Use of the Reciproc Blue instrument associated with photodynamic therapy: case report

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ABSTRACT

Introduction: The presence of microorganisms is considered the main cause of endodontic therapy failure. In addition, an internal anatomy also poses a major challenge for endodontists. In this way, avail a series of quick techniques and increase the chance of success. The reason of this study was to relate clinical cases, root canal treatment, using mechanized instrumentation with the system Reciproc Blue instrument, associated with photodynamic therapy. **Case report:** A female genetic patient, brown skin, presented at the school clinic of a dental school, with a major complaint of "blistering on the gum." At the clinical examination, the target dates are inside the mouth active in the selection bottom region near the apexes of the elements 12 and 22. Through clinical, radiographic, sensitivity and screening tests of fistulae, diagnosis and diagnosis of pulp necrosis, suggestive of chronic apex abscess of the incisors. **Results:** Endodontic treatment of the two dental elements was performed in a single session using the Reciproc Blue instrument in a reciprocating motion associated with photodynamic therapy. After 30 days of completion of endodontic and restorative treatments, one patient returned for evaluation and clinical follow-up. The new asymptomatic presentation and with a healing of the intrabucal fistulas. **Conclusion:** The system Reciproc Blue associated with photodynamic therapy was effective. It was verified the clinical and radiographic success of apicality, confirming the reestablishment of the apex region with regression of the radiographic lesion and the absence of clinical signs and signs of infection of the root canal. The patient is with the clinician and radiographic studies.

Keywords: Endodontics. Photochemotherapy. Dental Pulp Necrosis

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Introduction

The aim of endodontic therapy is to achieve a significant reduction in the quantity of pathogenic microorganisms and their by-products by means of chemical-mechanical preparation, performed with the purpose of eliminating pulp tissue and microorganisms installed within complex root canal systems (RCS).[1,2]

In cases of pulp necrosis, despite conventional chemical-mechanical preparation effectively diminishing the quantity of bacteria, complete decontamination of the entire RCS, although desirable, is impossible to attain. For more efficacious treatment, it is necessary for the irrigant solutions used to have effective antibacterial effect, including the capacity for inactivating endotoxins. In this case, sodium hypochlorite (NaOCl), which is the irrigant solution most used in Endodontics, is outstanding, due to its broad spectrum of antimicrobial action and its capacity for dissolving organic tissues, among its other properties.[3,4]

The existence and permanence of microorganisms in the RCSs have been pointed out as being the main cause of unsuccessful endodontic therapy, particularly when associated with a complex internal anatomy of the canals, shown by evidence of lateral and, secondary canals, apical deltas, isthmuses and curvatures.[5,6] Approximately 500 microbial species have been found in endodontic infections with *Enterococcus faecalis* being the species most frequently found in cases of endodontic treatment failure, showing a prevalence of up to 90%.[4] Studies have demonstrated that the good result of endodontic treatment is directly related to the percentage of bacteria eliminated during the therapy,[7] and there have been researches that have shown evidence that resistant microorganisms are capable of surviving the action or irrigant solutions and intracanal medications.[8,1]

Therefore, with the aim of helping to meet the challenge of endodontic treatment, photodynamic treatment known as Photodynamic therapy (PDT), is indicated as being a complementary tool in decontamination of the RCS. Low level laser therapy associated with a dye that has photosensitizing characteristics in the presence of oxygen, produces free radicals and singlet oxygen that will provide bacterial destruction without resulting in microbial resistance. This is an easy-to-perform and painless technique.[2,3,7-10]

Apart from microorganisms, the internal anatomy of root canals also poses a significant challenge to endodontists. With the aim of improving the management of anatomic difficulties in the RCS and limitations of stainless steel instruments, Nickel-Titanium rotary instruments were incorporated into clinical practice in 1990. These instruments became popular for use in root canal shaping procedures, particularly due to the advantages provided by their high degree of elasticity and effectiveness.[11]

The Reciproc Blue (RB) instruments (VDW, Munich, Germany), recently launched on the market, follow the same sequence as that of the conventional Reciproc M-wire instruments that have an S-shaped cross-section, with two cutting angles and inactive tip. The difference lies in the tip of the RB instruments in relation to the Reciproc M-wire instruments because they have a circular tip in the shape of a truncated tapered cone with a transition curve, while the conventional instrument has a tip with a transition angle.[12] Moreover, the new generation of RB instruments was developed with advanced thermal-mechanical treatment, patented by the manufacture as Blue NiTi alloy, which transforms the molecular structure of the alloy, resulting in a layer of titanium oxide on the instrument surface, leaving it with a blue color, and thereby conferring greater flexibility on the instrument, and increased resistance to cyclic fatigue.[13]

Based on these presuppositions, the aim of the present study was to report two clinical cases, in which mechanized instrumentation was performed with the new Reciproc Blue instrument associated with photodynamic therapy.

Case Report

The patient, a melanoderm woman, presented to the clinic of a Dental school of a municipality in Bahia, with the chief complaint of the "appearance of blisters on the gingiva". On clinical exam, it was possible to visualize two active intraoral fistulas in the vestibule bottom region close to the apexes of teeth 12 and 22 (Fig 1). These teeth were submitted to thermal cold pulp sensitivity tests with Endo Ice (Maquira, Maringá-PR, Brazil), and heat, with a bar of gutta percha (Dentsply, Nova York, USA), as well as vertical and horizontal percussion tests and apical palpation, with negative responses. There was no tooth mobility and periodontal probing was within the patterns of normality. On radiographic study exam, the presence of a periapical lesion associated with teeth 12 and 22 was detected (Fig 2).

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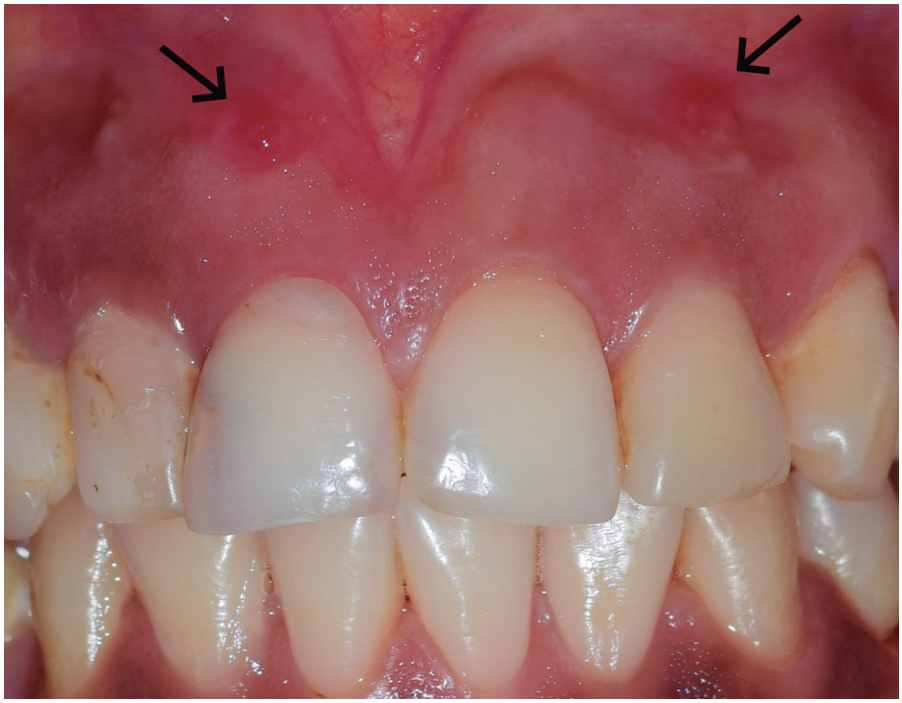

Figure 1. Active intraoral fistulas.

Immediately afterwards, the fistula was traced with a caliber 25 gutta percha cone (Dentsply Maillefer, Ballaigues, Switzerland) and using the digital sensor RVG 5100 (Kodak, Nova York, USA) and x-ray appliance (Gnatus, Ribeirão Preto, Brazil), showing evidence of the origin of the infectious process in teeth 12 and 22 (Fig 3). In view of the findings, the diagnosis of pulp necrosis and periapical pathology compatible with chronic apical abscess was established. Therefore, conventional endodontic treatment was instituted, associated with photodynamic therapy.

Treatment was performed in a single session for each tooth. In the first session, endodontic access was made to tooth 12, using a high speed diamond tip KG #1014 HL (Medical Burs, Cotia, Brazil). The entire procedure was performed with absolute isolation.

Odontometry was performed with an electronic apex locator Romiapex A-15 (Romidan, Kiryat Ono, Israel), with manual K-type file[15] (Dentsply Maillefer, Ballaigues, Switzerland), at 1 mm short of the apical foramen and radiographically confirmed.

Instrumentation was performed with the Reciproc Blue R40/.06 instrument (VDW, Munich, Germany) coupled to an endodontic X-Smart Plus motor (Dentsply Maillefer, Ballaigues, Switzerland), adjusted to the Reciproc function, in reciprocating motion, in accordance with the manufacturer's instructions. Foraminal patency was established with C-Pilot file #10 (VDW, Munich, Germany) and the chemical irrigant substance used was 2.5% sodium hypochlorite (Asfer, Santa Maria/SP, Brazil).

As the final irrigation protocol, the irrigant solutions were activated and potentiated by being agitated with the Easy Clean instrument (Easy Equipamentos Odontológicos, Belo Horizonte/MG, Brazil) coupled to the X-Smart Plus motor (Dentsply Maillefer, Ballaigues, Switzerland) in the Reciproc function. The protocol used was 3 cycles lasting 20 seconds for each irrigant, according to Van de Sluis,[14] totaling 1 minute of agitation with 2.5% NaOCl, followed by 3 cycles of agitation for 20 seconds with 17% EDTA trisodium (Biodinâmica, Ibiporã/PR, Brazil) and a further 3 cycles of agitation for 20 seconds with 2.5% NaOCl . After each agitation cycle, the irrigant solution was renewed. The canal was dried with absorbent paper points #40 (Tanari, Manacapuru/AM, Brazil).

After this, 0.005% methylene blue dye (Blumet5 DMC, São Carlos/SP, Brazil) was inserted into the canal for the pre-irradiation time of 5 minutes, for later activation with laser (Whithening Laser II DMC, São Carlos, Brazil) at the red wavelength 660nm, energy density 320j/cm^2, power of 100mw, by means of a fiber optic, in helicoidal movements within the canal for the time of 1'30"(Fig 4), two times, totaling 3 minutes. The dye was

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activated according to the helicoidal technique recommended by Gutknecht et al[31] and Segundo[32], promoting helicoidal movements in the apical cervical direction, in order to diffuse the light throughout the entire extension of the canal. After photodynamic therapy, the canal was again irrigated with 2.5% sodium hypochlorite and dried with absorbent paper points #40.

The root canal system was filled with an FM gutta percha cone (Odous De Deus, Belo Horizonte/MG, Brazil) associated with AH Plus cement (Dentsply Maillefer, Ballaigues, Switzerland), by means of the technique of vertical hydraulic compression of the accessory cone (recommended by De Deus)[15], using the Schilder type of condensers (Odous De Deus, Belo Horizonte, Brazil). Lastly, restoration was performed by the incremental technique with Opallis A2 resin composite (FGM, Joinville/SC, Brazil).

In the second session, the clinical case of tooth 22 was treated, by following the same operative steps and procedures as those described for tooth 12. However, as a result of the more accentuated curvature in the root of this tooth, file RB25/.08 was first used in instrumentation RB25/.08 (VDW, Munich, Germany) and afterwards, RB40/.06 (VDW, Munich, Germany).

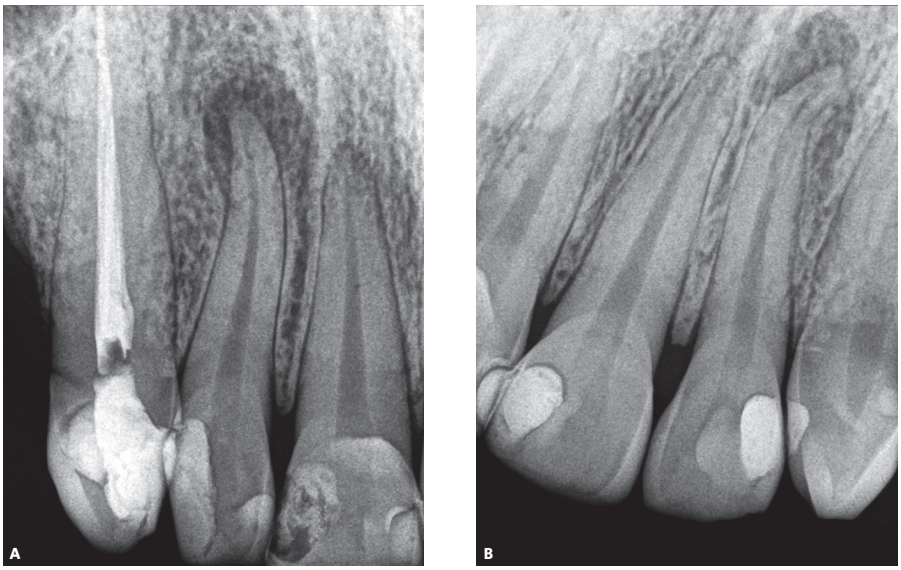

Figure 2. Study radiographs.

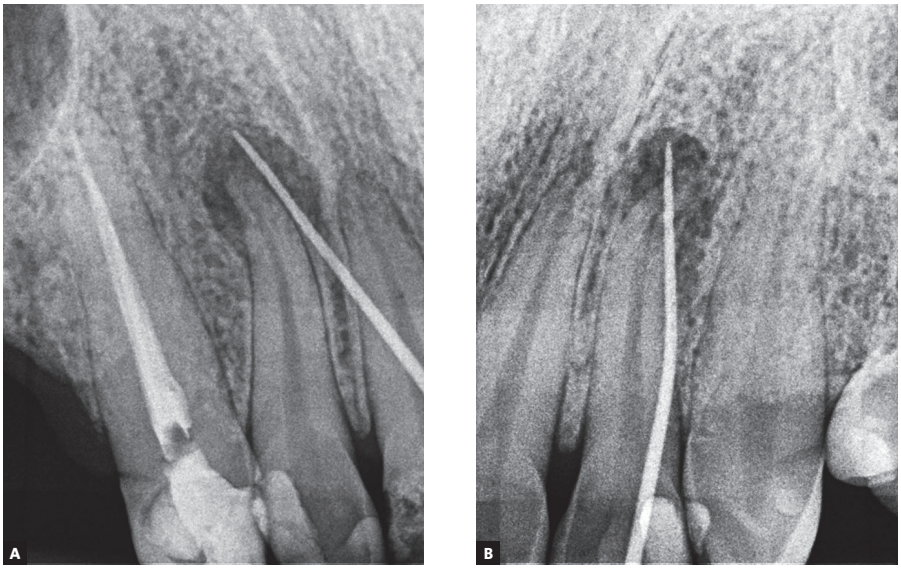

Figure 3. Radiographic screening.

Figure 4. Photodynamic therapy.

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Results

At 30 days after conclusion of the endodontic and restorative treatments, the patient returned for clinical assessment and follow-up. She was shown to be asymptomatic with cicatrization of the intraoral fistulas (Fig 5). The clinical and radiogaphic control exams at the time interval of 14 months (Fig 6) demonstrated re-establishment and repair of the periapical region.

Figure 5. Clinical evaluation after 14 months.

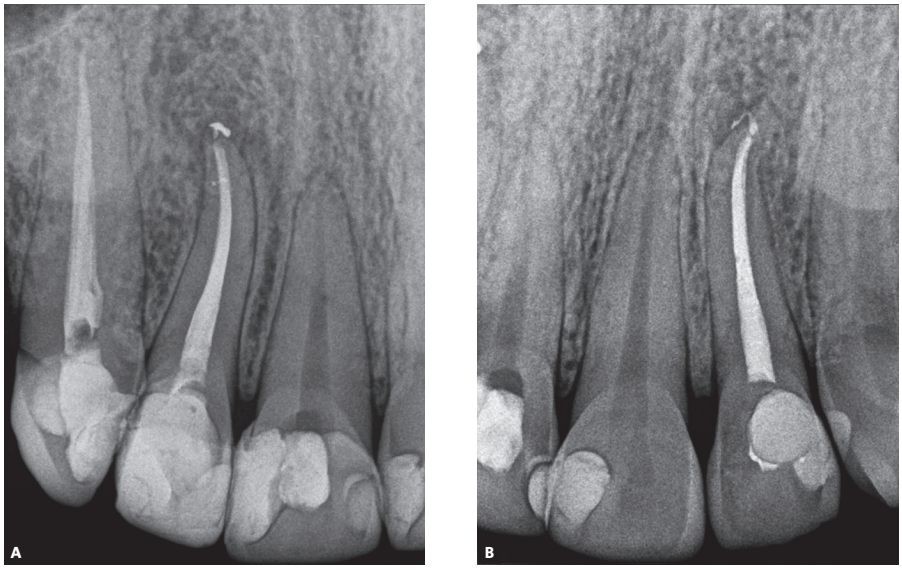

Figure 6. Control after 14 months.

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Discussion

The challenges of endodontic therapy consist of considerably reducing the number of pathogenic microorganisms, by means of efficient chemical-mechanical preparation, and of overcoming the difficulties found in the internal anatomy.[1,2] Contemporary techniques added to a motor, with emphasis on the use of nickel titanium (NiTi) reciprocating instruments, and the effective chemical action of intracanal irrigant solutions[16] represent an important stage of the therapy. Furthermore, three-dimensional filling of the RCS is of the utmost importance.[1] The clinical cases reported followed mechanized instrumentation protocols, activation and potentiation of the chemical substances such as sodium hypochlorite and EDTA, and filling by the thermoplasticized technique, in addition to the use of photodynamic therapy.

With the aim of ameliorating the difficulties found relative to the internal anatomy of the RCS and optimizing the time of performing the endodontic treatment, the nickel titanium rotary instruments have gained an outstanding place in the contemporary scenario.[17] The Reciproc Blue (RB) instruments were launched on the market, were an enhanced version of the conventional Reciproc M-wire instruments, about which recent studies have affirmed that they exhibit greater flexibility and increased resistance to cyclic and torsional fatigue when compared with other systems.[43,44] These characteristics allow [the use of] these instruments to perform an efficient, safe preparation, with a lower risk for the occurrence of fractures even in canals with severe curvature.[45] Furthermore, by reason of the innovate heat treatment process, the RB [files] may also be precurved to enable improved access to root canals.[20,21] For these reasons, the indication of these instruments has been reinforced in this case report.[11-13,18,19] By virtue of these mechanical properties, RB was the instrument of choice for performing treatment of the cases reported, since it concerns root canals with an apical curvature of a moderate degree and that could cause accidents and complications such as instrument fractures, steps, deviations and perforations, if conventional manual instruments made of stainless steel or NiTi were used.

Before final washing with irrigant solution of sodium hypochlorite, 17% EDTA was also used as chelating agent, for the purpose of removing the inorganic portions (smear layer), and allowing effective cleaning of the dentinal tubules, which would facilitate filling of the RCS.[4,25,26] The method most used for irrigation is the conventional type, with the use of a cannula with a frontal or lateral extremity coupled to a syringe. However, this method is extremely limited for cleaning the apical portion and areas such as isthmuses, lateral canals and curvatures.[27] Therefore, the new resources for activation and potentiating EDTA and sodium hypochlorite have appeared One of these devices is Easy Clean, made of plastic to be coupled to an electric motor with reciprocating motion.[26-28] Despite previous studies having reported greater turbulence of the irrigant solution and efficiency in cleaning root canal systems when the Easy Clean device has been used in continuous rotation,[27,46] this instrument was used in reciprocating motion in this study, in accordance with the manufacturer's recommendations. Moreover, based on a previous study, it has been shown that reciprocating motion was sufficient to promote cleaning of the apical region in curved canals.[47] Furthermore, it has been speculated that agitation of the irrigant solution with the use of the Easy Clean tip in continuous rotation, could increase the risk of extrusion of the liquid to the periapical region, which would cause injury to these tissues. Because of its advantages and based on a more effective process of cleaning the RCS, this was the instrument of choice for activating the intracanal chemical and irrigant solutions.

With the purpose of considerably reducing the number of microorganisms, in this study, the use of photodynamic therapy (PDT) was indicated and used. The mechanism of action of PDT is based on the localized application of a non-toxic photosensitizer, followed by irradiation with a low dose of visible light and adequate wavelength.[7,22] PDT was another coadjuvant and additional therapy used in decontamination of the system of root canals, particularly because the clinical cases were performed in a single session.

In Endodontics, the use of laser associated with a dye that has photosensitizing characteristics, the so called Photodynamic Therapy (PDT), has recently been explored in different studies.[33-35,48-51] Interest in the use of this therapy is mainly related to proven antimicrobial effect that has shown, because it does not promote microbial resistance. It is an easy technique to apply, is painless, and added to all these characteristics it has the beneficial effects arising from therapy with laser, such as biostimulation, analgesia and its anti-inflammatory

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aspect, important conditions for the success of all the phases of endodontic treatment.[23,24,35-39,49] In the oral cavity, he low cost, absence of systemic effects and of increasing microbial resistance to medications, indicate this therapy as an important therapeutic alternative to the conventional forms of treatment.[38-41] This reinforced its use in the clinical cases reported in this study.

The dye was activated according to the helicoidal technique recommended by Gutknecht et al[31] and Segundo.[32] promoting helicoidal movements in the apical cervical direction, in order to diffuse the light throughout the entire extension of the canal. Although there is no consensus about the ideal protocol, in the present study Methylene Blue was used as photosensitizer dye and light was applied for 3 minutes, in accordance with the manufacturer's recommendations. The fiber optic helped to propagate the light within the root canal, thereby improving the decontamination process.[48,52] This protocol was performed in the treatment of the clinical cases.

In addition to conventional endodontic treatment PDT is a useful tool for microbial reduction since it has a broad spectrum of action for the purpose of providing a treatment of higher quality. The literature has shown that teeth with apical periodontitis demonstrated better bone cicatrization and reduction in microorganisms after conventional treatment associated with PDT.[53] This allows the microbicidal effect to be attained in the areas that are most difficult to access in the RCA, which even the host defense agents are frequently incapable of reaching. Therefore, the introduction of thin, flexible fiber optics allows the laser light to penetrate into the apical third.[53] Thus, in the present study, the proposal was the use of the mechanized system associated with PDT with the use of the fiber during endodontic treatment of teeth with periapical lesions. The purpose was to potentiate decontamination of the root canal and favor apical repair, as in other case reports,[3,54,55] which led to corroborating its use in the clinical cases described.

The literature reports that in addition to eliminating bacteria, PDT accelerates the processes of bone formation in the peri-radicular area. Moreover, it is a strong stimulus of bone cicatrization,[55] as was shown in these clinical cases, in which the use of PDT in addition to endodontic treatment provided repair of the periapical tissue. The protocol established in these two treatments may have favored the clinical success of the cases presented.

Some studies have contraindicated performing endodontic treatment in a single session, using the justification that there are some problems related to difficulties with eliminating bacteria from the dentinal tubules and ramifications, and the occurrence of flare-ups.[29] However, there are studies, including systematic reviews, in which endodontic treatment in a single session has been defended. The argument used is that there were no statistical differences in the criteria between treatment performed in one or in multiple sessions to guarantee a successful treatment.[30] In the report of the clinical cases, the patient was shown to be asymptomatic, had dry root canals, without exudate and with negative vertical percussion and palpation tests, apart from adequate chemical-mechanical preparation, which made it safe to perform endodontic therapy in a single session in both cases.

In the initial planning, the resources used were the clinical exam, pulp sensitivity tests and radiographic exam. In the most up to date control visit at 14 months, repair of the periapical tissues was radiographically observed. Therefore, the indication of cone beam computed tomography was not necessary because despite it being a faithful three-dimensional Imaginological exam, it has a higher rate of radiation when compared with periapical radiographs, as well as a higher financial cost to the patient.

Conclusion

The use of the Reciproc Blue system associated with photodynamic therapy was effective. Clinical and radiographic success of the proposed therapy were found, when verifying re-establishment of the periapical region, with regression of the lesion and absence of clinical signs and symptoms of root canal infection. Moreover cicatrization of the intraoral fistulas was found, therefore, reaffirming the efficacy of all protocols of instrumentation, irrigation, activation of chemical substances, RCS filling and restoration of the teeth involved.

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