

# Prevalence of gingival biotype and its relationship to clinical parameters

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## Abstract

**Introduction:** The dimensions of gingiva and different parts of the masticatory mucosa have a profound impact in periodontics as it governs the way; the gingival tissue reacts to various physical, chemical, or bacterial insults. The purpose of the following study was to assess the gingival thickness (GT) and correlate it to gender, presence of recession, and width of keratinized gingiva (WKG) in a subset of the Indian population. **Methods:** A total of 400 subjects in the age range of 20–35 years (200 males and 200 females) were included in the study. Clinical parameters such as probing depth, recession depth, WKG, and GT were recorded for all the patients. **Results:** The prevalence of thin biotype was 43.25%, and that of thick gingival biotype was 56.75%. The mean GT of central incisor, lateral incisor, and canine in Group I was  $1.11 \pm 0.17$ ,  $1.01 \pm 0.16$ , and  $0.82 \pm 0.17$  mm, respectively. No significant association was observed between the gender and the presence of gingival recession to GT. The mean WKG of central incisor, lateral incisor, and canine in Group I was  $4.38 \pm 1.18$ ,  $5.18 \pm 1.25$ ,  $4.16 \pm 1.16$  mm, respectively. A positive correlation exists between WKG and the GT ( $P < 0.05$ ). **Conclusion:** It was concluded that the prevalence of thick and thin gingival biotype is 56.75% versus 43.25%, respectively, and there is no significant relationship between age, gender, and the presence of recession to gingival biotype. A positive correlation exists between WKG and the GT.

**Keywords:** Gender, gingival recession, gingival biotype, prevalence, width of keratinized gingiva

## Introduction

Dentistry began as a specialty catering to merely the functional needs of patients. Through its evolution, it has come a long way and now is driven primarily by esthetics. In this era of esthetic driven dentistry, it is paramount that clinicians consider how gingiva will respond to the various restorative, prosthetic, and periodontal procedures. Ochsenein and Ross<sup>[1]</sup> first indicated that there were two main types of gingival morphology, namely the scalloped and thin or flat and thick gingiva. A more comprehensive term “periodontal biotype” was later introduced by Seibert and Lindhe<sup>[2]</sup> to categorize the gingiva into “thick-flat” and “thin-scalloped” biotypes. Currently, the term gingival biotype has been used to describe the thickness of the gingiva in the facio-palatal dimension.<sup>[3]</sup> Thick gingival tissues are relatively dense in appearance with a rather wide

zone keratinized gingiva. On the other hand, a thin biotype is delicate and translucent, friable with a minimum zone of attached gingiva.<sup>[4]</sup>

Tissue biotypes are associated with the behavior of the periodontal tissues to any physical, chemical, or bacterial insult, outcome of restorative, periodontal therapy, root coverage procedures, and overall esthetics of a dentition. Careful consideration and assessment of the type of biotype has gained a fundamental importance in the treatment planning for any patient. Hence, it is important to gain knowledge about the prevalence of gingival biotype in the general population and its relationship with other known clinical parameters. The aim of this study was to evaluate the prevalence of gingival biotype and assess its relationship to gender, presence of recession, and width of keratinized gingiva (WKG).

## Methods

Four hundred patients (200 females, 200 males) between 20 and 35 years of age (mean age  $28.8 \pm 4.05$  years) were included in this study. All selected patients were given a verbal description of the study and were made to sign an informed consent form prior to commencement of the

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study. The study was approved by the Institutional Review Board. All the procedures followed were in accordance with the Helsinki declaration. All patients included in this study were systemically healthy and presented no dental crowding. Patients with a history of/current smoking habit or mouth breathing, those with any removable device such as a removable partial denture, or removable orthodontic retainer, or missing any of the six maxillary anterior teeth, and having Millers Class III or Class IV recession were excluded from the study.<sup>[5]</sup>

### Clinical parameters

The parameters that were evaluated included probing depth, WKG, gingival thickness (GT), and the presence of recession. All the measurements were made on six maxillary anterior teeth at the mid-buccal area of the tooth, that is, right and left canines, lateral incisors, and central incisors. A single blinded trained and calibrated examiner conducted the entire procedure. The recording of clinical parameters was carried out under local anesthesia (2% lidocaine HCl with 1:100,000 epinephrine).

Probing depth was measured using a UNC-15 periodontal probe (HuFreidy®, USA) from the crest of gingival margin to the base of the pocket. WKG was measured as the distance from gingival margin to the mucogingival junction, which was demarcated by the following method – visual assessment after staining the mucogingival complex with iodine solution. The iodine solution was based on Lugol's solution, prepared by diluting 2 g of potassium iodide and 1 g of iodine crystals in 60 ml of distilled water<sup>[6]</sup> to measure GT, a number of 15 endodontic spreader (Dentsply, India) with a rubber stop was inserted at a point at the center of gingival margin and mucogingival junction in a perpendicular direction and rubber stopper was slid up to the buccal aspect of the gingiva [Figure 1]. This measurement was then recorded against a commercially available digital vernier caliper with a resolution of 0.01 mm. The gingival biotype was considered thin if the measurement was  $\leq 1.0$  mm and thick if it measured  $> 1.0$  mm as described previously by Kan *et al.*<sup>[7]</sup> The presence of Millers Class I or Class II gingival recession was also recorded.

### Statistical analysis

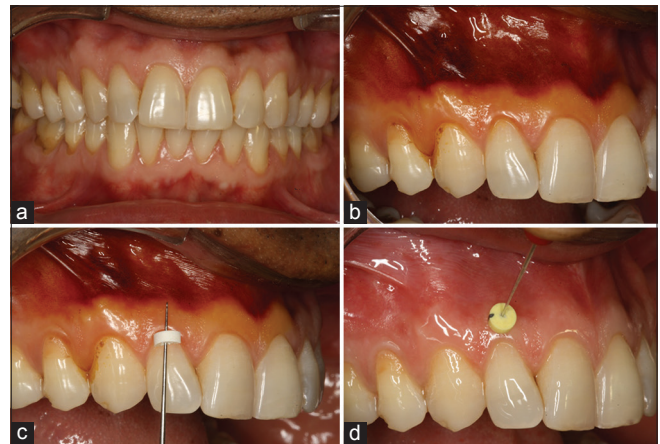
The statistical analysis was performed by using SPSS version 16.0 software (IBM SPSS Statistics, USA). The mean GT and WKG of the maxillary anterior teeth were compared using analysis of variance associated with the Bonferroni test for multiple comparisons. To compare mean GT and WKG between males and females Student's unpaired *t*-test was performed. For correlation of width of attached gingiva to GT, Pearson's correlation coefficient was used. For the entire test,  $P \leq 0.05$  was considered as statistically significant and  $P < 0.001$  was considered as statistically highly significant.

## Results

The mean age of the sampled population was  $28.82 \pm 4.05$  years. Of the total sample of 400 subjects, 173 (43.25%) subjects had thin gingival biotype (mean GT  $\leq 1$  mm) and 227 (56.75%) had thick gingival biotype (mean GT  $> 1$  mm). Sixty-six patients (31 males and 35 females, mean age  $30.90 \pm 3.32$ ) demonstrated Millers Class I or Class II gingival recession. Of these 34 (51.51%) had thin gingival biotype and 32 (48.48%) had a thick gingival biotype. This difference was statistically not significant [Table 1].

The thickness of gingiva in the central incisor ranged from 0.53 to 1.59 mm, 0.48–1.66 mm for lateral incisors, and 0.35–1.27 for canines. The mean GT observed was 1.11 mm for the central incisor, 1.01 mm for the lateral incisor, and 0.82 mm for the canine [Table 2]. There was a statistically significant difference between the mean GT of all three maxillary anterior teeth [Table 3]. For those presenting with the recession ( $n = 66$ ), the mean GT observed was 1.12 mm for the central incisor, 1.00 mm for the lateral incisor, and 0.79 mm for the canine. There was no significant difference between the overall GT ( $n = 400$ ) and of those presenting with the gingival recession ( $n = 66$ ).

With regard to WKG, only the individuals demonstrating no gingival recession were assessed ( $n = 334$ ). It was



**Figure 1:** (a) Before staining with iodine solution. (b) After staining with iodine solution (c) Measurement of width of keratinized gingiva (d) Measurement of gingival thickness using endodontic spreader and rubber stopper

**Table 1: Population distribution of thick and thin gingival biotype in those presenting with and without gingival recession**

|       | Recession | No recession | Total |
|-------|-----------|--------------|-------|
| Thick | 32        | 195          | 227   |
| Thin  | 34        | 139          | 173   |
| Total | 66        | 334          |       |

observed that the dimensions of WKG ranged from 1.21 to 7.54 mm for central incisors, 2.24–8.98 mm for lateral incisors, and 1.29–7.44 mm for canines. The mean WKG was 4.38 mm for the central incisor, 5.18 mm for the lateral incisor, and 4.11 mm for the canine [Table 2]. There was a statistically significant difference between the mean widths of keratinized gingiva of all three maxillary anterior teeth [Table 3].

No statistically significant differences ( $P > 0.05$ ) were observed for the WKG and GT between males and females. Significant positive correlation was observed between GT and WKG for central incisor (0.35), lateral incisor (0.35), and canine (0.32) [Figures 2-4].

### Discussion

The dimensions of gingiva and different parts of the masticatory mucosa demonstrate considerable site and subject variability. They have become the subject of considerable interest in restorative and periodontics from both an epidemiologic, as well as a therapeutic point of view.<sup>[8]</sup> Thick gingival tissues are more frequently associated with periodontal health. In the age group of 20–35 years, we found that 43.25% of individuals have thin gingival biotype. Similar prevalence rates have been reported in a previous study.<sup>[9]</sup> Such thin biotype requires special considerations during esthetic, restorative, and periodontal therapy. Patients with a thin biotype are more vulnerable

to connective tissue loss and epithelial damage, thus, they need special atraumatic treatment and oral hygiene techniques.<sup>[10]</sup> Thin gingival biotypes are less stable, and the occurrence of the papillary and marginal recession is more common in them.<sup>[11]</sup> Hence, more caution should be exercised while planning a subgingival margin placement or crown lengthening for patients with a thin biotype. A systematic review by Hwang and Wang in 2006 has proposed that a critical threshold of 1.1 mm exists for complete surgical root coverage.<sup>[12]</sup> Hence, the patients having a thinner biotype should be treated preferably with techniques that create a pseudo-thick biotype such as a connective tissue graft in

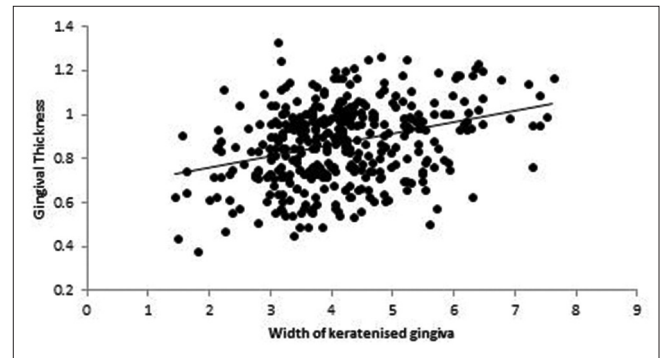
**Table 2: Tooth wise distribution of mean gingival thickness and width of keratinized gingiva**

|                 | Gingival thickness (mm) |           | Width of keratinized gingiva (mm) |           |
|-----------------|-------------------------|-----------|-----------------------------------|-----------|
|                 | Mean (SD)               | Range     | Mean (SD)                         | Range     |
| Central incisor | 1.11 (0.17)             | 0.53-1.59 | 4.38                              | 1.21-7.54 |
| Lateral incisor | 1.01 (0.16)             | 0.48-1.66 | 5.18                              | 2.24-8.98 |
| Canine          | 0.82 (0.17)             | 0.35-1.27 | 4.11                              | 1.29-7.44 |

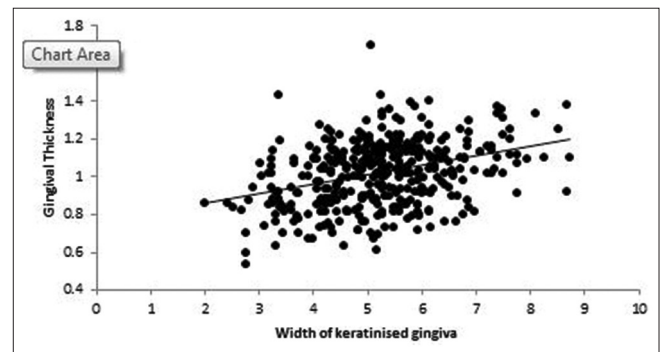
**Table 3: Tooth wise comparison of mean gingival thickness and width of keratinized gingiva**

| Tooth           | Gingival thickness (mm) | Width of keratinized gingiva (mm) |
|-----------------|-------------------------|-----------------------------------|
| Central incisor | 1.11                    | 4.38                              |
| Lateral incisor | 1.01                    | 5.18                              |
| $P^*$           | <0.05                   | <0.001                            |
| Lateral incisor | 1.01                    | 5.18                              |
| Canine          | 0.82                    | 4.11                              |
| $P^*$           | <0.001                  | <0.001                            |
| Canine          | 0.82                    | 4.11                              |
| Central incisor | 1.11                    | 4.38                              |
| $P^*$           | <0.001                  | 0.05                              |

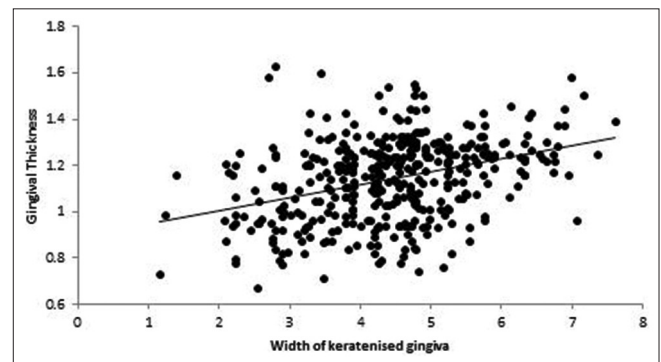
\*Bonferroni multiple comparison test



**Figure 2:** Relationship between gingival thickness and width of gingiva for central incisor



**Figure 3:** Relationship between gingival thickness and width of gingiva for lateral incisor



**Figure 4:** Relationship between gingival thickness and width of gingiva for canine

conjunction with coronally advanced flap as compared to a coronally advanced flap alone.<sup>[4]</sup> This would increase not only the percentage root coverage but also enhance the stability of the achieved result. A thin periodontal biotype is associated with a delicate and highly scalloped osseous gingival contour in which defects such as fenestrations and dehiscence are frequently encountered.<sup>[13]</sup> Though extractions should always be atraumatic, teeth with thin gingival biotypes merit more caution as excessive force is likely to fracture the alveolar plate, and result in bone resorption and unpredictable bone healing.<sup>[13]</sup> More extensive ridge remodeling followed by pronounced hard and soft tissue loss is expected in thin biotypes. Hence, an intervention such as ridge preservation should be planned in such cases to maintain an esthetic and functional soft and hard tissue contour following tooth extraction.<sup>[13]</sup> Hence, assessment and careful treatment planning considering a patient's biotype may enhance the esthetic outcomes of many routine restorative and periodontal therapies.

The mean GT for the central incisor, lateral incisor, and canine were 1.11 mm, 1.01 mm, and 0.82 mm, respectively. There was a statistically significant difference between all three values. Similar results have been reported in previous studies.<sup>[14-16]</sup> When compared to the subset with gingival recession, no significant difference was observed between the mean GT for central incisor, lateral incisor, and canine. Though, it may be expected that recession should be associated with a thinner biotype,<sup>[17]</sup> our observations failed to show any relation between the thickness of the gingiva and the presence of gingival recession. This can be attributed to the rigid upper and lower limits for thick and thin biotypes considered in this study. The sudden transformation of thin biotype at 0.99 mm to a thick biotype at 1.00 mm leaves a room for statistical error. Furthermore, the small sample of population encountered to have presented with gingival recession (66 out of 400), and the comparison of these with a larger population of those not presenting recession (334) could have caused a possible bias. The relatively younger age group that was included in the study (20–35 years of age) may contribute to our findings. Many of such subjects who present with a thin gingival biotype and may be prone to gingival recession in future, however, currently not presenting gingival recession were also considered.

Few previous studies have indicated that males have greater GT than females;<sup>[18-20]</sup> however, no significant difference was observed between males and females in our study group.

The width of the gingiva decreases with the recession, and hence, to assess the WKG and its relationship with GT, patients demonstrating no recession were included ( $n = 334$ ). The mean WKG was the greatest for lateral incisor followed by central incisor and canine. These findings are in agreement with those of the previous studies.<sup>[8,16,21]</sup> A significant positive co-relation has been observed between WKG and GT for

maxillary central incisor, lateral incisor, and canine, i.e., the patients with a thinner gingiva frequently present with a limited amount of attached gingiva. Considering the role of keratinized gingiva in periodontal health,<sup>[22]</sup> this finding further supports the notion that patients with a thin biotype require a more careful treatment planning.

The concept of gingival biotype influencing the diagnosis and treatment in periodontal scenario is a relatively new one. Studies with a larger sample size and including heterogeneous population are needed to confirm the results presented in our study. Future research can aim at developing a more flexible classification system to classify and analyze gingival biotypes. The type of biotype definitely has the potential to alter our treatment considerations. The differential tissue response that may be expected when compared with a thicker biotype must always be considered before initiating a restorative or a periodontal therapy.

There is a significant intra- and inter-individual variation in the GT among the population and around half of them possess thin gingival biotype. A gingival biotype is positively correlated to WKG maxillary canine, lateral incisor, and central incisor.

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#### Conflicts of interest

There are no conflicts of interest.

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