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Association between Gingival Phenotype and Crestal Bone Morphology in Maxillary Anterior teeth region – A Cross Sectional Study

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Abstract

Introduction: To injuries that stem from inflammation or periodontal treatment, individuals who have distinct gingival phenotypes typically respond in different ways. The friable thin biotype is frequently subjected to gingival recession whereas the thick resilient biotype is susceptible to pocket formation. The study aimed to assess a possible correlation between gingival phenotype and underlying crestal bone morphology in the anterior teeth region of maxillary arch.

Materials and Methods: Anterior teeth of maxillary arch from 60 systemically and periodontally healthy subjects (30 thin phenotype, 30 thick phenotype) with ages ranging from 20 to 50 years were incorporated into this research. The maxillary anterior region of all the subjects had healthy gingiva. By applying the probe transparency approach, the phenotypes of the patients were classified as thick or thin. The scalloped distance (SCD) between the tooth bone crest-contact point and the bone crest-midface was determined for all the maxillary anterior tooth in both the groups.

Results: The mean scalloped distance (SCD) in the thin phenotype was 2.96 mm, and 1.61 mm in the thick phenotype. The thin phenotype group had a statistically significant higher SCD value (p-value <0.05) than the thick phenotype group.

Conclusion: The crestal alveolar bone morphology can be possibly anticipated by the assessment of gingival phenotype.

Keywords: Gingival phenotype, scalloped distance, contact point, bone crest, crestal bone morphology

Introduction

To injuries that stem from inflammation or periodontal treatment, individuals who have distinct gingival phenotypes typically respond in different ways. The aesthetics of the maxillary anterior region has been closely related to the gingival shape and its characteristics. Gingiva was divided into two categories: flat-thick and scalloped-thin by Ochsenbein and Ross in 1969. They also established the correlation between scalloped gingiva and tapered tooth and flat gingiva with square tooth. Lindhe put forth the term "periodontal biotype". He also classified them into thick flat and thin-scalloped.1

A change in the term periodontal biotype to periodontal phenotype was highlighted in the recent classification of 2017 of periodontal and peri-implant diseases and conditions.2 Diversity of the clinical manifestations during periodontal disease process can be observed with variations in gingival phenotype. Hence during inflammation, the thin gingival

phenotype might grapple by apical migration of gingival margin, whereas a deep pocket formation may be exhibited by thick gingival phenotype.3 Weisgold posited that patients having scalloped, thin gingival biotype are more prone for gingival recession.4 The friable thin biotype is frequently subjected to gingival recession whereas the thick resilient biotype is susceptible to pocket formation.5

Therefore, the current study aimed to assess a possible relationship between gingival phenotype and underlying crestal bone morphology in the anterior teeth of maxillary arch.

Materials And Methods:

This study design was initiated after obtaining approval from the ethical review board of GITAM Dental College and Hospital, Visakhapatnam (Approval number: 74086061224).

The maxillary anterior teeth from 60 systemically and periodontally healthy subjects (30 thin phenotype, 30 thick phenotype) were screened from the outpatient section of GITAM Dental College and Hospital, Visakhapatnam with no underlying systemic diseases. Patients recruited in the study were between 20 to 50 years of age. Subjects excluded in this study were patients with gingival inflammation or gingival enlargement, patients with a periodontal pocket depth > 4 mm, interproximal papilla loss, history of dental injury and receiving orthodontic therapy at the time of the investigation.

A single clinician screened all the patients. The patient's demographic data was collected along with chief complaint, past medical and dental history. Using the probe transparency method, a total of 60 patients were split into 2 groups based on the gingival phenotypes (thick and thin). If the probe could be seen through the gingival tissue, it might be assigned a thin phenotype; if not, it may be ascribed a thick phenotype (Figure1).

1. The distance between the alveolar bone crest (BC) and the mesial contact point (CP) (Figure 4).
2. The distance between the extension of CP of radical center or centrifugation in the mid-face (MID) location of teeth and the alveolar crest (Figure 5).
3. The scalloped distance (SCD) was calculated as the difference of the distance in ① and ②(Figure 2)

Points were marked at the midface of all six maxillary anterior teeth (Figure 3 denotes markings on the maxillary central incisors). Under topical anesthesia, endodontic file (#10) with rubber stopper was inserted into the gingival crevice buccally till the alveolar crest was reached. The distance was set with the rubber stopper. The distance between the file tip and the rubber stopper was assessed using an endodontic gauge.

Statistical Analysis

To calculate the mean, standard deviation and standard error of mean values of each tooth, the CP to BC distance, midface to BC distance and SCD measurements of all subjects were used. Independent sample t test was used for the statistical analysis of the data to verify the differences between groups. p-value <0.05 was considered statistically significant. Statistical Package for Social Sciences (SPSS) version 25.0 was used to analyze the data.

Results

Cases of drop-outs and adverse events related to the measurement were not present. Table 1 depicts results derived from the analysis of the distance of the CP from the BC. The mean CP to BC value was significantly higher with respect to all the maxillary anterior teeth in thick phenotype individuals in comparison to thin gingival phenotype (p-value < 0.05). The findings of the analysis of the distance from the midface to the BC are shown in Table 2. The mean midface to BC value was significantly higher (p < 0.05) in thin phenotype individuals compared to thick phenotype except maxillary left canine. Table 3 represents the data obtained from the analysis of the difference in the scalloped distance of the bone between the thin and thick phenotype individuals. When comparing the six maxillary anterior teeth in the thin phenotype group to the thick phenotype group, there was a significant (p < 0.001) increase in bone scalloping. In the thin phenotypic group, the mean SCD was 2.96 mm, while in the thick phenotype group, it was 1.61 mm.

Discussion

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The response of the individuals with different gingival phenotypes to inflammation or any periodontal treatment varies widely. Hence, an understanding of such characteristics play an important role when performing periodontal, aesthetic, prosthetic and implant treatments.1

The primary goal of this study was to examine how the gingival phenotype affected the degree of scalloping of the underlying crestal bone. When gingival thickness is used as a clinical criterion for assessment, gingival phenotype is often classified as thin or thick. The periodontal probe's transparency through the gingival margin was used to determine the gingival phenotype. If the probe was visible, the gingiva was graded as thin; if not, it was graded as thick.6

Numerous techniques were developed to determine the soft tissue's thickness.1 Kan et al. was the first to describe a simple non- invasive method that was based on the gingival margin's transparency to the periodontal probe.7 Another method which is direct invasive is the transgingival probing method. However, the angulation, diameter, and periodontal probe pressure may all have an impact on this technique, and it may also cause tissue distortion when probing.8,9

Using an ultrasonic equipment is a simple technique for determining gingival phenotype and measuring periodontal soft tissue thickness. It is non-invasive, eliminates the discomfort of the patient effectively and the limitations that occur with invasive methods. However, examiner’s calibration and experience is required.10 The large probe diameter further restricts the study region, and humidity may further affect the outcomes.1

In this study, the mean SCD in the thin phenotype was 2.96 mm and in the thick phenotype was 1.61mm which is statistically significant ($p < 0.05$). Hence thin phenotype individuals showed more bone scalloping in the 6 maxillary anterior teeth when compared to the thick phenotype individuals.

In a study published in 2016, Kwang Ho et al. evaluated the relationship between underlying crestal bone shape and gingival biotype. The thin phenotype mean SCD in his study was 3.00±0.21 mm, while the thick phenotype had a mean SCD of 2.81±0.20 mm. The thin biotype's SCD value ($t=2.982$, $p < 0.01$) was statistically considerably higher than the thick biotype's. When the degree of crestal bone scallop in all the anterior teeth of maxillary arch was compared between the two groups, a higher bone scallop was noted in thin than in thick gingival phenotype in all the 6 teeth.1 The distance at the dry skull between the height of the interdental bone and the buccal alveolar crest was measured in a study by Becker et al.. The three groups of experimental individuals were categorized as flat, scalloped, and prominent scalloped, with corresponding measurements of 2.1, 2.8 and 4.1 mm. Significant differences were seen between the groups.11

In thick gingival phenotypes, the teeth often have a rectangular, bulging shape, and the contact point is positioned more apically; in thin gingival phenotypes, the teeth have a triangular shape, and the contact point is likewise located close to the incisal edge.12,13

Conclusion

Within the parameters of this investigation, alveolar bone morphology can be predicted by gingival phenotype evaluation. Therefore, by formulating treatment plans that are based on such assessments, successful outcomes of aesthetic treatments could be obtained.

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Tables

Table 1: Contact point (CP) to bone crest (BC) distance

Tooth	Gingival phenotype	Mean	Std. Deviation	Std. Error Mean	T value	P value
13	Thin	3.9000	.80301	.14661	-3.351	.001*
	Thick	4.6333	.88992	.16248		
12	Thin	3.7667	.67891	.12395	-3.337	.001*
	Thick	4.4333	.85836	.15671		
11	Thin	4.2000	.84690	.15462	-3.188	.002*
	Thick	5.0000	1.08278	.19769		
21	Thin	4.2000	.84690	.15462	-3.501	.001*
	Thick	5.1000	1.12495	.20539		
22	Thin	3.9333	.78492	.14331	-3.576	.001*
	Thick	4.7667	1.00630	.18372		
23	Thin	4.2333	.77385	.14129	-3.941	.001*
	Thick	5.1000	.92289	.16850		
Total	Thin	4.0389	.80059	.05967	-8.360	.001*
	Thick	4.8389	1.00370	.07481		

* Statistically significant, Independent sample t test.

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Table 2: Midface to bone crest distance

Tooth	Gingival phenotype	Mean	Std. Deviation	Std. Error Mean	T value	P value
13	Thin	6.7000	1.05536	.19268	2.266	.027*
	Thick	6.1000	.99481	.18163		
12	Thin	6.3333	.84418	.15413	2.578	.012*
	Thick	5.7667	.85836	.15671		
11	Thin	7.2333	.89763	.16388	2.317	.024*
	Thick	6.6667	.99424	.18152		
21	Thin	7.5333	.86037	.15708	2.308	.025*
	Thick	6.9667	1.03335	.18866		
22	Thin	7.0333	.96431	.17606	2.494	.015*
	Thick	6.4333	.89763	.16388		
23	Thin	7.2333	1.04000	.18988	1.504	.138
	Thick	6.8333	1.01992	.18621		
Total	Thin	7.0111	1.01381	.07556	5.073	.001*
	Thick	6.4611	1.04301	.07774		

* Statistically significant, Independent sample t test.

Table 3: Scalloped distance

Tooth	Gingival phenotype	Mean	Std. Deviation	Std. Error Mean	T value	P value
13	Thin	2.8000	.66436	.12130	8.334	.001*
	Thick	1.4667	.57135	.10431		
12	Thin	2.5667	.67891	.12395	8.128	.001*
	Thick	1.3333	.47946	.08754		
11	Thin	2.9667	.49013	.08949	9.698	.001*
	Thick	1.6667	.54667	.09981		
21	Thin	3.3333	.54667	.09981	8.806	.001*
	Thick	1.8667	.73030	.13333		
22	Thin	3.1000	.88474	.16153	7.109	.001*
	Thick	1.6667	.66089	.12066		
23	Thin	3.0000	.78784	.14384	6.747	.001*
	Thick	1.7000	.70221	.12821		

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Total	Thin	2.9611	.71974	.05365	18.771	.001*
	Thick	1.6167	.63664	.04745		

* Statistically significant, Independent sample t test.

Figure Legends

Figure 1: Images of patients with fig 1A Thin Phenotype

Figure 1: Images of patients with fig 1B Thick Phenotype

Figure 2: Measurements of the amount of bone scallop

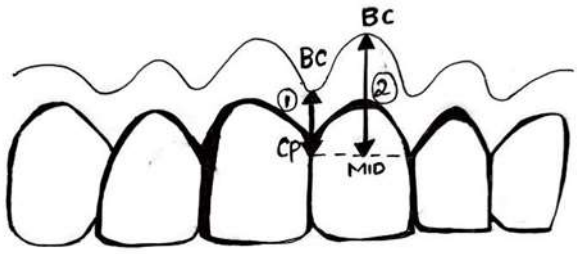

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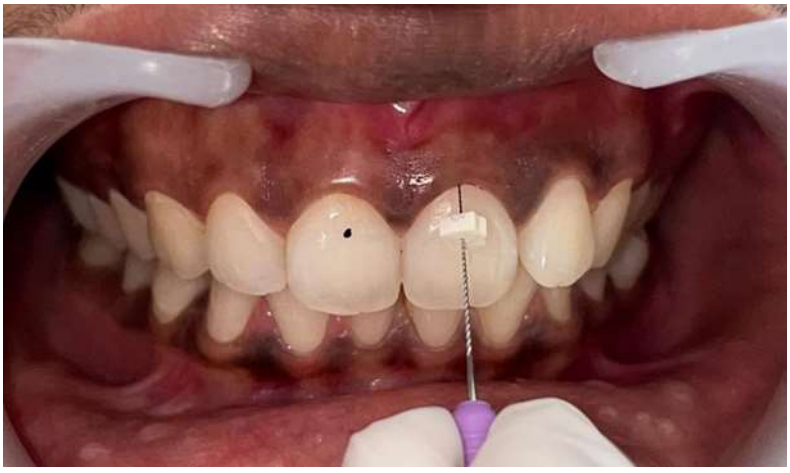
Figure 3: Markings on the midface of the teeth

Figure 4: Contact point to bone crest distance

Figure 5: Midface to bone crest distance



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