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CASE REPORT

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Rare multiple internal root resorption associated with perforation – a case report

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Abstract

Multiple internal root resorption is a rare outcome of chronic irreversible pulpitis. In some cases, a chronic apical periodontitis can be later on associated. Usually, the conventional intraoral radiograph is mandatory in diagnosis but only CBCT proved to detect the true location, shape and size of resorptive defect and, if present, a perforation generated by resorption extension through the canal wall. Unlike the intraoral radiograph, CBCT is also able to improve the management and the recall evaluation, demonstrating a higher accuracy and reliability.

***Keywords*:** multiple internal resorption, root perforation, chronic apical periodontitis, cone beam computed tomography, diagnosis, management.

Introduction

The bulk of papers dedicated to internal root resorption (IRR) are mostly case reports because actually this type of resorption of the tooth hard tissues represents a relative rare occurrence [1–7].

In the permanent dentition IRR, this loss of mineralized tissues, invariably inflammatory in nature, is pathologically induced by clastic activity synchronized by proinflammatory cytokines and transcription factors similar to those involved in bone remodeling [1, 2].

The pulp cells that resorb tooth hard tissues are odontoclasts. Morphologically they resemble osteoclasts because they are multinucleated giant cells. However, odontoclasts are smaller than osteoclasts and have fewer nuclei [1].

In osteoclasts and odontoclasts, the mechanism of mineralized tissues resorption is similar because both types of cells have comparable enzymatic equipment and generate a common feature of resorption, the so-called Howship's lacunae [1, 8, 9].

As dendritic cells of dental pulp share same hematopoietic lineage with osteoclasts, a very attractive and recent hypothesis suggests that dendritic cells themselves might function as precursors of odontoclasts. Accordingly, in chronic pulp inflammation odontoclasts could be locally recruited to the sites of irritation by proinflammatory cytokines [11, 12].

Dentin cannot be resorbed as long as is protected by odontoblasts and predentin. In case of different local injuries, such as caries, trauma, heat during operative procedures, orthodontic treatment, this outermost protective barrier disappears and odontoclasts may start their resorptive activity [13–15].

However, a first prerequisite to continuous progressing of IRR is an elevated blood supply of pulp tissue apical located to the defect because it provides the constant recruitment of odontoclasts and their precursors. The second one is a steady bacterial stimulation of pro-inflammatory cytokines [1, 11–15].

Clinically IRR is a matter of diagnosis concern because at inspection it may frequently be confused with cervical invasive resorption, particularly in case of "pink spot", when subepithelial granulation tissue that belongs to this type of external root resorption is undermining the enamel [9, 10, 13, 14].

As IRR usually progresses symptom-less, the certitude of its presence is provided by the radiographic appearance of an oval-shaped radiolucent enlargement located in the root canal or pulp chamber. Finally, the IRR evolution culminates in pulp necrosis, root canal perforation and infection. Associated acute or chronic apical periodontitis are rather frequently described [13–16].

To avoid the tooth loss due to complicated root fractures, both timely diagnosis and proper treatment are crucial as they might guarantee a better and predictable outcome [17].

The aim of this paper is to describe the use of cone beam computed tomography in the diagnosis and treatment of a rare case of perforating IRR affecting multiple permanent molars.

Patient, Methods and Results

A 23-year-old male patient was referred by one general practitioner colleague for root canal treatment of lower left first permanent molar (tooth 36). The patient complained of dull acute pain, sensitivity to biting pressure and extraoral facial swelling in the area of posterior cheek.

There was no history of previous trauma, including parafunctional habits. As far as the patient remembered the tooth was restored a couple of years ago.

Clinically, tooth 36 was tender to axial percussion. An intraoral swelling was observed and palpated in the lower left mucobuccal fold but there was no evidence of intraoral sinus tract in the area. The tooth was non-responsive at vitality tests. Vertical root fracture, crack tooth syndrome or split root were ruled out. No evidence of periodontal attachment loss was observed on both buccal and lingual sides of the tooth.

Digital periapical radiographs following the paralleling technique were taken using an X-Mind™ device from SATELEC. The sensor was scanned with Digora® scanner equipped with Digora® for Windows software.

The periapical radiograph showed an internal resorptive defect in mesial root and a chronic apical periodontitis associated with distal root (Figure 1). The evident ballooning of root canals in tooth 36 was located at the border of coronal with middle third of the mesial root.

Following the verbal and written consent of the patient, the emergency treatment was initiated and a CBCT (NewTom VGi, QR Srl, Verona, Italy) examination of the anatomical area associated with tooth 36 was indicated in order to evaluate the true nature, location, shape and size of abovementioned radiolucency (Figure 2).

A clear contoured internal resorption was seen in CBCT coronal view of mesial root, located at the high cervical positioned confluence of buccal and lingual canals (Figure 3). In axial view of CBCT, an obvious perforation of the mesial root was revealed, provoked by distal extension of resorptive pathological process (Figure 4).

Figure 1 – ***Preoperative periapical radiograph of left lower first molar (tooth 36) revealing internal root resorption in the mesial root and chronic apical periodontitis in the distal root.***

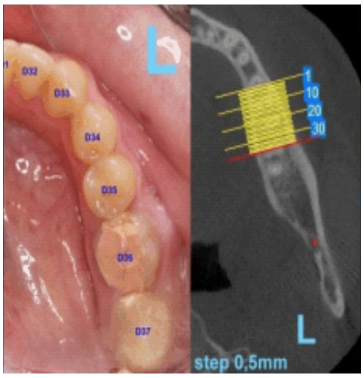

Figure 2 – ***Slices of exposure in CBCT for tooth 36 (axial view).***

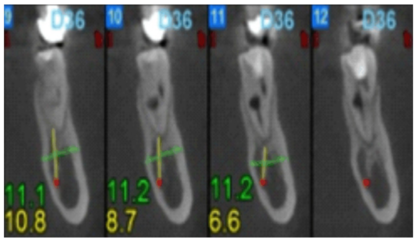

Figure 3 – ***Preoperative CBCT scan (coronal view of mesial root in tooth 36).***

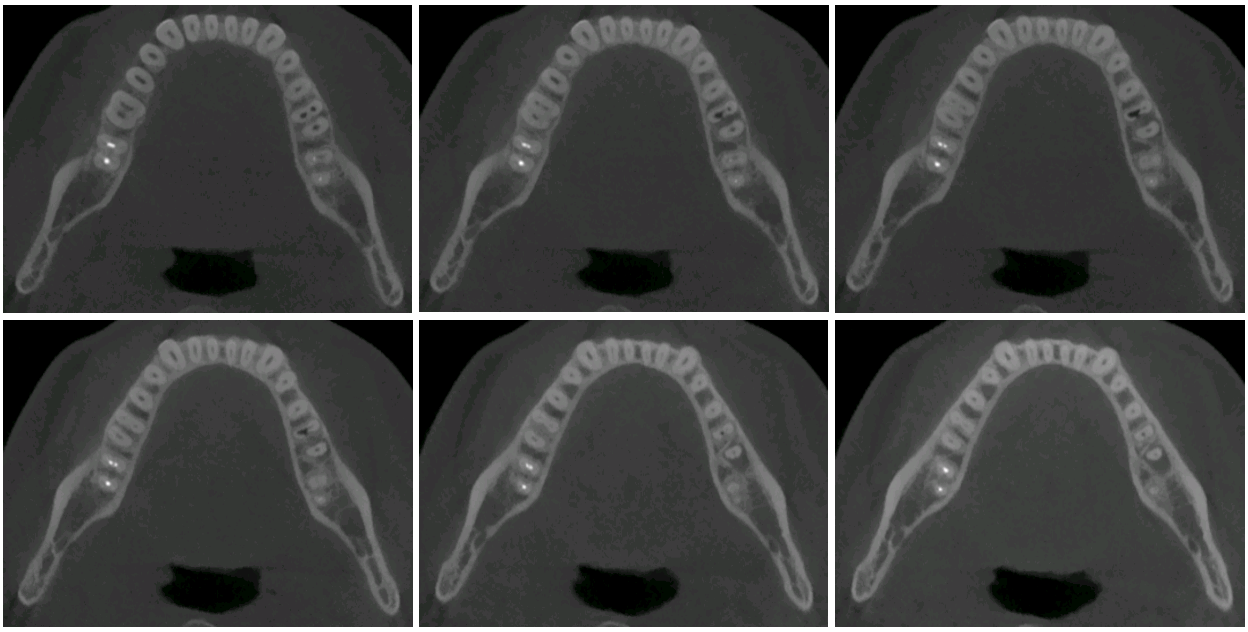

Figure 4 – ***Preoperative CBCT scan (axial view revealing the distal extension of the IRR with detectable perforation in mesial root of tooth 36).***

Before starting the conservative root canal treatment, the patient agreed with, he was also informed about the potential difficulties and predictability. The rubber dam was applied, the tooth 36 disinfected with sodium hypochlorite 1%, the pulp chamber was opened and the mesial root canals were preflared.

High difficulties were encountered in establishing the working length due to the defect perforation. The attempt of negotiating the mesio-buccal canal on full length was unsuccessful because the pathfinder impacted in defect walls. The recorded working length with an electronic apex locator (TriAuto ZX, Morita, Japan), confirmed radiographically for the mesio-lingual canal, was 20.5 mm, respective 19 mm for the distal canal. Fortunately, for a right endodontic treatment the CBCT slice in coronal view revealed the location of a resorptive defect at the confluence of the mesial root canals that have a common apical portal of exit (Figure 5).

Mechanical enlargement of root canals was performed with rotary instruments ProTaper Universal S1, S2, F1, F2, F3 (Dentsply Maillefer, Switzerland), followed by manual activated files up to master apical file (MAF) ISO 0.35 in the mesio-lingual canal and ISO 0.60 in the distal canal.

Throughout the chemo-mechanical preparation of root canals, a copious irrigation with sodium hypochlorite 5.25% solution was used. The mesio-lingual canal was carefully irrigated by syringe having the vent of the irrigation needle oriented to the opposite side of perforation in order to avoid the extrusion in the furcation area of molar tooth 36. The irrigation of the distal canal was ultrasonically passively activated but in the mesio-lingual canal, the sodium hypochlorite solution was manually gently agitated with an accessory pre-fitted gutta-percha point, short of the perforation level.

As is unanimously accepted manual or rotary files cannot be used for shaping the IRR walls and removing the vital or infected debris. Even though it is not an ideal treatment solution, only the irrigation procedure using sodium hypochlorite works. For further removal of smear layer, the root canals were irrigated with EDTA 17% solution.

After a final rinse of sodium hypochlorite, the root canals were dried with sterile paper points and an apical 3 mm MTA plug (mineral trioxide aggregate, Angellus, Edwards) was compacted in the distal canal. Perforation was also sealed with MTA using operative microscope. The root canals filling was completed using thermo-plasticized gutta-percha (Obtura Gun III, Obtura Spartan) and AHPlus sealer (Dentsply Maillefer). The rubber dam was removed and a final digital radiograph was taken (Figure 6). NSAI (non-steroid anti-inflammatory) medication and analgesics were prescribed, should they be needed.

The patient was reviewed one-year after the completion of the endodontic treatment. Tooth 36 was totally asymptomatic. No radiolucency in the alveolar bone around the mesial root with previous perforating IRR was revealed in a coronal view of CBCT (Figure 7).

A conventional periapical radiograph showed in the distal root the healing of former chronic lesion (Figure 8). Unlike the intraoral radiograph at the same one-year recall, in coronal view of CBCT, the chronic apical periodontitis is still present in tooth 36 (Figure 10). However, it has to be highlighted that, as compared to the patient preoperative status (Figure 9), the healing is in progress even if it is not yet completed.

While establishing the treatment plan for tooth 36 the patient was also informed about the retreatment necessity of the left lower second molar because the preoperative radiograph detected another IRR in the mesial root of tooth 37, this time a non-perforating one, associated to an underfilling (Figure 11). As expected, the location, size and shape of resorptive defect was better visualized in sagittal view of CBCT (Figure 12).

After the patient consent, tooth 37 was retreated using ProTaper Next rotary instrumentation. The postoperative radiograph reveals the complete filling of all root canals and confirms the non-perforating feature of IRR (Figure 13).

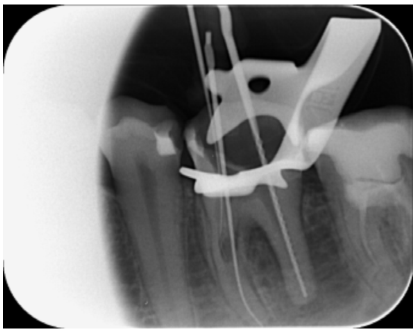

Figure 5 – ***Periapical radiograph showing working length determination of tooth 36.***

Figure 6 – ***Immediate postoperative periapical radiograph of tooth 36. Root filling control.***

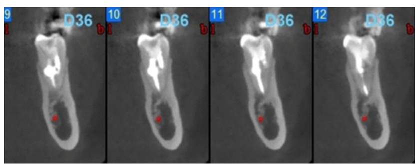

Figure 7 – ***CBCT scan of tooth 36 (coronal view of mesial root at one-year follow-up).***

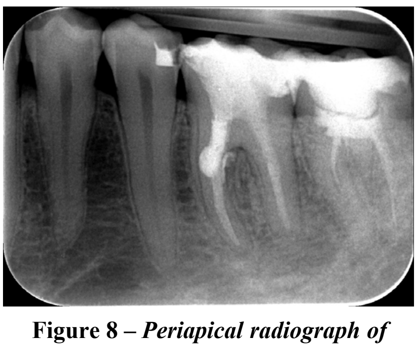

Figure 8 – ***Periapical radiograph of tooth 36 (one-year follow-up).***

Figure 9 – ***Preoperative CBCT in coronal view of distal root of tooth 36 revealing an apical radiolucency.***

Figure 10 – ***CBCT in coronal view of distal root of tooth 36 revealing an apical healing in progress (one-year follow-up).***

Figure 11 – ***Preoperative radiograph of tooth 37 revealing an IRR associated to an under-filling in mesial root.***

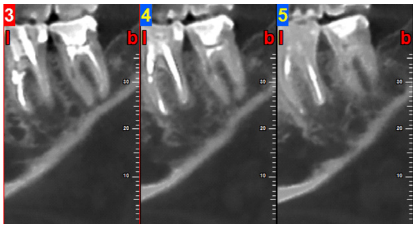

Figure 12 – ***Sagittal view of CBCT revealing an IRR in mesial root of tooth 37.***

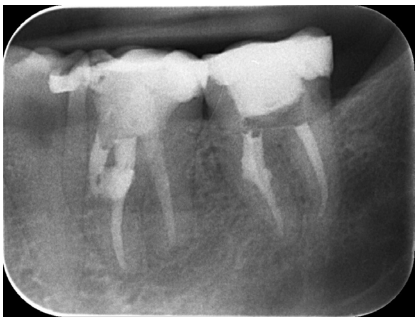

Figure 13 – ***Postoperative radiograph of tooth 37 revealing the non-peforating IRR in mesial root.***

Discussion

Often IRR is occasionally visualized. Radiographic diagnosis is fairly easy to establish due to the more or less well-contoured and usually symmetric radiolucent image that is centered on the pulp chamber or the root canal [2, 18–20].

Late during its course through a continue process of dentin erosion, IRR perforates the tooth root and generate a false portal of direct pathological communication between root canal and periodontal ligament. Pulp necrosis and root canal infection follow, sometimes accompanied by a periapical lesion. The lesion might progress unnoticed until a root fracture is occurring [21, 22].

The tooth can be symptomatic due to periapical inflammation and axial percussion is positive. A gingival abscess followed by fistula is emerging. Radiographically, a bone radiolucent area develops near perforation. Even though the walls of radicular defect are thin, the periapical preoperative radiograph cannot demonstrate the dentinal lesion. Conversely, due to the radio-density of root canal filling is easier to visualize the perforation in immediate postoperative or recall radiographs [23, 24].

The conventional periapical radiographs are a source of limited 2D information. Cone Beam CT reveals 3D reliable information about the resorptive defect, the existence of a perforation and the real extension of a periapical lesion in any slice and spatial orientation [25, 26].

The internal resorption due to the chronic pulp inflammation might be with or without root perforation. In case of perforation, IRR can be associated with progressive osseous defect. Therefore, an accurate diagnosis regarding the presence of a root perforation generated by the continuous "ballooning-out" of the canal is rather challenging [25, 26].

A perforation due to progressive resorption is not always revealed by persistent hemorrhage, lateral periradicular radiolucency or sinus tract. CBCT scan, especially in the transversal slice, became the investigation of choice for tracing perforations [23–26].

For conventional periapical radiograph is almost impossible to accurately reveal the thickness of the root canal wall, especially in the bucco-lingual orientation, the true volume of the internal destructive defect and the existence of a pathologically induced root perforation [3–7, 26].

Unlike the conventional periapical radiograph, the perforating IRR can be detected by CBCT scan with any doubt and moreover, regarding his highly suspected risk, in a timely manner. Furthermore, if the high quality three-dimensional imaging is considered, this investigational imagistic tool is extremely useful in diagnosis and management of this not easy to solve clinical situation [1–7].

The low effective dose of radiation in newest generation of CBCT scanners with limited FOV is in the same order of magnitude as a conventional periapical radiograph.

In our case, the three-dimensional information delivered by a CBCT scan enabled the right positioning of side-venting irrigation needle to avoid the inadvertent sodium hypochlorite extrusion in the furcal area through the resorptive defect perforation [17].

A more protective treatment protocol, including manual dynamic agitation of irrigant in a gentler manner, could be followed to prevent the unpleasant accidents of sodium hypochlorite extrusion in periradicular tissues [17].

CBCT scan also facilitates the choosing of root canal filling material and procedure depending on the real evaluation of IRR dimensions and location. MTA is highly biocompatible and to date is considered the option of choice. Moreover, corroborating CBCT to the operative microscope it proved to be extremely helpful in a more efficient clinical approach of IRR [21].

Formerly, the conservative non-surgical endodontic treatment consisted in a three months interval repeated calcium hydroxide canal medication until the bone around the root perforation was recovered and could be used as a biological matrix for root canal final filling. The dentinal perforation cannot be mineralized but the surrounding bone succeeds in healing [4, 22].

Depending on the perforation size and location, alternative recommended approaches for filling the defect are one-visit internal matrix technique, based on absorbable collagen membrane, or a two-visit technique based on mineral trioxide aggregate (MTA) that may be used either conservatively, through the access cavity or surgically, associated to a flap procedure [1, 4, 22].

Although there are very rare reports regarding multiple resorptions in lower molars such as the case hereby described, the dentist has to check the presence of IRR in all the teeth of the same patient, using CBCT scan.

If dental pulp is still vital, early treatment is required to stop a resorptive defect. In case of non-vital teeth with or without chronic apical periodontitis the root canal treatment in two appointments is preferred as the resorptive defect needs a stronger disinfection attitude. Difficulties may occur during working length determination in the infected canals in case of an IRR situated at the confluence of two canals [27–30].

Conclusions

Multiple IRR is a rare outcome of chronic irreversible pulpitis. Internal resorptive defects have irregular shape and developing course. Diagnosis and management of pulp diseases are highly improved using CBCT scan as compared to the conventional radiograph. When IRR occurs in a tooth, it is wise to check its presence on CBCT scan in all teeth. In case of perforating IRR, CBCT scan may reduce the risk of extrusion of sodium hypochlorite in peri-radicular tissue while irrigating the root canal, allowing the orientation of side-vented irrigation needle in the opposite direction. Unlike the conventional radiograph CBCT scan can prove the existence of a perforating IRR and in case of associated chronic apical periodontitis it allows a reliable follow up of the healing process.

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