Clinical and Radiologic Appearances of Invasive Cervical Resorption

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Abstract

Background: Invasive cervical resorption is a type of external resorption that begins below the epithelial attachment. Knowledge of the clinical and radiologic appearance of the resorption requires for the diagnosis and successful treatment. Therefore, this study aims to present the different clinical and radiologic appearances, and potential predisposing factors of these resorptions in a group of dental patients.

Methods: Eleven patients clinically and radiologically diagnosed as invasive cervical resorption have been assessed during the eight years period. Of the patients, 4 were males and 7 were females,age range was 23–71 years. Clinical and radiologic appearance of the resorptions and potential predisposing factors were analyzed.

Results: The clinical appearance of the resorptions varied considerably, and in early lesions, there was no external signs. Radiographic appearance also varied from well delineated to irregularly bordered mottled radiolucencies. Six resorptions were incidental radiographic findings;but the others were symptomatic. Cone-Beam-CT was performed in 3 patients diagnosing the exact size and location of the lesion. Bruxism and orthodontic treatment history were determined as predisposing factors in three patients.

Conclusion: Since invasive cervical resorption may be easily overlooked or misdiagnosed as caries or artifact; dental clinicians and oral radiologists must be careful during the clinical and radiologic examinations.

Key Words: Invasive cervical resorption, External resorption, Radiography, Clinical examination, Predisposing factors

Introduction

Invasive Cervical Resorption (ICR) is a relatively uncommon and aggressive form of external root resorption that is initiated by damage to the cementum immediately below the epithelial attachment [1]. This pathologic process progressively resorbs cementum, enamel and dentin with replacement by fibrovascular tissue derived from the periodontal ligament [2-4]. For unknown reasons, a well vascularized granulation tissue containing activated dentoclasts starts to invade the dentin and forms branched resorptive channels which encircle the pulp cavity, but do not penetrate across the innermost dentin [5]. It has been demonstrated that predentin contains a resorption inhibitor which prevents ICR from penetrating into the pulp cavity [6]. As a result the resorption spreads in an apico-coronal direction and circumferentially along and around the root canal as soon as it reaches the predentin. While the lesion grows larger, a bone- or cementum-like hard tissue arises, which in part adheres to the resorbed dentin surfaces and in part forms fine trabeculae within the granulation tissue [5].

The etiology and pathogenesis of ICR are largely unclear. A hypothesis regarding its development claims that a local discontinuity of the protecting layer of radicular cementum renders the subjacent dentin accessible for osteoclasts or dentoclasts. Indeed, voids in cementum frequently occur in the cervical root areas close to the cementoenamel junction [5,7].These voids can arise as a primary malformation or secondarily result from a physical or chemical trauma. Therefore, orthodontic treatment, dental trauma, intracoronal bleaching and periodontal treatment have been analyzed the most common predisposing factors [1,8-12]. Some patients have multiple factors, whereas 15% of the patients have no predisposing factors [2,3,12].

Clinically, ICR presents a challenging situation. The diagnosis is often made when the disease is extensive due to the lack of signs or pulpal involvement early in the process.[2] Resorption of coronal dentin and enamel often creates a clinically obvious pinkish color in the tooth crown as highly vascular resorptive tissue becomes visible through thin residual enamel. Although a pink discoloration of the crown indicates the resorptive process, some teeth give no visual signs and diagnosis is usually the result of a routine radiologic examination [12]. Cone-Beam Computed Tomography (CBCT) is extremely useful in the diagnoses and treatment planning of ICR. In addition, CBCT is often used as an adjunct to conventional radiography to assess the extent of the lesion and the prognosis of the affected tooth [13], CBCT is not always necessary, but in selected cases, it can be very useful [14-16].

The treatment regimen for patients with an early stage of ICR included careful case selection, the topical application of trichloracetic acid, thorough curettage, nonsurgical root canal treatment if necessary, restoration of the resorptive defect with glass-ionomer cement, and follow-up examinations [12,15,17-20].

ICR is relatively uncommon; however if not diagnosed early, these lesions can result in extensive destruction of tooth structure or unnecessary loss of tooth. In the literature, there is only few studies regarding clinical and radiologic features of ICR and most of these are case reports [1,14,15,17-22]. Therefore the purpose of the study is to present the different clinical and radiologic appearances, and potential predisposing factors of ICR in a group of dental patients.

Materials and Methods

Eleven patients with ICR have been analyzed by the author

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during the 8 years period (2005- 2013). After the clinical examination, periapical or panoramic radiographs were taken. If the resorption could not located with conventional radiographs, CBCT was performed. The age, gender, potential predisposing factors of the patients and clinical classifications of the resorptions were recorded.

Results

Of the patients, 4 were males and 7 were females. The patients' age range was 23-71 years. In the medical history, one patient had hypertension but others were unremarkable for any systemic disorder. Although one patient had bruxism history and two patients had orthodontic treatment history, no etiologic factor was determined in the other 8 patients (Table 1). At the end of the study, prevalence of ICR was almost 0.08%.

Clinical Appearance

The clinical appearance of ICR varies considerably depending on the extent of the resorptive process. The condition is usually painless and teeth give no visual signs. In the study, diagnosis was the result of a chance radiologic examination in the six patients (Figures 1, 2a and 2b). However, a pink discoloration of the crown indicated the resorptive process (Figure 3).

ICR is usually painless, because the pulp remains protected by a thin layer of predentin and dentin until late in the process. However, the pulpal or periodontal infection supervenes, symptoms associated with pulpitis and infection in the periodontium adjacent to the infiltrating tissue can result in pain and local swelling. In this study, five of the 11 cases were symptomatic because of pulpal or periodontal infection (Figures 4a,4b).

Clinical Classification

A clinical classification has been developed by Heithersay [12] as follows;
• Class 1: a small, invasive resorptive lesion characterized by shallow penetration into the dentine near the cervical area;
• Class 2: a well-defined, invasive resorptive lesion that has penetrated close to the coronal pulp chamber but has little or no extension into the radicular dentine;

• Class 3: a deeper invasion of the dentine that involves the coronal dentine and extends into the coronal third of the root;
• Class 4: a large invasive resorptive process that has extended beyond the coronal third of the root.
In this study, 5 lesions classified as Class 2 and 6 lesions classified as Class 3.

Radiologic Appearance

The only sign of ICR may be radiologic appearance, revealing a radiolucency with poorly defined borders in the cervical-third of the root and can be confused with dental caries.[1] However, a characteristic radiopaque line usually separates the image of the lesion from that of the root canal [12] (Figure 5). Angled periapical radiographs using the parallax technique may be helpful to determine the location (palatal or labial) of the lesion, however, conventional radiographs do not provide an indication of the depth of such lesions [1,14] (Figure 6a). CBCT is often used as an adjunct to conventional radiography to assess the extent, size and location of the lesion (Figure 6b).

Treatment

The aim of the treatment is the inactivation of all active resorbing tissue (Figure 7), and the reconstitution of the resorptive defect either by the placement of a suitable filling material or by the use of biological systems such as membranes, so that the tooth may be healthily and aesthetically retained [12].

The nonsurgical treatment involved the topical application of a 90% aqueous solution of trichloracetic acid to the resorptive tissue, curettage, endodontic treatment where necessary (Figure 4b), and restoration with glass-ionomer cement. Adjunctive orthodontic extrusion was also employed in some advanced lesions [12]. Surgical treatment of varying degrees of ICR has generally involved periodontal flap reflection, curettage, restoration of the defect with amalgam, composite resin, glass-ionomer cement and repositioning the flap to its original position [12].

In this study, after the clinical and radiologic examination, the defect was sealed with mineral trioxide aggregate in two patients; But in three patients root canal treatment was performed. Since the resorptive lesion extended from the cervical area into the root surface, the teeth were extracted

Table 1. The age, gender, tooth number, potential predisposing factors and clinical classification of the ICR.

Cases	Patients' age	Gender	Tooth No	Etiologic Factors	Classification
1	52	M	35	No	Class 2
2	71	M	43	No	Class 2
3	40	F	37	Bruxism	Class 3
4	60	F	33	Orthodontic treatment	Class 3
5	47	M	21	No	Class 3
6	23	F	21	No	Class 3
7	63	F	16	No	Class 3
8	48	F	46	No	Class 3
9	26	F	45	Orthodontic treatment	Class 2
10	35	F	36	No	Class 2
11	33	M	11	No	Class 2

Figure 1. *Left mandibular canine tooth showed irregular radiolucency around the root canal on the periapical radiograph.*

in four patients. Two patients did not accept the treatment because of asymptomatic.

Discussion

ICR is an external resorption that is characterized by invasion of the cervical region of the tooth by fibrovascular tissue [2]. The invading tissue arises from the periodontal ligament but differs from periodontal tissues in both structure and behaviour. The precurcor cells of the periodontal ligament have the potential to differentiate into cells capable of laying down fibrous or calcified tissue. For invasion to occur, a defect in the cementum/cementoid layer is a likely prerequisite [8]. This may be of developmental origin in a small zone near the cervical area or the result of physical or chemical truma.

ICR is primarily caused by dental trauma or injury of the cervical periodontal attachment. In a study, a group of 222 patients with a total of 257 teeth displaying varying degrees of ICR had been assessed. Of the potential predisposing factors had been identified, orthodontics and trauma was the most common two factors in that study [2]. Similarly, in the present study only two etiologic factors, bruxism and orthodontic treatment history were determined in the three of 11 patients.

In a study, one of the few research article in the literature, was revealed that prevalence of ICR was less than 0.1% [3]. This study showed that prevalence of ICR was almost 0.08% and consistent with the literature. Although relatively small number of patients, the data provided comparison to other studies.

Frequently ICR is detected incidentally in a routine intraoral or panoramic radiograph, because the lesion is usually painless and do not elicit any clinical signs [1,2,5,12,15]. They present an irregular radiolucency with indistinct

margins and sometimes a mottled appearance in early stage [5]. The radiopaque outline of the root canal walls through the radiolucency may also suggest that the lesion is ICR [1]. An early diagnosis is desirable to avoid the gross tooth destruction that is a future of advanced lesions. In this study, six of the 11 cases were detected routine clinical or radiologic

Figure 2a. *Left mandibular second premolar tooth appeared normal on clinical examination.*

Figure 2b. *A periapical radiograph revealed a surprisingly extensive irregular radiolucency. Gulsahi A, Gulsahi K, Ungor M (2007) Invasive cervical resorption: clinical and radiological diagnosis and treatment of 3 cases. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 103:e65-e72.*

Figure 3. *Pink discoloration on the labial surface of right central incisor tooth indicates the resorptive process.*
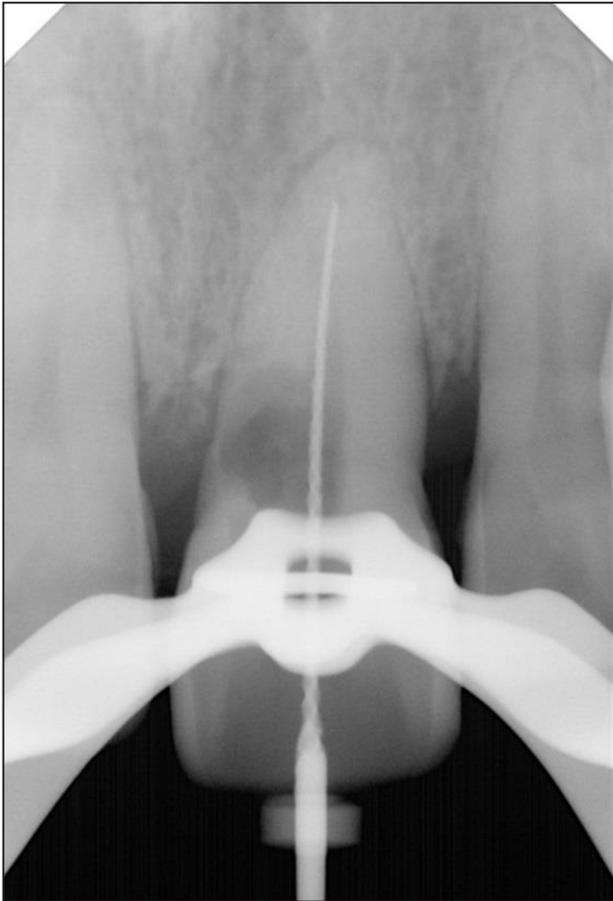
Figure 4a. *Left maxillary central incisor tooth shows irregular radiolucency extended to the mesial root surface on the periapical radiograph.*

Figure 4b. *Periapical radiograph of the left maxillary central incisor tooth after root canal treatment.*
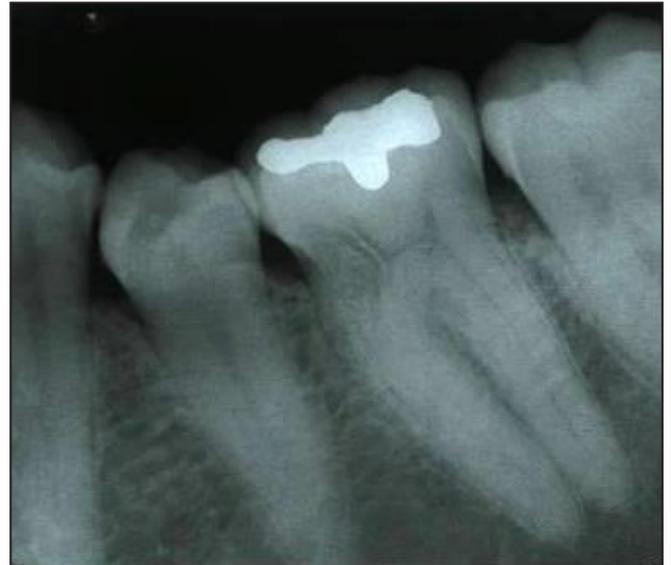
Figure 5. *A periapical radiograph of the left mandibular first molar tooth shows the characteristic radiopaque line separated the image of the lesion from that of the root canal.*

Figure 6a. *A periapical radiograph shows an irregular radiolucent area in the right central incisor tooth.*

examination.

ICR is often misdiagnosed as internal resorption. While a pink discoloration of the crown may indicate ICR; it may as well result from an internal resorption [1,2,23]. Radiographs taken using the parallax technique may also be used to differentiate ICR from internal resorptive lesions. If the lesion is ICR, the radiographic position of the lesion alters when the angle of the X-ray beam is changed [1] Luso&Luder [5] concluded that, two radiographic features are considered as signs of ICR:
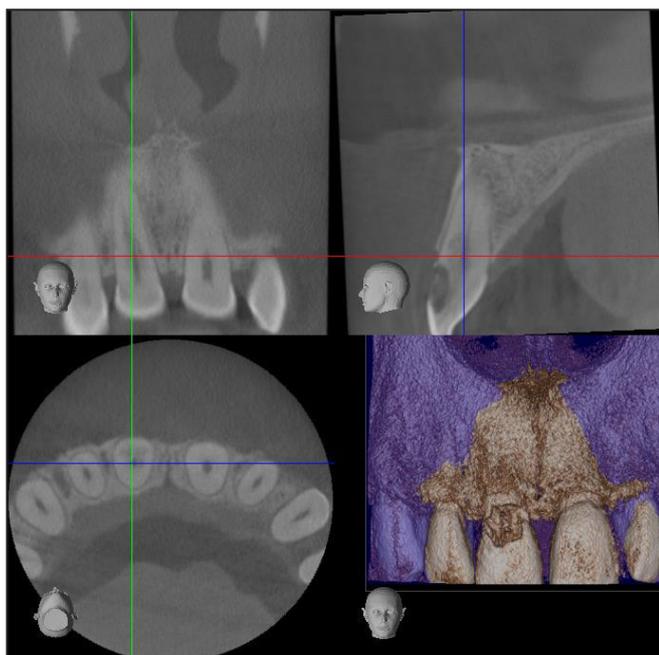
Figure 6b. *CBCT reveals the extent, size and location of the lesion.*

Figure 7. *Active resorbing tissue in the right central incisor tooth.*

(1) A communication of the resorptive defect with the periodontal space and
(2) An intact dentinal wall against the pulp cavity.

This type of resorption difficult to diagnose and it is even more challenging to identify the extent and nature of the process, especially in cases where the resorptive defect is buccal or palatine location. With conventional radiographic images, there are limitations that not only prevent the proper identification of the resorptive process, but also hinter the planning and the evaluation of the prognosis with a treatment [1,13-17]. CBCT is a relatively new three dimensional imaging technique requiring a significantly lower radiation dose than conventional computed tomography. The use of CBCT is very helpful in diagnosing the exact size and location of the resorption. In the present study, CBCT was performed in 3 patients to better visualization of the resorptive lesions.

The present study showed that six of the lesions were classified as class 3, other five lesions were classified as class 2. Due to the small sample size, the examined lesions were classified into two stages, whereas Heithersay [12] in regard to the therapy distinguished four classes. Luso&Luder [5] speculated that the restriction to three stages seemed to make all the more sense, as the classes 2 and 3 are difficult to distinguish histologically. They also stressed that class 2 and class 3 approximately corresponded to the advanced stage, while the class 1 and class 4 coincided with the early and late stages, respectively.

In this study, only eleven patients with ICR have been analyzed during the 8 years period by the author. However, knowledge of the prevalence, as well as clinical and radiologic appearance of ICR, help practitioners to determine the diagnosis and successful treatment. Identification of potential predisposing factors may also allow some preventive measures to be implemented. Since ICR may be easily overlooked or misdiagnosed as caries or artifact; dental clinicians and oral radiologists must be careful during the clinical and radiologic examinations.

Conflict of Interest

The author declare that no conflicts of interest related to this study.

Acknowledgement

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