Etiological factors for loss of interdental papilla in maxillary central incisors- A non-invasive approach.

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Citation of this Article: Aishwarya Durai, Kota Bala Chaithanya Prasad., "Etiological factors for loss of interdental papilla in maxillary central incisors- A non-invasive approach.", IJDSIR- December - 2020, Vol. – 3, Issue - 6, P. No. 88 – 97.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Background: For an esthetic smile soft tissue contour along with an intact papilla is of utmost importance. Hence the study aimed at analyzing etiological factors for loss of interdental papilla in maxillary central incisors using a non –invasive methodology.

Materials and Methods: Forty subjects was analyzed for clinical and radiographic parameters. The clinic parameters included; Age, Gender, Grade of papillary recession, tooth shape, distance between the contact point (CP) to the papilla tip, biotype and bioform. The Radiographic parameters included; distance from the crest of the bone (AC) to the CP, distance from the CP to the proximal CEJ, distance from proximal CEJ to the AC, tooth shape, Inter-radicular distance (IRD), size of the embrasure, length of the gingival niche area. The Radiographic analysis was made using digital software (DIGORA VERSION 2.9.113.490).

Results: An intergroup comparison for the appearance of the papillary tip was made using chi-square test. In test group 75% of the subjects showed flat and 25% of the subjects showed pointed papillary tip .

Conclusion: Within the limitation of the present study, the study showed a complete presence of the interdental papilla with a distance of 6mm from the CP-AC in Indian population.

Clinical Significance: Distance from the CP-AC is considered as one of the main etiological factor for the presence of interdental papilla. In contrary with other population. Indian Subjects showed complete presence of interdental papilla with 6mm distance from CP-AC.

 Keywords: Interdental papilla, Papillary recession, Periodontitis, smile

Introduction

There is increasing concern for a perfect smile in the present world.Hence the domain of Periodontics has changed from being a strict health service to one where smile enhancement has been brought to the fore front of treatment planning.For an aesthetic smile, teeth and gingiva has shown to play a pivotal role. The increased esthetic demands require a soft tissuecontour with an intact papilla and a symmetric gingival outline.

Initially inter-dental papilla was considered as a gingival trait having a pyramidal shape and functioning as a deflection of the interproximal food debris. Later in 1959 Cohen first described the morphological aspects of papilla.[1]The presence of which is considered to be a key esthetic factor in any individual.[2]The interdental area comprises of the contact area, interproximal embrasure and interproximal dentogingival complex.The loss in the interproximal dentogingival complexheight can result in open gingival embrasure, phonetic problems, food impaction and aesthetic concern.

The gingival black space has been defined has the distance from the cervical black space to the interproximal contact.[3] Kokich observed the gingival black triangle of more than 3mm to be aesthetically a problem for the dentist and the general population, whereas orthodontists rated a 2mm open embrasure to be unaesthetic.[4]The incidence of occurrence of black triangle was upto 67% in population over 20 years of age and 18% in population under 20 years of age.[3] Another study reported an incidence of 15% in adolescents, 41.9% in subjects treated for maxillary incisor crowding, more than 1/3rd of adults and 38% adult ortho patients.[5] Numerous factors have been analyzed for the loss of the interdental papilla.A widespread analysis of the factors related to the fidelity of the interproximal papilla is essential for prevention and management of black triangle space.

Black triangles can result as a secondary consequence of periodontal disease or periodontal surgical therapy, periodontal attachment loss with a resultant gingival recession, an excessive distance from the alveolar bone to the proximal contact, tight proximal contact near the incisal edge,excessively divergent roots,triangular shaped crowns.[6]

Hence a comprehensive understanding as how these factors affect the interdental papilla loss is required for a proper treatment planning. In this regards, our study aims at, analyzing an array of elements that may be associated with the loss of interproximal papilla in an otherwise healthy maxillary central incisor, in Indian population.

Materials and Methods

Study Population: This observational study recruited forty subjects, who had attended to the outpatient block of the private practice from June 2015 to October 2015 based on the inclusion and exclusion criteria. The following inclusion criteria was considered: Age >18years, patients who have not undergone any periodontal or orthodontic therapy previously, periodontal health with oral hygiene index(s) 0-1, no midline diastema, well aligned dental arch, presence of identifiable and reliable natural CEJ and Exclusion criteria being: Patients under medications known to cause gingival hyperplasia, pregnant or lactating women, patients with any prosthesis in the maxillary anteriors. A written informed consent was obtained from all the subjects, after a thorough explanation of the nature, risks and benefits of the clinical investigation.

Study Design: The study was planned as an observational pilot study.The study subjects were initially divided into Control Group (Consisting of 20 subjects with complete papillary fill) and Test Group (Consisting of 20 subjects with loss of papillary fill) based on the Norland and

Tarnows Classification and Papillary Presence Index by Cortelllini. These two groups were further sub- divided into flat and pointed tip based on the clinical appearance of the papillary tip (Fig 1).

Clinical Analysis: All clinical parameters were analyzed by a single trained examiner using a UNC-15probe(Hu-Friedy, Chicago, IL, USA).The following clinical parameters where assessed; age, gender, grade of papillary recession- Norland and Tarnows classification ; papillary presence index by Cortellini, tooth shape (measured by the ratio of length of the tooth is to width of the tooth), distance between the contact point to the papilla tip: (measured from the tip of the papilla to the point below the contact area), biotype (the thick or thin biotype was measured based on the transparency of the probe when placed into the gingival sulcus of the affected tooth), bioform (measured as the discrepancy between interproximal gingival peak & mid-facial gingival margin peak).

Radiographic Analysis: An Intra-Oral Periapical Radiographs were taken using paralleling technique and with a 1mm metal grid. The analysis were made using a digital software(DIGORA VERSION 2.9.113.490).The following radiographic analyses were made: Distance from theAC-CP, distance from the CP-pCEJ, distance from pCEJ– AC, tooth shape: measured using the formula $\frac{1}{2}(d1/d2 + d3/d4)$[22] ,IRD: measured at the CEJ, size of the embrasure : measured as the sum of IRD + distance from CP-AC, length of the gingival niche area : measured as the distance from the CP- AC – distance from the papilla tip – CP.

Statistical Analysis

The statistical analysis was done using SPSS version 20.0. The measurement data was evaluated in terms of normal distribution by application of the Kolmogrov-Smirnov test. The Chi-Square Test wasperformed to analyze the significant difference between the groups andPearson's Correlation Coefficientwas performed to analyze the statistical significance between variables.

Results

Forty patients within an age range of 20-40 years were recruited into the study based on the Norland and Tarnows classification and Papillary Presence Index by Cortellini et al. They were divided into Control group and Test group based on presence /absence of papillary fill in the maxillary central incisors.

An intergroup comparison for the appearance of the papillary tip was made using chi-square test(TABLE 1). In control group 100% of the population showed pointed papillary tip and in test group 75% of the population showed flat and 25% of the population showed pointed papillarytip.

Intergroup comparisons for the radiographic parameters were madeusing chi-square test (TABLE 2). A high level of statistical significance was achieved for the following parameters in the test group: distance from CP-AC, distance from CEJ-AC, IRD, and size of the embrasure.

Correlation of The Clinical And Radiographic Variables:

Table 3 shows the correlation of the clinical and radiographic variables were done using Pearsons Correlation Test. A strong correlation was observed between Distance from the CP-AC with distance from CP-CEJ, distance from CEJ-AC, length of ging.niche area, size of the embrasure; distance from CP-CEJ with distance from theCP-AC,distance from CEJ-AC, length of ging.niche area, size of the embrasure; distance from CEJ-AC with distance fromCP-AC, distance from CEJ-BC, length of ging.niche area, size of the embrasure; Length of the gingival niche area with distance from theCP-AC, distance from CP-CEJ, distance from CEJ-AC,size of the embrasure; size of the embrasure with distance from the

CP-AC, distance from CP-CEJ, distance from CEJ-AC, length of the gingival niche area.

Discussion

Esthetic smile has become a growing demand in the field of periodontal plastic surgery. For an esthetic smile, a soft tissue contour with an intact papilla and a symmetric gingival outline is required. The loss in the interproximal dentogingival complex height can result in open gingival embrasure. Black triangles canresult as a consequence of periodontal disease or periodontal surgical therapy,an excessive distance from the alveolar bone to the proximal contact, a tight proximal contact near the incisal edge,excessively divergent roots,triangular shaped crowns.Ultimate result ofwhich is the phonetic problems, food impaction and aesthetic concern.

Till date many studies have been done to examine the elements that are associated with the existence of interproximal papilla in various populations, but only few studies have examined the existence of interproximal papilla from the perspective of multilateral factor in Indian Population. To our knowledge this is the first study to assess the etiological factors associated with the loss of interdental papilla in maxillary central incisors from a multifactorial perspective, in Indian population. The multi-lateral factors includes horizontal factors (inter-radicular distance),vertical factors (Distance from CP-AC, Distance from CEJ-CP, Distance from CEJ- AC,length of the gingival niche area) and a combination of these (Tooth form and Embrasure morphology).All these findings can be analysed using an Intra-Oral Periapical Radiograph which is non-invasive[8,9,13],reliable method[8]and is patient compliant. Hence in the present study a digital Intra-Oral Periapical Radiograph was taken using paralleling techniqueand with a 1mm metal grid piece. The analysis was then made using digital software (DIGORA VERSION 2.9.113.490).

This study shows a significant relationship between the presence of interdental papillary loss and the CP-AC distance, where in increase in the distance form CP-AC was directly proportional to the amount of papillary loss. This finding is in agreement with many previous studies[.5, 9,10]In a landmark study by Tarnow et al,[9] he examined both anterior and posterior inter-proximal sites using bone sounding technique and found that the interdental papillae were almost present when the CP-BC distance was ≤5mm, 56% of the interdental papillae were present at6mm, and only 27% of the interdental papillae were present at 7mm. However in the present study a mean distance of 6mm from the CP-AC showed complete papillary fill. This difference can be attributed to the variations in population origin and to the site examined.

The present study also showed a significant relationship between distance from the proximal CEJ-AC and the papilla presence. This was in accordance with the study by Chang et al,[19]were he demonstrated that increase in the distance of the CEJ-BC showed a positive correlation with loss of the interdental papilla height after adjusting for confounding factors using multifactorial logistic regression analysis. The similarity in results could be due to the physiology of the soft tissue, where it follows the bony architecture; the increase in the distance causes the interdental papilla to recede downward as a physiological process resulting in black triangle.

In the present study,Inter-radicular distance showed a strong association with the size of the embrasure. This could be attributed to the increase in the inter-radicular distance and the distance from the CP-AC, the sum of which forms the size of the embrasure. The previous studies[20,23] concluded that the number of interproximal papillae that shows complete fidelity decreases with increasing inter-radicular distance, which is in accordance which the present study.

Tooth form calculated using the formula ½(d1/d2+d3/d4), showed a positive correlation with the loss of interdental papilla. The more triangular the tooth form the more was the papillary loss; this was in accordance with the previous studies. This could be attributed to increase in the inter-radicular distance and the long, thin narrow gingival embrasure space. In the present study, it was also shown that the distance from the contact point to the bone crest and the distance from CEJ to the bone crest increased as the tooth shape became more triangular.

Although significant correlations were achieved, this study has its own limitations of small sample size which may affect the reproducibility of the results.Hence, within the limitations of the present study it could be concluded that no one factor can be associated with the papillary loss, however the tooth form being the strong predictor for the fidelity of the interdental papilla presence. A valid finding from the present study was the complete presence of the interdental papilla when a distance of 6mm from the CP-AC was present which was converse to the landmark study by Tarnow et al.

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Legend Tables and Figure

Table 1: Demonstrates the shape of the papilla tip between groups

	Flat	Pointed	p-valvue
Control group	0%	100%	<o.o1**
Test group	75%	25%	

**Denotes significance at 1% level (p< 0.01)

Table 2: Demonstrates the inter-group variability for each parameters

	Group	Mean	Std. Deviation	P value
Dist. from CP to AC	Control	6.4140	1.35074	<0.001**
	Cases	8.2955	1.84475	
Dist. from CP to CEJ	Control	5.5275	1.58554	0.794
	Cases	5.6420	1.13653	
Dist. from CEJ to Bone crest	Control	1.7685	.43327	<0.001**
	Cases	2.9240	1.03892	
Length of ging.nichearea	Control	6.4140	1.35074	0.320
	Cases	6.9455	1.93671	
IRD	Control	2.3535	.64994	<0.005*
	Cases	2.9155	.62407	
Size of the embrasure	Control	8.7430	1.65626	<0.001**
	Cases	11.1970	2.11628	

**Denotes significance at 1% level (p< 0.01)

*Denotes significance at 5% level (p< 0.05)

Table 3: Correlation of the clinical and radiographic variables

	Age in years	Dist. from CP to AC	Dist. from CP to CEJ	Dist. from CEJ to Bone crest	Length of ging.niche area	IRD	Size of the embrasure
Age in years	1	-.145	-.044	-.116	-.215	-.205	-.180
Dist. from CP to AC	-.145	1	.715(**)	.850(**)	.968(**)	.299	.958(**)
Dist. from CP to CEJ	-.044	.715(**)	1	.318	.645(**)	.244	.686(**)
Dist. from CEJ to Bone crest	-.116	.850(**)	.318	1	.825(**)	.214	.806(**)
Length of ging.niche area	-.215	.968(**)	.645(**)	.825(**)	1	.295	.927(**)
IRD	-.205	.299	.244	.214	.295	1	.560(*)
Size of the embrasure	-.180	.958(**)	.686(**)	.806(**)	.927(**)	.560(*)	1

*Denotes a high level of significance of 1%

**Denotes significance at a level of 5%

Figure 1: Representation of Study Design