Original Article

# Prevalence of Gingival Biotype and its Relationship to Dental Malocclusion

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## Abstract

**Introduction:** Gingival biotype is broadly categorized into two main types, namely, scalloped and thin or flat and thick gingival. The term periodontal biotype was introduced later to categorized the gingiva into thick flat and thin scalloped biotypes. Tissue biotype is one of the critical factors influencing the esthetic treatment outcomes. **Aim:** The aim of this study was to determine the association between gingival biotype and type of malocclusion, gender, and smoking status of patient. **Materials and Method:** Two hundred participants (100 males and 100 females) in the age range of 18–60 years were included in the study. Four maxillary incisors were examined in each participant for the gingival biotype. They were divided into group based on various factors such as malocclusion, age, gender, and smoking status. The gingival biotype was then assessed using probe transparency (TRAN) method. **Results:** The mean age was 29.42 years. Thin gingival biotype was observed in 44.5% of the sample, of which 54.5% were female and 34.5% were male ($P = 0.00001$). Only 35.2% of current smokers had thin gingival biotype compared to 41.9% former and 48.4% of subjects who never smoked ($P = 0.008$). On the basis of age, it was observed that the subjects under 18–30 years of age had thinner biotype compared to their age groups. No significant association between dental malocclusion and the gingival biotype was found. **Conclusion**: A high prevalence of thin gingival biotype was observed in females and young age group. Smokers had thicker gingival biotype. No relationship was found between gingival biotype and angle's classification of malocclusion.

**Keywords:** Malocclusion, Prevalance, Gingival biotype.

## Introduction

Different parts of the masticatory mucosa, especially gingival thickness, have become the subject of considerable interest in periodontics from both an epidemiological and therapeutic point of view.[1] It was suggested that since the two tissue biotypes have different gingival and osseous architectures, they exhibit different pathological responses when subjected to inflammatory, traumatic, or surgical insults.[2] These different responses dictate different treatment modalities. Therefore, an accurate diagnosis of gingival tissue biotype is of utmost importance in forming an appropriate treatment plan to achieve a predictable treatment outcome.

Tissue biotype is a critical factor that influences the esthetic treatment outcomes. There were two main types of gingival morphology, namely, the scalloped and thin or flat and thick gingiva.[3] The contour of the gingival biotype closely followed the contour of the underlying alveolar bone. The term "periodontal biotype" was later introduced to categorize the gingiva into "thick-flat" and "thin-scalloped" biotypes.[4] During treatment planning, the soft-tissue biotype should be taken into consideration as it affects the final treatment outcome.[5] Many methods were proposed to measure tissue thickness. These include direct measurements,[6] probe transparency (TRAN),[7] ultrasonic devices,[8] and most recently, cone-beam computed tomography (CBCT).[9] Probe transparency method is a simple, rapid, and minimally invasive method.

### Aim of the study

The aim of this study was to determine the association between gingival biotype and type of malocclusion, gender, and smoking status of patient.

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### Inclusion criteria

Inclusion criteria were as follows:

- Subjects who were between the age group 18 and 60 years.
- All subjects who had maxillary anterior teeth.

### Exclusion criteria

The following criteria were excluded from the study:

- Subjects with crowns or extensive restoration on maxillary anteriors.
- Pregnant or lactating females.
- Subjects on certain medication with their effect on periodontal soft tissues.
- Subjects who required antibiotic premedication before dental examination.
- Subjects who had moderate to severe gingival inflammation.

## Materials and Methods

Once the subjects met the inclusion criteria, they were enrolled in the study to determine the association between gingival biotype and type of malocclusion, gender, and smoking status of patient. Assessment of gingival biotype was done by William's periodontal probe.

The study included 100 males and 100 females. Based on the dental occlusion, the subjects were classified by the angle's classification of malocclusion as follows:

- Angle's Class 1 – Mesiobuccal cusp of maxillary permanent 1st molar occludes in the buccal groove of mandibular 1st permanent molar.
- Angle's Class 2 – Distobuccal cusp of the upper 1st permanent molar occludes in the buccal groove of lower 1st permanent molar.
- Angle's Class 3 – Mesiobuccal cusp of the maxillary 1st permanent molar occluding in the interdental space between the mandibular 1st and 2nd molar.

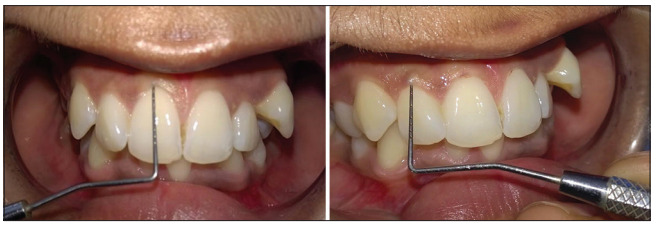
Subjects were also classified into three groups (current, former, and never smoked) based on their smoking habit.

- Current smoker has smoked ≥100 cigarettes in their lifetime and currently smoked.
- Former smoker has smoked ≥100 cigarettes in their lifetime and does not currently smoked.
- Non-smoker has not smoked ≥100 cigarettes in their lifetime and does not currently smoked.

Based on age, subjects were classified as:

- 18–30 years.
- 31–40 years.
- 41–50 years.
- 51–60 years.

Gingival biotype was evaluated in the present study based on the transparency of the periodontal probe through the gingival margin, while probing the sulcus at the midfacial aspect of the four incisors of the maxillary arch. If the probe could be seen, it was categorized as thin; if not, it was categorized as thick.[10]



## Results

A total of 200 participants, in the age range of 18–60 years, who were eligible and willing to participate were included in the study. Four maxillary incisors were examined in each participant for the gingival biotype. They were divided into groups based on various factors such as malocclusion, age, gender, and smoking status. The gingival biotype was then assessed using probe transparency method.

Table 1 shows the age of participants ranging from 18 to 60 years with a mean age of 29.42 years.

Assessment of gingival biotype using probe transparency method in types of dental malocclusions (Tables 2 and 3, Graph 1).

This table depicts the frequency distribution of different biotypes among different classes of malocclusion. Out of 456 teeth of 114 participants with Class I malocclusion, 213 had thin biotype and 243 had thick gingival biotype. In 52 subjects with Class II malocclusion, out of 208 teeth examined, 95 had thin biotype and 113 had thick biotype. Moreover, in 34 participants with Class III malocclusion, 88 had thick gingival biotype and 48 had thin biotype. In the present study, no statistically significant association was found between gingival biotype and molar relationship.

In a 2 × 3 contingency table denoting probe transparency absent/present in Class I/II/III malocclusion, the results were not statistically significant ("*P*" = 0.0582).

This graph shows the prevalence of gingival biotype in three groups. In Class I malocclusion, gingival biotype thickness was observed to thicker (53.3%) compared to thin (46.7%). Among Class II malocclusion, gingival biotype thickness was thick in 54.3% and thin in 45.7%. Moreover, among Class III malocclusion subjects, the prevalence of thick biotype was found (64.7%) when compared to thin form (35.3%). It is seen that gingival biotype has no significant association of thickness in relation to different molar relationships.

Assessment of gingival biotype was evaluated using probe transparency method in various age groups (Tables 4 and 5, Graph 2).

This table denotes the frequency distribution of different biotypes among various age groups. Among 18–30 years age group, out of 584 teeth, 339 had thick gingival biotype and 245 had thin gingival biotype. Among 31–40 years age group, out of 112 teeth, 63 had thick and 49 had thin gingival biotype. In 41–50 years individuals, 16 teeth were having thin and 16

**Table 1: Showing the age related statistics**

| Statistics | |
|---|---|
| **Age** | **???** |
| *n* | 200 |
| Mean | 29.42 |
| Median | 26.00 |
| Minimum | 18 |
| Maximum | 60 |

**Table 2: Showing gingival biotype count**

Crosstab

| Probe transparency | Count (percentage within malocclusion) | | | |
|---|---|---|---|---|
| | Malocclusion | | | Total |
| | Class I | Class II | Class III | |
| Absent (thick biotype) | 243 (53.3) | 113 (54.3) | 88 (64.7) | 444 (55.5) |
| Present (thin biotype) | 213 (46.7) | 95 (45.7) | 48 (35.3) | 356 (44.5) |
| Total | 456 (100.0) | 208 (100.0) | 136 (100.0) | 800 (100.0) |

**Table 3: Comparison using Chi-square tests**

Chi-square tests

| Test type | Value | df | Asymptotic significance (two sided) |
|---|---|---|---|
| Pearson Chi-square | 5.6849 | 2 | 0.05828 |
| Number of valid cases | 800 | | |

**Table 4: Showing gingival biotype age related count**

Crosstab

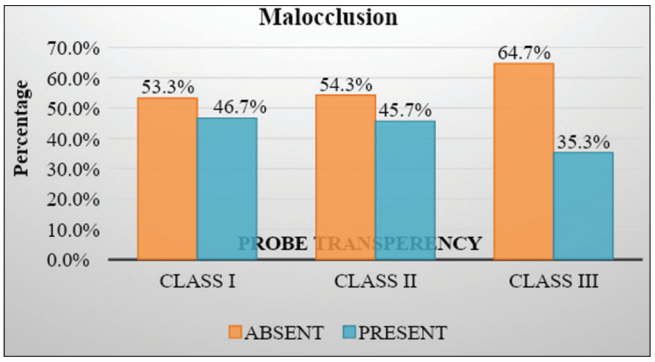
| Probe transparency | Count (percentage within age) | | | | |
|---|---|---|---|---|---|
| | Age (years) | | | | Total |
| | 18–30 | 31–40 | 41–50 | 51–60 | |
| Absent (thick biotype) | 339 (58) | 63 (56.3) | 16 (50) | 26 (36.1) | 444 (55.5) |
| Present (thin biotype) | 245 (42) | 49 (43.7) | 16 (50) | 46 (63.9) | 356 (44.5) |
| Total | 584 (100) | 112 (100) | 32 (100) | 72 (100) | 800 (100.0) |

**Table 5: Comparision using Chi-square test**

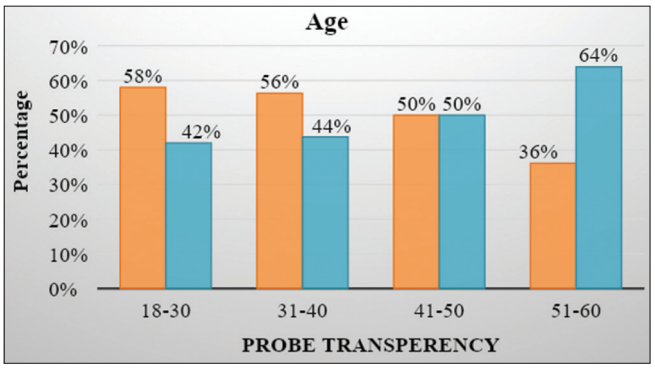
Chi-square tests

| Type of Test | Value | df | Asymptotic significance (two sided) |
|---|---|---|---|
| Pearson Chi-square | 12.9119 | 3 | 0.004831 |
| Number of valid cases | 800 | | |

had thick gingival biotype. Moreover, among 51–60 years age group, 46 teeth had thin biotype and 26 had thick gingival biotype.




**Graph 1: Graph showing type of malocclusion**




**Graph 2: Graph showing age related changes to gingival biotype**

In a 2 × 4 contingency table denoting association between probe transparency and distribution of age, there was a statistically significant association with a "*P*" = 0.004831.

This graph shows the prevalence of gingival biotype in four age groups. Among the 18–30 years age group, thicker gingival biotype was observed to be more prevalent (58%) than thin form (42%). Among 31–40 years of age group, 56% had thick gingival biotype. In 41–50 years age group, gingival biotype thickness was thick in 50% and thin in 50%. Moreover, among 51–60 years of age group, 36% of the teeth had thick gingival biotype and 64% had thin gingival biotype. As the age increased, the thickness of the gingiva decreased, which was found to be statistically significantly.

Assessment of gingival biotype using probe transparency method in both the genders (Tables 6 and 7, Graph 3).

This table depicts the frequency distribution of different biotypes among males and females. Out of 400 teeth in males, 262 had thick gingival biotype and 138 had thin gingival biotype. Moreover, in females, out of 400 examined teeth, 182 had thick gingival biotype and 218 had thin gingival biotype.

In a 2 × 2 contingency table denoting probe transparency absent/present and distribution among male/female, there was a statistically significant association with a "*P*" = 0.00001.

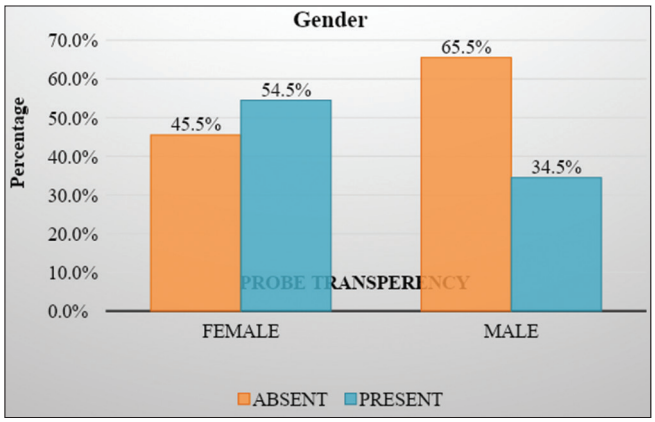
This graph shows the prevalence of gingival biotype among males and females. About 65.5% teeth in males had thick biotype ad 34.5% had thin gingival biotype. Whereas, 45.5%

**Table 6: Showing gingival biotype Count (percentage within gender)**

| Crosstab | | | |
|---|---|---|---|
| Probe transparency | Count (percentage within gender) | | |
| | Gender | | Total |
| | Female | Male | |
| Absent (thick biotype) | 182 (45.5) | 262 (65.5) | 444 (55.5) |
| Present (thin biotype) | 218 (54.5) | 138 (34.5) | 356 (44.5) |
| Total | 400 (100.0) | 400 (100.0) | 800 (100.0) |

**Table 7: Comparision using Chi-square test**

| Chi-square tests | | | |
|---|---|---|---|
| Type of test | Value | df | Asymptotic significance (two sided) |
| Pearson Chi-square | 32.3919 | 1 | 0.00001 |
| Number of valid cases | 800 | | |




**Graph 3: Showing gender distribution**

teeth in females had thick biotype and 54.5% had thin biotype. The results of the present study show a statistically significant difference between gingival biotype of males and females. It is significantly seen that gingival biotype is thin in female gender.

Assessment of gingival biotype using probe transparency method in non-smokers, current smokers, and former smokers (Tables 8 and 9, Graph 4).

This table depicts the frequency distribution of different biotypes among non-smokers, former smokers, and current smokers. Out of total 200 participants examined, 125 were non-smokers, 31 were former smokers, and 44 were current smokers. Among the non-smokers, 285 teeth had thick gingival biotype and 242 teeth had thin gingival biotype. Among the former smokers, 72 teeth had thick and 52 teeth had thin gingival biotype. Among current smokers, 114 teeth had thick biotype and 62 had thin biotype.

In a 2 × 3 contingency table denoting probe transparency absent or present in non-smokers, former smokers, and current smokers, a statistically significant association with $P = 0.008$ was noted.

This graph shows the prevalence of gingival biotype among non-smokers, former smokers, and current smokers. About 65% of current smokers, 58% of former smokers, and 52% of non-smokers had thick gingival biotype. The results of present study show a statistically significant association between gingival biotype and smoking status.

## Discussion

Gingival biotype plays an important role in determining the final esthetic outcome. Therefore during treatment planning, it is important to recognize differences in gingival tissue types. According to Claffey and Shanley (1986), there were two main types of gingival morphology, namely, the scalloped and thin or flat and thick gingiva. A gingival thickness of >2 mm was considered as thick tissue biotype and a gingival thickness of <1.5 mm was referred as thin tissue biotype.[11]

De Rouck *et al*. (2009) suggested that for comparing thin and thick gingival biotypes, a periodontal probe was used through the gingival margin. This is a visual method based on the transparency of the periodontal probe through the gingival margin while probing the buccal sulcus at the midfacial aspect of both central maxillary incisors. When the outline of the underlying periodontal probe was seen through the gingival margin, the gingival biotype was considered thin. The gingival biotype was thick in the other case. This methodology was originally developed for maxillary examinations.[12]

Cuny-Houchmand (2013) evaluated the relevance of the probe test in classifying the gingival biotype based on the transparency of the periodontal probe through the gingival margin while probing the sulcus, it demonstrates a weak percentile of agreement of gingival biotypes between maxillary and mandibular anterior teeth (57%). They concluded that the use of probe transparency through the gingival margin is an accurate and simple method for gingival biotype diagnosis to discriminate a thin gingival from a thick gingival.[13]

Gingival biotype is essential, especially before orthodontic tooth movement because it defines the soft and hard tissues surrounding teeth. It is observed that during orthodontic treatment, alteration of mucogingival dimensions may occur. Therefore, it becomes imperative to assess the association between dental malocclusion and gingival biotype.

In this study, gingival biotype was correlated to the type of malocclusion and before orthodontic tooth movement, a statistically insignificant result with $P = 0.058$ was obtained, which corresponded to the results obtained by Zawawi *et al*. who also found that there was no significant association between gingival biotype and dental malocclusion and there is lack of literature in relation to these parameter to state further correlation between them.[14]

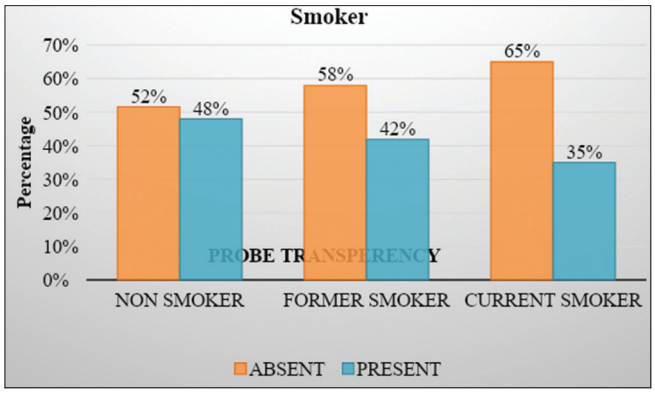
In the present study, 200 healthy subjects between the age groups of 18 and 60 were examined for the evaluation of gingival biotype with mean age group was of 27.8 and the results suggested that younger age group had thicker gingiva than the older age group. Similar results were observed by

**Table 8: Showing Count (percentage within smoker)**

| Crosstab | | | | |
|---|---|---|---|---|
| Probe transparency | Count (percentage within smoker) | | | |
| | Smoker | | | Total |
| | Non-smoker | Former smoker | Current smoker | |
| Absent (thick biotype) | 258 (51.6) | 72 (58.1) | 114 (64.8) | 444 (55.5) |
| Present (thin biotype) | 242 (48.4) | 52 (41.9) | 62 (35.2) | 356 (44.5) |
| Total | 500 (100.0) | 124 (100.0) | 176 (100.0) | 800 (100.0) |

**Table 9: Comparision using Chi-square test**

| Chi-square tests | | | |
|---|---|---|---|
| Type of test | Value | df | Asymptotic significance (two sided) |
| Pearson Chi-square | 9.5368 | 2 | 0.008494 |
| Number of valid cases | 800 | | |




**Graph 4: Distribution of smokers**

Vandana and Savitha (2005) who suggested that younger age group had thicker gingiva but less width than the older age group as the changes in the oral epithelium were caused by the age-related thinning of epithelium and diminished keratinization. Kolte *et al*. (2005) also stated that the biotype for young subjects was thicker as compared to the older one. Bhatia *et al*. (2014) also observed that as age increased, the prevalence of thinner biotype also increased.[1,15,16]

In the present study, when the evaluation of gingival biotype was done on the basis of gender, the biotype was thinner in females as compared to males. When the statistical evaluation was done for the gender, the significant association with $P = 0.00001$ was obtained. Similar to the present study, Muller *et al*. (1997) and Vandana *et al*. (2005) showed that female volunteers had significantly thinner gingival biotype than males.[1,8] Eghbali *et al*. (2009) documented the presence of thin scalloped gingival forms in female sample whereas a broad band of keratinized tissues and thick flat biotype for the male sample.[8] Bhatia *et al*. (2014)[17] also observed that the biotype was thicker in males than females.[16]

When the thickness of gingival biotype was evaluated in smokers and non-smokers, a statistically significant result was obtained. The biotype was thinner in non-smokers as compared to smokers. The increase in local temperature and the by-product from tobacco oxidation induces and increases the thickness of stratum basale, therefore, increasing the thickness of gingival epithelium. In accordance to the present study, Villar *et al*. (2003) also showed that the gingival biotype was thinner in non-smokers whereas stratum basale thickness was more in smokers.[14,18]

## Conclusion

In accordance to the present study, Villar et al. (2003) also showed that the gingival biotype was thinner in non-smokers whereas stratum basale thickness was more in smokers.

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