

The Prevalence of the Palatoradicular Groove in a Selected Saudi Population and its Effect on Caries Occurrence

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Abstract. Palatoradicular grooves (PRGs) are developmental anomalies of the maxillary incisors teeth. They usually begin in the central fossa, cross the cingulum, and extend to varying distances apically. The purpose of this study was to investigate the prevalence of palatoradicular grooves in upper lateral incisors, and determine caries prevalence in the grooves in a selected Saudi population. Two hundred and seventy six Saudi patients attending the College of Dentistry clinics at King Saud University in Riyadh city were selected for examination. The patients were aged 11-55 years. Those patients with restored grooves, crowned, or missing upper lateral incisor on any side were excluded. Both right and left upper lateral incisors were carefully examined for the presence, extension of the PRGs and the incidence of caries. Descriptive data analysis was used to report findings. The prevalence of the PRGs was 10.3%. They were found to be 6.5% as coronal grooves and 3.8% as apical grooves. Bilateralism was found to be 72.2% for coronal grooves and 47.6% for apical grooves. Caries prevalence was 5.4%, and completely absent in teeth without the groove. One half of teeth with grooves were found to be carious. Within the limitation of this study; it was concluded that the prevalence of the PRGs is high in Saudi community and they are associated with increased caries experience.

Introduction

Effect of dental plaque accumulation has been studied for decades (Bowen, 1976). Since then it has been realized that inaccessible areas for cleaning are at risk for caries development.

Numerous local anatomical factors predispose to plaque accumulation and retention, enhancing the chance for caries development; such factors include marginal ridge discrepancies, food impaction, cervical enamel projections, open contacts, and pits and grooves or fissures.

Palatoradicular grooves (PRGs) are developmental anomalies of the maxillary incisor teeth. They usually begin in the central fossa, cross the cingulum, and extend to varying distances apically (Withers *et al.*, 1981; Atkinson, 1943) and possibly reaching the root apex (Assaf and Roller, 1992; Robison and Cooley, 1988; Walker, 1976). They can be in the midpalatal, mesial, or distal region of the tooth (Hou, *et al.*, 1988; Kogon, 1986; Lee *et al.*, 1968). PRGs extending apically onto the root have been regarded

as funnels for the retention of dental plaque (Lee *et al.*, 1968; Prichard, 1963; Everett and Kramer, 1972; Simon *et al.*, 1971; Hou *et al.*, 1986).

Many studies have been conducted to evaluate the prevalence of the PRGs. The first large survey of the prevalence of PRGs in extracted lateral incisors was conducted by Everett and Kramer (1972); the prevalence of PRGs was less than 2% in 625 teeth, and of those teeth only 0.5% had the groove extended to the root apex.

Withers *et al.* (1981) examined 531 patients and reported a prevalence of 2.33% in both the maxillary central and lateral incisors and 4.4% in maxillary lateral incisors alone. PRGs were associated with poorer periodontal health and greater plaque accumulation.

Kogon (1986) examined extracted maxillary incisors with a dissecting microscope, reporting PRGs in 4.6% (5.6% in lateral incisors; 3.4% in central incisors); 54% of PRGs terminated on the root and 58% extended 5mm or more apically.

The purpose of this study was to investigate the

prevalence of palatoradicular grooves in upper lateral incisors and caries prevalence in the grooves in a selected Saudi population.

Materials and Methods:

Two hundred and seventy six Saudi patients attending to the College of Dentistry clinics at King Saud University in Riyadh city were selected for examination. Their age ranged from 11-55 years old. Any patient with restored grooves, crowned, or missing upper lateral incisor on any side was excluded.

Both right and left upper lateral incisors were carefully examined for the presence and extension of the PRGs and the presence of caries in the grooves, using a mouth mirror and dental explorer.

The groove extension was categorized into **Coronal** grooves (coronal to the cemento-enamel junction "CEJ"), and **Apical** grooves (extending to the root, beyond the CEJ).

Presence of caries was marked as 1 and absence was marked as 0. Under adequate light condition, presence of caries was determined by pulling the tip of a sharp explorer laterally over the grooves looking for stickiness and avoiding apically directed force (Yassin, 1995; Van Dorp *et al.*, 1988; Warren *et al.*, 2003).

Three examiners collected the data. For inter-examiner calibration, and before starting data collection, a training session with a senior examiner was carried out, so as to standardize examination. At the beginning, twenty patients were examined by all examiners, in which the first examiner performed examination and recorded data followed by the second and third examiners in an orderly manner. The data were then cross-matched using the Kappa value. All statistical analysis was calculated using the SPSS program version 10 and then descriptive data analysis was used to report findings.

Results

A high degree of inter-examiner reproducibility was observed with the first twenty patients examined by all examiners. The mean Kappa values obtained are shown in Table 1.

The prevalence of the PRG was 10.3%. Coronal grooves accounted for 6.5% of the total sample and apical grooves 3.8% (Table 2). Bilateralism of the PRGs was calculated to be 63.16%, regardless of the type of groove; it was 72.2% for coronal grooves and 47.6% for apical grooves (Table 3).

Table 1. The mean Kappa values after inter-examiner calibration

Variable	Min.	Max.	Mean	Std. deviation
Groove	0.817	1.000	0.892	0.084
Caries	1.000	1.000	1.000	0.000
Plaque	0.571	1.000	0.819	0.138

Table 2. Prevalence of the palatoradicular grooves

Structure	Structure frequency	Structure (%) of total grooves	Structure (%) of total sample	Total
No groove	495	-	89.7 %	89.7 %
Coronal groove	36	63 %	6.5 %	10.3 %
Apical groove	21	37 %	3.8 %	
Total	552	100 %	100 %	100%

Table 3. Bilateralism of the palatoradicular grooves

Groove	Frequency	Bilateralism Frequency	Bilateralism (%)
Coronal	36	26	72.2 %
Apical	21	10	47.6 %

Caries prevalence was 5.4% regardless of groove expression (n= 552). It was completely absent with teeth having no groove. Caries prevalence of coronal and apical grooves in relation to total number of teeth was 2.18% and 3.26% respectively, and the difference was statistically significant (Table 4).

Table 4. Percentage of caries with different groove expressions.

*Statistically significant at P<0.0001 compared to no groove

Teeth	Frequency of structure	Frequency of caries	Caries (%) of structure	Caries (%) of total sample
No groove	495	0.0	0.0	0.0*
Coronal groove	36	12	33 %	2.18 %*
Apical groove	21	18	85.7 %	3.26 %*
Total	552	30	52.6 %	5.4 %*

Caries was detected in 12 teeth with coronal groove, which represent 33% of the teeth with the

groove. It was detected in 18 teeth with apical groove, which represent 85.7% of the teeth with the groove (Table 4).

Discussion

Since three examiners collected the data, it was important to unify and standardize their method of examination and data collection.

The mean Kappa statistics obtained were high, and this suggests that the three examiners reached an excellent inter-examiner reliability.

The prevalence of PRGs in this study was high compared to the prevalence reported by Everett & Kramer (1972), which was less than 2%, and the one reported by Kogon (1986), which was 5.6%. This great difference could be attributed to different methodology used, as they conducted their research on extracted teeth. Another reason for this great difference may be racial and genetic factors.

The predominance of the PRG in the lateral incisor (Withers *et al.*, 1981; Kogon, 1986) may be due to the undesirable position of the tooth during the growth of the maxilla. While still a tooth germ, it is trapped between the central incisor, canine and first premolar, which are in a more advanced phase of dental development. Mineralization of the crown of the maxillary lateral incisor starts later, compared to central and canine, making this germ, under these conditions, highly susceptible to folding (Atkinson, 1943; Vanessa *et al.*, 2000).

The occurrence of the apical and coronal grooves in this study was not equal. It was 63% for coronal grooves which is almost twice the occurrence for apical grooves (Table 2). This is different from the report by Kogon (1986): he observed almost equal occurrence of the coronal and apical grooves (54% and 58% respectively).

Form this study; it can be seen that there was only a moderate trend towards bilateral occurrence. This may indicate that, during tooth development, the events that have occurred on one side, did not occur on the other side when occurrence was unilateral, which may cause this uneven distribution of the groove expression between the right and left sides.

The funnel-like shape of the PRG promotes the accumulation of plaque and calculus, which are difficult to remove, at times making proper cleaning by the patient, or even the dentist nearly impossible (Everett and Kramer, 1972; Simon *et al.*, 1971; Vanessa *et al.*, 2000; Santa Cecilia *et al.*, 1998; August, 1978). Caries prevalence in relation to total sample was low in this study. But in cases where the PRG was absent, caries was not detected.

Furthermore; it was found that half of the teeth with grooves were carious, which supports the idea that the PRG represents foci for plaque accumulation and predispose for caries lesions development. In addition to that; the method by which caries was examined, i.e. avoiding apically directed force, might have contributed to lower caries prevalence (Yassin, 1995; Van Dorp *et al.*, 1988; Warren *et al.*, 2003).

From the present study, and because of the increased prevalence of the PRG in Saudi population (10.3%) compared to what found in other studies (Withers *et al.*, 1981; Kogon, 1986), more attention should be paid by clinicians to carefully examine the upper anterior teeth for the presence of the PRGs, particularly the lateral incisors, since they have a higher chance of developing this anatomical landmark. A larger study that represents the entire Saudi population should be conducted for more precise estimation of prevalence of the PRGs in Saudis.

Conclusion

Within the limitation of the study the following conclusions can be drawn:

1. The prevalence of the palatoradicular groove in a selected Saudi population was 10.3%.
2. Caries prevalence was 5.4% in relation to total number of teeth.
3. Almost 53% of teeth with grooves were found to be carious.
4. Palatoradicular grooves are associated with increased caries prevalence.

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انتشار الثلمات الحنكية الجذرية وتأثيرها على حدوث نخر الأسنان في الرباعية العلوية في عينة مختارة من السعوديين

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ملخص البحث. الثلمات الحنكية الجذرية هي عيوب تخلقية في القواطع العلوية وعادة ما تبدأ في الحفرة المركزية وتتعدى البروز اللساني وتمتد بمسافات متفاوتة ذروباً. إن الهدف من هذه الدراسة هو التحقق من انتشار الثلمات الحنكية الجذرية وحدوث نخر الأسنان في الرباعية العلوية في عينة مختارة من السعوديين. تم فحص ٢٧٦ مريضاً سعودياً حضروا إلى كلية طب الأسنان بجامعة الملك سعود في مدينة الرياض، وتراوح أعمارهم بين ١١-٥٥ سنة. تم استثناء المرضى الذين لديهم ثلمات مرممة أو قواطع عليها تيجان أو مفقودة في أي من الجهتين. كلا الرباعيتان العلويتان اليمنى واليسرى تم فحصهما بعناية لوجود وامتداد الثلم الحنكي الجذري وحدوث نخر الأسنان فيه. تم استعمال تحليل البيانات الوصفية لتوضيح النتائج. كان انتشار الثلم الحنكي الجذري بنسبة ١٠,٣٪، أما نسبة الثلم التاجي فكانت ٦,٥٪ والثلم الذروي كانت ٣,٨٪. ووجدت الثلمات التاجية بنسبة ٧٢,٢٪ في كلا الجهتين، أما للثلمات الذروية فكانت ٤٧,٦٪. وكان انتشار النخر فيها بنسبة ٥,٤٪، وبالمقارنة لم يوجد نخر بالأسنان التي ليس بها ثلم. استنتج من هذه الدراسة أن انتشار الثلم الحنكي الجذري عالٍ في المجتمع السعودي وأن وجوده مرتبط بزيادة حدوث نخر الأسنان.