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# Gingival Biotype Assessment in Association with Age, Gender and Dental Arch Location using a Novel Approach

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ABSTRACT

To assess the gingival biotypes in a sample of periodontally healthy volunteers and to correlate their prevalence in accordance with age, gender and dental arch location using Hu-friedy Colorvue® Biotype probe. A total of ninety subjects with age groups of 16-34 years (22 males, 23 females) and 35-54 years (23 males, 22 females) were selected for this study. Gingival biotype was assessed in maxillary and mandibular anteriors and was differentiated into thin, medium, thick and very thick biotype using Colorvue® Biotype probe. Collected data was statistically analyzed using chi-square test. The association of age, gender and gingival biotype was not significant in relation to 31,32,33,41,42 and 43 but significant in relation to 11,12,13,21,22 and 23. Study showed that thick biotype decreased with advancing age. Medium and thicker gingival biotype were more prevalent in males. On dental arch comparison, the gingiva was found to be thicker in the maxillary arch as compared to mandibular arch. It was concluded that gingival thickness varies according to age, gender and dental arch. Colorvue® biotype probe was found to be an excellent tool for assessing gingival biotype in the most atraumatic and efficient way and thus aiding in selection of proper treatment protocol.

**Key Messages:** Since gingival biotype is gaining considerable attention as one of the key elements influencing aesthetic treatment outcome, assessment of gingival biotype is of paramount relevance. The Hu-friedy Colorvue® Biotype probe proves to be an excellent tool for assessing gingival biotype in the most atraumatic and efficient way.

**Keywords:** Gingival biotype; Colorvue biotype probe; Dental arch location

## 1 INTRODUCTION

The clinically healthy marginal periodontium varies from subject to subject and even among different tooth types. Many features are genetically determined; others seem to be influenced by tooth size, shape and position and biological phenomena such as gender, growth and aging. [1]

The bulky, slightly scalloped marginal gingiva with short and wide teeth on one hand and the 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". [2]

The term "gingival or periodontal phenotype" was coined by Muller HP 1997. [1] Gingival biotypes may present thickness varying from 0.7 to 1.5 mm and it has been generally suggested that when the gingival thickness is >1 mm the biotype can be classified as thick, whereas a thin biotype is ≤1mm. [3]

Gingival biotype play an important role in esthetics, function, and periodontal health maintenance and has been

claimed as a predictor of long-term success in periodontal and implant therapy.[4] It has been recommended that a direct correlation exists among gingival biotype and the susceptibility to gingival recession following surgical and restorative therapy. Therefore, evaluation of gingival tissue biotype is of paramount importance in devising an appropriate treatment plan to achieve predictable esthetic outcome.[3]

A clinician's knowledge in identifying gingival thickness is utmost for attaining optimal treatment outcomes.[5] Various methods are used to measure gingival thickness: both invasive and non-invasive. Most commonly used methods are visual assessment and probe transparency method. There is no universal standardization of visual assessment, and it relies on the clinical experience of the examiner and is, therefore, subjective. On the other hand, assessment using a periodontal probe provides some objectivity with the visibility during the biotype estimation.[6]

In general, by using visual assessment methods, the gingival biotype can only be differentiated as either thick or thin. The Colorvue® biotype probe is a newly introduced reliable, non-invasive manual dental tool that enables a precise assessment of the periodontal biotype. It aids in the classification of biotype into thin, medium, thick or very thick in a quick and easy manner.

Attempts to assess gingival thickness using Colorvue® biotype probe and the correlation of the gingival biotype with age, gender and dental arch location in maxillary and mandibular anterior segment is scanty.

Hence this study was conducted to assess the gingival biotypes in a sample of periodontally healthy volunteers and to correlate their prevalence in accordance with age, gender and dental arch location using Colorvue® biotype probe.

## 2 MATERIALS AND METHODS

### 2.1 *Patient selection*

A total of ninety subjects in the age groups of 16-34 years (22 males, 23 females) and 35-54 years (23 males, 22 females) who visited Department of Periodontology, Yenepoya Dental College, Mangalore from February 2018 to January 2019 participated in this cross-sectional study. The inclusion criteria were (a) clinically healthy periodontal tissues with no loss of attachment and (b) presence of all maxillary and mandibular anteriors.

The exclusion criteria were as follows (a) Pregnancy and lactation (b) gingival recession in the anterior teeth, (c) Presence of extensive restorations or implant supported prosthesis in upper & lower anteriors, (d) probing pocket depth $\geq$ 3 mm in relation to anterior teeth, (e) smoking and pan chewing (f) subjects undergoing orthodontic treatment and (g) use of any medication possibly affecting the periodontal tissues.

The study protocol was reviewed and approved by the Institutional Research Ethics Committee, Yenepoya deemed to be University. The purpose of the study was explained to all the participants and an informed consent was obtained prior to their enrollment in the study.

### 2.2 *Clinical examination of the study sample*

Clinical examination consisting of recording a brief case history and intra-oral examination were mainly focused on the maxillary and mandibular anteriors. The examiner assessed the gingival biotype mid-facially on the labial aspect of all the maxillary and mandibular anteriors at approximately 2 mm apical to free gingival margin. Hu-Friedy colorvue® biotype probe was used to differentiate the gingival biotype in four categories:

- **Thin biotype:** Once inserted into the sulcus, the white color of the probe is clearly visible through the tissue (Figure 1).
- **Medium biotype:** The green portion of the probe is clearly visible through the tissue, and the white one is not visible (Figure 2).
- **Thick biotype:** The blue color of the probe is clearly visible through the tissue, but neither the white nor the green tip is visible (Figure 3).
- **Vey thick biotype:** The blue and consequently also the other two colors, are not visible through the tissue (Figure 4).

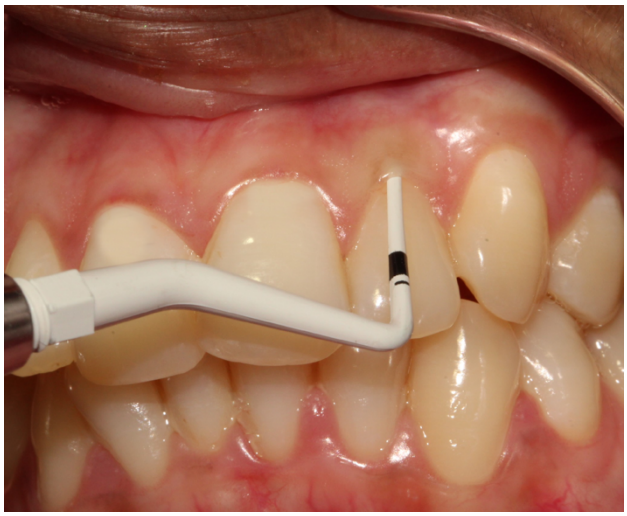

**Fig. 1:** Thin biotype

### 2.3 *Statistical analysis*

Collected data was analyzed using chi-square test. p value <0.05 was considered as statistically significant. Data was subjected to statistical analysis with the Statistical Package for Social Science Software version 22.0

**Fig. 2:** Medium biotype

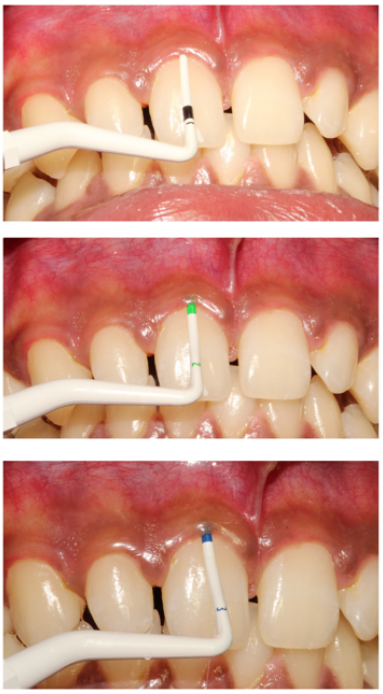

**Fig. 3:** Thick biotype

**Fig. 4:** Very thick biotype

## 3 RESULTS

### *3.1 Age and gingival biotype*

The association of age and gingival biotype was not significant in relation to 31,32,33,41,42 and 43 but significant in relation to 11,12,13,21,22 and 23. (Table 1)

Among the younger group, more subjects had thicker and medium gingival biotype and in the older age group, more prevalence of thinner biotype was seen.

### *3.2 Gender and gingival biotype*

The association of gender and gingival biotype was not significant in relation to 31,32,33,41,42 and 43 but significant in relation to 11,12,13,21,22 and 23. (Table 2)

Among the male population, thicker and medium gingival biotype was observed to be more prevalent whereas in female population, higher prevalence of thin biotype was found.

### *3.3 Dental arch and biotype*

Association of gingival biotype age-wise and gender-wise was significant in relation to 13, 12, 11, 21, 22 and 23 but not significant in relation to 31, 32, 33, 41, 42 and 43. (Tables 1 and 2).

The study results showed that the thin biotype was more prevalent in mandibular anteriors and in females. Medium and thick biotype was more in maxillary anteriors and in males. Very thick biotype was present only in maxillary anteriors and in males but the prevalence was comparatively less.

## 4 DISCUSSION

In the past few years, the dimensions of different parts of the masticatory mucosa, particularly gingival thickness, has become a topic of interest in periodontics speciality both from an epidemiologic and a therapeutic point of view.[7] The purpose of this study was to assess the gingival biotypes in a sample of periodontally healthy volunteers and to correlate their prevalence in accordance with age, gender and dental arch location. Ninety subjects participated

**Table 1: The distribution of subjects according to age and gingival biotype**

| Age group | 11 | | | | 12 | | | | 13 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Thin** | **Medium** | **Thick** | **Very thick** | **Thin** | **Medium** | **Thick** | **Very thick** | **Thin** | **Medium** | **Thick** | **Very thick** |
| 16-34 Yrs | 6 (13.30%) | 15 (33.30%) | 21 46.70%) | 3 (6.70%) | 13 (28.90%) | 17 (37.80%) | 14 (31.10%) | 1 (2.20%) | 25 (55.60%) | 19 (42.20%) | 0 (0.00%) | 1 (2.20%) |
| 35-54 Yrs | 14 (31.10%) | 23 (51.10%) | 5 (11.10%) | 3 (6.70%) | 28 (62.20%) | 11 (24.40%) | 6 (13.30%) | 0 (0.00%) | 37 (82.20%) | 5 (11.10%) | 3 (6.70%) | 0 (0.00%) |
| Total | 20 | 38 | 26 | 6 | 41 | 28 | 20 | 1 | 62 | 24 | 3 | 1 |
| p value | **0.002** | | | | **0.012** | | | | **0.002** | | | |
| Age group | 21 | | | | 22 | | | | 23 | | | |
| | Thin | Medium | Thick | Very thick | Thin | Medium | Thick | Very thick | Thin | Medium | Thick | Very thick |
| 16-34 Yrs | 6 (13.30%) | 16 (35.60%) | 20 44.40%) | 3 (6.70%) | 12 (26.70%) | 18 (40.00%) | 13 (28.90%) | 1 (2.20%) | 26 (57.80%) | 18 (40.00%) | 1 (2.20%) | 0 (0.00%) |
| 35-54 Yrs | 13 (28.90%) | 23 (51.10%) | 5 (11.10%) | 4 (8.90%) | 32 (71.10%) | 8 (17.80%) | 5 (11.10%) | 1 (2.20%) | 39 (86.70%) | 3 (6.70%) | 3 (6.70%) | 0 (0.00%) |
| Total | 19 | 39 | 26 | 7 | 44 | 26 | 18 | 2 | 65 | 21 | 4 | 0 |
| p value | **0.005** | | | | **0.002** | | | | **0.001** | | | |
| Age group | 31 | | | | 32 | | | | 33 | | | |
| | Thin | Medium | Thick | Very thick | Thin | Medium | Thick | Very thick | Thin | Medium | Thick | Very thick |
| 16-34 Yrs | 32 (71.10%) | 13 (28.90%) | 0 (0.00%) | 0 (0.00%) | 34 (75.60%) | 11 (24.40%) | 0 (0.00%) | 0 (0.00%) | 36 (80.00%) | 5 (11.10%) | 2 (4.40%) | 0 (0.00%) |
| 35-54 Yrs | 38 (84.40%) | 7 (15.60%) | 0 (0.00%) | 0 (0.00%) | 39 (86.70%) | 6 (13.30%) | 0 (0.00%) | 0 (0.00%) | 36 (80.00%) | 9 (20.00%) | 0 (0.00%) | 0 (0.00%) |
| Total | 70 | 20 | 0 | 0 | 73 | 17 | 0 | 0 | 74 | 14 | 2 | 0 |
| p value | **0.128** | | | | **0.178** | | | | **0.202** | | | |
| Age group | 41 | | | | 42 | | | | 43 | | | |
| | Thin | Medium | Thick | Very thick | Thin | Medium | Thick | Very thick | Thin | Medium | Thick | Very thick |
| 16-34 Yrs | 31 (68.90%) | 14 (31.10%) | 0 (0.00%) | 0 (0.00%) | 32 (71.10%) | 13 (28.90%) | 0 (0.00%) | 0 (0.00%) | 35 (77.80%) | 6 (13.30%) | 2 (4.40%) | 0 (0.00%) |
| 35-54 Yrs | 36 (80.00%) | 9 (20.00%) | 0 (0.00%) | 0 (0.00%) | 37 (82.20%) | 8 (17.80%) | 0 (0.00%) | 0 (0.00%) | 37 (82.20%) | 10 (22.20%) | 0 (0.00%) | 0 (0.00%) |
| Total | 67 | 23 | 0 | 0 | 69 | 21 | 0 | 0 | 72 | 16 | 2 | 0 |
| p value | **0.227** | | | | **0.213** | | | | **0.217** | | | |

**Table 2: The distribution of subjects according to gender and gingival biotype**

| Gender | 11 | | | | 12 | | | | 13 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Thin** | **Medium** | **Thick** | **Very thick** | **Thin** | **Medium** | **Thick** | **Very thick** | **Thin** | **Medium** | **Thick** | **Very thick** |
| Male | 8 (17.80%) | 14 (31.10%) | 19 (42.20%) | 4 (8.90%) | 15 (33.30%) | 18 (40.00%) | 17 (37.80%) | 1 (2.20%) | 26 (57.80%) | 15 (33.30%) | 3 (6.70%) | 1 (2.20%) |
| Female | 12 (26.70%) | 24 (53.30%) | 7 (15.60%) | 2 (4.40%) | 26 (57.80%) | 10 (22.20%) | 3 (6.70%) | 0 (0.00%) | 36 (80.00%) | 9 (20.00) | 0 (0.00%) | 0 (0.00%) |
| Total | 20 | 38 | 26 | 6 | 41 | 28 | 20 | 1 | 62 | 24 | 3 | 1 |
| p value | **0.022** | | | | **0.001** | | | | **0.068** | | | |
| Gender | 21 | | | | 22 | | | | 23 | | | |
| | Thin | Medium | Thick | Very thick | Thin | Medium | Thick | Very thick | Thin | Medium | Thick | Very thick |
| Male | 7 (15.60%) | 14 (31.10%) | 19 42.20%) | 5 (11.10%) | 16 (35.60%) | 18 (40.00%) | 15 (33.30%) | 2 (4.40%) | 27 (60.00%) | 14 (31.10%) | 4 (8.90%) | 0 (0.00%) |
| Female | 12 (26.70%) | 25 (55.60%) | 6 (13.30%) | 2 (4.40%) | 28 (62.20%) | 8 (17.80%) | 3 (6.70%) | 0 (0.00%) | 38 (84.40%) | 7 (15.60%) | 0 (0.00%) | 0 (0.00%) |
| Total | 19 | 39 | 25 | 7 | 44 | 26 | 18 | 2 | 65 | 21 | 4 | 0 |
| p value | **0.006** | | | | **0.001** | | | | **0.017** | | | |
| Gender | 31 | | | | 32 | | | | 33 | | | |
| | Thin | Medium | Thick | Very thick | Thin | Medium | Thick | Very thick | Thin | Medium | Thick | Very thick |
| Male | 33 (73.30%) | 12 (26.70%) | 0 (0.00%) | 0 (0.00%) | 33 (73.30%) | 12 (26.70%) | 0 (0.00%) | 0 (0.00%) | 34 (75.60%) | 10 (22.20%) | 1 (2.20%) | (0.00%) |
| Female | 37 (82.20%) | 8 (17.80%) | 0 (0.00%) | 0 (0.00%) | 40 (88.90%) | 5 (11.10%) | 0 (0.00%) | 0 (0.00%) | 40 (88.90%) | 4 (8.90%) | 1 (2.20%) | 0 (0.00%) |
| Total | 70 | 20 | 0 | 0 | 73 | 17 | 0 | 0 | 74 | 14 | 2 | 0 |
| p value | 0.310 | | | | 0.159 | | | | 0.217 | | | |
| Gender | 41 | | | | 42 | | | | 43 | | | |
| | Thin | Medium | Thick | Very thick | Thin | Medium | Thick | Very thick | Thin | Medium | Thick | Very thick |
| Male | 32 (71.10%) | 13 (28.90%) | 0 (0.00%) | 0 (0.00%) | 31 (68.90%) | 14 (31.10%) | 0 (0.00%) | 0 (0.00%) | 34 (75.60%) | 10 (22.20%) | 1 (2.20%) | 0 (0.00%) |
| Female | 35 (77.80%) | 10 (22.20%) | 0 (0.00%) | 0 (0.00%) | 38 (84.40%) | 7 (15.60%) | 0 (0.00%) | 0 (0.00%) | 38 (84.40%) | 6 (13.30%) | 1 (2.20%) | 0 (0.00%) |
| Total | 67 | 23 | 0 | 0 | 69 | 21 | 0 | 0 | 72 | 16 | 2 | 0 |
| p value | 0.468 | | | | 0.182 | | | | 0.543 | | | |

in this cross-sectional study who were categorized into two age groups- 16-34 years and 35-54 years. All maxillary and mandibular anteriors were included as reference teeth because differences between biotypes are most explicit for these teeth. To the best of our knowledge, this is the only study in which the attempt was made to assess gingival biotype using Hu-friedy Colorvue® biotype probe and correlating it with age, gender and dental arch location in maxillary and mandibular anteriors.

Recent research has demonstrated that an entirely subjective and non-instrumental assessment give rise to an unacceptably high number of errors, even in the case of assessment by an expert clinician.[8] Hu-friedy Colorvue® Biotype probe is a non-invasive manual dental tool that enables a precise assessment of the periodontal biotype without the above-mentioned drawbacks.

In this study, we used a Hu-friedy Colorvue® Biotype probe for gingival biotype assessment, which is a reliable and reproducible newly introduced device. Based on the visibility of the colored tip of the probe through the gingiva, the biotype was assessed.

The use of Colorvue® Biotype probe has several advantages over the other instrumental methods. It is a smooth and simple tool to use which do not induce any trauma in the periodontal tissues. Moreover, the results are quick and easy, and reliable to interpret.

Periodontal biotype evaluation is an important parameter in establishing patient expectations in many complex esthetic procedures by allowing the clinician to predict therapeutic outcome.[9] Thin gingival biotypes are comparatively less stable and are more prone for papillary and marginal recession whereas thicker biotype are relatively more resistant to gingival recession following surgical and/or restorative therapy.[6,10]

The findings of this study are in concurrence with the study results by several authors.[7,11–14] This is in contrast to the observation of Waraaswapati et al.[15] Chang[16] in his study stated that an inverse relationship is found to be existing between papilla height and age. In the present study, among male population, medium and thick gingival biotype was observed to be more prevalent and in female population, there was a higher prevalence of thin biotype. These results are in agreement with the study conducted by several authors[1,2,11–13,17,18] which reported that males have a thicker gingival biotype than females. However, contradictory results were reported by Agarwal et al[14] and Shah et al.[19]

Dental arch comparison of gingival biotype demonstrated a prevalence of thinner biotype in mandibular arch and more medium and thicker biotype in maxillary arch. It could be due to the anatomic difference between the maxillary and mandibular teeth and alveolar sizes. These findings are in accordance with Muller et al[1] and Agarwal et al.[14] and in contrast to the results of Vandana and Savitha.[7]

To the best of our knowledge, there are no studies reporting gingival biotype assessment preformed on both maxillary and mandibular anteriors and categorizing into four different biotypes- thin, medium, thick and very thick. Since gingival biotype appears to influence the outcome of various dental procedures including periodontal, restorative, implant and orthodontic treatment its precise assessment is important for treatment planning. Thus, the biotype assessment should incorporate an easy and reproducible method for discriminating different biotypes. One such promising tool for biotype assessment is Hu-friedy Colorvue® Biotype probe. The reproducibility of this probe enables a precise comparison of the data emerging from different clinical studies, and consequently affords an opportunity to improve our understanding of the behavior of different periodontal biotypes in response to different therapies.

## 5 CONCLUSION

Within the limits of the present study, it is demonstrated that medium and thicker gingival biotype are more prevalent in younger subjects than older subjects. Females exhibited a thinner gingiva as compared with males. On dental arch comparison, the gingiva was found to be thicker in the maxillary arch as compared with the mandibular arch. Since gingival biotype is gaining significant attention as one of the key elements influencing aesthetic treatment outcome, evaluation of gingival biotype is of paramount relevance. The Hu-friedy Colorvue® Biotype probe proves to be an excellent tool for assessing gingival biotype in the most atraumatic and efficient way and thus aiding in selection of proper treatment protocol.

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