CASE REPORT

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# The use of cone beam computed tomography in the diagnosis and management of internal root resorption associated with chronic apical periodontitis: a case report

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**Abstract**

Internal root resorption is a consequence of chronic pulp inflammation. Later on, the pulp necrosis followed by a chronic apical periodontitis is installed. Hence, usually, in clinical practice, both lesions have to be simultaneously managed. Conventional periapical radiograph is mandatory in diagnosis. Improving the diagnosis and management of both lesions, cone beam computed tomography proves to be more reliable than conventional radiography.

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

## Introduction

Internal root resorption (IRR) is the consequence of a chronic pulp inflammation induced by trauma and infection. Currently is incidentally revealed through routine radiographic examination as a uniform radiolucent area with smooth contours of a rather oval shape that widens the root canal [1–3].

Depending on the evolution stage of the resorption, the affected tooth could be initially symptomless but preserving its vitality for a while. Later on, in coronal location of granulation tissue, the pink spot on labial crown surface of upper or lower incisors is pathognomonic for diagnosis [4, 5].

However, usually the coronal pulp is necrotic and the dentin destruction progresses in the root area. Accordingly, the tooth could be non-responding in clinical sensibility tests even though the apical pulp is still vital [6, 7].

Regarding the location of internal resorption defect, if the appropriate endodontic treatment is not performed, fistula and pain may occur following the crown or root perforation. Lastly, the tooth become non-vital, chronic apical periodontitis is usually developing and in case of radicular internal resorption, the root is prone to fracture [8–11].

Vital pulpectomy is the treatment of choice while dental pulp is still vital. In case of complete necrosis, the adequate root shaping and cleaning for infected root canals has to be performed [6, 12].

As it was already abovementioned, the periapical radiographs are the main diagnostic procedure in internal resorption. Even in cases of differential diagnosis *versus* the external cervical invasive resorption, just an additional exposure in horizontal angulated projection clarifies the issue [13].

Nevertheless, the traditional radiograph is sometimes uncertain due to the two-dimensional feature of the image and the anatomical noise that underestimates the defect size [13, 14].

Additionally to the three-dimensional assessment of resorptive defect, cone beam computed tomography (CBCT), the newcomer imagistic means, is extremely useful mainly in signaling the perforating and the undetected internal resorption on periapical radiographs as well [15, 16].

The aim of this case report is to reveal the imagistic support of CBCT in diagnosis and management of IRR associated with a chronic apical periodontitis.

## Patient, Methods and Results

A 37-year-old female patient reported a mild pain in the area of left lateral upper incisor (tooth 22). There was no history of trauma, but the tooth was prepared and restored with an acrylic crown seven years previously. The margins of the crown were defective. The tooth presented small secondary caries.

Clinically, the axial percussion showed tenderness. No erythema, swelling or sinus tract was detected. The pulp test response was negative. There was no evidence of marginal periodontitis, with probing depths within normal values.

Conventional radiographic examination using paralleling technique provided the image of periapical radiolucency. In the middle third of the root, we could visualize a large ballooning of the root canal, with sharp margins. On the radiograph, we could not find out if there is a perforation or not (Figure 1).

Digital radiographs were taken using an X-Mind™

device from SATELEC; the sensor was scanned using a Digora® scanner and the Digora® for Windows software.

For a precise diagnosis and a proper management of root canal treatment, it was mandatory to exclude the presence of a root perforation. In that respect, a CBCT examination (NewTom VGi, QR Srl, Verona, Italy) was recommended (Figures 2 and 3).

The analysis of the transverse (Figure 4) and axial (Figure 5) slices showed no perforation of the canal walls, although the defect was rather extended. The CBCT provided additional information regarding the real extent of the periapical lesion, which proved to be larger than on the conventional periapical radiograph (Figure 6).

After patient verbal and written consent, rubber dam was applied and the tooth 22 was disinfected with 1% sodium hypochlorite. The pulp chamber was opened and the root canal was preflared with Gates–Glidden drills, sizes 3–4.

The working length was established at 20 mm, with an electronic apex locator (TriAuto ZX, Morita, Japan), confirmed radiographically and reevaluated during the root shaping and cleaning (Figure 7). Due to the size and shape of the defect, the larger files impacted on the walls of the resorptive defect and we had to prebend these stainless-steel files with the Endobender (Sybron Endo, USA) to gain access to the apical foramen. In this case we could not use the rotary Ni-Ti instruments for the mechanical enlargement. Accordingly, the root canal shaping was performed exclusively with manual stainless-steel files. The master apical file was ISO 0.40.

Throughout the procedure we used copious preheated irrigant solution of sodium hypochlorite (5.25% NaOCl) ultrasonically passively activated. The prerequisite of a successful treatment in IRR is the complete removal of all chronic inflamed or necrotic pulp remnants from the root canal. As this therapeutic objective cannot be accomplished in IRR within the boundary of the balloon-like shaped defect with manual or rotary files, for the removal of the organic tissues the only feasible means is the chemical cleaning of the defect's walls using sodium hypochlorite irrigation (5.25% NaOCl). To further remove the smear-layer, the root canal was irrigated with 17% EDTA solution for two minutes. In between, the canal was rinsed with sterile water to avoid the chemical reaction of EDTA with NaOCl.

After a final rinse with sodium hypochlorite, the root canal was dried with sterile paper points and filled by warm vertical condensation of gutta-percha (Buchanan technique of continuous wave of condensation) using System B (Sybron Endo), Obtura Gun III (Obtura Spartan) and AhPlus sealer (Dentsply Maillefer). This root canal filling technique with warmed gutta-percha was chosen because is indicated to completely fill the root lacuna (Figure 8).

The rubber dam was removed and a postoperative digital radiograph was taken to verify the root canal filling. Afterwards the patient was referred to her general dentist for tooth crown restoration.

The patient was reviewed one year after the completion of root canal treatment. Until this time, the tooth was asymptomatic and functional, also on clinical examination there was no sign of inflammation. Digital periapical radiographic examination showed an almost complete healing of the chronic apical periodontitis (Figure 9). The CBCT provided us with more accurate information. The transverse slices revealed a significantly decreased apical radiolucency, but not a complete healing (Figure 10).

**Figure 1** – ***Preoperative periapical radiograph. Associated IRR (radiolucent enlargement in middle third of the root canal) and chronic apical periodontitis in upper left lateral incisor (tooth 22).***

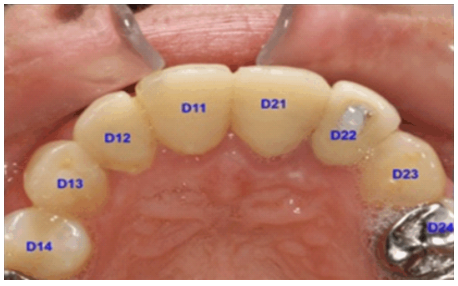


**Figure 2** – ***Clinical palatinal view of tooth 22.***

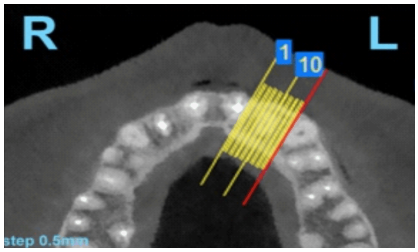


**Figure 3** – ***Planes of exposure in CBCT scans for tooth 22 (axial view).***

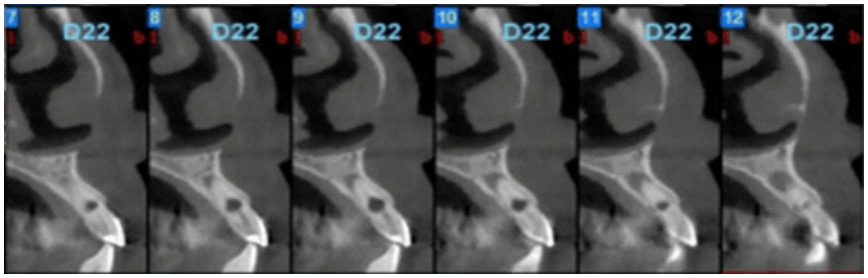


**Figure 4** – ***Preoperative CBCT. Sagittal view of neighboring slices showing location and size of internal resorptive defect without root perforation and the associated chronic apical periodontitis in tooth 22.***

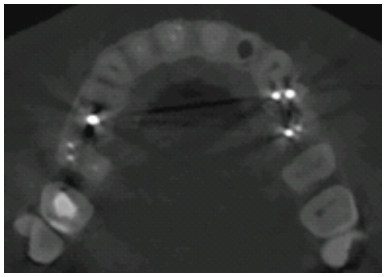

**Figure 5** – ***Preoperative CBCT in axial view showing the largest extension of internal resorptive defect without root perforation.***

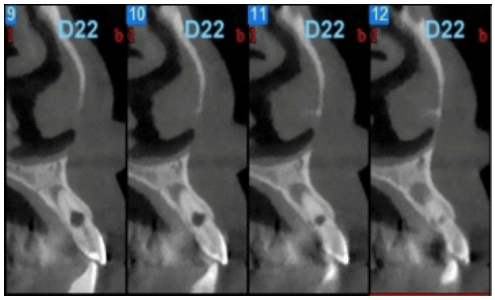


**Figure 6** – ***Preoperative CBCT. Sagittal view of the real size of periapical lesion in tooth 22.***

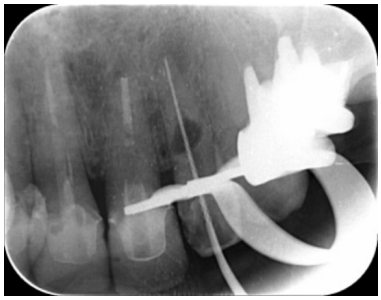

**Figure 7** – ***Periapical radiograph showing working length determination in tooth 22.***

**Figure 8** – ***Immediate postoperative periapical radiograph of the root filling in tooth 22.***

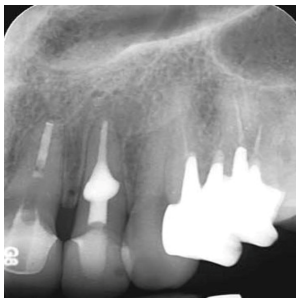

**Figure 9** – ***Periapical radiograph: one-year follow-up. Apical lesion seems to be healed.***

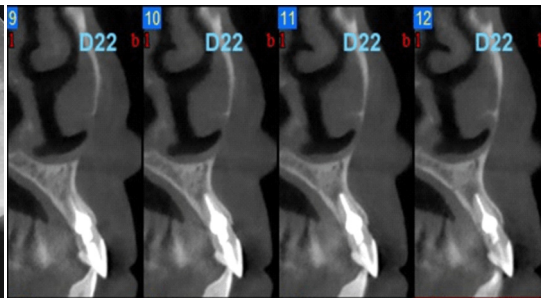


**Figure 10** – ***Decreased size of the periapical lesion in one-year follow-up CBCT (sagittal view).***

## Discussion

Internal root resorption (IRR) is generated by chronic pulp inflammation that in either a slow or rapid manner develops a dentin progressive inner lesion, mostly irregular in shape, subsequently involving enamel and cementum. Spontaneous healing is quite unusual [17, 18].

Chronic inflammatory tissue occurs rather frequently in dental pulp, but rarely is associated in permanent teeth with the recruitment of odontoclasts, dentinoclasts or osteoclasts. In case of IRR, these multinucleated giant cells promote a complex process of demineralization lying in cytokine-mediated cell interactions [19, 20].

The classic so-called "pink spot" could be a useful diagnostic sign in coronal location of granulation tissue next to undermined enamel. However, a careful clinical inspection has to avoid the misdiagnosis with invasive cervical root resorption [5].

In tooth root location of IRR, the sensitivity tests may be both, either positive or negative. It has to be highlighted that commonly, while the resorptive inflammatory lesion is active, the apical pulp tissue remains still vital even if the coronal pulp often becomes necrotic. Consequently, in these particular clinical circumstances a negative sensitivity test cannot confirm a pulp necrosis [4–6].

While in IRR tooth is still vital, the treatment of choice lies in pulpectomy. Removing the chronically inflamed pulp tissue, the resorptive process of root canal walls is immediately blocked. It has to be underlined that the "wait and see" attitude may jeopardize the tooth survival.

The expected progression of chronic inflammation is the final breakdown of pulp tissue. Sooner or later the root canal is invaded by oral microorganisms and eventually a chronic apical periodontitis occurs.

The IRR typical image on a periapical radiograph is the well-known fairly uniform radiolucent "ballooning-out" of the root canal that modifies its previous anatomical natural contour.

Often IRR is too late unintentionally diagnosed on periapical radiograph targeted for some other teeth in the area. Accordingly, clinical experience demonstrated that radiographically in non-vital teeth this associated feature of simultaneous presence of IRR and chronic apical periodontitis is quite widespread.

The major radiographic confusion of IRR is usually the invasive cervical resorption that represents an external form of pathological root resorption. To overcome the misdiagnosis risk, a change of X-ray exposure angle is a simple and efficient technical maneuver [4–7].

Unlike external resorption, that moves away in opposite direction to mesial or distal X-ray changed angle, the IRR radiographic image is located next to the root canal outline.

Usually in IRR no changes in surrounding bone are associated, excepting the case when occurs a perforation of canal walls because of resorptive lesion outward advancement.

Concerning the external inflammatory root resorption, it is noteworthy to mention that on the periapical radiograph, it is always associated with obvious signs of bone resorption around the lateral aspect of the tooth root. Over the past decade, high-resolution cone beam computed tomography (CBCT) considerably improved radiographic diagnosis in accurately detecting the root resorptions and chronic apical lesions as well [15].

Therefore, due to the serial cross-sectional slices that allows the tri-dimensional inspection in axial, sagittal and coronal views it is also possible to evaluate the IRR location and size.

Currently, CBCT scans may assess the true extension either of the resorptive root defect or of the chronic apical periodontitis, which clinically is also of paramount importance for follow-up studies [21–24].

In the present case report is depicted a non-perforating IRR associated with chronic apical periodontitis. As expected, the CBCT scan was extremely advantageous in treatment decisions, timely operative intervention and better treatment outcome. It was also helpful to confirm the anatomical integrity of external root surfaces and surrounding alveolar bone.

The one-year follow-up intraoral radiograph showed a favorable healing process of the chronic apical periodontitis but a radiolucent area is still present on CBCT image. It means that the desired healing outcome was not yet achieved and if it had to choose between periapical radiograph and CBCT scan, only CBCT proved to be reliable. At the one-year recall, the successful management of non-perforating IRR was also noted, as no lateral bone radiolucency occurred in the proximity of tooth root.

As compared to periapical radiographs in both categories of non-vital teeth, endodontically untreated or already having root canal fillings, CBCT can demonstrate a higher prevalence of periapical radiolucencies because it corroborates axial, coronal and sagittal image views [25].

This case report is emphasizing the valuable contribution of CBCT examination for correct diagnosis and efficient management of root canal treatment in internal root resorption associated with chronic apical periodontitis.

However, CBCT scan cannot be recommended as usual imagistic examination in endodontics because is mandatory to keep the radiation dose as low as reasonable. Recently, in order to balance the patient protection and technical progress in radiology, the *European Society of Endodontology* (ESE) introduced the guidelines for using CBCT in diagnosis and management of dental pulp diseases [26].

Accordingly, the cone beam computed tomography with a limited field of view (FOV) may be considered for diagnostic assessment and management of some clinical situations, such as IRR [26].

## Conclusions

X-ray examination is mandatory in diagnosis of internal root resorption. Conventional periapical radiograph provides an acceptable accuracy for diagnosis. If the diagnostic power is assessed, cone beam computed tomography proved to be more reliable than conventional radiography due to the additional information such as differential diagnosis, true location, shape and size of internal dentin defect. Unlike periapical radiography, a further support of CBCT in internal root resorption associated with chronic apical periodontitis relies in improving the management of both lesions.

**Conflict of interests**

The authors declare that they have no conflict of interests.

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## References

[1] Andreasen JO, Bakland LK. Pathologic tooth resorption. In: Ingle JI, Bakland LK, Baumgartner JG (eds). Ingle's endodontics 6. 6th edition, BC Decker, Inc., Hamilton, 2008, 1358–1382.

[2] Trope M. Endodontic considerations in dental trauma. In: Ingle JI, Bakland LK, Baumgartner JG (eds). Ingle's endodontics 6. 6th edition, BC Decker, Inc., Hamilton, 2008, 1330–1357.

[3] Sigurdsson A, Trope M, Chivian N. The role of endodontics after dental traumatic injuries. In: Hargreaves KM, Cohen S (eds). Cohen's pathways of the pulp. 10th edition, Mosby Elsevier, St. Louis, 2011, 620–654.

[4] Monea MD. Resorbţia radiculară internă. In: Iliescu A (ed), Tratat de endodonţie. Ed. Medicală, Bucureşti, 2014, 249–259.

[5] Levin L, Trope M. Root resorption. In: Hargreaves KM, Goodis HE (eds). Seltzer and Bender's dental pulp. Quintessence Publishing Co., Chicago, 2002, 425–447.

[6] Castellucci A. Root resorption. In: Castellucci A (ed), Endodontics. Il Tridente, Firenze, 2009, 868–903.

[7] Hülsmann M, Schäfer E. Resorptionen. In: Hülsmann M, Schäfer E (Hrsg). Probleme in der Endodontie. Quintessenz Verlags-GmbH, Berlin, 2007, 457–470.

[8] McDonald NJ, Torabinejad M. Endodontic surgery. In: Walton RE, Torabinejad M (eds). Principles and practice of endodontics. 3rd edition, W.B. Saunders, Philadelphia, 2002, 424–444.

[9] Torabinejad M, Simon DE III. When and how to refer. In: Walton RE, Torabinejad M (eds). Principles and practice of endodontics. 3rd edition, W.B. Saunders, Philadelphia, 2002, 71–86.

[10] Hasselgren G. Treatment of the exposed dentin-pulp complex. In: Ørstavik D, Pitt Ford TR (eds). Essential endodontology – prevention and treatment of apical periodontitis. Blackwell Science, Oxford, 1998, 192–210.

[11] Machtou P, Reit C. Non-surgical retreatment. In: Bergenholtz G, Hørsted-Bindslev P, Reit C (eds). Textbook of endodontology. Blackwell–Munksgaard, Oxford, 2003, 300–310.

[12] Ruddle CJ. Nonsurgical endodontic retreatment. In: Castellucci A (ed). Endodontics. Il Tridente, Firenze, 2009, 998–1075.

[13] Iliescu AA, Gheorghiu IM, Iliescu MG. Examenul imagistic în endodonţie. In: Iliescu A (ed). Tratat de endodonţie. Ed. Medicală, Bucureşti, 2014, 931–959.

[14] Patel S, Dawood A, Wilson R, Horner K, Mannocci F. The detection and management of root resorption lesions using intraoral radiography and cone beam computed tomography – an *in vivo* investigation. Int Endod J, 2009, 42(9):831–838.

[15] Estrela C, Bueno MR, De Alencar AHG, Mattar R, Valladares Neto J, Azevedo BC, De Araújo Estrela CR. Method to evaluate inflammatory root resorption by using cone beam tomography. J Endod, 2009, 35(11):1491–1497.

[16] Bhuva B, Barnes JJ, Patel S. The use of limited cone beam computed tomography in the diagnosis and management of a case of perforating internal root resorption. Int Endod J, 2011, 44(8):777–786.

[17] Patel S, Ricucci D, Durak C, Tay F. Internal root resorption: a review. J Endod, 2010, 36(7):1107–1121.

[18] Gabor C, Tam E, Shen Y, Haapasalo M. Prevalence of internal inflammatory root resorption. J Endod, 2012, 38(1): 24–27.

[19] da Silveira PF, Vizzotto MB, Montagner F, da Silveira HL, da Silveira HE. Development of a new *in vitro* methodology to simulate internal root resorption. J Endod, 2014, 40(2): 211–216.

[20] Trowbridge HO. Histology of pulp inflammation. In: Hargreaves KM, Goodis HE (eds). Seltzer and Bender's dental pulp. Quintessence Publishing Co., Chicago, 2002, 227–246.

[21] Hegde N, Hegde MN. Internal and external root resorption management: a report of two cases. Int J Clin Pediatr Dent, 2013, 6(1):44–47.

[22] Fernandes M, de Ataide I, Wagle R. Tooth resorption part I – pathogenesis and case series of internal resorption. J Conserv Dent, 2013, 16(1):4–8.
[23] Ashouri R, Rekabi AR, Parirokh M. Surgical intervention for treating an extensive internal resorption with unfavorable crown-to-root ratio. J Conserv Dent, 2012, 15(4):388–391.
[24] Martos J, Silveira LFM, Souza JM, Vieira MM, Silveira CF. Internal root resorption in the maxillary central incisor. Rev Sul-Bras Odontol, 2010, 7(2):239–243.
[25] Abella F, Patel S, Durán-Sindreu F, Mercadé M, Bueno R, Roig M. An evaluation of the periapical status of teeth with necrotic pulps using periapical radiography and cone-beam computed tomography. Int Endod J, 2014, 47(4):387–396.
[26] European Society of Endodontology, Patel S, Durack C, Abella F, Roig M, Shemesh H, Lambrechts P, Lemberg K. European Society of Endodontology position statement: the use of CBCT in endodontics. Int Endod J, 2014, 47(6):502–504.

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