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CASE REPORT/CASO CLINICO

Cyst-like periapical lesion healing in an orthodontic patient: a case report with five-year follow-up

Guarigione di una lesione periapicale simil-cistica in un paziente ortodontico: case report con follow-up di 5 anni

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PAROLE CHIAVE

Lesione simil-cistica;
Incisivi centrali superiori;

Abstract

Aim: To report the orthodontic movement of two central incisors through the healing site of a maxillary cyst-like lesion of endodontic origin after nonsurgical treatment.

Case summary: This report shows the treatment of a 18-year old patient, male, with a Class II division 2 malocclusion. He came to our attention seeking for orthodontic treatment.

Radiographic examinations revealed a large cyst-like lesion in the maxillary anterior area, extending from the mesial surface of tooth 12 to the distal surface of tooth 21. The two upper incisors were nonresponsive to pulp sensitivity tests. Endodontic treatment was performed first. One week after root canal treatment had been completed with gutta-percha fillings, orthodontic treatment was started while the bone lesion healing was still underway. At the end of the orthodontic treatment, incisor retroclination was corrected, periapical lesion healing was completed and there were no signs of root resorption. The five-year follow-up revealed that

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Trattamento ortodontico;
Trattamento endodontico;
Riassorbimento radicolare.

occlusal relationship and dental alignment were kept stable and excellent radiographic resolution of the periapical lesion was obtained.

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Riassunto

Scopo: Riportare il movimento ortodontico di due incisivi centrali attraverso il sito di guarigione di una lesione simil-cistica di origine endodontica dopo trattamento non chirurgico.

Riassunto del caso clinico: Questo articolo riporta il trattamento di un paziente di 18 anni, affetto da malocclusione di Classe II divisione 2, venuto alla nostra osservazione con la richiesta di trattamento ortodontico.

Gli esami radiografici hanno messo in evidenza un'ampia lesione simil-cistica nella regione mascellare anteriore, che si estendeva dalla superficie mesiale 12 alla superficie distale del 21. I due incisivi centrali superiori rispondevano negativamente ai test di sensibilità pulpare. Una settimana dopo il completamento del trattamento endodontico con otturazione canalare con guttaperca, è stato iniziato il trattamento ortodontico mentre la guarigione della lesione ossea era ancora in corso. Al completamento del trattamento ortodontico, la retroclinazione incisiva risultava corretta e la guarigione della lesione periapicale era completa; inoltre, non erano visibili segni di riassorbimento radicolare. Il follow-up a 5 anni, ha mostrato che i rapporti occlusali e l'allineamento dentale erano stati mantenuti stabili; al controllo radiografico si era evidenziata una restituzione ad integrum della lesione ossea periapicale.

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Introduction

Changes in pulp blood supply, mainly due to dental trauma, may induce several pulp responses, leading to necrosis. Tissue necrosis and anaerobic conditions are the ideal environment for root canal colonization on the part of opportunistic microorganisms. Inflammatory reactions, including abscesses, granulomas and apical cysts, may develop in the periodontal tissue in response to intracanal antigenic content through immunopathological mechanisms.¹

In order to differentiate radicular inflammatory periapical lesions, an accurate histopathological analysis of lesions is required.² Nair et al.,³ after histological analysis, found that

15% of a sample of 256 periapical lesions were cysts, whilst 52% of the lesions were found to be epithelialized. Suspected cystic periapical lesions may undergo asymptomatic evolution and can become quite large.⁴ Extensive periapical lesions may heal after conventional endodontic therapy, contrary to which periapical surgery may be necessary to allow nonresponsive lesions to heal.⁵

Orthodontic treatment has been considered as a major factor involved in root resorption.⁶ While a well cleaned and shaped endodontically treated tooth is known to exhibit less propensity for apical root resorption during orthodontic tooth movement,^{7–10} less is known about the effects of orthodontic movement during the healing phase of periapical lesions. Relevant literature has always suggested to wait for

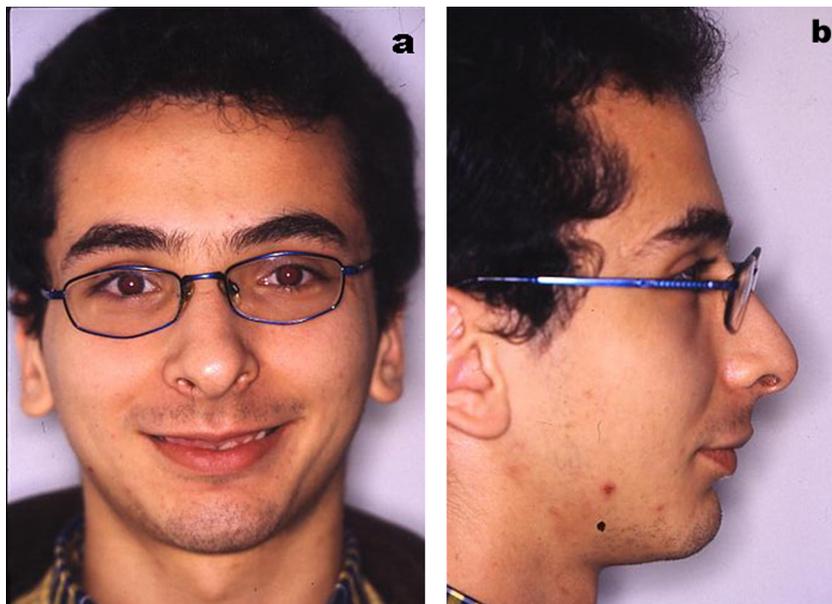


Figure 1 Pre-treatment frontal (a) and profile (b) view of the 18-year-old patient.

the complete healing of the apical lesion before applying an orthodontic force, because of the high risk of root resorption.¹¹

This case report illustrates a combined endodontic–orthodontic treatment in a patient with a severe deep bite and traumatic necrosis of upper incisor and radiographic signs of cyst-like lesion.

Case report

An 18-year-old male, with a non-contributory medical history, was brought to our attention for orthodontic treatment. The patient's main complaint was an unpleasant smile. Profile and frontal photographs showed an increased lower height. The facial profile was convex. Labial competence was

reached physiologically while a slight gummy smile was observed (Fig. 1a and b). The intraoral examination (Fig. 2a–f) revealed that oral hygiene was acceptable. First molars and the right lower second molar had amalgam fillings. A complete permanent dentition was present (the four third molars were asymptotically included). Facial and both arch midlines corresponded. Intraoral frontal and lateral views showed a severe deep bite. The incisor margin of both central incisors traumatized the vestibular lower incisor gingiva. The patient resulted having a bilateral Class I molar relationship. The maxillary central incisor crowns were displaced palatally to the arch, thus requiring considerable apex movement during orthodontic therapy.

Evaluation of the panoramic radiography revealed signs of bony pathosis. A large radiolucent lesion extended from the

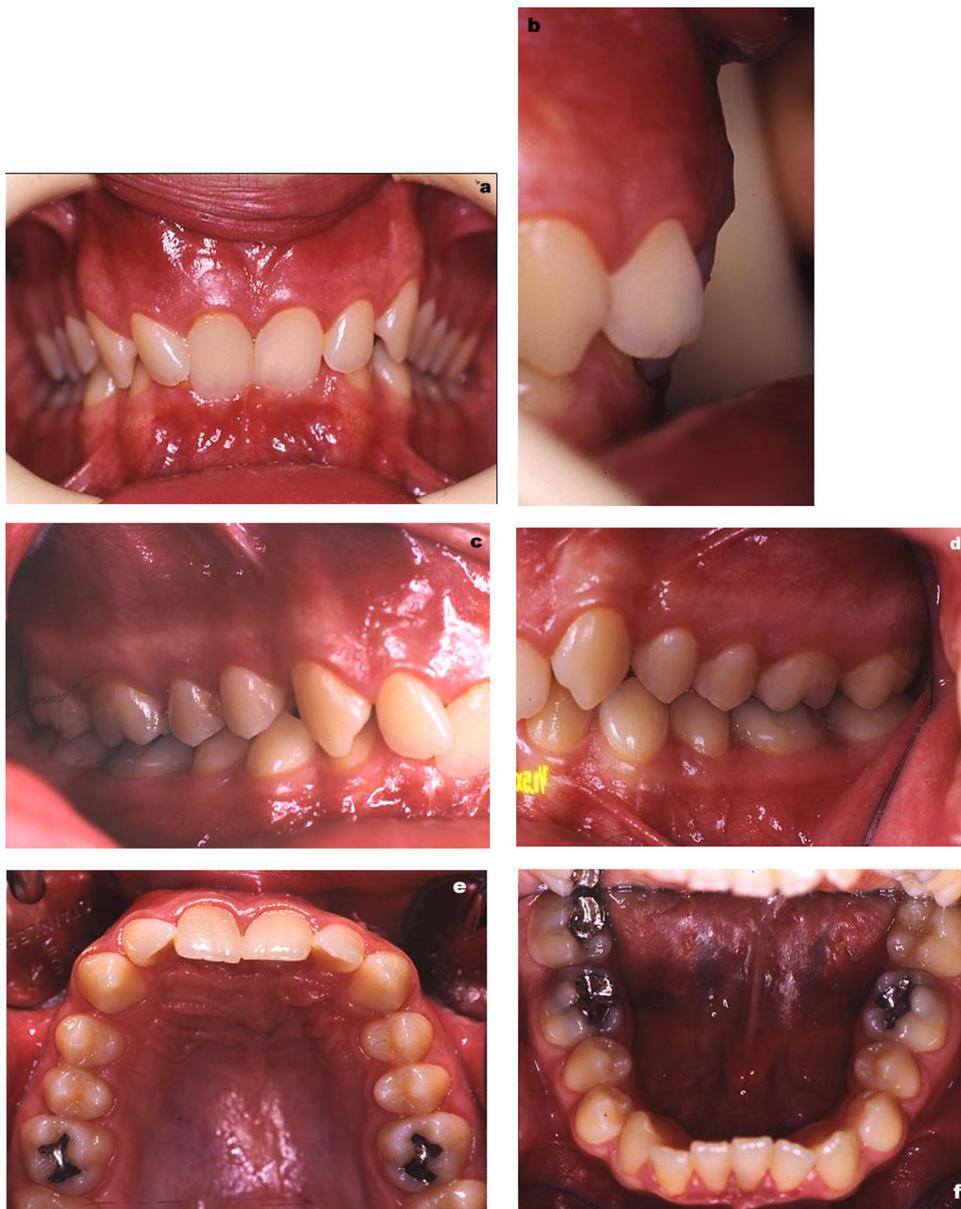


Figure 2 Pre-treatment intraoral views. (a) Frontal view shows the severe deep bite. (b) Overjet view. (c) Right and (d) left side views show a bilateral class I molar relationship (e) Occlusal upper and (f) lower arch views, note the palatally displaced central incisors.

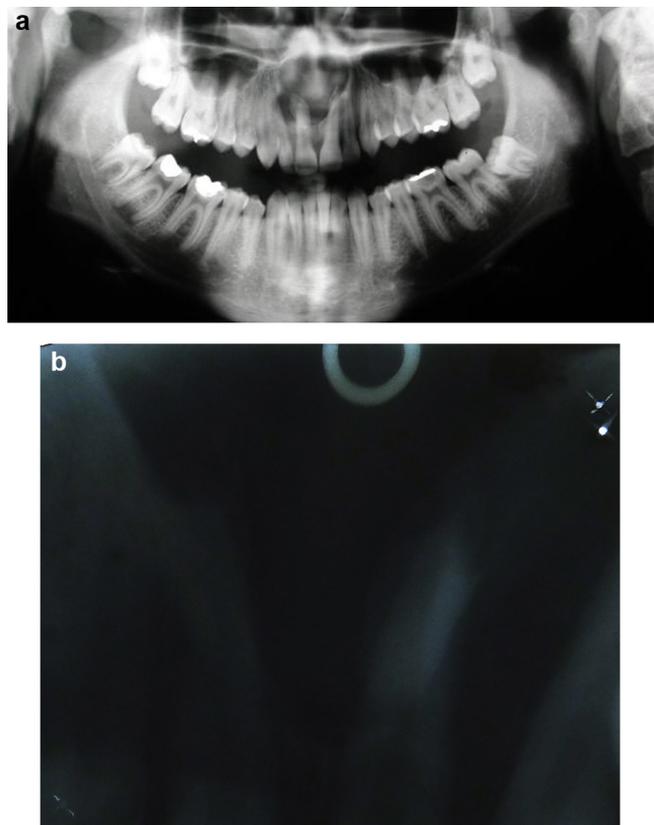


Figure 3 Inizial panoramic radiograph (a) and preoperative intraoral radiograph (b) showing the large radiolucent lesion.

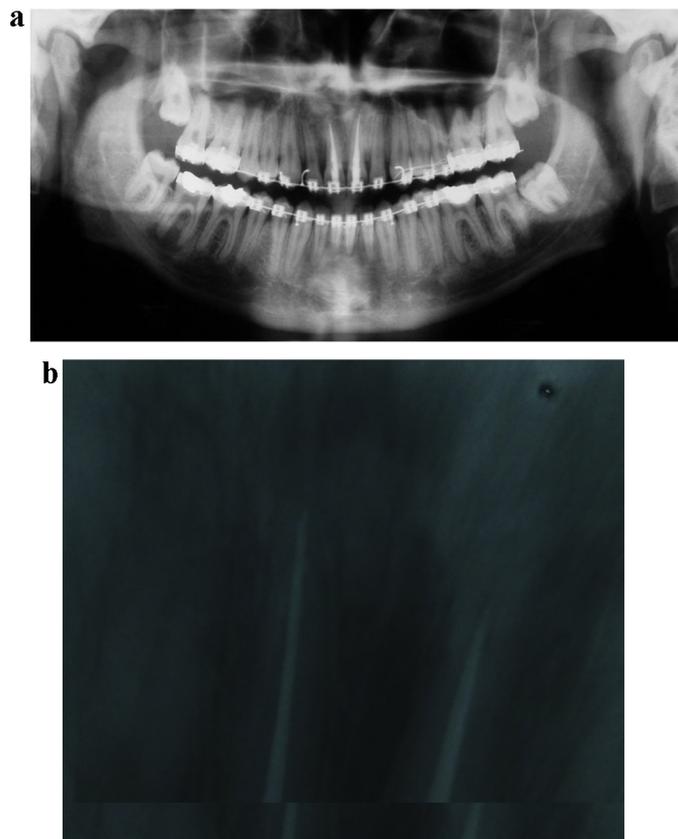


Figure 4 Two years post-treatment panoramic and intraoral radiograph showing the complete healing of the periapical lesions and healthy root apices.

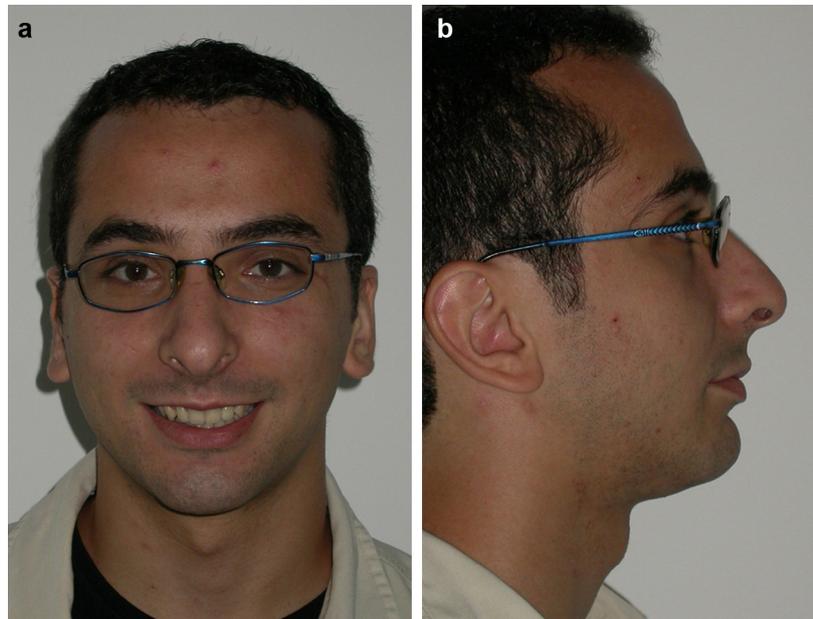


Figure 5 Post-orthodontic treatment (a) frontal and (b) profile views. Note smile characteristic and profile improvements as compared with Fig. 1.



Figure 6 Post-orthodontic treatment intraoral views. (a) Frontal and (b) overjet views indicate that overjet and overbite are in the norm. (c) Right and (d) left side views show a good functional occlusion. (e) Occlusal upper and (f) lower arch views reveal the correction of the incisor inclinations. A lower canine-to-canine fixed retainer has been applied for retention.

mesial surface of tooth 12 to the distal surface of tooth 21 measuring 27 mm in diameter (Fig. 3a and b). The patient referred to have had whiplash in the past, and to present a sporadic click in the right temporomandibular joint.

Before starting orthodontic treatment, an endodontic consultation was required. The patient was also examined according to the Research Diagnostic Criteria for Temporomandibular disorders (RDC/TMD)¹² because of the higher frequency of disc displacement in individuals suffering from whiplash syndrome.¹³

The endodontic examination revealed that the upper central incisors were nonresponsive to electronic and thermal pulp testing whilst adjacent teeth presented physiological responses. Pulp necrosis was diagnosed. Neither decay nor periodontal pockets were present. It is possible that the occlusal trauma derived from the severe anterior deep bite which had most likely triggered off the incisor necrosis, or from the trauma of the year before.

A diagnosis of pulp necrosis of traumatic origin with extensive apical periodontitis was established and root canal treatment on both incisors was performed. Upon access to the pulp chamber, a yellow serous exudate was evident in the canals. They were debrided with K-type files and irrigated with 5% sodium hypochlorite solution. The working length was assessed by apex locator and periapical radiographic analysis. Five days later, when active drainage ceased, we were able to perform the step back technique of canal preparation under rubber dam isolation: canals were instrumented using Ni-Ti rotary files accompanied by irrigation with 5% sodium hypochlorite.⁴³ To avoid possible fractures, a single patient use of a set of rotary file was preferred.¹⁴ A temporary dressing of calcium hydroxide was then applied and changed every 3 weeks for 2 months. After removal of the dressing using K-type file and irrigation with 5% NaOCl, root canals were filled with gutta-percha cones and Sealapex cement (Kerr/Sybron Dental Specialities Inc., Glendora, CA, USA) using cold lateral condensation technique.

One week later, orthodontic treatment was started. The patient's upper arch was bonded from tooth 16 to tooth 26 using straightwire self-ligating appliance to reduce initial orthodontic forces and chairside time.¹⁵ Two months later the lower arch was completely bonded, thanks to correction of the incisor inclinations. The use of heat activated archwires was preferred to reduce initial orthodontic forces and patient pain complaint.¹⁶ Torque of maxillary incisors was controlled using translation arch.¹⁷ Two years after completion of the endodontic treatment, no radiographic signs of bony defect nor root resorption were observed in the maxillary incisor area (Fig. 4a and b). After 26 months of active orthodontic therapy, profile improved (Fig. 5a and b), correct molar and canine relationships were achieved, overjet and overbite were within the norm and maxillary and mandibular arches were coordinated (Fig. 6a–f).

Comparison between pre- and post-orthodontic treatment lateral cephalograms showed evident correction of incisor inclination and torque, demonstrating the wide movement of incisor roots (Fig. 7a and b).

The patient was most satisfied with the final result. The five-year follow-up demonstrates that facial profile and smile characteristic improvements have been maintained (Fig. 8a and b) and the teeth have settled into a good functional occlusion with excellent facial aesthetics (Fig. 9a–f). The

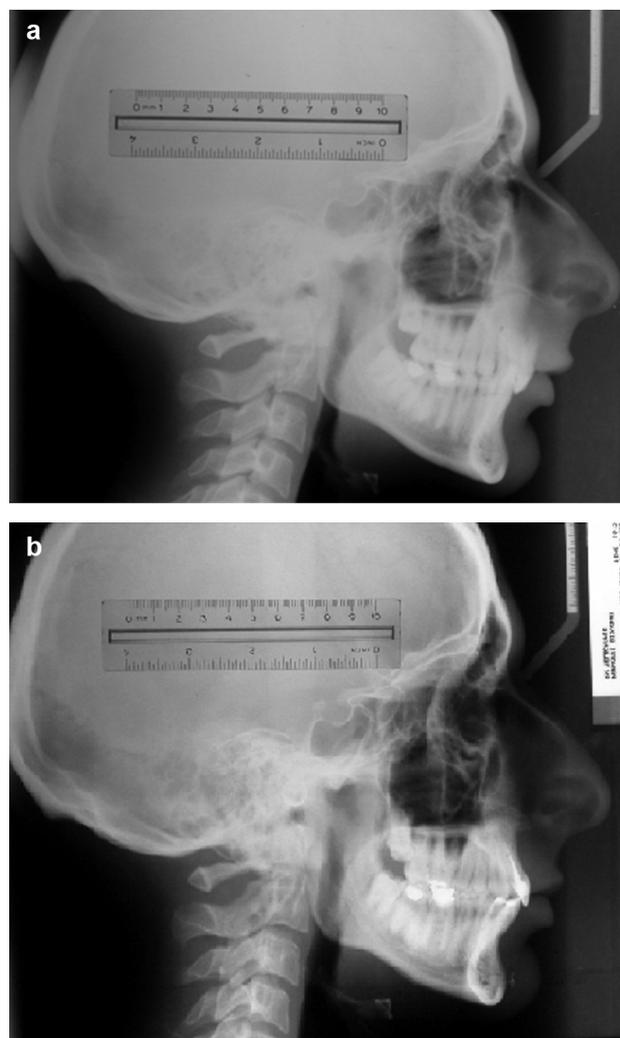


Figure 7 Pre- (a) and post- (b) orthodontic treatment lateral cephalograms. Note the correction of upper incisor inclination and torque, thanks to wide movement of incisor root.

panoramic radiograph revealed no signs of pathologic root resorption and periapical tissues were healthy (Fig. 10).

Discussion

Dental trauma, when associated with the disruption of pulp blood supply, can lead to necrosis. Circulatory breakdown causes tissue necrosis and anaerobic conditions for opportunistic microorganisms growth, favouring the development of inflammatory periapical lesions.^{1,18} When the inflammatory periapical process involves the epithelial islands of Malassez, these cells can proliferate and lead to the development of periapical cysts.³ Cysts are reported to be more frequent in males than females^{19,20} and the maxillary anterior teeth are more vulnerable than mandibular teeth.²¹ Traditionally, periapical lesions larger than 10 mm were considered as apical cysts whilst smaller ones were considered as granulomas.^{22,23} The reported incidence of cysts among periapical lesions varies from 6 to 55%. However, an accurate histopathological analysis of the lesions removed *in toto* is necessary in order to



Figure 8 Follow-up five years after completion of orthodontic treatment. (a) Frontal and (b) profile views show that good facial aesthetics is maintained.

differentially diagnose either radicular cysts or apical granulomas.²

A study, based on meticulous serial sectioning of periapical lesions, has shown that the incidence of radicular cysts is approximately 15% of all periapical lesions.³ The same author, according to a previous study,²⁴ differentiates “apical true cysts” from “apical pocket cysts” on the basis of their histological characteristics and connection to the tooth apex. The latter type, also known as “bay cysts”, is not completely enclosed in the epithelial lining, but is open to the root canals.² From a clinical and radiographic standpoint, it is impossible to differentiate granulomas and cysts or “apical cysts” and “bay cysts”.²⁵ As concern our specific patient, a clinical diagnosis of periapical cyst, based on epidemiological data, clinical and radiographic results, was possible, as previously reported by Çalişkan.²⁶ While a “pocket” or “bay” cyst is likely to heal after conventional nonsurgical therapy due to the removal of antigen intra-canal source, true cysts are less likely to respond successfully to conventional root canal therapy.²⁷ Root canal treatment using calcium hydroxide has resulted in more than 70% complete healing of large periapical lesions^{28,29} and many authors have previously supported the conservative nonsurgical approach to treatment.^{30,31}

In this case report, the endodontic treatment was performed according to the nonsurgical root canal treatment using calcium hydroxide proposed by Çalişkan.²⁶ The decompression of the cyst, demonstrated by the conspicuous drainage through the canals, associated with the accurate removal of intracanal irritants and with the renewal of calcium hydroxide dressing, led to significant periapical lesion resolution. The use of calcium hydroxide is effective in improving histological responses thanks to its anti-inflammatory action, neutralization of acids products, activation of alkaline phosphatase, and anti-bacterial action.^{32,33} These

effects seem to depend on the release of calcium and hydroxyl ions involved in several cellular and molecular mechanisms leading to the regeneration of periapical connective tissue.⁴ Endodontically treated teeth are reported to move as readily and for the same distances as teeth with vital pulps.^{34–37} Even if orthodontic movement is the main cause of external apical root resorption,⁶ some authors report that teeth with previous successful root canal treatment are less inclined to apical root resorption.¹⁰ Although this outcome cannot be considered conclusive,¹¹ it has been suggested that, owing to pulp removal, there may be loss in release of neuropeptides which are usually triggered off by orthodontic treatment.^{7–9}

Baranowskyj³⁸ investigated the healing rate of periradicular tissues in dogs after early application of an orthodontic intrusive force on teeth that had undergone periradicular surgery and retrograde root fillings. After comparison with non-orthodontically-treated group, the author concluded that the early application of orthodontic forces after surgical endodontic treatment greatly delayed the healing process and the specific cause was identified in tooth mobility. Whatever the case, no comparison could be made with this study, because of different species and protocol design, and, to our knowledge, no previous article deals with orthodontic movement performed during the healing phase of a cystic like lesion after conventional endodontic treatment in humans. Nonetheless, it has been reported that if endodontic treatment is needed, orthodontic treatment should be postponed until completion of endodontic treatment and clinical and radiographic evidence of healing.³⁹

In this case report, two months and two weeks after incisor pulp chambers were opened, and one week after the endodontic treatment with gutta-percha canals filling was completed, the upper arch was bonded and the active orthodontic treatment commenced. Moreover, in order to



Figure 9 Five-year follow-up intraoral views. (a) Frontal, (b) overjet, and (c, d) lateral photographs display that post-treatment results have been maintained. (e) Occlusal upper and (f) lower views show good teeth alignment.

complete lower arch bonding, impeded by the severe deep bite, the first active orthodontic movements were performed on the maxillary incisors. A 0.016 inches NiTi heat activated wire was used to obtain the vestibular inclination of incisor

crowns that corresponded to palatal movement of root apices. Light forces, like those exerted by a thin NiTi heat activated wire, with its peculiar surface characteristics,⁴⁰ are necessary to avoid the risk of root resorption.^{41,42}

Conclusions

This article presented a combined endodontic–orthodontic treatment performed in an adult patient with Class II division 2 malocclusion and a large periapical cyst-like lesion in the maxilla anterior region. A large periapical cyst-like lesion may respond to nonsurgical root canal treatment. In this case report, the orthodontic movement of incisor roots was successfully performed during the healing phase and through the healing site of the cyst-like lesion.

Clinical relevance

The long-term successful outcome of the present study suggests that clinicians could perform an orthodontic tooth



Figure 10 Follow-up five years after completion of orthodontic treatment. Panoramic radiograph revealing healthy periapical tissues.

movement without awaiting the complete healing of periapical cyst-like lesions, if appropriate root canal treatment has been previously completed. Further studies are needed to demonstrate the clinical suggestions of this report on large scale.

Conflict of interest

The authors declare no conflict of interest.

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