How to Cite:
Haritha, J., Anusha, P., Karthik, K. V. G. C., Sunkala, L., Madhav, G. V., & Rai, P. (2022). Assessing the gingival biotypes for better planning of esthetics in Indian population: A cross sectional study. *International Journal of Health Sciences*, *6*(S2), 12929–12937. https://doi.org/10.53730/ijhs.v6nS2.8410

Assessing the gingival biotypes for better planning of esthetics in Indian population: A cross sectional study

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***Abstract*---**Background: Anterior fixed prosthesis fabrication is a challenging one which involves many aspects and one among them which dictates the most is the gingiva. Any recession causes exposure of the tooth and prosthetic junction leading to esthetic failure. Hence it is important to know the biotypes before planning the restoration. Aim: To evaluate the prevalence of different gingival biotypes in individuals with relation to age, gender, tooth size and papillary height with respect to maxillary central incisors. Methods & Materials: A total of 200 subjects in the range of 18-50 years participated in the study. Three clinical parameters were recorded which included crown width

Manuscript submitted: 09 March 2022, Manuscript revised: 18 April 2022, Accepted for publication: 27 May 2022

& crown length ratio, papillary height and gingival transparency of two maxillary central incisors. The measurements were tabulated and statistically analyzed. Data was statistically analyzed using SSPS software. Results: The relationship of biotypes with clinical parameters was assessed using t test and chi square test. Thicker gingival biotype was more prevalent in male population with short, wider form of teeth whereas in females' thin gingival biotypes with long and narrow teeth forms were observed. Conclusion: Both the young and old age groups have the same prevalence of thick gingival biotype. Decrease in the mean papillary height was observed with thin biotype.

***Keywords*---**gingival biotype, papillary height, gingival transparency, crown length, crown width.

Introduction

Esthetics signifies "natural beauty", a quality that comes from within. It can be defined as the science of beauty that is applied in nature and in art. [1] An esthetic restoration is one that resembles a natural tooth in all respects. Previously much emphasis was placed on restoration of masticatory function and on the macroscopic and microscopic design of the implant in attaining primary stability and osseointegration, now a days, it had been shifted toward creating an esthetic restoration that is indistinguishable from natural teeth and stable over time. [2] Construction of an esthetically pleasing restoration involves not only harmonizing the size, shape, position and color of each prosthetic tooth with the adjacent teeth, establishing gingival perspective with the surrounding gingiva. [3, 4] The gingival perspective depends on gingival complex, tooth morphology, contact points, hard and soft tissue considerations, periodontal bioform and biotype. [5]

The identification of gingival morphology is considered important because difference in soft and hard tissue architecture have shown to exhibit a significant impact on the final esthetic outcome of restorative therapy, periodontal therapy, root coverage procedures and implant esthetics. [6, 7] The bulky slightly scalloped marginal gingival with short and wide teeth on one side and thin highly scalloped marginal gingiva with slender teeth on the other, may serve to illustrate the existence of markedly different periodontal entities or so called "gingival biotypes".The term "gingival or periodontal phenotype" was coined by Muller. [8] Various factors such as age, gender, growth, tooth position, tooth size and genetically determined factors affect the gingival biotype.

Periodontal biotypes were classified based on gingival thickness, gingival width and subjacent alveolar bone thickness. According to Ochsenbein & Ross [9] gingival biotypes are of 2 types – flat and highly scalloped, according to Seibert & Lindhe [10] the gingiva was classified either as thin scalloped or thick-flat. Various methodologies have been proposed for the measurement of the gingival tissue form. This includes visual inspection, ultrasonic devices, Transgingival probing and cone beam computerized tomography imaging. The use of simple methods to identify the gingival tissue biotype can help the clinician with the better treatment

planning and definitive treatment outcome. So the aim of the present study was to identify the prevalence of gingival biotypes in different age groups [18-30, 31-50], gender and to categorize them based on tooth size, papillary height and gingival transparency.

Materials and Methods

The present study was a cross sectional study. After obtaining the institutional ethical clearance (CKS/IEC/SS/03/2018), a total of 200 subjects in the range of 18-50 years, healthy individuals with good oral hygiene were included in the study. Subjects with crown or restorations on maxillary anterior teeth, with history of periodontal disease and orthodontic treatment, pregnant or lactating mothers, trauma from occlusion, malocclusion (rotations, cross bite), abrasion, erosion, and caries involving the cervical margin of maxillary central incisors were excluded from the study. Based on the age and gender, they were divided into four groups (Table 1).

Clinical parameters

All the clinical parameters for both maxillary central incisors were systematically recorded by a single examiner. Clinical parameters assessed were $\frac{crownwidth}{crownlength}$ ratio of the maxillary central incisors, Papillary height, Gingival transparency. The crown length (Fig 1A) was measured as the distance between the incisal edge of the crown and the free gingival margin, while the crown width (Fig 1B) was measured at the junction of the middle and the cervical portion or at the broadest portion of the maxillary right and left central incisor crown. Then the $\frac{crownwidth}{crownlength}$ ration was calculated for both central incisors and scores were averaged. [11] Papillary height (Fig 2A) was calculated as the distance from the top of the papilla to a line connecting the midfacial soft tissue margin of the two adjacent teeth. The measurements were made with digital vernier caliper (Fig 2B). [11, 12] Gingival thickness was assessed and categorized into thick and thin biotypes based on transparency of periodontal probe Williams 14w probe (Fig 3) through the gingival margin on passing through the midfacial aspect of gingival sulcus. If the probe was visible considered as thin type and if not visible considered as thick biotype. [12, 13]

Statistical analysis

The obtained data was subjected to statistical analysis. Data were entered using Microsoft excel and was statistically analyzed using Statistical software package (IBM, SPSS Statistics 20.0, Chicago, IL). For describing patient characteristics standard deviation, mean and percentage were used .The relationship of biotypes with clinical parameters were assessed using t test and chi square test.

Results

Out of the total 200 participants 100 were in the younger age group (18-30) and 100 were in older age group (31-50). Thicker gingival biotype was more prevalent in both younger and older groups with no significant difference. In males thicker

biotype was more prevalent (76%) and among females thinner biotype was more prevalent(74%). Mean crown width to crown length ratio in Group I participants with thick biotype had a ratio of 0.91 and with thin biotype 0.94. In Group II and IV participants had a ratio of 0.90 and 0.89 for both thick and thin biotypes respectively. Group III participants with thick biotype had a ratio of 0.92 and with thin biotype 0.89 (Table 2). The mean PH was found to be more in males (3.95) compared to females (3.65). The PH was found to be lesser in participants with thin biotype as compared to thick biotype (Table 2).

Discussion

Understanding gingival aspect of restorative dentistry is important in harmonizing esthetics and biological function. Achievement of optimal esthetics can be difficult due to inherent different topography of surrounding hard and soft tissue of the natural dentition under individual clinical scenario. To obtain these optimum results, one of the simple and reliable method is to identify the gingival biotype in clinical practice which would be advantageous to plan the treatment for an individual and to predict its specific outcome. [14, 15] Clinical appearance of healthy periodontium differs from subject to subject and even among different tooth types. Various factors influence the form of gingival tissue around the natural tooth or fixed prosthesis. Many features are genetically determined; others seem to be influenced by tooth size, shape and position, and biological phenomena such as aging.

Different methods to measure the thickness of gingival thickness that includes visual inspection, ultra sonic and CBCT imaging are noninvasive methods, probe transparency, Transgingival probing are invasive methods. [13, 16, 17] In the present study, a simple and inexpensive probe transparency and visual assessment method was used to determine the thickness of gingival biotype. In the present study, the probe transparency method (Probe is visible through the soft tissue it was categorized as thin biotype and if it was not visible, then categorized as thick biotype) was used. The ability of gingival tissue to conceal any underlying material is important in achieving esthetic results, especially in restorative and implant dentistry, where subgingival alloys are present extensively. Therefore, using the metal periodontal probe to evaluate gingival tissue thickness is a logical and minimally invasive method. Kan [18] et al. in their study concluded evaluating gingival biotype with a periodontal probe is an adequately reliable and objective than visual assessment. In contrast, study conducted by Olsson [19] *et.al* , Eghbali [20] *et.al* concluded that simple visual inspection could not be relied as an effective method irrespective of the clinician's experience.

In accordance to our study results, De Rouck T et. al , Chandulal D and Vinay bhat*et.al* From thick gingival biotype was more prevalent in males (76%) compared to that of females. [21, 22, 23] The frequency distribution of prevalence of gingival transparency in relation to $\frac{crownwidth}{crownlength}$ ratio in maxillary central incisors states that short, wider teeth are associated with thick biotype while long slender teeth are associated with thin biotype. The degree of inter proximal fill is also dependant on the periodontal biotype. A thick periodontal biotype encourages interdental fill, while a thinner tissue type creates unaesthetic hollow gingival

embrasures. This problem encountered when an implant is placed next to a natural tooth. It is the interproximal bone of the adjacent natural tooth that determines the presence, or absence of a papilla, not the bone surrounding the implant fixture. For thick biotypes, the papilla may be established to normal dimensions of 5mm, but for thin biotypes, it is difficult to recreate a papilla longer than 4mm from the osseous crest.

A study by AgarwalV [24] showed that the thickness of gingiva significantly decreased with age in both the arches and was significantly higher in females than males. Vandana and Savita [25] in their study showed thicker gingiva in younger age group may be due to decrease in keratinization. In contradiction, the present study results show the prevalence of gingival biotypes between different age groups, the thicker biotype has been more prevalent in male younger and older age groups. In the present study, the decreased papillary height has been observed in relation with thin biotype. A study by Vinay Bhat et al [23] concluded that papillary height found to be lesser in participants with thin biotype as compared to thick biotype. In contradiction to present study Chang [26] in his study stated that an inverse relationship has found to be existing between PH and age.

Gingival biotypes have significant effect on placement of margins. There would be esthetic failures if gingival biotype was not considered during margin placement. Thick biotype prevents mucosal recession, hides the restorative margins and is more resistant to mechanical irritation compared to thin biotype. Gingival retraction should be cautiously done in thin biotype as it would cause additional trauma and gingival recession in long term leading to esthetic failure. Hence alternative treatment options should be considered for thin biotype in these situations. Tissue biotypes also have significant influence on implant esthetics. Jia Hui [6]*et.al* has proposed a guideline that demonstrates possible ways to increase soft tissue thickness around implants through PDP management triad which includes implant position(P),implant design(D), and prosthetic design(P).

Studies by Becker *et.al* [27] have shown that thin biotypes were associated with thin buccal bone plate, bony dehiscence and fenestrations having a greater risk of fracture and alveolar resorption overtime. PDP triad recommends the use of smaller diameter implants to preserve buccal bone thickness, minimize crestal bone loss and mucosal recession. Alternatively, positioning an implant more palatally and apically will also serve this purpose. The appropriate choice of implant design can help increase soft tissue thickness on facial aspect of the implant. It is recommended to use smaller diameter implants, platform switching configuration, straight or parallel walled implant instead of conical implants as there is less outward pressure on Periimplant mucosa, reducing potential gingival recession and/or remodeling after implant placement. A concave abutment or crown profile is selected for prosthetic design as it provides additional space for soft tissue ingrowth, creating an esthetic profile. The limitation of the present study is sample size. To validate the findings and results sample size needs to be done on large sample.

Conclusion

Within the limitations of the present study, the following conclusions were drawn. Thicker gingival biotype was more prevalent in Indian male population while thin gingival biotype was seen in females. Thick gingival biotype was associated with short, wider form of teeth while thin biotype with long, narrow tooth form. Both the young and old age groups have the same prevalence of thick gingival biotype. To achieve a predictable outcome, knowing the gingival biotype yields better result after clinical procedures.

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Tables

Table 1: Based on the age and gender, they were divided into following groups

GROUP	GENDER	AGE	SAMPLE SIZE
GROUP I	MALE	18-30	50
GROUP II	FEMALE	18-30	50
GROUP III	MALE	31-50	50
GROUP IV	FEMALE	31-50	50

Table 2: Mean Values of Clinical Parameters Among Groups

GROUP		Gingival Transperancy	N	Mean	Std. Deviation	p value
GROUP 1 MALE BELOW 30 YEARS	CROWN WIDTH TO LENGTH RATIO	Thick	37	0.917	0.086	0.379
		Thin	13	0.942	0.089	
	PAPILLARY HEIGHT	Thick	37	4.289	0.524	0.381
		Thin	13	4.151	0.347	
GROUP 2 FEMALE BELOW 30 YEARS	CROWN WIDTH TO LENGTH RATIO	Thick	14	0.902	0.101	0.956
		Thin	36	0.904	0.086	
	PAPILLARY HEIGHT	Thick	14	3.704	1.021	0.406
		Thin	36	3.920	0.730	
GROUP 3 MALE ABOVE 30 YEARS	CROWN WIDTH TO LENGTH RATIO	Thick	39	0.921	0.118	0.592
		Thin	11	0.897	0.155	
	PAPILLARY HEIGHT	Thick	39	3.919	0.370	0.244
		Thin	11	3.776	0.286	
GROUP 4 FEMALE ABOVE 30 YEARS	CROWN WIDTH TO LENGTH RATIO	Thick	12	0.893	0.059	0.980
		Thin	38	0.892	0.124	
	PAPILLARY HEIGHT	Thick	12	3.863	0.313	0.035
		Thin	38	3.378	0.752	

Figure Legends

Fig 1: A) Measurement of Crown Length Using Vernier Caliper B) Measurement of Crown Width Using Vernier Caliper

Fig 2: A) Marking to Measure Papillary Height. B) – Measurement of Papillary Height Using Vernier Caliper

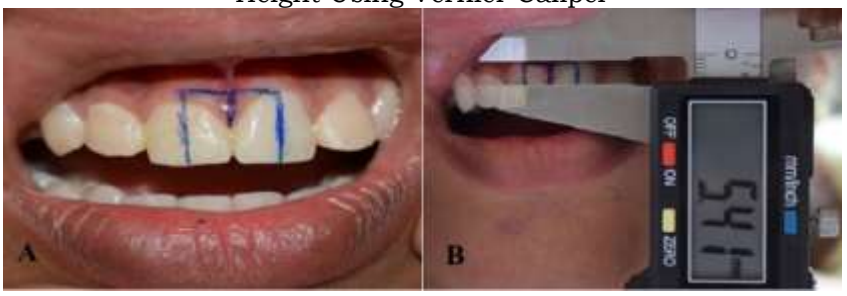

Fig 3 – Measurement of Gingival Thickness Using Periodontal Probe