabilitated (Fig 1E). Recent study showed that lack of satisfactory te restorations after endodontic therapy can contribute for failure of endodontic treatment.[33]

All clinical protocols used in this case showed to be effective and lead to the success of the treatment. In addition, the clinical procedures were performed accordingly with the scientific literature, which favor a suitable tissue healing and health to the patient.

Conclusion

After 1 year and a 8 months of clinical and radiographic follow up, it was possible to conclude that ultrasonic is important tool to optimize the endodontic treatment, resulting in a higher quality treatment with greater predictability.