

# External Root Resorption of Young Premolar Teeth in Dentition with Crowding

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## ABSTRACT

The present study was conducted to investigate the prevalence of external cervical resorption (ECR) in different tooth surfaces of maxillary first premolars in a Sri Lankan population.

A sample of 59 (15 males, 44 females) permanent maxillary first premolars (age range: 11-18 years) were used. The teeth had been extracted for orthodontic reasons and were stored in 10% formalin. Morphologically, sound teeth were selected for the study. The teeth were stained with carbol fuchsin. The cervical regions of the stained teeth were observed under 10× magnifications using a dissecting microscope (Olympus SZ) to identify any resorption areas. The resorption areas present on buccal, lingual, mesial and distal aspects of all teeth were recorded.

Fifteen (25.4%) [4 males (26.7%), 11 females (25.0%)] permanent maxillary first premolars showed areas of resorption on buccal, lingual, mesial or distal surfaces. Mesial (33.3%) and distal (33.3%) surfaces exhibited areas of resorption more frequently than buccal (20.0%) and lingual (13.3%) aspects. The difference was not statistically significant.

It can be speculated that the ECR of root surfaces of these young premolar teeth could have been triggered by the excess pressure exerted on their proximal surfaces by the crowding of teeth.

**Keywords:** External root resorption, Premolar teeth, Crowding, Sri Lankan population.

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## INTRODUCTION

Root resorption is the process that may lead to a partial loss of dental hard tissues (e.g. resorption of dentin and cementum as a result of odontoclastic action). Root resorption can be physiological or pathological. Physiological root resorption of deciduous teeth results in the exfoliation of the teeth allowing the eruption of the permanent successors. Root resorption which may occur in permanent teeth is due to a pathological inflammatory action which leads to irreversible damage and eventual loss of teeth.<sup>1</sup>

Root resorption has been classified by its location in relation to the root surface as external and internal resorption. External resorption is further classified into surface resorption, external inflammatory resorption, external replacement resorption, external cervical resorption (ECR) and transient apical breakdown. Meanwhile, ECR is the

least understood type of root resorption, characterized by its cervical location and invasive nature. This resorptive process which leads to progressive and usually destructive loss of tooth structure has been a source of interest to clinicians and researchers for over a century.<sup>2-5</sup> The exact cause of ECR is poorly understood. Although the etiology and pathogenesis remain obscure, several potential predisposing factors have been put forward and, of these, the intracoronal bleaching has been the most widely documented factor.<sup>6</sup> In addition, dental trauma, orthodontic treatment, periodontal treatment, surgery involving the cements/enamel junction and idiopathic etiology have also been described.<sup>2,7-11</sup>

Meanwhile, localized lesions of multiple root resorption have also been reported to occur in the absence of either systemic or local factors that contribute to root resorption.<sup>9,12</sup> Liang et al<sup>9</sup> reported that cervical root resorption with unknown etiology was most frequently seen in young females while others have reported no gender difference. In addition, ECR in different root surfaces, such as mesial, distal, buccal and lingual, has not comprehensively investigated to date. Moreover, occurrence of ECR in the teeth of Sri Lankan people has not been reported in the literature. Therefore, we conducted this study to investigate the prevalence of ECR in different tooth surfaces of maxillary first premolars in Sri Lankan population. The present study also determines any gender difference of the occurrence of ECR.

## MATERIALS AND METHODS

The study material was obtained from a collection of premolar teeth available at the Department of Basic Sciences, Faculty of Dental Sciences, University of Peradeniya. The sample includes 59 (15 males, 44 females) permanent maxillary first premolars (age range: 11-18). Only morphologically sound teeth were selected for the study. Teeth with morphological or developmental abnormalities, caries, fracture/trauma, or erosions/attrition were excluded. Immediately after extraction, the teeth were stored individually in 10% formalin until the time of investigation. The teeth were cleaned taking special care to avoid any damage to the external root surface and stained with carbol fuchsin to visualize the areas of resorption. The cervical regions of the stained teeth were observed under 10× magnification using a dissecting microscope (Olympus SZ) to identify any resorption areas. The resorption areas present on buccal, lingual, mesial and distal aspects of all

teeth were recorded and frequency of occurrence of ECR was calculated.

The teeth with external root resorption were decalcified with 8% EDTA, transverse sections were then taken and stained with hematoxylin and eosin in order to identify the resorption lacunae with possible resorbing cells attached to them under 40×, 100× magnification using a light microscope (Olympus BX 20).

**RESULTS**

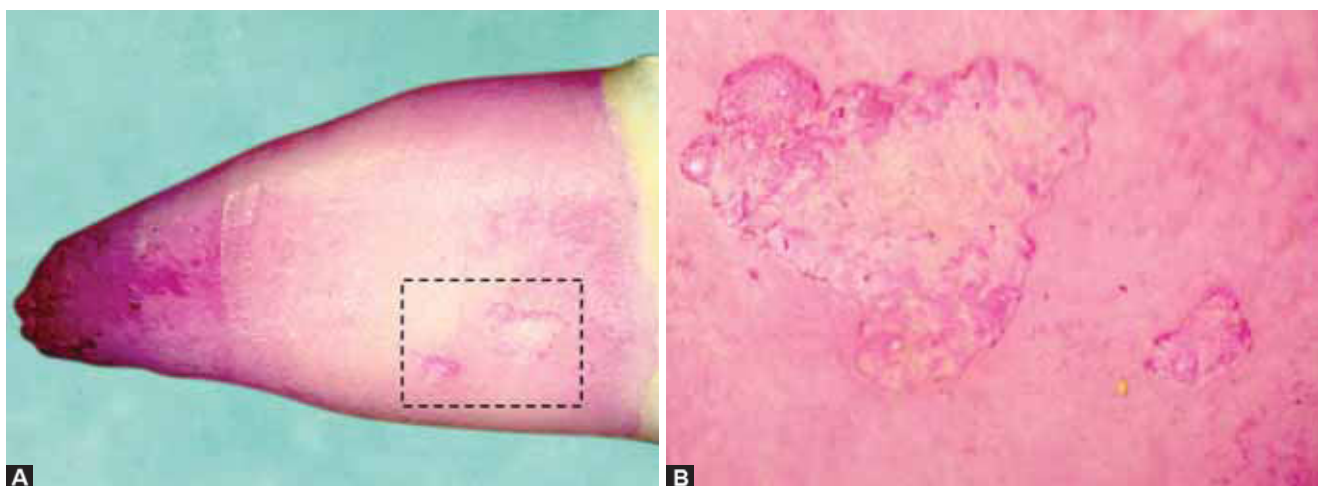
Fifteen (25.4%) [4 males (26.7%), 11 females (25.0%)] out of the total sample of permanent maxillary first premolars stained with carbol fuchsin showed areas of resorption on buccal, lingual, mesial or distal surfaces (Figs 1A and B). Mesial and distal surfaces of the teeth exhibited areas of resorption more frequently than buccal and lingual aspects in both males and females (Table 1). However, the difference was not statistically significant. Furthermore, no difference

was observed in root resorption between male (26.7%) and female (25.0%).

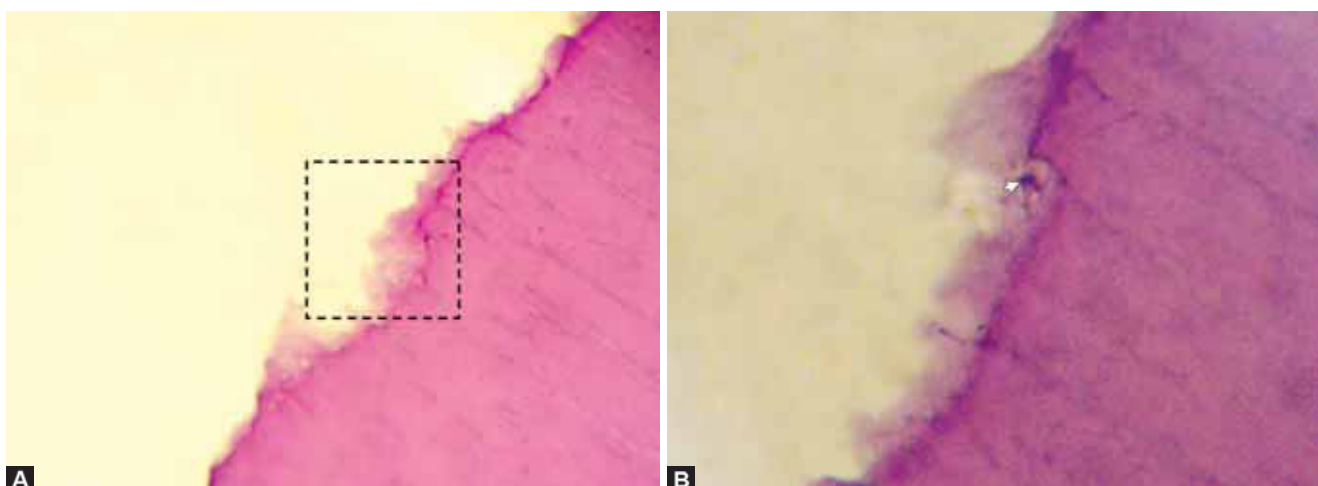
In stained histological sections of teeth with ECR, lesions showed granulomatous tissues with resorptive lacunae like areas and cementum-like reparative tissue, lining the lacunae (Figs 2A and B). In addition, odontoclast-like mononuclear resorptive cells were seen in association with lacunae (see Figs 2A and B).

**DISCUSSION**

The ECR is reported to be a relatively uncommon condition.<sup>7</sup> However, when present it is a challenge to clinicians due to the invasive nature of this condition. Diagnosis of ECR is made based on radiographic assessment. However, there are limitations to this process. For example, it is difficult to locate such resorptive areas unless they are fairly large. In addition, it is impossible to obtain useful information on buccal and lingual aspect as they are undetectable due to roentgenographic superimposition. Hence, it is possible that the incidence of ECR is much higher than those of reported.



**Figs 1A and B:** ECR seen at the cervical one-third of the mesial side of the permanent maxillary first molar stained with carbol fuchsin stain: (a)10× magnification and (b) 40× magnification



**Figs 2A and B:** ECR lesions showing granulomatous tissues with resorptive lacunae-like areas and cementum-like reparative tissues and odontoclast-like mononuclear resorptive cells (arrowhead) in association with lacunae: (A) 20× magnification and (B) 100× magnification

**Table 1:** The distribution of resorption sites on buccal, lingual, mesial and distal surfaces at cervical region of the permanent maxillary first premolar (percentages are in parentheses)

	ECR present					ECR absent
	Total	B	L	M	D	
Male	4 (26.7)	1 (25.0)	1 (25.0)	2 (50.0)	0 (0)	11 (73.3)
Female	11 (25.0)	2 (18.2)	1 (9.1)	3 (27.3)	5 (45.4)	33 (75.0)
Combined male and female	15 (25.4)	3 (20.0)	2 (13.3)	5 (33.3)	5 (33.3)	44 (74.6)

Present study utilizes premolar teeth extracted for orthodontic purposes from young individuals. Results revealed that, although not statistically significant, there is a higher incidence of cervical resorption in the females than males. When considering the site of the resorption area a higher percentage is seen in proximal surfaces (mesial: 33.3%, distal: 33.3%) involving the cervical region than buccal (20.0%) and lingual (13.3%) surfaces (see Table 1).

Although the precise etiology of root resorption is unknown, several potential factors have been proposed; orthodontic tooth movement, oral surgical procedures, periodontal root scaling and planning, tooth bleaching, trauma, bruxism, tooth fracture, developmental defects or a combination of these predisposing factors.<sup>13</sup> It is reported that ECR of teeth is initiated by an inflammatory condition, mechanical stimulation or by pressure in the periodontal ligament as a result of neoplastic process or unerupted teeth. Pressure-induced external root resorption occurs in association with impacted teeth, exerting pressure on roots of adjacent teeth or as a result of space occupying pathological lesions.<sup>14,15</sup> However, the present sample of teeth has not been exposed to none of the factors mentioned. Therefore, it can be speculated that ECR of root surfaces of these young premolar teeth may be triggered by the pressure exerted on their proximal surfaces by the crowding of teeth since they were extracted for the orthodontic treatment in order to relieve the crowding or gain space. Furthermore, during eruption of the permanent teeth, pressure resorption of maxillary lateral incisors by the canine and mandibular second molar by the third molar are commonly reported. However, this type of resorption is usually arrested when the stimulus is discontinued, such as relieving crowding, extraction of third molar, etc.<sup>14,15</sup>

The distribution of mineralized tissues at the cemento-enamel junction is irregular and unpredictable.<sup>16-19</sup> According to a study of Arambawatta et al<sup>16</sup>, 30.7% showed gaps with exposure of dentin at the cemento-enamel junction. Therefore, these findings allow us to infer that there is a strong predisposition at the cemento-enamel junction for the development of pathological changes, such as ECR.

Denuded mineralized tissue is colonized by multinucleated cells which initiate the resorption process. This is supported by the present study showing resorptive-like cells closely associated with resorption lacunae in histological sections (see Figs 2A and B). However, without further stimulation of resorptive cells, the process will end spontaneously. Repair with cementum-like tissue will occur within 2 to 3 weeks if the damaged surface does not cover a large surface area (see Figs 2A and B). If the damaged root surface is large, bone cells will attach to the root before the cementum producing cells, and ankylosis is the result of this process. Continuation of the active resorption process is dependent on a common stimulation factor of the osteoclastic cells, either infection or pressure. Therefore, the various types of root resorption should be identified according to the stimulation factors. When these stimulation factors are identified, it will be possible to reverse the process by removing the etiological factors. Although the present study reports the ECR in maxillary first premolars, it may present in other teeth of the crowded dentition as well. Therefore, it is important and essential to ensure that these teeth are affected by ECR before and after orthodontic treatment. However, further studies are warranted in order to explore the precise etiology, diagnosis and management of this condition.

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