

# RELATAIONSHIP BETWEEN PALATO-RADICULAR GROOVE AND PERIODONTAL HEALTH IN MAXILLARY LATERAL INCISORS

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## ABSTRACT

*Palato-radicular grooves (PRGs) are developmental anomalies of the maxillary incisors teeth. The purpose of this study was to investigate the relationship between PRGs presence and periodontal health of maxillary lateral incisors in a selected sample of Saudi adults. A total of 552 maxillary lateral incisors were examined in a group of 276 Saudi adults for the presence of PRG. The groove extension was categorized into coronal and apical grooves. The plaque index (PI), bleeding index (BI) and probing depth (PD) were recorded on six specific sites (three labial and three palatal) of the teeth examined. Chi square test was used to evaluate the association between the PRGs existence and presence of plaque and bleeding. Differences in PD between groups were analyzed using the unpaired-t-test. The PRG was observed in 10.3% of the sample. The lowest percentage of PI (80%) and BI (78%) were recorded in teeth without the PRGs. The percentages for PI and BI in teeth with the apical grooves were 100% for both parameters. 97% of teeth with the groove experienced bleeding on probing compare to only 78% of teeth without the groove. Teeth with apical grooves showed a statistically significant deeper probing depth compared to the teeth without the grooves. In conclusion maxillary lateral incisors with PRGs particularly those with apical extension of the groove were significantly associated with poorer periodontal health status manifested as more susceptibility for bleeding on stimulation and tendency to attain deeper probing depth in contrast to teeth without PRGs.*

**Key words:** Palato-radicular groove, lateral incisors, periodontal health, Saudi population

## INTRODUCTION

Dental plaque is an adherent biofilm of bacteria and their products that forms on all tooth surfaces and dental prosthesis.<sup>1</sup> Factors that may contribute to plaque accumulation and retention include; marginal ridge discrepancies, food impaction, cervical enamel projections, open contacts, and pits and grooves on tooth surfaces.

Palato-radicular grooves (PRGs) are developmental anomalies of the maxillary incisors. The PRGs usually arise from the central fossa of the maxillary incisors, cross the cingulum, and extend to varying distances in an apical direction.<sup>2</sup> Some studies<sup>3,4,5</sup> have reported that PRGs may even reach the root apex. There is no absolute anatomical location for the PRGs. Studies have reported PRGs to be present in the midpalatal, mesial, distal and also at the labial aspect

of the maxillary permanent incisors<sup>6,7,8,9</sup> PRGs extending apically onto the root<sup>8,9,10,11,12,13</sup> have been regarded as funnels for the retention of microbial dental plaque.

The prevalence of the PRGs has been investigated. The first large survey of the prevalence of PRGs was conducted in 1972 by Everett and Kramer.<sup>11</sup> In their study, the prevalence of PRGs in 625 extracted maxillary lateral incisors was less than 2%. Another study examined the prevalence of PRGs among 531 study participants,<sup>2</sup> and reported a prevalence of 4.4% in maxillary lateral incisors alone. Kogon et al.<sup>7</sup> reported a total prevalence of 4.6% in extracted maxillary incisors. In their study, the prevalence of PRGs in maxillary central and lateral incisors were 5.6% and 3.4% respectively; about half of PRGs terminated on the root and 58% of these extended more than 5mm from the cemento-enamel junction (CEJ).<sup>7</sup>

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Although a connection between PRGs and poor periodontal health is frequently observed, only a limited number of studies have assessed this relationship. Hou and Tsai have demonstrated a relationship between PRGs and localized periodontitis using standard periodontal indices.<sup>14</sup> They reported a statistically significant relationship between the depth and location of PRGs and the gingival and plaque indices and development of deeper probing depths in affected teeth.

Since, the periodontal inflammatory conditions in patients with PRGs needs further exploration using relatively large sample size, the purpose of the present study was to investigate the relationship between PRGs presence and periodontal health of maxillary lateral incisors in a selected sample of Saudi adults.

## METHODOLOGY

The study was approved by the ethics committee of the College of Dentistry Research Centre, King Saud University, Riyadh, Saudi Arabia.

For the purpose of the study, 276 Saudi adult male patients (aged between 11 and 55 years) were recruited from the College of Dentistry, King Saud University, Riyadh, Saudi Arabia. Individuals with restored grooves, crowns or missing maxillary lateral incisor on any side were excluded. Both right and left maxillary lateral incisors were carefully examined for the presence and extension of the PRGs using a mouth mirror and dental explorer. The groove extension was categorized into coronal grooves (coronal to the CEJ), and apical grooves (extending to the root, beyond the CEJ).

Three examiners performed the clinical examinations. For inter-examiner calibration, a training session with a senior periodontist was carried out, so as to standardize examination protocols. 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. Inter-examiner agreements were then analyzed and reported using Kappa statistics.

Plaque index (PI), bleeding index (BI) and probing depth (PD) were recorded on six specific sites (three facial and three palatal) of the sampled teeth using a

periodontal probe. Presence of plaque in the cervical third of the buccal and palatal surfaces of each tooth was marked as 1 and absence was marked as 0. BI was measured by moving the probe by sulcular sweeping (the probe tip extended 0.5 mm apical to the gingival margin) presence of bleeding was marked as 1 and absence was marked as 0. PD was defined as the distance (in millimeters) from the gingival margin to the base of the sulcus.

The prevalence of PRGs among lateral incisors and the presence of plaque and bleeding were calculated between groups with different groove expressions. Association between PRGs presence and periodontal health parameters was analyzed using the chi-square test. Differences in probing depth between groups were analyzed using unpaired-t-test. All tests were performed with SPSS version 10 (SPSS, Chicago, IL). All significance level were set at 5%.

## RESULTS

A high degree of inter-examiner reproducibility was observed except for bleeding index. The mean Kappa values obtained are shown in Table 1. The prevalence of the PRG was 10.3%. The percentages of coronal and apical grooves were 6.5% and 3.8% respectively (Table 2). The lowest percentage of PI (80%) and BI (78%) were observed in teeth without the PRGs. Values for PI and BI for teeth with coronal grooves were 87.5% and 93.8% respectively. The percentages for PI and BI in teeth with the apical groove were 100% (Table 3).

A significant association between presence of the groove and plaque accumulation was found (Table 4). Plaque was found in 93% of the teeth with the groove while 80% of teeth without the groove showed plaque

TABLE 1: THE MEAN KAPPA VALUES AFTER INTER-EXAMINER CALIBRATION

Variable	Min.	Max.	Mean Kappa	Std. deviation
Groove	0.817	1.000	0.892	0.084
Plaque	0.571	1.000	0.819	0.138
Bleeding	0.186	1.000	0.556	0.294
Probing depths	0.432	1.000	0.858	0.156

TABLE 2: PREVALENCE OF THE PALATO-RADICULAR GROOVES

Structure	Frequency	Percent-age of total sample	Total
No groove	495	89.7 %	89.7 %
Coronal groove	36	6.5 %	10.3 %
Apical groove	21	3.8 %	
Total	552	100 %	100 %

TABLE 3: PLAQUE INDEX (PI) AND BLEEDING INDEX (BI) IN LATERAL INCISORS WITH DIFFERENT GROOVE EXPRESSIONS

Structure	PI (%)	BI (%)
No groove	80	78
Coronal groove	87.5	93.8
Apical groove	100	100

TABLE 4: FREQUENCY OF PLAQUE PRESENCE AROUND LATERAL INCISORS WITH AND WITHOUT GROOVE

Groove Presence	Plaque	
	Yes	No
No (n=495)	398 (80%)	97 (20%)
Yes (n=57)	53 (93%)	4 (7%)

Pearson's Chi-Square: 5.41 (P=0.020)

TABLE 5: FREQUENCY OF BLEEDING ON PROBING AROUND LATERAL INCISORS WITH AND WITHOUT GROOVE

Groove Presence	Plaque	
	Yes	No
No (n=495)	386 (78%)	109 (22%)
Yes (n=57)	55 (97%)	2 (3%)

Pearson's Chi-Square: 10.903 (P=0.0009)

TABLE 6: MEAN PROBING DEPTHS FOR THE RIGHT AND LEFT LATERAL INCISORS WITH DIFFERENT GROOVE EXPRESSIONS

Teeth	Structure	Frequency	Mean PD (mm)	Std. Deviation
Right lateral incisors (n= 276)	No groove	248	1.94	0.496
	Coronal	20	2.07	0.542
	Apical	8	2.39*	0.654
Left lateral incisors (n= 276)	No groove	247	1.92	0.477
	Coronal	16	2.07	0.512
	Apical	13	2.32*	0.579

\*Statistically significant difference compared to no groove at P<0.05

accumulation. On the other hand, a highly significant association between groove existence and bleeding on stimulation was found (Table 5). Bleeding on probing was found in 97% of teeth with the groove while only 78% of teeth without the groove experienced bleeding on probing.

Teeth with no PRGs displayed the lowest PD (mean: 1.94 mm and 1.92 mm for right and left maxillary lateral incisors correspondingly). Patients having the coronal groove had a mean PD value of 2.07 on both sides. The deepest PD was found in teeth with apical grooves (mean: 2.39mm and 2.32mm for right and left laterals respectively). Teeth with apical grooves showed a statistically significant deeper probing depth compared to the teeth without the grooves (Table 6).

## DISCUSSION

The high mean Kappa values suggested that the three examiners reached an excellent inter-examiner reliability, except for bleeding index, which had a lower kappa value compared to other indices. This was most probably due to trauma induced by the three examiners as they probed the teeth successively. During calibration, it was observed that the first examiner had the least readings of BI, followed by the second examiner while the third examiner had the highest readings. Nevertheless, the kappa results, in general, suggested a careful protocol followed in the clinical examination of the participants.

In this study, the prevalence of PRGs in maxillary lateral incisors was high (10.3%) compared to the prevalence reported by Everett and Kramer<sup>11</sup> (< 2%), and the prevalence reported by the Kogon<sup>7</sup> (3.4%). This great difference could be attributed to different methodology used, as they conducted their research on extracted teeth. Another reason for this high difference may be race and genetics; However, a study by Storrer et al<sup>15</sup> reported a prevalence of 9.58% of the

palato-radicular groove in a sample of 73 extracted maxillary lateral incisors, which is comparable to our results of 10.3%.

The present results showed that the occurrence of the coronal grooves was nearly twice as common as the apical grooves. Conversely, Kogon<sup>7</sup> reported almost equal occurrence of the coronal and apical grooves (54% and 58% respectively). Due to the limited number of studies published in this regard, the author found it exigent to determine an absolute explanation regarding the high occurrence of coronal grooves in this study. However, it could be attributed to race and genetics of the participants.

The funnel-like shape of the PRG promotes the plaque and calculus stagnation, which may be difficult to remove by the patient as well as the oral healthcare providers.<sup>11,12,16,17,18</sup> This study showed that plaque accumulation and bleeding on probing were more frequent in teeth with grooves than teeth with no grooves, which supports the findings reported by Withers *et al.*<sup>2</sup> Apical grooves tend to accumulate more plaque than coronal grooves, thus causing more bleeding. Bleeding on probing is the most important sign of gingival inflammation, thus, the presence of PRGs causes gingival inflammation and deterioration of periodontal health. This is in accordance with Hou and Tsai (1993)<sup>14</sup> findings. The sulcus around lateral incisors with PRGs tends to be deeper than laterals without grooves. In support of the latter statement, this study, showed a significant difference in the mean probing depths between teeth with apical grooves and those with no grooves.

In light of the relatively high prevalence of the PRG in Saudi adults (10.3%), more emphasis should be placed on careful examination of the maxillary anterior teeth for the presence of PRGs particularly the lateral incisors, as they are more likely to develop such anatomical landmark. A larger sample that represents the entire Saudi population would provide a more precise estimation of prevalence of the PRGs in Saudis.

## CONCLUSION

Within the limitations of the present study, it can be concluded that maxillary lateral incisors with PRGs particularly those with the apical extension of the groove were significantly associated with poorer periodontal health status manifested as more susceptibility for bleeding on stimulation and tendency to attain deeper probing depth in contrast to teeth without PRGs.

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