Descriptive Analysis of Factors Associated with External Cervical Resorption

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Abstract

Introduction: The aim of this study was to perform a descriptive analysis of the occurrence of external cervical resorption (ECR) in relation to the patients' characteristics (sex, age, and tooth type) and the potentially involved predisposing factors. **Methods:** This study includes data on 284 patients (337 teeth with evidence of ECR) referred to the University Hospital Leuven (Leuven, Belgium) and Endo Rotterdam (Rotterdam, the Netherlands) for diagnosis and treatment from 2010 to 2015. The medical history, existing radiographs, and dental records were available for evaluation. Each patient was then interviewed followed by a thorough clinical and radiographic examination. Intraoral pictures using a dental operating microscope and digital camera were taken during clinical examination. The radiographic examination consisted of digital periapical radiography and/or cone-beam computed tomographic imaging. A review of existing literature provided a potential predisposing factor checklist for ECR. The clinical data were correlated with the dental and medical history of each patient in an attempt to identify some potential predisposing factor(s) that could contribute to ECR. The frequency of the occurrence of ECR was correlated with tooth type, sex and age of the patient, and each 1 of the recorded potential predisposing factor(s). **Results:** From the examined teeth (337) with ECR, 175 (54%) were found in male patients and 162 (46%) were found in female patients. In 59% of the cases, more than 1 potential predisposing factor was identified. Most ECR cases were observed on maxillary central incisors (29%) followed by maxillary canines (14%), mandibular molars (14%), and maxillary premolars (11%). In addition, most ECR cases were observed on maxillary teeth (72%). The most frequently appearing factor was orthodontics (45.7%). Other frequently observed factors were trauma (28.5%), parafunctional habits (23.2%), poor oral health (22.9%), malocclusion (17.5%), and extraction of a neighboring tooth (14%). **Conclusions:** The data indicate that ECR is not related to patient sex. ECR occurs most often in the maxillary central incisor. In the majority of the cases, more than 1 potential predisposing factor was identified, indicating that ECR may be mainly multifactorial. The most frequently appearing factors were orthodontics, iatrogenic or accidental trauma, and poor oral health. This information may be helpful in diagnosing ECR at an early stage when screening patients presenting with these predisposing factors. *(J Endod 2017;■:1–9)*

Key Words

Cone-beam computed tomography, external cervical resorption, hypoxia, orthodontics, potential predisposing factors

Significance

It is believed that this work can be applied as a useful prescreening method by evaluating the occurrence of various predisposing factors that are frequently related to ECR. Future controlled studies can be guided by this concept, and emphasis should be given in groups having an orthodontic treatment. Especially the combination of orthodontics with poor oral health and/or parafunctional habits should be highly considered.

External cervical resorption (ECR) is a dynamic phenomenon that involves periodontal, dental, and pulpal tissues (1, 2). Animal studies have shown that for a resorption to initiate, the protective periodontal ligament and cementum layer need to be damaged (3). This can be either caused by an anomaly during development resulting in a gap at the cementoenamel junction or damage induced by a chemical or physical trauma (2). However, in actual clinical cases, the etiology of ECR is more complicated and thus remains unclear and confusing for clinicians. Research studies have not shown a direct link between risk factors and the occurrence of ECR. This has resulted in reference to the etiology in many cases as idiopathic (4–6).

Heithersay (4)was the first to investigate the etiology involved in ECR using a group of 222 patients. This study reported that many ECR cases can be related to previous orthodontic treatment, traumatic injury, internal bleaching, surgery, bruxism, restoration, and so on. However, in that research, no potential predisposing factor could be identified in 16.4% of the examined teeth. These cases were then classified as idiopathic.

In recent years, new studies have shown that other factors can also be linked to the initiation of ECR. In particular, extraction of a neighboring tooth (7), malocclusion (8), playing wind instruments (9), periodontitis (10), autotransplantation (11), transmission of feline viruses to humans (12), herpes zoster (13, 14), and the use of bisphosphonates (15) have been linked to ECR. In addition, a new theory proposes that hypoxia plays a vital role in ECR evolution (2). Hypoxia is a driving force of

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TABLE 1. Overview of the Examined External Cervical Resorption (ECR) Cases

	Examined ECR cases						
Sex	Number of patients having 1 ECR tooth	Number of patients having 2 ECR teeth	Number of patients having 3 ECR teeth	Number of patients having 4 ECR teeth	Number of patients having 5 ECR teeth	Number of patients with ECR	Number of teeth with ECR
Female	117	11	3	1	2	134	162
Male	135	9	4	0	2	150	175
Total	252	20	7	1	4	284	337

angiogenesis and could play a role in the continuous development of highly vascularized granulation tissue accompanying ECR (16).

One can speculate that all clinical conditions and iatrogenic procedures that can cause cementum damage, periodontal ligament (PDL) compression, hypoxia, and chronic irritation are at the basis of ECR initiation and continuation. Medical and dental history and clinical observations can help to unravel potential predisposing factors.

To obtain a better understanding of the etiology of ECR, all recent evidence and information should be collected and evaluated, and the existing list of potential predisposing factors should be carefully revised. One of the main objectives of this study is to shed light on potential predisposing factors and investigate their occurrence in a large group of clinical cases. The outcome would be a thorough descriptive analysis of both the patient and the tooth involved, correlating ECR occurrence with tooth type, sex and age of the patient, and the recorded potential predisposing factors.

Heithersay (4)identified orthodontic treatment as a potential etiologic factor in 24.1% of his examined ECR teeth. Existing literature confirms the correlation between orthodontic forces and treatment time with root resorption occurrence (17). However, since Heithersay's pioneer work in 1999, no follow-up research has been performed in this field despite the fact that in recent years there has been a significant increase in the number of adult patients seeking orthodontic (18) and/or surgical orthodontic treatment (19). In addition, during the last decade, orthodontics has evolved significantly in terms of new techniques and approaches (20). However, there is no evidence showing whether this increasing trend in orthodontic treatments and the new techniques adopted have an effect on the occurrence of ECR.

It should also be pointed out that previous studies used conventional 2-dimensional radiography for the detection of ECR cases (4). Since the introduction of high-resolution radiographic techniques such as cone-beam computed tomographic (CBCT) imaging, the detection and evaluation of ECR became more precise (21). This has led to the identification of ECR cases that previously remained undetected (22–24). In addition, CBCT diagnosis helps in a better evaluation and follow-up of cases with previous traumatic injuries (22), which are also alleged to potentially result in ECR.

The objective of this study was to present a descriptive analysis of the occurrence of ECR in relation to patients' characteristics (sex, age, and tooth type) and potential predisposing factors. For a better understanding of the observed phenomena and their synergism, typical clinical examples are displayed.

Material and Methods

In this study, 284 patients (337 teeth) were included. They were referred to the University Hospital Leuven (Leuven, Belgium) and Endo Rotterdam (Rotterdam, The Netherlands) from 2010 to 2015 for further diagnosis and possible treatment of teeth with evidence of ECR. From the 284 patients, 150 were male (175 teeth) and 134 were female (162 teeth). The analytical list of the examined patients and teeth with ECR is presented in Table 1.

To identify the potential predisposing factors, a 2-step approach was followed. As a first step, the patients were interviewed in order to obtain complete information on their dental and medical history. The following factors were included: medication; viral infections; history of parafunctional habits (eg, nail or tool biting, tooth clenching and grinding, piercing biting, and so on); occlusal splint; playing wind instruments; traumatic injuries; previous dental treatments such as orthodontic, restorative, and periodontal treatments; and the occupation of the patient. The list of examined potential predisposing factors was based on clinical and research evidence (7, 9, 25–27) as well as on an extensive literature study in this field (4, 8, 10, 12–15, 17, 28–34).

TABLE 2. A List of Potential Predisposing Factors for External Cervical Resorption (ECR) and the Frequency of the Appearance of Each Factor

Method of examination	Factors associated with ECR	Frequency of appearance of each factor out of 337 teeth, % (*n*)
Clinical, radiographic evaluation, and dental history	Cracks	2.1 (7)
	Poor oral health (eg, calculus, plaque, and periodontitis)	22.9 (77)
	Development disorders (eg, grooves, invaginations, etc)	1.5 (5)
	Malocclusion (eg, premature contacts, overloading, etc)	17.5 (59)
	Frenulum tension at the cervical gingiva	0.6 (2)
	Eruption disorders (eg, collision during eruption)	2.7 (9)
	Extraction of a neighboring tooth	14 (47)
	Nonvital bleaching	2.7 (9)
	Orthodontics	45.7 (154)
	Orthognathic surgery (eg, osteotomy, etc)	6.2 (21)
	Parafunctional habits (eg, bruxism, nail biting, etc)	23.2 (78)
	Periodontal surgery	1.8 (6)
	Previous traumatic injury (eg, avulsion, autotransplantation, etc)	28.5 (96)
	Restorative and endodontic procedures	1.2 (4)
Medical history	Systemic diseases and medication (eg, bisphosphonates)	2.4 (8)
	Viral infections (eg, herpes virus, feline odontoclastic resorptive lesion, etc)	10.1 (34)
Interview	Playing of wind music instruments, occupational behavior	2.7 (9)