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Influence of Labial Frenum and Gingival Thickness on Marginal Tissue Recession: A Cross-Sectional Study.

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Abstract

Title: Influence of Labial Frenum and Gingival Thickness on Marginal Tissue Recession: A Cross-Sectional Study.

Background: Periodontal disease is multifactorial and hence treatment planning needs to be holistic. Labial frenum is a dynamic structure, varying in morphology and attachment, with a possible predisposition to gingival recession and delayed healing.

Objective: To evaluate the relationship of gingival thickness and labial frenum presentation to marginal tissue recession.

Materials And Methods: A total of 200 labial frena (both maxillary and mandibular) from 100 individuals were evaluated. Demographic data, anatomy, morphology and level of frenal attachment, gingival thickness and recession were recorded. Data collected was analyzed using descriptive statistics. A co-relation between the gingival thickness and the gingival recession was calculated using Pearson correlation coefficient with the corresponding 95% confidence interval. P-value <0.05 was considered statistically significant.

Results: Thin gingiva, frenum with no nodule, parallel and mucosal attachment showed highest prevalence. Results demonstrated that 33.9% thin gingiva,46.7% tectolabial,32.1% parallel morphology and 50% papillary attachment frena were associated with marginal tissue recession.

Conclusion: Gingival thickness and frenal morphology may influence marginal tissue recession.

Keywords: Gingival Thickness, Labial Frenum, Gingival Recession, Tectolabial, Papillary, No Nodule

Introduction

A Periodontal diseases are multifactorial and many factors can affect the ultimate outcome of the disease or alter the prognosis. One of the factors being the gingival phenotype that includes gingival thickness and keratinized tissue width. The term gingival biotype is defined as the thickness of gingiva in the facio-palatal and facio-lingual dimension.[1] The term gingival biotype introduced by Seibert and Lindhe later replaced by gingival phenotype in 2017 world workshop is categorized into thick-flat, thick-scalloped and thin-scalloped biotypes. It has been suggested that gingival recession is affected by the gingival biotype. Thick gingival tissue (flat or scalloped) is associated with a broad zone of the keratinized tissue, fibrotic gingiva and thick bony architecture and hence more resistant to inflammation and trauma. Thin gingival tissue is associated with a thin band of the keratinized tissue, thin delicate

gingiva and relatively thin bony architecture and hence more sensitive to inflammation and trauma leading to gingival recession.[2] Gingival recession is characterized by the apical relocation of the gingival margin, exposing the root surface. Multiple factors are involved in its etiology, including anatomical, physiological, pathological and traumatic factors which probably do not act simultaneously or to the same degree and it is probably impossible to identify which one is the most important factor.[3] Attachment of the frenum to the gingiva is one among the numerous local environmental factors identified to precipitate gingival recession. Frequently, frenum attached closer to the gingival margin leads to decreased amount of attached gingiva. These aberrantly positioned frenums can cause deleterious effects on the gingiva finally leading to gingival recession.[4]

Therefore, the aim of the current study was to know the relationship of gingival thickness and labial frenum presentation to marginal tissue recession.

Materials And Methods:

A total of one hundred patients were screened at random from the outpatient section, GITAM Dental College and Hospital, Visakhapatnam. Patients included in the study were between the age group 22 to 60 years with no underlying systemic diseases such as diabetes mellitus, desquamative gingivitis, hypertension, asthma, connective tissue disorders and cardiac problems. Patients excluded from this study were pregnant women, completely edentulous patients, lactating mothers, smokers, patients with partially edentulous space in relation to the maxillary and mandibular anterior region.

This study design was initiated after obtaining approval from the scientific and ethical review board of GITAM Dental College and Hospital, Visakhapatnam.

A single clinician screened all the patients. The patient's demographic data was collected along with chief complaint, past medical and dental history. A total of 200 frena (100 each of maxillary and mandibular labial frenum) from 100 individuals were evaluated. Each frenum was assessed for parameters including type of frenal attachment by Swerin et al (1971), the medial maxillary labial frenal classification based on morphology by Mohan R. et al (2014), morphology of labial frenum by Monti et al, level of frenal attachment by Placek et al (1971), Miller`s grade of gingival recession, gingival biotypes based on Siebert and Lindhe`s classification (1989).[5-8] Gingival biotype was also assessed on the basis of visual method that is probe transparency method. Based on the findings a correlation between the incidence of gingival recession with that of the biotype and also labial frenum presentation was assessed.

Statistical Analysis:

Descriptive analysis was carried out to determine the frequency of frenum types and level of attachment. The relationship of frenal attachment with gender, age and gingival biotype were studied. Data collected was analyzed using descriptive statistics (frequencies, percentages, means and standard deviation). A co-relation between the gingival thickness and the gingival recession was calculated using Pearson correlation coefficient with the corresponding 95% confidence interval. P-value <0.05 was considered statistically significant. Statistical Package for Social Sciences (SPSS) version 26.0 was used to analyze the data.

Results

Demographic Data:

The data procured from the present epidemiologic study was analyzed and the percentage prevalence of each parameter is depicted in Table 1. Among the one hundred patients examined 59 were males and 41 were females with a mean age of 33.49 ($\pm$10.34). Among one hundred patients examined, 60.5% had thin gingival biotype and 39.5% had thick gingival biotype. Based on the feature of frenum given by Swerin et al of the examined 200 frena 78% had frenum with no nodule, 9% showed nodule at middle 3rd, 7.5% showed tectolabial type of frenum and 5.5% showed nodule at alveolar 3rd. Based on the frenal attachment level (Placek et al) 72.5% had mucosal labial attachment, 14.5% had gingival labial attachment, 7% had Tectolabial frenum, 5% had papillary penetrating labial frenal attachment and 1% had papillary attachment. Morphology of labial frenum (Monti et al) revealed 79.5% of study population had an elongated parallel labial frenal margin, 17.5% had triangular labial frenum with apical base while 3% of the study population had

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triangular labial frenum with alveolar base. It was also found that 69% of the population had healthy gingiva while 30% had gingival recession and the remaining 1% had gingival enlargement.

While comparing Labial frenum morphology with gingival marginal level (**Table-2**) based on the feature of frenum (Swerin et al) it was observed that highest prevalence of gingival recession was associated with tectolabial frenum (46.7%), followed by nodule at middle 3rd (33.3%), no nodule (28.8%) and nodule at alveolar 3rd (18.2%) but the difference was not statistically significant (P =0.283). Frenum level (Placek et al) demonstrated highest prevalence of recession in relation to papillary attachment frenum and tectolabial type (50%), followed by mucosal attachment (29%), gingiva attachment (27.6%) and papillary penetrating frena (20%) with no statistically significant difference (P =0.640)

Based on the morphology of frenum (Monti et al) it was observed that highest prevalence of gingival recession was associated with parallel morphology (32.1%), followed by apical base (22.9%) and alveolar base frena (16.7%), however, the difference was not statistically significant (P = 0.670). Though not statistically significant (P =0.163), marginal tissue recession was more frequently observed with thin gingiva (33.9%) in comparison to thick gingiva (24.1%).

Analysis of percentage prevalence of different frenum characteristics to gingival biotype revealed the following results (**Table-3**). Feature of frenum (Swerin et al) analysis demonstrated that frenum with no nodule was associated with 64.7% of thin and 35.3% of thick gingival biotype. Whereas, frenum with nodule at alveolar 3rd was observed in 63.6% thick, 36.4% thin gingival biotype and those with nodule at middle 3rd were associated with 61.1% of thick and 38.9% of thin gingival biotype. Tectolabial frenum was associated with 60% thin and 40% thick gingival biotype. However, the above differences were not statistically significant (P = 0.061). When the level of frenal attachment was studied, gingival type of attachment was observed in 55.2% of thin gingiva and 44.8% of thick gingival biotype. Papillary attachment was observed in 55.2% of thin and 44.8% of thick gingival biotype. Papillary penetrating type of attachment was observed in 55.2% of individuals with thin gingival biotype where as 44.8% showed thick gingival biotype. Tectolabial attachment was observed in 57.1% of thin and 42.9% of thick gingival biotype but the differences were not statistically significant (P=0.542). Based on the morphology of frenum, triangular frenum with alveolar base was observed in 66.7% of thick and 33% of thin gingival biotype, whereas, triangular frenum with apical base was observed in 60% of thick and 40% of thin gingival biotype. Parallel frenum with elongated margins was observed in 66% of thin and 34% of thick gingival biotype. This observed difference in frenal morphology in relation to gingival biotype was statistically significant (P = 0.005).

TABLE-1 Depicts the percentage of data gathered and tabulated for analysis from the above-mentioned epidemiological survey

Characteristics	Type	Percentage
Gingival biotype	Thick	39.5
	Thin	60.5
Feature of frenum (Swerin et al)	No nodule	78.0
	Nodule at alveolar 3rd	5.5
	Nodule at middle 3rd	9.0
	Tectolabial	7.5
Attachment level (CEJ)	At CEJ	69.0
	Enlargement	1.0

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	Recession	30.0
Attachment level (Placek et al)	Gingival	14.5
	Mucosal	72.5
	Papillary	1.0
	Papillary penetrating	5.0
	Tectolabial	7.0
Morphology of frenum (Monti et al)	Alveolar base	3.0
	Apical base	17.5
	Parallel	79.5

TABLE – 2 Comparison of labial frenum morphology with gingival marginal level

Characteristics		**Gingival margin level**			**P value**
		At CEJ	Above CEJ	Recession	
Frenum feature (Swerin et al)	No nodule	70.5%	0.6%	28.8%	0.283
	Nodule at alveolar 3rd	81.8%	0%	18.2%	
	Nodule at middle 3rd	61.1%	5.6%	33.3%	
	Tectolabial	53.3%	0%	46.7%	
Frenum level (Placek et al)	Gingival	72.4%	0%	27.6%	0.640
	Mucosal	69.7%	1.4%	29%	
	Papillary	50%	0%	50%	
	Papillary penetrating	80%	0%	20%	
	Tectolabial	50%	0%	50%	
Frenum morphology (Monti et al)	Alveolar base	83.3%	0%	16.7%	0.670
	Apical base	77.1%	0%	22.9%	
	Parallel	66.7%	1.3%	32.1%	
Gingival biotype	Thick	75.9%	0%	24.1%	0.163
	Thin	64.5%	1.7%	33.9%	

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TABLE 3: Comparison of labial frenum morphology with gingival biotype

Characteristics		Gingival biotype		P value
		Thick	Thin	
Frenum feature (Swerin et al)	No nodule	35.3%	64.7%	0.061
	Nodule at alveolar 3rd	63.6%	36.4%	
	Nodule at middle 3rd	61.1%	38.9%	
	Tectolabial	40%	60%	
Frenum level (Placek et al)	Gingival	44.8%	55.2%	0.542
	Mucosal	36.6%	63.4%	
	Papillary	50%	50%	
	Papillary penetrating	60%	40%	
	Tectolabial	42.9%	57.1%	
Frenum morphology (Monti et al)	Alveolar base	66.7%	33%	0.005*
	Apical base	60%	40%	
	Parallel	34%	66%	

Discussion

The gingival biotype term was presented by Seibert and Lindhe in 1989 to divide the gingiva into “thick flat” and “thin scalloped” biotypes The gingival biotype has been used to describe the thickness of the gingiva in the facio-palatal dimension.[9] The labial frenum is a mucosal fold that attaches the lip to alveolar mucosa, gingiva and periosteum. Many morphological variations can occur in the attachment.[10] Glickman suggested that frenum attached to the gingival margin pull the tissue margin away from the tooth and facilitate plaque accumulation further leading to gingival recession so an adequate vestibular depth, particularly in the mandibular anterior segment is considered essential for maintenance of periodontal health.[11]

Gingival thickness varies among different individuals and different areas of the mouth within the same individual.[12] Maxillary central incisors present with the greatest mean gingival thickness, followed by lateral incisors and canines and similarly maxillary lateral incisors have the greatest keratinized tissue width, followed by the central incisors, and canines.[13] There are evidences which suggest that thick tissue resists trauma and recession, improves implant aesthetics, enhances creeping attachment, exhibits less clinical inflammation, allows tissue manipulation and improves surgical outcomes. Neverthless, thin biotype is characterized by thin gingival tissue making it delicate and almost translucent in appearance. There are evidences which show that the thin gingival tissue is less resistant to any inflammatory, traumatic, or surgical insult and thus usually exhibits gingival recession.[9] Studies have concluded that gingival thickness plays a crucial role in development of mucogingival problems and in wound healing (Anderegg et al) and in the success of treatment for gingival recession (Carlo 1999).[14]

In the present study, highest prevalence of frena observed was simple frenum with no nodule (Swerin et al), mucosal type of frenal attachment (Placek et al) and frenum with parallel morphology (Monti et al). These results are in accordance with Bervian et al (2016), Christabel and Gurunathan (2015) and Townsend et al (2013).[15-17] In consonance to the current study that demonstrated mucosal labial attachment type of frenum to be the most prevalent (72.5%), Jindal et al (2016) and Mirko et al (1974)

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also reported mucosal frenal attachment to be most prevalent.[18,7] It was also noted that tectolabial and papillary frenum (Placek et al) showed highest association with recession whereas least association was observed with triangular frenum with alveolar base (Monti et al) followed by frenum with nodule at alveolar 3rd (Swerin et al) and papillary frenal attachment (Placek et al). Contrary to the above findings, Janczuk and Banach (1980) observed mucosal attachment most often in the mandible with decreased amount of attached gingiva indicating increased chances for gingival recession.[19] Placek et al stated that the enhanced resistance to gingival recession was observed in maxillary gingival and mandibular mucosal type of frena.[7]

In the present study 33.9% of thin gingival biotype was associated with gingival recession whereas only 24.1% of thick gingival biotype was associated with gingival recession demonstrating higher prevalence of gingival recession in thin gingival biotype. Vasishta et al (2022) observed 56.6% thin and 43.39% thick gingival biotypes was associated with gingival recession.[20] Frederico et al (2015) and Shah et al (2015) observed that lower the gingival thickness, the higher is the degree of gingival recession.[9] Ward (1976) demonstrated that patients with healthy gingiva had a wide range of vestibular depths, types and levels of frenal attachment.[21] Despite the observed results it is still difficult to predict gingival health or recession, the level and type of labial frenum and the gingival biotype. However, Claffey et al (1986) reported less noticeable loss of attachment following treatment of non-bleeding sites with thick biotype compared to thin gingival biotype indicating reduced resistance of thin gingival biotype. Shah et al (2015) has indicated that a critical threshold thickness of gingiva should be greater than 1.1mm to achieve 100% root coverage during treatment of multiple recession defects.[9] Nevertheless, based on the present study one can safely presume that individuals with recession in both maxillary and mandibular anterior teeth more frequently present thin gingival biotype, that could be aggravated by the type and level of labial frenal attachment which alters the treatment plan, and overall periodontal prognosis.

Conclusion

Within the limits of the present study, it appears that thin gingiva, tectolabial type of frenum, parallel morphology and papillary attachment type of frenum were associated more frequently with marginal tissue recession. This indicates that gingival thickness and frenal morphology may influence marginal tissue recession. Since gingival thickness and frenal morphology are significant predictors of the clinical outcome of certain procedures in periodontal surgery. It is vital to thoroughly assess the gingival biotype, frenal morphology and attachment before planning any dental treatment. Also, by thorough examination of frenum characteristics and gingival tissue biotype, a clinician can perform appropriate clinical procedure to reduce gingival recession and bone loss and achieve more favorable tissue morphology.

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