Multidisciplinary approach for the treatment of external cervical resorption: case report

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ABSTRACT

Introduction: Root resorption is a pathological process that results in loss of cementum, dentin and bone. It is triggered by an imbalance between osteoblasts and osteoclasts. Diagnosis usually occurs through radiographic examination and/or CT scan. **Objective:** This study reports the treatment of a case of external cervical resorption with a multidisciplinary approach involving Endodontics, Orthodontics, Periodontics, and Prosthodontics. **Methods:** CT image revealed external cervical resorption in the palatine root, extending from distal, following to palatal and mesial. After opening, and placing of intracanal dressing, the endodontist referred the patient for orthodontic evaluation. Orthodontic traction was suggested, and an attempt was made to expose the area of lesion. To reach the final position of the tooth between the second and third order and occlusal adjustments, the orthodontic stage lasted eleven months, including three months of retention. One month before removing the orthodontic appliance and one year after the beginning of traction, root canal filling was performed. While keeping the orthodontic appliance in place, surgery was performed to correct the bone and gingival levels, which tended to follow the tooth, allowing visualization of the entire resorption area. One month after clinical coronary augmentation surgery, the orthodontic appliance was removed and prosthetic treatment performed with a gold alloy-fused metallic core and a ceramic crown with a zirconia infrastructure. **Conclusion:** The authors therefore concluded that by employing a multidisciplinary approach it is possible to treat cases of external cervical resorption.

Keywords: Endodontics. Osteoclasts. Computed tomography. X-ray.

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Introduction

Root resorption is the loss of hard dental tissue as a result of clastic activities. It is a pathological process that causes loss of cementum, dentin and bone, involving both vital and pulpless teeth. The resorption process is associated with damage to periodontal ligament as a result of injury and necrosis.[1,2] Root resorption is triggered by an imbalance between osteoblasts and osteoclasts which, in a normal clinical situation, maintain or remodel supporting periodontal structures.[3] Diagnosis usually occurs by means of occasional radiographic findings, with exposure of a radiolucent area with irregular borders and at different root heights.[4,5] However, examinations analyzed through intraoral radiographs are influenced by a large number of variables, including exposure time, angulation changes, processing and visualization conditions, and overlapping of anatomical structures.[4,6] Cone-beam computed tomography (CBCT) is an alternative tool for early diagnosis of root resorption. It allows three-dimensional inspection of images in axial, sagittal and coronal slices, making it possible to assess the location and size of resorptions.[1,7]

Treatment of root resorption depends on its etiology, which is most often non-surgical. Thus, endodontic treatment is used with delay calcium hydroxide dressings.[8] However, mineral trioxide aggregate (MTA) is frequently employed as repair material for root resorption, given its hydrophilic and sealing characteristics that can be used in moist environments. MTA triggers a chemical reaction that hardens the material while also affording biocompatibility and inducing the formation of hard tissue, ideal for repair of the affected area.[5,9-11]

The present study reports a case of external cervical resorption treated by means of a multidisciplinary approach involving Endodontics, Orthodontics, Periodontics and Prosthetics.

Case report

A 31-year-old female patient underwent routine examinations in a dental office. Adjacent teeth and tissues seemed clinically normal (Fig 1). Periapical radiograph showed the presence of a radiolucent image of indefinite borders in the cervical third of tooth #14 root, compatible with root resorption. Connection between the root canal and the resorption area could not be observed (Fig 2).

After performing a CBCT (Prexion 3D high-resolution scanner), the image disclosed an external cervical resorption in the palatine root, which extended from distal to palatal and mesial. No disruption of distal, palatal or root canal walls was observed, despite their obvious thinness (Fig 3).

The patient was referred to an endodontist. In the first session, root canals were instrumented with MTwo system (VDW, Munchen, Germany) up to #35.04 file in the buccal canals and #40.04 in the palatal canal, and thereafter treated with Ultracal calcium hydroxide (Ultradent, South Jordan, USA) (Fig 4). Follow-up CT scan was performed and sagittal slices obtained on a Kodak 9000 3D high resolution imaging system (Fig 5). Subsequently, 2.5% sodium hypochlorite (Danafarma, Curitiba, Brazil) was used as irrigating solution. The endodontist referred the patient for evaluation by an orthodontist. With a view to exposing the area of lesion, orthodontic traction of tooth #14 was suggested, given the root length and its buccal inclination. A fixed orthodontic appliance was bonded passively from first molar to canine on the same side. For this purpose, a single tube was placed on tooth #16 and 0.022-in aesthetic brackets (GAC - Dentsply International, USA), with self-ligating brackets on teeth #13 and #25, and conventional brackets on tooth #14. The latter was chosen to ensure greater torque control (inclination) during extrusion of the aforementioned tooth, since at the beginning of treatment it showed excessive buccal inclination which, in turn, induced alveolar bone fenestration observable at the level of buccal root apex.

In order to maintain the level of initial gingival margin without it migrating along with the tooth, the authors performed extrusion movement by applying interrupted force. This was carried out by means of progressively placing vertical bends in the form of steps on stainless steel wires (0.019 x 0.025-in GAC Dentsply International. USA) (Fig 6). In order to allow freedom of movement while not generating premature contacts, as movement occurred, it proved necessary to abrade the occlusal surface of tooth #14. To reach the final position of the tooth, including second and third orders activations and occlusal adjustments, the orthodontic stage spanned a total of 11 months, including three months of retention. During this period, the patient was seen every three weeks, and the amount of extrusion obtained was approxi-

mately 3.5 mm. In addition to the clinical aspect, in which occlusal migration of the tooth equator was observed, extrusion of the tooth was evinced by a change in the relationship between the apex of its palatine root and the cortex of maxillary sinus floor.

The patient was monitored twice a month for occlusal adjustments, given that as the tooth extruded it began to come into premature contact on the palatal surface. Patient's retainer was kept in place for about three months with the aid of the fixed appliance itself. During orthodontic treatment, calcium hydroxide medication was changed every three months. As a result, six months thereafter, concurrently with traction, it became possible to view the area of root resorption due to the presence of bleeding and invagination of periodontal ligament. The authors therefore decided to build a barrier with MTA (MTA-Angelus™, Londrina, PR, Brazil) in order to prevent periodontal ligament hyperplasia in the region. The barrier would be removed after traction had ended. This barrier remained intact throughout traction, ultimately isolating the periodontal ligament from the pulp chamber, which can be visualized in follow-up CT scans (Figs 7 and 8) and periapical radiograph (Fig 9A).

Figure 1. Initial clinical aspect of tooth #14.

Figure 2. Initial periapical radiograph (Dec/2013).

Figure 3. Axial slice of CBCT scan showing root resorption in palatine root (Dec/2013).

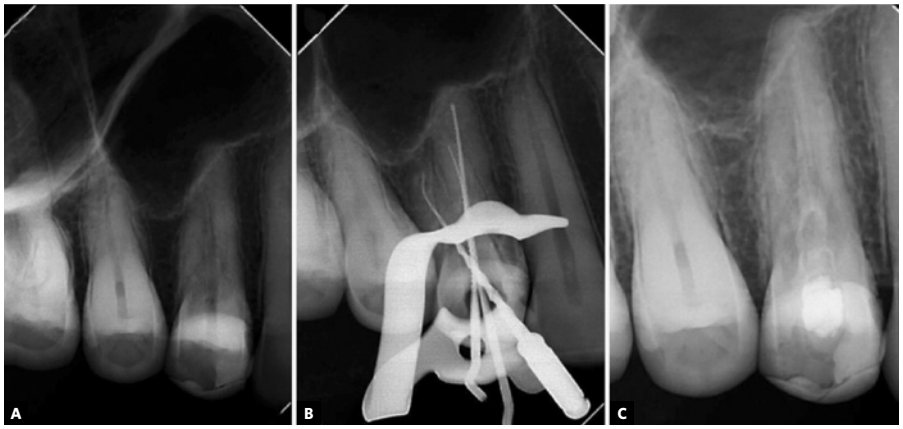

Figure 4. A) Initial periapical radiograph; **B**) Odontometry; **C**) Dressing with calcium hydroxide (Nov/2013).

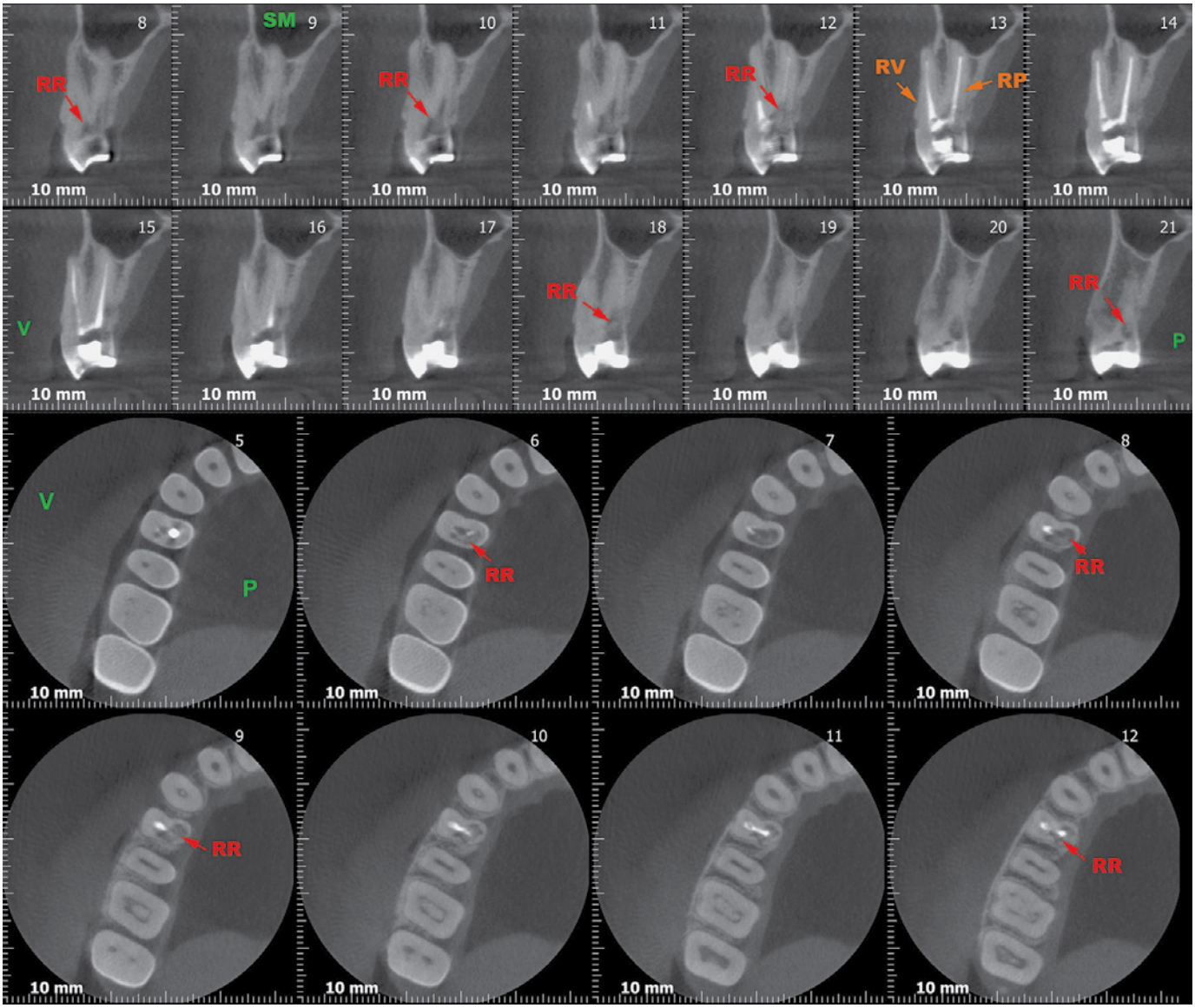

Figure 5. CBCT scan after dressing with calcium hydroxide (Dec/2013). In sagittal and axial slices, root resorption is observed in the coronal cervical third at the level of the pulp chamber and the cervical third at PR of tooth #14, extending in distal and palatal direction. No disruption of the distal and palatal tooth walls was observed, despite their obvious thinness.

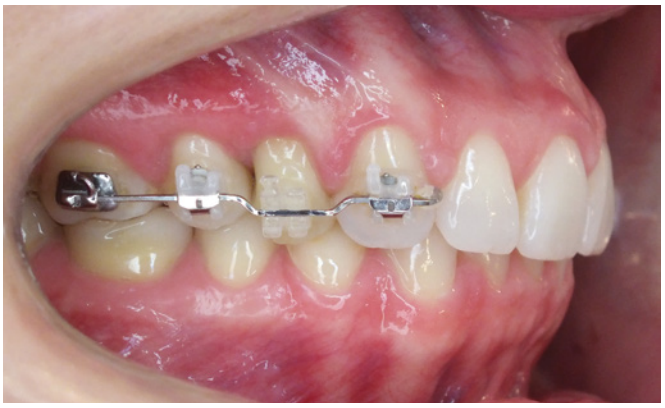

Figure 6. Orthodontic appliance activated for extrusion of tooth #14.

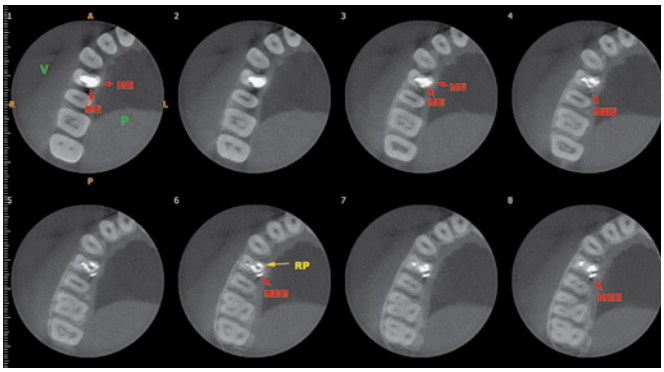

Figure 7. CBCT endodontic treatment follow-up (Dec/2014) showing in axial slices, at the level of the cervical third in PR, endodontic material overfilling and spreading towards the external lateral wall, both palatally and distally.

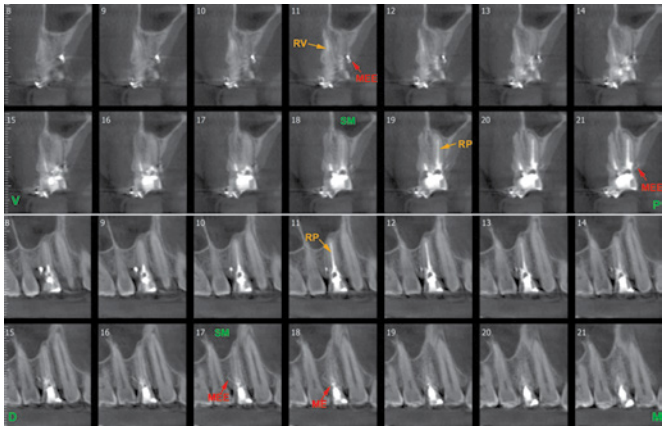

Figure 8. CBCT endodontic treatment follow-up (Mar/2015), showing, at the level of the cervical third in PR, with the endodontic material overfilling and spreading towards the external root wall, both palatally and distally. In sagittal and coronal slices, at the level of bone plates, which can be observed, both palatally and distally, in close proximity to the overfilled endodontic material.

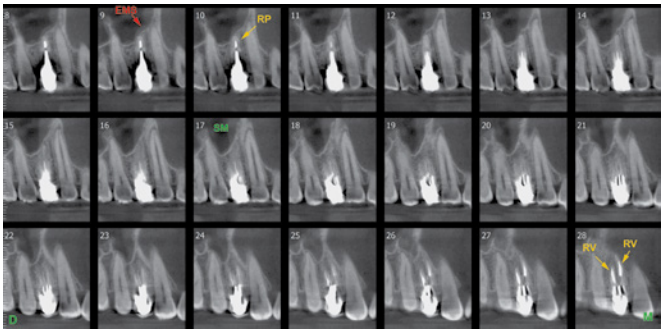

Figure 10. CBCT endodontic treatment follow-up (Dec/2015). Endodontic material can be seen inside the root canals of tooth #14, indicative of endodontic therapy and presence of intra-canal pins.

Figure 9. A) MTA barrier. **B**) Tooth #14, filled.

One month before removing the orthodontic appliance and one year after the beginning of traction, root canals were filled with gutta-percha cones (Odous de Deus, Belo Horizonte, Brazil) calibrated to the diameter corresponding to the last files that reached the work length (Denstply, York, USA), as it can be seen in both periapical radiograph (Fig 9B) and CBCT scan (Fig 10). In sagittal slices, the relationship between the apex of the palatine root and the cortical area of maxillary sinus floor can be viewed (Fig 11).

While still keeping the orthodontic appliance in place, surgery was performed to correct bone and gingival levels, which tend to follow the tooth, making it possible to visualize the entire resorption area (Fig 12).

One month after clinical crown augmentation surgery, the orthodontic appliance was removed (Fig 13) and root canals (Fig 14) and transsurgical impression

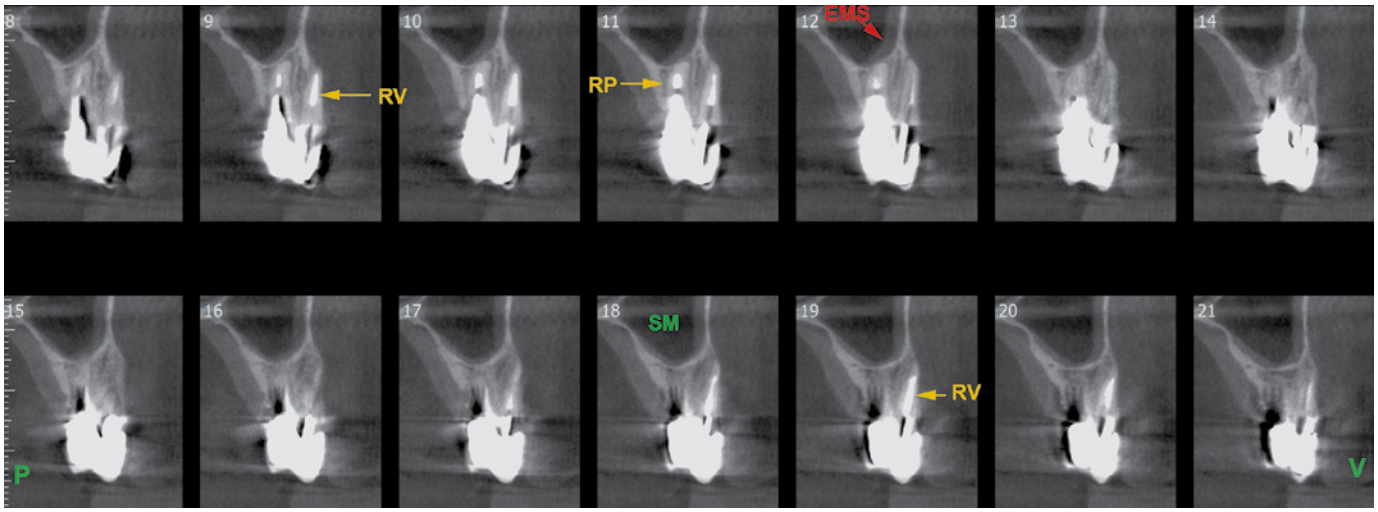

Figure 11. CTCT scan (Dec/2015). In sagittal slices, there is a change in the relationship between apex of palatine root and cortical area of maxillary sinus floor.

were prepared in order to complete subgingival preparation for placement of a cast metal core with gold alloy for clinical use (Au-Pd-Pt 63%, Todes Plat, CNG Indústria de Artigos e Equipamentos Odontológicos Ltda, São Paulo, SP, Brazil) one week later (Fig 15). This core was adapted subgingivally to the cavosurface angle, with the end of prosthetic preparation being placed at the gingival level.

Figure 12. Palatal view after orthodontic extrusion of tooth #14 and clinical coronary augmentation surgery, showing lesion exposure and presence of MTA, preventing invagination of gingival tissue in the cervical third of the palatine root.

Figure 13. Buccal view after orthodontic extrusion of tooth #4 and removal of orthodontic appliance.

Figure 14. Preparation of root canals for impression taking and subsequent placement of metal cast core.

Figure 15. Metal cast core with gold alloy cemented with zinc phosphate.

Figure 16. Dental preparation performed for subsequent impression taking and crown cementation with zirconia infrastructure.

Figure 17. Color selection using Vita Lumin Classical shade guide (Vita Zahnfabrik, BadSäckingen, Germany), with color B1 as predominant.

Figure 18. Photo of tooth #24 ready for the laboratory with emphasis on the form, to facilitate color stratification in ceramics.

Figure 19. Positioning retractor wires to take impression with addition silicone.

Figure 20. Clinical aspect immediately after cementation of crown on tooth #14.

Figure 21. Clinical buccal view after 5-month follow-up.

Figure 22. Clinical palatine view showing sealing of gingival tissue around subgingivally cemented metal core.

Preparations were performed under high rotation and cooling with #4102MF and # 3098MF (KG Sorensen, Barueri, SP, Brazil) diamond burs (Fig 16). Ultrapak #00 (Ultradent) retraction wire was adapted to prepare the cervical margin. Preparations were refined with a multiplier (Sirona Dental Systems, Bensheim, Germany) with diamond burs for FF and red Sof-Lex low-speed discs (3M ESPE, St.Paul, MN, USA). The color of tooth was determined using Vita Lumin Classical shade guide (Vita Zahnfabrik, Bad-Säckingen, Germany), whereby color B1 was found to be predominant (Fig 17), and photograph of tooth #24 was also taken to facilitate color stratification at the laboratory (Fig 18).

One week later, #00 and #000 retractor wires (Ultrapack, Ultradent, South Jordan, USA) were fitted into the gingival sulcus for casting (Fig 19). After five minutes had elapsed, impression was taken with addition silicone (Virtual, Ivoclar Vivadent, Schaan, Liechtenstein) in a single step. The cast was poured and die-cut for crown-making in feldspathic ceramics (CZR Noritake, Nishi-ku, Nagoya, Japan) with zirconia infrastructure.

Two weeks thereafter the crown was cemented with RelyX Ultimate resin cement (3M ESPE). Occlusion was carefully checked, since this is one of the factors that will allow the longevity of this case to be predicted.

Immediate final clinical aspect (Fig 20), and aspect observed five months after installation (Figs 21 and 22) of prosthesis reveal sealing of gingival tissue around the subgingivally cemented metal core.

Discussion

In most cases, internal and external resorption processes do not present any symptoms.[5,12] Among their key etiological factors are the following: orthodontic movement, impacted teeth, infections, inflammation, occlusal trauma and necrosis. Nevertheless, certain systemic factors can also cause root resorptions, such as renal dystrophy, hormonal imbalance and Paget's disease.[3,5,12-14]

Diagnosis is usually established by conventional routine radiographs.[2,5,12,15] However, the image may be stretched or shortened, masking fractures and lesions,[1,6] thereby corroborating the present case report of which initial diagnosis was based on periapical radiograph.

Several studies have recommended the use of cone-beam computed tomography (CBCT) to perform differential diagnosis and thus accurately determine the anatomy of the canal, as well as the presence of resorptions, lesions and fractures, given the axial, sagittal and coronal image slices of examination.[1,4,6,7,16,17] According to Perlea et al,[7] CBCT provides valuable contribution to diagnosis, agreeing with the case reported herein in which cone-beam CT scan was used throughout treatment, affording accurate and decisive diagnostic and anatomical information. In this report, such information was not gleaned with the purpose of evaluating endodontic treatment, but rather traction, since the critical root showing resorption was the palatine root, and it is only in a sagittal image that the orthodontist can follow up and determine when to end the traction.

External cervical resorptions preserve pulp contour of pre-dentin. The radiographic image obtained thereby matches with accuracy the outline of root canal, which overlaps and juts out over the irregular area.[5,12,18] Although treatment is basically endodontic, it depends on the location and extension of resorption.[5,8,10,12] However, calcium hydroxide dressings can raise the pH of adjacent regions, thus inhibiting the process of external inflammatory resorption and altering the microbial ecosystem, contributing decisively to the process of root repair and elimination of inflammatory cells. It should be noted that this treatment is effective in small injuries.[3,9,19] Thus, the use of MTA yields relevant results in terms of sealing and repair, given its biocompatibility and ability to induce tissue formation of the affected area.[9,10,11] In the case reported herein, calcium hydroxide and MTA were used prior to filling the root canal.

The present case proved somewhat challenging due to the depth of external resorption in the palatine root. As it was located mostly infra- and supra-osseous, but also subgingival, the authors opted to employ orthodontic traction in order to expose the entire resorption area. Had it been completely inflexible, perhaps the only option might have been endodontic treatment alone, with the use of MTA. Orthodontic traction usually lasts anywhere from one to a few months. However, in this particular case, it took one year to achieve this goal. Nevertheless, during calcium hydroxide dressing changes, the presence of hyperplastic tissue from the periodontal ligament near the palatine canal was common, due to traction, which caused mild bleeding in the region. As a result, intra-canal contamination could not be ruled out. Another issue under discussion involves the fact that the function of MTA is to seal connections between the inner part of root canal and periodontal ligament, but the only material that might remain intact when in contact with fluid was MTA, which in this case was used provisionally. Thus, it remained intact until the end of treatment, preventing invagination of periodontal ligament and maintaining the canal free from fluids during changes of medication. Once traction was completed, MTA was removed for prosthetic treatment.

Given the high risk of relapse,[5,20] the authors would like to underscore the importance of follow-up after the end of treatment of an external cervical resorption by maintaining periodic radiographic and clinical controls.[5,20] This was the protocol adopted by the authors in the present case.

Conclusion

The authors concluded that with proper planning, a multidisciplinary approach, and periodic radiographic and clinical controls, it is possible to successfully treat cases of external cervical resorption.

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