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The influence of the distance from the contact point to the crest of bone and clinical attachment level on the height of interdental papilla: A cross-sectional study

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ABSTRACT

Aim: The purpose of the present study was to determine relation of vertical distance and clinical attachment level with the classification of interdental papilla recession after surgical exposure in chronic periodontitis patients.

Materials and Methods: This cross-sectional interventional study involved 231 interdental papillae in 60 chronic periodontitis patients subjected to open flap debridement. The subjects were divided into four groups according to loss of height of interdental papillae: Normal papilla, Class I papilla, Class II papilla, Class III papilla. The clinical attachment level and vertical distance was measured. The vertical distance was measured from apical point of the contact area to alveolar crest.

Results: The vertical distance and clinical attachment level found to be significantly affecting all the classes of loss of papillary height ($p<0.05$). Majority of cases belonging to the loss of height of papilla (class I and class II) also exhibited the distance from the contact point to the alveolar crest ≤5mm. Clinical attachment level was also found to be significantly affecting the loss of height of interdental papillae. Clinical attachment level of ≤1mm was found in normal/intact papilla but it does not necessarily indicate the normal papilla in all cases.

Conclusion: Vertical distances and clinical attachment level affect the height of interdental papilla, other factors which influence the existence of interdental papilla should also be taken into consideration for diagnosis and treatment planning to achieve better aesthetics.

INTRODUCTION

The existence of interdental papillae and healthy gingiva harmonizing with the natural dentition is one of the important aspects that need to be considered in diagnosis and treatment. In the present era of youth and beauty, satisfying the esthetic demands of the patient while restoring the periodontium to a healthy and functional state, is needed in day to day practice. Previously, interdental papilla was considered as a gingival trait having a pyramidal shape and functioning as a deflection of the interproximal food debris. Now it is clear that the physiology of the papilla is more complex. Loss or absence of interdental papilla creates black triangles which are unesthetic. Therefore, it is very important to respect papillary integrity during all dental procedures and to minimize its disappearance as much as possible.

Interdental papillae occupy the interdental space. The contact point maintains a stable dentition and restricts food impaction into the interdental embrasure. The embrasures made by the mesial and distal surfaces of the adjacent teeth protect interdental papillae[1]. The interdental space is divided into a vertical dimension between the contact point and the alveolar crest and the horizontal dimension between the mesial and distal surfaces of the adjacent teeth. Tarnow et al[2] reported that the interdental papillae are almost always present when the vertical dimension is ≤5mm. Cho, Jang, Kim et al[3] found that the horizontal and vertical dimension of the interdental space have an independent and combined effect on the existence of interproximal papillae.

The shape and health of interdental papilla is affected by many factors such as the alignment of each tooth, the shape of the adjacent tooth crown, and amount of the interdental space. Other factors that can affect the shape and health of the interdental soft tissue includes inflammation in the periodontium, the probing depth around the adjacent teeth, the fibrotic or edematous condition of the interdental soft tissue, the volume of the interdental space, course of cemento-enamel junction (CEJ), history of surgical or non-surgical periodontal treatments, prosthodontic restorations in the adjacent teeth, pressure on the interdental soft tissue by an orthodontic appliance or ovate pontic.[4-11]

Studies till date have investigated the interdental papilla and the factors affecting it in terms of its presence or absence.[2,3,8] In the present study the loss of interdental papilla was analyzed in terms of various stages of its loss as determined by anatomical landmarks (Nordland and Tarnow classification[12]) and an attempt was made to find its relationship with the vertical distance from contact point to alveolar crest and clinical attachment level with respect to the neighbouring surfaces of teeth.

MATERIALS AND METHODS

Study design

The study was cross-sectional interventional study. Patientswere selected from Outdoor Patient Department of Periodontics, Post Graduate Institute of Dental Sciences, Rohtak irrespective of socio-economic status, religion and sex. The present study was approved by institutional review board.

Patients requiring surgical intervention for the treatment of mild to moderate chronic periodontitis and having normal contact points were included in the study. Exclusion criteria were: teeth with open contacts, history of periodontal surgery, orthodontic treatment, translocated or tilted teeth, proximal/ cervical restorations or abrasions, pregnancy, history of taking medications known to increase the risk of gingival enlargement.

After completion of etiotropic phase therapy, establishing optimal plaque control and gingival health conditions, the patients were asked to report after one month. Sites with Sulcus bleeding index >2 were excluded as evaluation of papillary height may be influenced by inflammation. A total of 231 interproximal sites in sixty patients were selected to be included in the present study. The study design was discussed with patients and informed consent was obtained.

On the basis of the classification given by Nordland and Tarnow[3], the papillae were assigned into following four groups; Group I: Normal papilla, Group II: Class I papilla, Group III: Class II papilla, Group IV: Class III papilla

On the day of surgery, sulcus bleeding index, probing depth, clinical attachment level, height of interdental papillae were measured and recorded presurgically. Vertical distance from the contact point to alveolar crest were measured and recorded after raising the mucoperiosteal flap for open flap debridement (Figure 1). The measurements were done with the help of periodontal probe (UNC-15 probe).

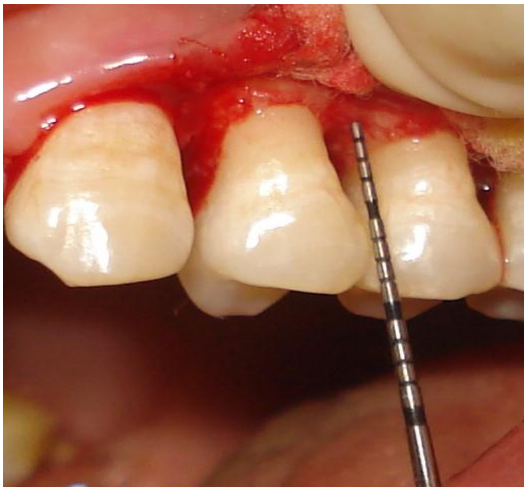

Figure1: Vertical distance from the contact point to alveolar crest

Statistical Analysis

Mean value along with standard deviation were calculated and were analysed. Anova test was applied for multiple group comparison. For intergroup comparison t-test was applied. All differences among values were considered very highly significant at P ≤0.001, highly significant at P ≤0.01, Significant at P ≤0.05.

RESULTS

Sixty patients were included in the study. Sixty-eight surgeries were done in them and total of 231 papillae were analysed.

Table I: Descriptive analysis of clinical parameters with different type of interdental papillae

Parameters (mm)	Group I (n=8)	Group II (n=30)	Group III (n=176)	Group IV (n=17)
Vertical distance (CP-BC)	4.88±0.35	6.20±1.19	7.11±1.55	8.17±1.23
Average CAL	0.81±0.63	1.93±0.67	5.17±1.43	6.67±1.69

While considering the various groups, the analysis of variance (ANOVA) F test revealed the difference in means of all the groups as highly statistically significant (P ≤ 0.001) for vertical distance and average clinical attachment level.

Table II: Intergroup comparision of clinical parameters

Groups	Vertical Distances (CP-BC) (mean±SD)	Average Clinical attachment level (CAL) (mean±SD)
Group I (n=8)	4.88±0.35	0.81±0.63
Group II (n=30)	6.20±1.19*	1.93±0.67
Group III (n=176)	7.11±1.55$^{+,\#}$	5.17±1.43
Group IV (n=17)	8.17±1.23$^{++,\#\#,\$,\$\$}$	6.67±1.69

P<0.01 indicates significant and P<0.001 indicates highly significant.

* intergroup comparision of Group I and Group II,$^{+}$ intergroup comparision of Group I and Group III,$^{++}$ intergroup comparision of Group I and Group IV, $^{\#}$ intergroup comparision of Group II and Group III,$^{\#\#}$ intergroup comparision of Group II and Group IV, $^{\$}$ intergroup comparision of Group III and Group IV, $^{\$\$}$ intergroup comparision of Group II and Group IV.

Table III: Type of Papillae (% of cases) according to various vertical distances

Vertical distance (CP-BC)	Group – I (n=8)	Group – II (n=30)	Group - III (n=176)	Group - IV (n=17)
5mm (n=36)	19.44%	22.22%	58.33%	0%
6mm (n=49)	0%	22.45%	73.47%	4.08%
7mm (n=50)	0%	10%	84%	6%
≥7mm (n=95)	0%	6.32%	81.05%	12.63%

Table III shows that 5mm distance does not ensure to presence of normal / intact papillae as many cases belonging to loss of papillae (class I and class II) also exhibited the same distance.

Table IV: Type of Papillae (% of cases) according to Clinical attachment level

CAL	Group – I (n=8)	Group – II (n=30)	Group - III (n=176)	Group – IV (n=17)
≤1mm (n=8)	50%	50%	0%	0%
2mm (n=17)	5.88%	94.12%	0%	0%
3mm (n=9)	0%	11.11%	88.89%	0%
≥3mm (n=197)	0%	0%	90.81%	9.19%

Table IV shows all normal papillae at ≤1mm, but this does not necessarily indicate the presence of intact papillae as 50% were found to be normal and rest 50% as class I.

DISCUSSION

Management of the soft tissue around natural teeth during various periodontal procedures is the key to an aesthetically pleasant smile. Interdental papillae are considered as an essential component of it. Studies have demonstrated that several factors contribute to the loss of interdental papilla, the most common reason in the adult population is loss of periodontal support.

The purpose of the present study was to analyse the loss of height of interdental papillae and its relation with the vertical distance from the contact point to the alveolar crest, and clinical attachment level on the neighbouring surfaces of teeth. Patients requiring surgical intervention for the treatment of chronic periodontitis were included in the study as papilla height had to be related with the alveolar crest.

Clinical parameters in the current study were analysed with the loss of height of interdental papilla as classified by Nordland and Tarnow[12]. The purpose of classifying the loss of height of interdental papilla was to allow easy means to assess progressive degrees of interdental papilla loss using readily observed anatomical landmarks for reference. It provides a description of the extent of reduction of papillary height[13].

The vertical distance and clinical attachment level found to be significantly affecting all the classes of loss of papillary height ($p<0.05$).

Table I represents the mean vertical distance in Group I to be 4.88±0.35mm, Group II to be6.20±1.19mm, Group III to be 7.11±1.55mm, Group 1V to be 8.17±1.23mm. Intergroup comparison revealed statistically significant difference in all the groups (Table II).

Tarnow et al[2]designed a studyto determine whether the distance from the base of the contact area to the crest of bone could be correlated with the presence or absence of the interproximal papilla in humans. The results presented that when the measurement from the contact point to the crest of bone was 5 mm or less, the papilla was present almost 100% of the time. When the distance was 6 mm, the papilla was present 56% of the time, and when the distance was 7 mm or more, the papilla was present 27% of the time or less. The results of the present study demonstrated that in the control group (normal papilla), the distance from the contact point to the alveolar crest was found to be 5mm, except one unit where it was 4mm. The results also revealed that the distance ≤5mm also exhibited many cases belonging to loss of papilla (class I and class II).These results deviate from the finding observed in the study by Tarnow et al where almost all the units belonging to 5mm distance exhibited intact interdental papilla. The results of the present study reveal that out of 231 units, 36 papillae were found to have the distance from the base of the contact area to the crest of bone equal to 5mm. Out of these only 19.44% were normal papilla, 22.2% class I papilla and 58.3% class II papilla (Table III).

Cho et al[3] study investigated the existence of interdental papillae at certain distances from the contact point to the alveolar crest, depending on the interproximal distance between roots. They reported that 89.7% of the papillae were present when distance from the contact point to the alveolar crest was 4mm, 58.5% at 5mm, 35.2% at 6mm, <7.5% at >7mm. In the present study numbers of units with 6mm vertical distance were found to be 49. Out of these 22.45% were class I, 73.47% class II, 4.08% class III. None of these units were found to have normal papillae. These results are not in accordance with the results observed in the above studies. This disparity could be due to small sample size of normal papilla group. 50 papillae were found to have 7mm distance, out of these 10% belonged to class I, 84% class II and 6% class III. Rest of the 95 papillae were having distance >7mm, of which 6.32% were class I, 81.05% class II, 12.63% class III papillae.

Clinical attachment level in Group I was0.81±0.63mm, Group II was1.93±0.67mm, Group III was5.17±1.43mm, Group 1V was6.67±1.69mm (Table 1). Intergroup comparison revealed statistically significant difference in all the groups (Table II).

All normal papillae were having clinical attachment level ≤1mm except one. But clinical attachment level ≤1mm does not necessarily indicate the presence of intact papilla. Out of 8 papillae having clinical attachment level of up to 1mm, 50% were normal and 50% as class I. At 2mm clinical attachment level 17 papillae were found, 5.88% normal and 94.12% as class I. It was seen that some amount of attachment loss was present in normal papilla which if not taken into consideration can lead to loss of papillary height and its functions in future. At 3mm clinical attachment level 9 papillae were found, 11.11% class I and 88.89% as class II. Clinical attachment level above 3mm was found in class II and class III papillae only (Table IV).

Perusal of the available literature reveals that there are very few published reports evaluating the factors affecting height of interdental papilla in terms of its classification as given by Nordland and Tarnow. Direct surgical exposure

has an advantage over radiographic evaluation thereby precisely measuring the vertical distance from contact point to alveolar crest.

A clear understanding about all the factors affecting the height and health of interdental papilla should be considered to avoid its disappearance while performing dental procedures. This knowledge also helps to predict the long-term success in papilla regenerative procedures.[14-17]

Further studies can be conducted to evaluate interdental papilla height in smokers and non- smoker group including socioeconomic status and large sample size.

CONCLUSION

The vertical distance and clinical attachment level found to be significantly affecting all the classes of loss of papillary height. The distance from the contact point to the alveolar crest ≤5mm does not ensure the presence of intact interdental papilla as reported by earlier studies. Majority of cases belonging to the loss of height of papilla (class I and class II) also exhibited the same distance. Clinical attachment level of ≤1mm was found in normal/intact papilla but it does not necessarily indicate the normal papilla in all cases.

Nevertheless, there might be other factors influencing the existence of interdental papilla. Further investigations exploring this area are indicated.

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