

# The Relationship Between Gingival Biotypes and Dentopapillary Complex: An Observational Study

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## Abstract

**Background and Aim:** Gingival biotype is a principal component in restorative and implant procedures, especially in the aesthetic region. Immediate determination of the gingival biotype by the clinician could lead to a more successful outcome, especially during implant placement in the aesthetic zone. The aim of this study was to investigate a possible relationship between gingival biotypes and gingival thickness, crown length (CL), crown width (CW), papillary height (PH), and papillary width (PW).

**Materials and Methods:** In this cross-sectional study, 50 subjects were selected who had all anterior teeth in the upper and lower jaws with a healthy periodontium and no attachment loss. Gingival thickness was recorded based on the transparency of a periodontal probe. CL, CW, PH, PW, area of the facial papilla (AP), and facial surface area of anterior teeth (AT) from canine to canine were measured and analyzed using descriptive statistics and t-test in SPSS 16.0 software.

**Results:** When comparing thin and thick gingival biotypes, the mean CL (8.3 mm vs. 8.76 mm;  $P=0.14$ ), CW (7 mm vs. 7.25 mm;  $P=0.13$ ), PH (2.86 mm vs. 2.99 mm;  $P=0.49$ ), and PW (2.86 mm vs. 2.99 mm;  $P=0.04$ ) were lower in the thin gingival biotype group. The AP and AT were smaller in the thin gingival biotype group but the difference with the thick gingival biotype was not significant ( $P=0.22$  and  $0.07$ , respectively).

**Conclusion:** According to the results, comparable dentopapillary dimensions can be expected in thick and thin gingival biotypes. No association was detected between the dentopapillary complex and gingival biotypes.

**Key Words:** Periodontium, Dental Implantation, Dentistry

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## Introduction

Gingival biotype is a principal component in restorative and implant procedures, especially in the aesthetic region [1,2]. There are several gingival biotypes according to the literature, which are generally divided into two main categories including thick and thin biotypes [3]. The thin gingival biotype, unlike the thick

biotype, is more susceptible to periodontal recession after immediate implant placement, incomplete root coverage after root coverage procedures, and soft tissue loss in case of periodontal inflammation [4]. This type of periodontium is also more prone to ridge resorption after tooth extractions and instability of the interdental papilla dimensions

after immediate implant placement. The soft tissue reflects the underlying bony structures; in patients with a thin tissue biotype, lack or deficiency of the buccal bone plate is not unexpected [5].

As mentioned earlier, correct biotype estimation is essential prior to implant placement, especially in the aesthetic area [1,2]. The simplest method has been described by Kan et al [6] by observing the transparency of a periodontal probe through the gingival margin prior to implant treatment in the upper anterior region. Furthermore, it has been suggested that different gingival biotypes are associated with different tooth shapes [7,8]. The relation between the appearance of the gingival papilla, crown shape, and gingival thickness also has been addressed in several studies [2,3,9,10]. Stein et al [4] showed that the crown width (CW)/crown length (CL) ratio and the gingival width could be considered as a surrogate parameter for the gingival thickness at the cemento-enamel junction (CEJ). Malhotra et al [9] claimed that the CL is the best unique determinant of the gingival biotype. Fischer et al [3] found a similarity between the soft tissue dimensions and gingival biotypes.

Finding any relationship between the appearance of the teeth and the papilla and the biotype of the periodontium could be helpful in the immediate determination of the gingival biotype by the clinician before establishing a treatment plan, which leads to a more successful outcome, especially during implant placement in the aesthetic zone. The aim of the present study was to assess the relationship between the gingival thickness and the dentopapillary complex dimensions.

### Materials and Methods

This cross-sectional study included 50 subjects with a healthy periodontium and no attachment loss, who referred to the Department of Periodontology of School of Dentistry, Shahid Sadoughi University of Medical Sciences, Yazd, Iran, in 2017. The sample size was estimated according to similar previous studies [9,10]. Participants were screened for eligibility, and the following exclusion criteria were applied:

- Clinical signs of periodontal disease with a probing depth of more than 3 mm,
- Lack of the presence of all anterior teeth in the upper and lower jaws,
- Coronal restoration or filling at the incisal edge of maxillary teeth,
- Taking any medication affecting soft tissue health,
- Pregnant and lactating females.

After a thorough explanation of the study, each participant signed an informed consent form. Eligible subjects were greeted and seated in an appropriate position on a dental chair unit. The parameters of the six upper anterior crowns and their interproximal papillae were measured using a Williams probe (Williams PW, Hu-Friedy, Chicago, IL, USA). The gingival biotype was also determined. All measurements were made by a single examiner. The gingival thickness was categorized into thin and thick biotype groups according to the probe's transparency at the mid-facial area of central incisors. If the outline of the periodontal probe could be seen through the gingiva, the biotype was categorized as thin; if the probe was not observable, the biotype was categorized as thick.

The CL was determined as the distance between the incisal edge and the zenith of the gingival margin, or if discernible, the CEJ (in abnormal cases that met our inclusion criteria, e.g., over eruption, anomalies, etc.).

Subsequently, the CL was divided into three equal parts, and the CW was measured between the cervical and the middle parts of the crown. The papillary height (PH) was calculated as the distance between the tip of the papilla and the line connecting the mid-facial portion of the soft tissue margins of adjacent teeth.

The papillary width (PW) was assessed at the base of the papilla between two adjacent teeth. The area of the facial papilla (AP) and the facial surface area of anterior teeth (AT) from canine to canine were also measured. The intra-examiner repeatability of the clinician who performed the examinations was analyzed; 10 subjects were reexamined one week after the first recording by the same clinician. The

intraexaminer repeatability was evaluated using Pearson's correlation coefficient for all continuous variables.

All total continuous variables, mean values, and standard deviations (SD) were calculated. Statistical analysis was performed using SPSS 16.0 software (SPSS Inc., Chicago, IL, USA). Unpaired two-sample t-test was used after testing the normal distribution of the data.  $P \leq 0.05$  was considered as statistically significant.

The study protocol was evaluated and approved by the Ethics Committee of Shahid Sadoughi University of Medical Sciences, Yazd, Iran (IR.SSU.REC.1395.142).

## Results

Fifty subjects with a healthy periodontium participated in this study. Nine subjects (18%) were determined as thin and 41 subjects (82%) were determined as thick biotype periodontium. The mean CL was 8.76 mm for thick periodontium and 8.4 mm for thin periodontium. The mean CW was 7.25 mm for thick periodontium and 7 mm for thin periodontium. The mean PH was 2.99 mm for thick periodontium and 2.86 mm for thin periodontium. The mean PW was 7.39 mm for thick periodontium and 6.91 mm for thin periodontium. The mean AT was 63.78 mm<sup>2</sup> for thick periodontium and 58.86 mm<sup>2</sup> for thin periodontium. The mean AP was 11.04 mm<sup>2</sup> for thick periodontium and 9.93 mm<sup>2</sup> for thin periodontium. No statistically significant correlation could be detected between the dentopapillary complex dimensions and the gingival biotype ( $P > 0.05$ ; Table 1).

## Discussion

Gingival biotype has an important role in several dental procedures including dental implant placement and operative dentistry [1,9]. The soft tissue reflects the status of the underlying bony structures; therefore, evaluation of the soft tissue could determine the need for soft and hard tissue augmentation to avoid probable complications [9].

Determination of the gingival biotype through a surrogate parameter would be useful for

treatment planning, especially in the aesthetic zone [4].

Several methods have been used to distinguish thick and thin gingival biotypes; one of them is the observation of the transparency of a periodontal probe through the gingival margin [11]. However, this method has been identified as an invasive approach. Another method is the use of an ultrasonic device, which is considered as a non-invasive method but it has some shortcomings such as unavailability of the instrument and non-reliable results when the thickness of the gingiva is more than 2-2.5 mm. Therefore, observation of the transparency of a periodontal probe can be considered as an appropriate approach to determine the gingival biotype [4,9]. De Rouck et al [11] stated that if the outline of the periodontal probe can be observed through the gingival margin, the biotype is categorized as thin; otherwise, it is categorized as the thick gingival biotype [11]. The result of the present study indicates that the CL was greater for the thick biotype compared to the thin biotype. Also, the CW, PH, and PW were greater in the thick gingival biotype group. In addition, the AP and the AT were greater in the thick gingival biotype. No correlation was detected between the dentopapillary complex and the gingival biotypes.

A study by Fischer et al [3] in 2014 did not show any correlation between different biotypes and supracrestal gingival height or between the gingival biotypes and the CW/CL ratio. The results of the cited study are in accordance with our outcomes regarding the similarity between the soft tissue biotypes and the crown shape.

Also, in 2012, Anand et al [5] evaluated the correlation of gingival biotypes with gender and tooth morphology; they described the lack of a significant relationship between the CW/CL ratio and gingival thickness, which is in accordance with earlier studies including research by Eger et al [12] in 1996 and De Rouck et al [11] in 2009.

In contrast to our results, in 2014, Malhotra et al [9] confirmed the correlation of different gingival biotypes with the dentopapillary complex dimensions. According to their finding,

there is a highly significant correlation between the gingival biotype and the CL and the AP [9]. In 2013, Lee et al [13] showed that thin biotypes are susceptible to gingival recession. Also, the AP and the papillary length (PL) were respectively the first and the second determinants of the gingival biotype in the studied population [13].

We should state some factors which influenced our results, and in fact, are the limitations of our study. Firstly, subjects with more than 3 mm of probing depth were excluded from the study, which might result in the omission of very thick biotype cases, leading to case selection. Another influential factor is the tooth position which was not considered in our study. The present

**Table 1.** Comparative analysis of mean values of the related parameters in the two study groups

Gingival biotype	Thin		Thick		P-value
	Mean	Std. Deviation	Mean	Std. Deviation	
<b>Crown length</b>	8.40 mm	0.53	8.76 mm	1.05	0.14
<b>Crown width</b>	7.00 mm	0.41	7.25 mm	0.52	0.13
<b>Papillary height</b>	2.86 mm	0.47	2.99 mm	0.66	0.49
<b>Papillary width</b>	6.91 mm	0.58	7.39 mm	0.69	0.04
<b>Area of papilla</b>	9.93 mm <sup>2</sup>	2.17	11.04 mm <sup>2</sup>	3.10	0.22
<b>Area of crown</b>	58.81 mm <sup>2</sup>	6.05	63.78 mm <sup>2</sup>	10.19	0.07

study was not evaluated in a case-control manner and was done in a subpopulation without group matching; therefore, it is recommended to evaluate the association between the gingival biotypes and the dentopapillary complex with group matching and using a case-control design.

### Conclusion

The results of the present study revealed that comparable dentopapillary dimensions can be expected in thick and thin gingival biotypes. No association could be confirmed between the dentopapillary complex and the gingival biotype.

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