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CASE REPORT/CASO CLINICO

Importance of CBCT in the management plan of upper canine with internal resorption

Importanza della CBCT nel piano di trattamento di un canino superiore con riassorbimento interno

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Nonsurgical endodontic therapy.

Abstract
Aim: Internal root resorption is a particular medical condition which requires the clinician to a treatment as early as possible to avoid complications such as excessive loss of mineralized tissues and periodontal communications.
Methodology: This article describes the diagnosis and treatment of a case of internal resorption of an upper canine in a patient of 21 years. The presence of pain and swelling periodontal gum showed an interest, a sign of the presence of a perforation.
Result and conclusions: Accurate diagnosis associated with the three-dimensional evaluation of the internal fault (CBCT examination) have allowed a conservative treatment who has allowed the recovery of the tooth.

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PAROLE CHIAVE
Riassorbimento interno;
Riassorbimento radicolare interno con perforazione;
Cone Beam tomografia compiuterizzata;
Mineral Trioxide Aggregate;
terapia endodontica non chirurgica.

Riassunto
Obiettivi: Il riassorbimento interno radicolare rappresenta una particolare condizione patologica che obbliga il clinico ad un trattamento il più precoce possibile onde evitare complicazioni quali l'eccessiva perdita dei tessuti mineralizzati e le comunicazioni parodontali.
Materiali e metodi: Questo articolo descrive la diagnosi e il trattamento di un caso di riassorbimento interno di un canino superiore in una paziente di 21 anni. La presenza di dolore e di una tumefazione gengivale evidenziava un interessamento parodontale, segno della presenza di una perforazione.
Risultati e conclusioni: Una diagnosi accurata associata alla valutazione tridimensionale del difetto interno (esame CBCT) hanno permesso un intervento conservativo che ha consentito il recupero dell'elemento dentario.

Introduction

Internal root resorption (IRR) is a relatively rare condition in permanent teeth that poses many difficulties for treatment.[1–5] IRR occurs exclusively as a result of pulp inflammation, indeed IRR is the progressive destruction of intraradicular dentin and dentinal tubules along the middle and apical thirds of the canal walls as a result of clastic activities.[1] IRR can manifest by means of a slow or rapid progression.[6]

The etiology of IRR is not fully understood, however, it can be associated with many factors such as partial removal of the pulp, trauma, orthodontic treatment, caries, pulp capping with calcium hydroxide or pulpotomy, extreme heat and a cracked tooth. These factors stimulate the pulp tissue, thus initiating inflammatory processes and then some undifferentiated cells of the pulp convert themselves to osteoclasts or macrophages, which results in dentinal resorption.[1,7,8]

The clinical characteristics of internal root resorption depend on the degree and stage of the resorption.[9] Usually IRR is asymptomatic and detected coincidentally through routine radiographs,[1,4] during active progression of the resorption the tooth is at least partially vital and may show typical symptoms of pulpitis.[1] However, it may include the presence of a reddish area — pink spot, which represents the granulation tissue showing through the resorbed area.[10] Untreated teeth often turn gray/dark gray if the pulp becomes Necrotic[9].

The diagnosis and follow-up of IRR is primarily based on radiographic examinations and supplementary information gained from the patient history and clinical findings.[1,6]

In conventional radiographs IRR can appear as round, oval or elongated radiolucent enlargements of the root canal space with well-defined margins, and shifted radiographs do not change the positional relationship of the canal to the resorptive entity.[1,9]

Conventional radiography is often unable to identify the true extent, location, or portal of entry of a resorptive lesion.[1,11]

Recently Cone Beam Computed Tomographic (CBCT) allows a more accurately diagnosis than conventional radiographs.[10–12] CBCT images also display the location and extension of perforations and resorptive defects.[12–14] Several case reports and case series have confirmed the usefulness of CBCT imaging in diagnosing and managing resorptive lesions.[1,11,15] In particular the use of small *FOV (fi eld of view)* captures clear images that allow display even small perforation. CBCT scanning has been shown to help determine treatment complexity and aid the clinician in offering an accurate prognosis.[3]

Several reports have shown that in cases where internal resorption was not a result of inflammation, the arrest of resorption was followed by apposition of calcified tissue.[16,17]

Root canal treatment remains the treatment of choice of internal root resorption as it removes the granulation tissue and blood supply of the clastic cells.[8]

The complex irregularities of the root canal system, especially in internal resorption defects, pose technical difficulties for the thorough cleaning and obturation of the root canal. The persistence of organic debris and bacteria in these irregularities may interfere with the long-term success of the endodontic treatment.[17,18] Therefore, the importance of achieving total obliteration of the root canal space has been stressed in case of internal resorption.[19]

Instrumentation and cleaning of the root canal space of teeth with IRR is a challenge different from those of normal endodontic treatment. In case of actively resorbing vital tissue, excessive bleeding makes it difficult to locate the root canal openings.[20] However, irrigation with sodium hypochlorite (NaOCl) or inter appointment calcium hydroxide ($Ca(OH)^2$) dressing (to control bleeding, and to necrotize residual pulp tissue and to make the necrotic tissue more soluble to NaOCl[1,9]) will in most cases help to reduce the bleeding.[1,21,22]

The NaOCl penetration in the endodontic space and its antibacterial activity can be enhanced by ultrasonic activation.[23]

Various materials available for the treatment of internal root resorption include MTA, glass ionomer cement, Super EBA, hydrophilic plastic polymer, zinc oxide eugenol and zinc acetate cement, amalgam alloy, composite resin and thermoplasticized gutta-percha by injection or condensation techniques.[10]

When IRR was perforated the mineral trioxide aggregate (MTA) was indicated for filling the resorption cavity.[2–5] MTA is most commonly used because of its biocompatibility, sealing ability and potential induction of osteogenesis and cementogenesis followed by thermoplasticized gutta-percha obturation techniques.[2,24–26]

Figure 1 Clinical photograph showing localized swelling.

Figure 2 Pre-operative periapical radiograph showing a periapical lesion with severe internal root resorption on the right maxillary canine.

Materials and methods

A 21-year-old female was referred to our practice for pain and swelling since 8—10 days. The medical history was noncontributory. She had no story of traumatic injury but she led the orthodontic appliance fixed 7 years ago for 2 years.

The patient's oral hygiene was fair and the periodontal condition was excellent.

Clinical examination revelated periodontal abscess in 22—23 area (Fig. 1), no sinus tract is present. The crown of 2.3 did not show any pink spot (Fig. 1). The tooth responded positively to the test of percussion while the thermal test (crio test) was uncertain, cold testing with ENDO-ICE frozen gas (Pharmaéthyl Septodont, Saint-Maur-des-Fossés, Cedex, France). The tooth did not present pathologic mobility. The adjacent teeth responded normally to pulp vitality tests.

The examination of palpation at the apex of the 2.3 the patient reported pain. The patient do not take farmacology therapy.

A preoperatory periapical radiographic examination (Fig. 2) (Insight, Carestream Dental, Rochesters New York, USA) showed a radiolucency elongated positioned along the pulp chamber and the coronal portion of the root canal in the mesial part of the tooth with a crescent radiolucency lesion in the alveolar bone next to a resorptive lesion.

A CBCT was performed (Fig. 3) (Orthophos XG 3D, SIRONA DENTAL SYSTEMS, Verona, Italy) with a small field of view (5×5.5 cm) and high resolution (0.1 mm slice thickness) for the study of real dimension, position and shape of the resorption (SIDEXIS XG 2.61 SIRONA DENTAL SYSTEMS, Verona, Italy). In particular the bucco-palatal anatomy can be visualized (with conventional radiography cant be displayed). Three dimensional imaging also aids the clinician to evaluate the exact location of perforation that preoperative radiograph has not determined.

The patient was advised of the technical difficulties and potential risks of the endodontic treatment and the uncertainty healing. The patient gave written consent for the proposed treatment.

Treatment plain including cleaning of the resorptive cavity and the canal space, obturation of the resorption with MTA, endodontic obturation with gutta-percha and direct composite.

At the first session after mouth rinse with 0.2% chlorhexidine gluconate (Curasept, Curaden Healthcare, Saronno, VA, Italy) the tooth was anesthetized with buccal infiltration of

Figure 3 (a—c) Axial, coronal and sagittal CBCT cross-sections, is possible to showing the extension of the internal root resorption lesion on the right maxillary canine, the extension of periapical lesion and the septum that divide the resorption by endodontic canal. (d) The 3D reconstruction of coronal CBCT cross-section showing the resorption area with perforation of radicular walls.

Figure 4 Clinical photograph showing endodontic access is possible see the blooding by perforation.

2% Articaine containing 1:100,000 epinephrine (Ubistesin 3M ESPE, Neuss, Germany).

The tooth was isolation with a rubber dam (Nictone Manufacturera Dental Continental, Zapopan, Jalisco, Mexico), a classic palatal access cavity was prepared with tungsten carbide bur (Fig. 4) (2P SS White Burs Inc., Lakewood, NJ, USA).

Based on the CBCT findings, the lesion was diagnosed as a perforating internal resorption and the treatment was performed under surgical microscope at 8—12.5× of magnification (Leika M400-E, Sesto San Giovanni, MI, Italy). Irrigation was performed with 5.25% NaOCl (Niclor Ogna, Muggió, MB, Italy) at 50 °C with ultrasonic activation (Fig. 5) (ProUltra™ Endo7, Maillefer Dentsply, Baillaigues, Switzerland).

The resorptive cavity it has been cleaned with the aid of ultrasonic inserts (Figs. 6 and 7) (ETBD Satelec, StartX® 1 Maillefer Dentsply, Baillaigues, Switzerland) and the granulation tissue was removed almost completely. The first working length hypothetical was performed by a preoperative radiograph and then by CBCT software. The pulp tissue has been removed from the root canal and then was shaped provisionally. calcium hydroxide was placed as interappointment dressing (Endoidrox Ogna, Muggió, MB, Italy), which has good tissue dissolution property to remove completely the granulation tissue in the clastic cavity.

After 10 days the periodontal swelling was clinically healing (Fig. 8) and the root canals were re-entered and irrigated alternately with 5.25% NaOCl at 50 °C and sterile saline 0.9% (S.A.L.F., Cenate sotto, BG, Italy) to remove the temporary dressing. Root canal were cleaned and then the electronically working length has been taken by a apex locator (Justy

Figure 5 Clinical photograph showing ultrasonic activation of endodontic irrigant.

Figure 6 Clinical photograph showing the internal resorption after detersion.

Figure 7 Clinical photograph showing the endodontic canal and the two perforations.

II, Yoshida Dentcraft, Tokio, Japans) and it was 28 mm. The resorption cavity was cleaned and finished with ultrasonic insert (K25 Acteon Satelec, MERIGNAC cedex, France) and dried gently with a sterile paper points (Absorbent paper point size coarse, Inline, TO, Italy). Communication with the external root surface was evident (Fig. 9). While the coronal part of root canal was sealed with a large paper point, the white MTA Prooroot Maillefer Dentsply, Ballaigues, Switzerland) was condensed into the resorption cavity using a non-surgical MTA carrier (Micro Apical Placement System,

Figure 8 Clinical photograph showing healing of gengiva after 10 days.

Figure 9 Clinical photograph showing the internal resorption after cleaning and shaping by ultrasonic tip under operative microscope.

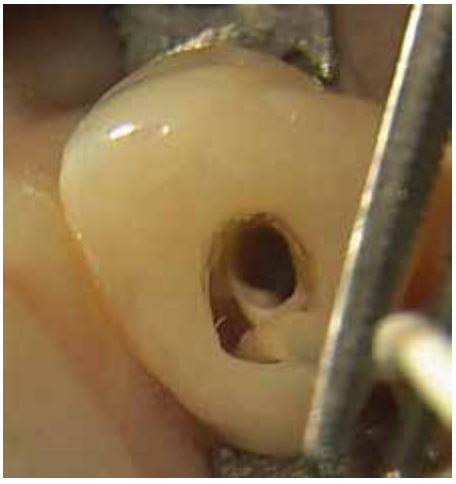

Figure 10 Clinical photograph showing root canal drie with calibrated absorbent paper points.

Produits Dentaires, Vevey, Switzerland) and with the help of root canal pluggers and paper points wet the MTA cement was adapted into cavity (Figs. 10 and 11). (Maillefer Dentsply, Ballaigues, Switzerland). A moist cotton pellet was placed in the pulp chamber to stimulate MTA setting and a control

Figure 11 Clinical photograph showing the resorptive area has been filled with MTA.

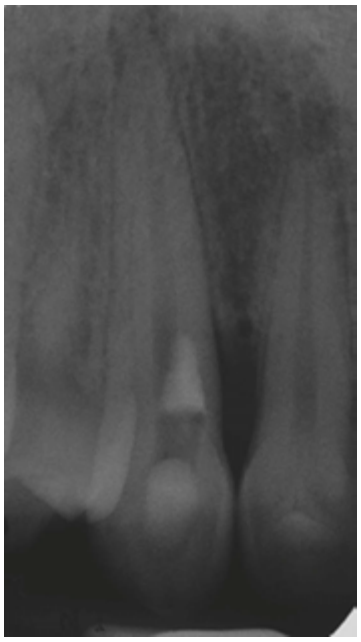

Figure 12 Intra-operative periapical radiograph showing the MTA place in the resorption area.

radiograph was acquired to verify the quality of the MTA placement (Fig. 12).

The next appointment, after 7 days, after checking the complete hardening of the MTA (Fig. 13), the canal was prepared using crown down technique with ProTaper Universal files (Maillefer Dentsply, Ballaigues, Switzerland) accompanied by copious irrigation with 5.25% sodium hypochlorite at 50 °C. The last endodontic file used was Protaper Universal F5 iso 50 taper .04 (Maillefer Dentsply, Ballaigues, Switzerland) and the master cone radiograph was taken.

Before the drying of the root canal after a final rinse with EDTA (E.D.T.A. 17% Ogna, Muggió, MB, Italy) and the last rinse with NaOCL, the root canals were dried with calibrated absorbent paper points and the canal was obturated with gutta percha (Dentsply, Maillefer) and Argoseal (Argoseal Ogna, Muggió, MB, Italy) using vertical compaction with heated pluggers and condensers (Calamus dual Maillefer Dentsply, Ballaigues, Switzerland).

Figure 13 Clinical photograph showing the hardening of MTA.

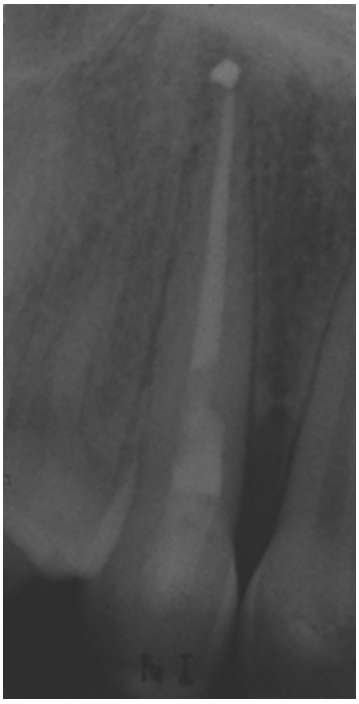

Figure 14 Periapical radiograph after 3-month showing the initial healing of periapical lesion and the essence of parodontal defect.

Between the therapy appointment the access cavity was temporarily sealed with Cavit G (3M ESPE, Neuss, Germany). At the fourth clinical session the coronal chamber was restored with a fiber post (Tech 21 cop size Isasan, Rovello Porro, CO Italy) and composite (Optibon Solo Plus Keer Scafati, SA Italy; Enamel Plus HFO mycelium Rosbach, Germany) an immediate postoperative radiograph was taken and radiographic follow up was conducted three month later (Fig. 14). Clinical examination was performed six months after proving a functional tooth without periodontal probe and inflammatory.

Discussion

Internal Root Resorption (IRR) is a pathologic condition that destroys the hard tissues of teeth by reactivating odontoclastic activity.[1,20] IRR begins in the endodontic space to then continue along the external surface of the tooth and requires a partial pulp vitality.[1,7] If detected at an early stage, it is possible to have a conservative treatment — such as a root treatment — and therefore save the tooth.[1,4] In case of late diagnosis — which often occurs due to a lack of symptoms — and IRR with one or more communications with the paradontal tissue, a clinician has to face two issues: diagnosis and treatment.

For what concerns diagnosis, as periapical radiograph is a two-dimensional representation of a three-dimensional structure, it does not give us the full picture of the clinical condition and, therefore, does not allow a correct treatment plan. In recent years, cone beam CT has been introduced in dentistry.[5,11,12] The use of a small FOV (*field of view*) has led to the use of this technology in the diagnosis and assessment of many dental pathologies — among which IRR — thus limiting X-ray exposure.[11] In particular, 3D view allows us to see the buccopalatal dimensions and the possible presence and exact position of all parodontium communications, something radiograph does not show.[4,5]

For what concerns treatment, the choice is strongly linked to a precise diagnosis.[1,3] That is why we believe that Cone Beam CT does not only allow a better resorption diagnosis, but, since it gives us more data, it allows clinicians to establish the most appropriate treatment, thus it reduces overtreatment when recovery is no longer possible.[11,14,15]

In this clinical case, due to cone beam CT, we were able to plan the conservative treatment starting from a correct diagnosis and precise indication of all perforations.

In the orthograde conservative treatment for this kind of disorder, the key is a correct disinfection and cleansing of the endodontic space with heated NaOCl and EDTA, and ultrasonically activating them using ultrasonic inserts.[22,23] The effect of NaOCL is important also to deactivate clastic activity by blocking the resorption process.[1,8,10] The use of a $Ca(OH)^2$ medication between appointments is necessary to reduce the presence of bacteria in the endodontic space.[22] Furthermore, the tissue dissolution capacity of calcium hydroxide[22] improves mechanical removal in those anatomic areas that cannot be reached by endodontic tools. Resorption anatomy causes difficulties in its cleansing; at the same time, the possible presence of debris and bacteria may hinder treatment prognosis, hence some authors recommend the use of ultrasonic tips for resorption cleansing.[4,23]

The prognosis of teeth treated with IRR depends on the size of the lesion and the presence of perforations associated with compromised parodontal tissues.[1,9,18] Moreover, wide lesions imply a reduced mechanic resistance of the tooth with a greater risk of vertical fracture. An early diagnosis is still the best solution for conservative and resolutive treatments.[1,8]

In our clinical case, the presence of more communications with the parodontal tissue led to closing this defect with MTA based cement.[17,2,26] This because this kind of cement creates a stable seal and grip when liquids are present. Finally, the many properties MTA cements have — biocompatibility, bactericide effect and radiocapacity — make them the first choice for the treatment of IRR with perforation.[7,2,24,26]

Conclusions

Although this clinical case has only been completed recently — radiograph follow up after three months and control visit after six months — the rapid solution of the symptoms and parodontal abscess after only a few days could be considered as a concrete base for the long-term recovery of the tooth.

Clinical relevance

This case report has shown the limited accuracy of 2D radiographs and the superior performance of cone beam CT exam in the management of internal resorption with perforation.

Conflict of interest

The authors deny any conflicts of interest.

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