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# Gingival Thickness and its Importance for Timeline of Far Future in Periodontics: A Clinical Study

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## ABSTRACT

**Background**: The purpose of this study was to determine the thickness of facial gingiva and its association with age, gender and dental arch location.

**Methods and Materials**: The study group included 52 systemically healthy individuals (26 males and 26 females) with an age range of 16-38 years, divided into two groups. Gingival thickness was assessed in the maxillary and mandibular anteriors by transgingival probing (TGP).

**Results**: The results of the study showed that the gingiva is significantly thicker in the younger age group (both maxilla and mandible), in males and in the mandibular arch as compared to older age group, males and maxillary arch respectively. Also, according to tooth, gingiva was found to be thicker in incisors followed by canines.

**Conclusion**: The present study concluded that gingival thickness varies with age, gender, dental (both inter and intra arch) arch and its assessment is important for periodontal health.

**Keywords:** Gingival thickness, gingival biotype, gingiva, transgingival probing, age, gender, dental arch.

## INTRODUCTION

Gingival health dictates the periodontal picture of an individual. The inflammatory status of the periodontium can be directly compared to its clinical appearance. The predictability of outcome of the periodontal treatment may ultimately be determined by the periodontal anatomy that patient presents with rather than the clinician's ability to manage state-of-the-art procedures.[1]

The anatomic landmarks of the gingiva and their dimensional inter relationships have been extensively described. Width of the free and attached gingiva, depth of the sulcus, and relationship of the cementoenamel junction (CEJ) to the gingival margin, terminal junctional epithelium and alveolar crest have received particular attention.[2] Lately, the subject of dimensions of the masticatory mucosa, especially gingival thickness, has caught a lot of attention in periodontics both from an epidemiologic and a therapeutic point of view.[3]

Biotype or thickness of the gingiva is one of the important keys in predicting an outcome of any periodontal procedure.[1] The term gingival or periodontal phenotype has been coined to address a common clinical observation of great variation in thickness and width of facial keratinized tissue.[4] Knowledge of gingival thickness or biotype is the deciding factor in patient and technique selection for gingival augmentation procedures. Any variations in tissue thickness may significantly

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affect the treatment outcome. Hence it is important to identify those variations in clinical practice.

The diagnostic ability of gingival thickness measurement is helps to distinguish bony and gingival enlargement. Similarly, the prognostic ability of gingival thickness measurement assists in detecting the inflammatory induced clinical changes as well as those induced due to fibrosis. Along with recording the clinical features of gingiva like of color, consistency, texture and position, the measurement of gingival thickness measurement is also an imperative tool for the outcome of disease and treatment measurement.[5]

There is a considerable intra-individual and inter-individual variation in both width and thickness of the facial gingiva. Factors affecting the clinical picture of the healthy marginal periodontium are genetically determined: others like such as gender, growth and age, seem to be influenced by tooth size, shape and position and biological phenomena.[3] Thinner is the marginal tissue more are the chance of development of gingival recession after non surgical periodontal therapy. Gingival thickness seems to play an important role in wound healing and flap management during regenerative surgical procedures. Thick gingival tissue favors easy management, vascularity and increased wound healing during and after surgery. Likewise thick palatal mucosa, in particular, has attracted considerable attention with regards to a possible donor site for connective tissue transplants in plastic surgery.[6]

Although abundant literature is available on previously investigated thickness of palatal masticatory mucosa, the majority of subjects were edentulous, who had complete dentures, and the thickness was assessed non-invasively using ultrasonic device. Muller and Eger in 2000 [4], assessed the transgingival probing (TGP) method in dentate subjects, but, only the palatal gingiva was evaluated. Furthermore, the characterization of the facial gingival thickness by TGP in human subjects, and the correlation of the gingival thickness with age, gender and dental arch in the anterior segment is scanty.[3]

Hence, this study was conducted to assess the thickness of facial gingiva and its relation with age, gender and dental arch location.

## MATERIALS AND METHODS

Fifty-two systemically healthy individuals (26 males, 26 females, age range 16–38years) took part in this study. Out of the total subjects, 26 comprised the younger age group and 26 were in the older age group. The younger age group (16-24 years) had a mean age of 18.8 years and older age group (25-38 years) had a mean age of 27.8 years.

The inclusion criteria were:

(a) Healthy periodontal tissues with no loss of attachment.

(b) Presence of all anterior teeth in both upper and lower jaw.

The exclusion criteria were:

a) Gingival recession in the anterior teeth
b) Extensive restorations
c) Maloccluded teeth
d) Patients with prior orthodontic treatment.
e) Use of any medication causing gingival hyperplasia
f) Pregnancy and lactation
g) Systemic disease like diabetes mellitus and smoking etc.

All the participants were explained about the nature of the study and the written consent was obtained.

The study design was approved by the ethical committee of the institute, Ref No. GNDDC/2012/3/166.

### Procedure for measurement of gingival thickness

The gingival thickness was assessed midbuccally [Figure 1], in the attached gingiva, half way between the mucogingival junction and free gingival groove (Goaslind et al. 1977)[2] and at the base of the inter-dental papilla [Figure 2]. The measurement points on the facial gingiva were marked with a marking pencil. The gingival thickness was assessed by anaesthetizing the facial gingiva with topical lignocaine aerosol (Lidocaine USP 15% w/w) and if required, infiltration was given using 2% lignocaine HCl with 1:2,00,000 adrenaline injection. Using an

UNC-15 probe, the gingival thickness was assessed after injection.

The measurements recorded were compiled and subjected to statistical analysis.

Fig 1. Assessment of gingival thickness Mid- Bucally.

Fig 2. Assessment of the gingival thickness at the base of the interdental papillae.

**Statistical Analysis**

The paired t-test was used to compare the TGP measurements, mid-buccally and at the inter-dental papillary region.

In the present study, Mann Whitney test was used for comparison between two age groups and for comparison between male and female groups. Wilcoxon signed rank test was used for comparison between mandibular and maxillary teeth.

## RESULTS

Tables 1–4 show the results in mean scores of the gingival thickness at the subject level.

The mean thickness of the gingiva mid-buccally in maxilla was 0.82 (± 0.09) and in mandible was 0.87 (± 0.12) mm and was 0.98 (± 0.18) in maxilla and 1.08 ( ± 0.21) mm in mandible, at the inter-dental papilla in the younger age group (16–24 years). The mean thickness of the gingiva midbuccally in the maxillary and mandibular arches was 0.70 ( ± 0.11) and 0.79 ( ±0.09) mm, and 0.82 (±0.11) and 0.93 ( ± 0.17) mm at the interdental papilla in the older age group (25–38 years). The age groups comparison of the gingival thickness at the mid-buccal and inter-dental papillary region indicated that the gingiva was significantly thicker in the younger age group than the older age group. The difference was statistically significant in all the cases ($p < 0.001$), Table 1.

The mandibular arch showed a thicker gingiva both mid-buccally (0.83 ± 0.12mm) and in the inter-dental papillary region (1.00±0.20 mm) compared with the maxillary arch. The difference was statistically significant both in the mandibular mid-buccal ($p < 0.002$) and inter-dental papillary region ($p < 0.001$), Table 2.

On comparison, between males and females at both sites, female volunteers had lesser gingival thickness than males, but the difference was statistically significant only in the mandibular inter-dental papillary region ($p < 0.001$), Table 3.

On toothwise comparison between the canine and incisor at the mid-buccal region, the incisors showed a thicker gingiva mid-buccally (0.78 ± 0.14 mm) compared with the canine region, which was statistically significant ( $p <0.001$), Table 4.

Table 1: Comparison of gingival thickness in millimeters at mid-buccal location and inter-dental papilla between the younger and the older age group.

| | 16-24 yrs (mean±SD) | 25-38 yrs (mean±SD | Difference between age groups. p-value |
|---|---|---|---|
| MB Max.<br>MB Mand | 0.82 ± 0.09<br>0.87 ± 0.12 | 0.70 ± 0.11<br>0.79 ± 0.09 | ≤ 0.001 HS<br>0.02 S |
| IDP Max<br>IDP Mand | 0 .98 ± 0.18<br>1.08 ± 0.21 | 0.82 ± 0.11<br>0.93 ± 0.17 | ≤ 0.001 HS<br>0.01 S |

Table 2: Comparison of gingival thickness in millimeters between the maxillary and mandibular arch.

| | Maxillary (mean ±SD) | Mandibular (mean±SD | p-value |
|---|---|---|---|
| MB | 0.76 ± 0.12 | 0.83 ± 0.12 | 0.002 HS |
| IDP | 0.90 ± 0.17 | 1.00 ± 0.20 | 0.001HS |

Table 3: Comparison of gingival thickness in millimeters between males and females.

| | MALE (mean ±SD) | FEMALE (mean±SD) | M Vs F p-value |
|---|---|---|---|
| MB Max.<br>MB Mand | 0.77 ± 0.09<br>0.84 ± 0.09 | 0 .76 ± 0.14<br>0.81 ± 0.14 | < 0.730 NS<br>< 0.507 NS |
| IDP Max<br>IDP Mand. | 0.94 ± 0.09<br>1.06 ± 0.20 | 0.87 ± 0.22<br>0.95 ± 0.20 | < 0.102 NS<br>0.001HS |

Table 4: Comparison of gingival thickness in millimeters between incisors and canines.

| | Incisors (mean ±SD) | Canines (mean±SD | I vs. C p-value |
|---|---|---|---|
| MB | 0.78 ± 0.14 | 0.60 ± 0.16 | <0.001 HS |

## DISCUSSION

The present study provides new understandings into the role of subject related factors when considering thickness of gingival tissue. Normally, there is a considerable inter-individual and intra-individual variations in both thickness and width of facial gingiva, a fact that suggests the presence of different gingival phenotypes in adult population.

Individuals with thicker tissue resistant to ginigival recession and results often lead to pocket formation after any apical migration of the junctional epithelium. The thin gingival biotype is more vulnerable to recession and interproximal loss of gingival tissues following any surgical procedure.[1] Hence, its critically important to examine of the gingival biotype in order to guide the treatment and follow up of the patient during treatment, specially in orthodontics and periodontal clinical practices.

Thickness of gingiva also plays a vital role in the success of treatment of recession and wound healing of the gingiva. Many invasive and non-invasive methods have been used for examination of gingiva. Most commonly practiced method is using a periodontal probe under local anesthesia (Vandana KL 2005)[3] or by more precise method of transgingival probing (TGP) also called Bone Sounding (BS – *bone sounding*) (Da Silva 2004, Studer S.P. 1997).

Another low invasive way to assess the thickness of the palatal and gingival mucosa is by the method of computed tomography. It gives a 3D visualization of skeletal conditions, but is a very expensive and still hard to get method. Its generally used in determination of soft tissue thickness in implantology. An equally safe and painless method is ultrasound gingival thickness measurement (UGTM), but it requires an appropriate instrument.

Also there are some other drawbacks, like:

- difficulty in maintaining the directionality of the transducer,
- non-reliable results when the gingival thickness exceeds 2–2.5mm.The inaccuracy of such ultrasonic examination is found to be about 25%.(Wojciech 2011).[7] A recent study conducted by B Savitha and KL Vandana (2005), has shown that both transgingival probing (TGP) and ultrasonographic method (USG) measurements are reliable in measuring gingival thickness midbuccally but USG measurements but cannot be relied upon in papillary region. Therefore in the present study the conventional TGP being a more cost effective and easy to perform method (as against USG measurements done atraumatically), was used to assess the thickness of gingiva.[8]

Waraaswapati N. et al (2001) and Studer SP et al (1997) studied that the thickness of palatal masticatory mucosa reported the palatal mucosa to be thicker in younger than older subjects, which might be attributed to decreased keratinization associated with age and sub mucosal layer of adipose tissue and small mucous glands. There are numerous studies recording the thickness of palatal mucosa by TGP and the data on assessing the thickness of facial gingiva using the same method is scanty. The present study was carried on to evaluate the association of gender, age, and dental

arch location with the thickness of facial gingiva in Indian population.[3]

According to the results obtained by the present study, the gingiva is significantly thicker in both maxilla and mandible, in the younger age group individuals than the older age group. These results are in accordance with the study conducted by Vandana KL and Savitha B (2005)[3], which suggests the role of factors like changes in the oral epithelium with aging age, related to thinning of the epithelium and decreasing keratinization (Van der Velden 1984) apart from other racial and genetic factors that need to be studied further.[9]

Gingival thickness was found to be lesser in females than male volunteers in the present study, a finding similar to the study of Muller *et al.* (2000)[4] (in which method ultrasonography was used) and Stipetic *et al*. (2005) transgingival probing that demonstrated significantly thick palatal masticatory mucosa in men using TGP.[9] Similar results were reported by Savitha B and Vandana KL (2005).[8] However, the results were not statistically significant, except for interdental papillary thickness.[3]

This study has shown that the thickness in of midbuccal and papillary gingiva was more in the mandible than the maxillary gingiva, respectively, in contrast to the results of Muller (2000)'s study with a thicker gingiva in the maxilla than in the mandible, with the thinnest facial gingiva found at maxillary canines as well as mandibular 1st premolars. On tooth wise assessment, significantly greater mid-buccal gingival thickness was seen in the incisor region as compared to the canine region in the present study.

But, in a study conducted by Vandana KL and Savitha B (2005)[5] using transgingival probing, it was seen that the gingiva was thicker in the mandibular arch as compared to the maxillary arch[5]. Holthuis AF and Chebib FS (1983) reported the variation in the blood flow to mandibular gingiva is statistically different in healthy and inflamed sites, whereas the variation in the same to the maxillary gingiva in healthy and inflamed sites is not statistically significant. All of these results reinforce the present hypothesis and indicate that a difference should be observed between the gingival thickness in the maxilla and mandible,[10] which might be due to the varying tooth form like greater size and root prominence of canines.

In the view if the limits of the present study, it is demonstrated that: younger subjects have significantly thicker mucosa; Females exhibited a thinner gingiva; Gingiva was thicker in the mandibular arch than the maxillary arch. Olson and Lindhe (1991)[10] concluded in a study that varying form of teeth is associated with variation in the periodontal characteristics, like gingival thickness.[10] They also proposed that gingival recession is more commonly seen in the long narrow teeth than short–wide teeth because of the variation in their periodontal thickness. In 1993, Olsson et al.[10] reported no significant difference between narrow and wide crown forms with respect to the thickness of the free gingiva. A moderate association of the gingival thickness with the underlying labial alveolar bone, was initially reported, by Seibert and Lindhe (1989).[10]

Gingival biotype plays an important role in flap management during regenerative surgical procedures and root coverage procedures.[3]

Muller et al (2000) stated in a study that trends of more recession and an unfavorable bleeding/plaque ratio in subjects with thin gingiva are less common, whereas mean probing depth are significantly higher in subjects with thicker gingiva.[4,11]

Shekhawat N K et al (2012) conducted a study to establish a correlation of bleeding on probing with gingival thickness and determination of gingival thickness in different gender. The study showed that thinner gingiva bleeds more as compared to thicker gingival and gingival thickness strongly depends on gender also and males have thick gingiva compared to females.[6] Since gingival thickness is a significant predictor of the clinical outcome of periodontal surgical procedures, appreciating any changes in the same will lead to a better understanding of pathogenesis, diagnosis and treatment planning.[12] Other genetic and racial factors that may influence the thickness of the gingiva need further investigation.

## CONCLUSION

A careful examination of the dimensions of thickness of the gingiva and its variations with age, gender and dental arch, is necessary for the

thorough treatment and monitoring of the patient. Assessment of gingival thickness not only helps in achieving the precise diagnosis of the periodontal disease but also helps in the optimization of the proper treatment plan which is extremely important for prognosis. Hence, it may be concluded that for timeline of far future of periodontal health, assessment of gingival thickness is critically important.

## CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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