

## ORIGINAL RESEARCH

# Comparative Assessment of Alveolar Bone Thickness and Its Influence on Soft Tissue Thickness Using CBCT and Transgingival Probing: A Pilot Study

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## ABSTRACT

**Background:** Assessment of periodontal biotype is an important element in clinical practice. The influence of gingival thickness has been documented in various applications including non-surgical periodontal therapy, mucogingival therapy, guided tissue regeneration, crown lengthening and implant dentistry. Differences in the gingival and osseous architecture have been shown to exhibit significant impact on the outcome of restorative therapy. Many methods have been tried in assessing periodontal biotype, and it is proved that probe visibility is not a reliable indicator in assessing periodontal biotype. Therefore the present study was conducted to evaluate the association between alveolar bone thickness and overlying soft tissue by comparing the values obtained by CBCT and transgingival probing.

**Aim:** The present study is to evaluate the association between alveolar bone thickness and overlying soft tissue thickness by correlating information obtained by transgingival probing and CBCT.

**Materials and Methods:** Ten systemically healthy patients within the age group of 20-40 were recruited from the outpatient department of periodontics Sri Sai College of Dental surgery Vikarabad. Examination of the subjects included in the study begun with the measurement of clinical parameters like gingival recession and attachment loss. To assess the gingival thickness clinically, transgingival probing was done in lower anteriors. Hard and soft tissue measurements were obtained from cross sectional CBCT scans in lower anterior region. Soft tissue values obtained from CBCT were compared to the values of transgingival probing to test the reliability of clinical method. Hard tissue thickness was correlated with the soft tissue to find out the influence of gingival biotype on labial bone thickness.

**Results:** No statistically significant difference was found between the labial bone thickness and gingival thickness. Variable results were found when gingival thickness was assessed using CBCT and transgingival probing.

**Conclusion:** Within the limitations of this study, it can be concluded that gingival thickness varies according to the underlying bone morphology, position of tooth in the arch. Soft tissue CBCT can be considered as one of the best non-invasive method in determining the thickness of the gingival tissue and labial bone.

**KEYWORDS** transgingival probing, CBCT, alveolar bone thickness, soft tissue thickness

## INTRODUCTION

Among all the factors which impedes the success of dental treatment, gingival thickness plays a major role when considering mucogingival surgeries and implant placement.<sup>1</sup> The term “periodontal biotype” was introduced to describe the thickness of the gingiva in a bucco-lingual dimension (thick or thin).<sup>2</sup> Early, in the year 1923, Hirschfield observed a thin alveolar contour and made an assumption that a thin bony contour was probably accompanied by thin gingival form.<sup>3</sup> In 1969 Ochsensbien and Ross specified that gingival biotypes are of two types - they are scalloped

and thin or flat and thick gingiva. They proposed that the contour of the gingiva closely follows the contour of the underlying bone.<sup>4</sup> In 1986, Claffey and Shanley defined thin tissue biotype as a gingival thickness of  $\leq 1.5$  mm, and the thick tissue biotype was referred to as having a tissue thickness  $\geq 2$  mm.

Many methods (both invasive and noninvasive) have been used to evaluate the thickness of facial gingival and other parts of the masticatory mucosa. These methods include conventional histology on cadaver jaws, injection needles, transgingival probing, histologic sections, cephalometric radiographs, probe transparency, ultrasonic devices and CBCT.<sup>5</sup> Previous clinical studies have

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Fig. 1 Transgingival probing.

demonstrated that probe transparency is more subjective assessment and may lead to errors. Even though transgingival probing is considered to be the best method to assess gingival thickness, this procedure is invasive and requires administration of local anaesthesia (Fig. 1). To overcome this disadvantage Januario and Barriveira in the year 2008 introduced a soft tissue CBCT technique, in which soft tissue images can be obtained efficiently by keeping the cheeks and lips retracted.<sup>4</sup>

To the best of our knowledge, there are no studies comparing this new technique with transgingival probing, hence the aim of the present study is to comparatively assess the labial bone thickness and its influence on overlying soft tissue thickness using soft tissue CBCT and transgingival probing.

## MATERIALS AND METHODS

The study group consists of individuals attending to the outpatient Department of Periodontics, Sri Sai College of Dental Surgery. The duration of the study spanned over a period of 2 months i.e., January 2015 to February 2015. Ethical clearance was obtained from Institutional Ethics Committee Board (EC Board number: 497/sscds/IRB-E/OS/2015). The study included 10 patients both males and females within the age group of 20–40 years. Informed consent was obtained from the patients, CBCT scans were obtained from and images were obtained on the computer using software. Patients were seated with cheek retractors in their mouth, and they were asked to keep their tongue at the lower level, so that all the soft tissues will be positioned away from the gingival margin. Their heads and chin were stabilised for CBCT scan. All the scans were obtained from 33–43 regions. Individual teeth were assessed radiographically. A point was marked at the crest of alveolar bone then a line of 2 mm was drawn below it (Fig. 2). Both the hard and soft tissue measurements (Fig. 3) were taken at two points at each tooth for all the patients. Hard tissue thickness was assessed as a distance from tooth (A) to the facial bony crest (B) and soft tissue assessment was done as a distance from the outer bony crest to the gingival surface. After CBCT measurements were obtained, transgingival probing was done at the same sites for 6 mandibular teeth.<sup>31–33,41–43</sup>

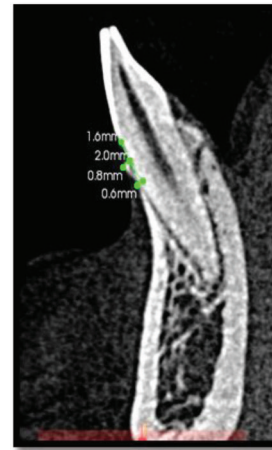


Fig. 2 CBCT measurements of alveolar bone.



Fig. 3 CBCT measurements of soft tissue.

## STATISTICAL ANALYSIS

Pearson's correlation coefficient was done to find out the correlation between hard and soft tissue thickness. Unpaired t test was done to find out whether there was any statistically significant difference between the values obtained from transgingival probing and soft tissue CBCT. P value <0.05 was considered to be statistically significant.

## RESULTS

The study included 30 systemically and periodontally healthy subjects. A total of 60 teeth from lower anterior region were assessed, measurements done by both the methods are illustrated in the graphs (Figs. 4, 5).

1. It was found that 20 teeth had thin gingival biotype i.e. <0.8 mm and it was also seen that those teeth had labial bone thickness of less than 1mm. There was no statistically significant difference between the hard and soft tissue thickness.
2. P value was found to be less than 0.05 at three sites when measurements of hard and soft tissues

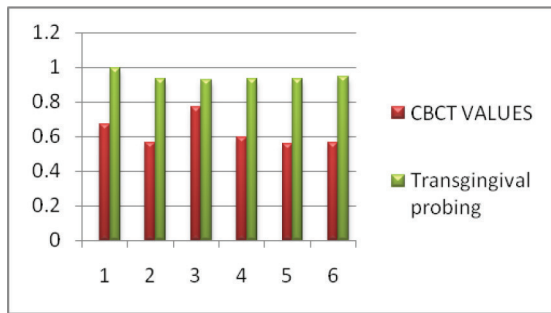


Fig. 4 Values obtained from CBCT and transgingival probing.

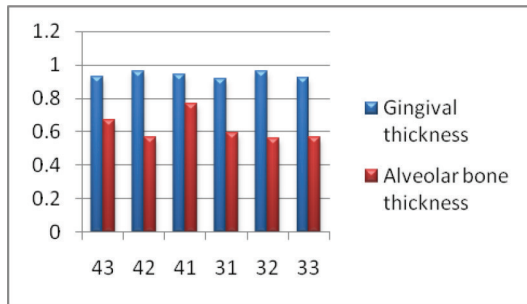


Fig. 5 Correlation between alveolar bone thickness and gingival thickness.

were compared by CBCT and transgingival probing method.

## DISCUSSION

Relationship between maxillary labial bone and gingival biotype have been described in many studies.<sup>5</sup> Oschenbein & Ross, in 1969<sup>6</sup> and Becker et al. in 1997<sup>7</sup> postulated that gingival phenotypes correlate with bone-crest contours, suggesting that there are three main types of gingival architecture – flat, scalloped and pronounced scalloped – which are associated with different thicknesses of keratinized mucosa. It has been known that the clinical appearance of healthy gingiva differs from subject to subject and even among different tooth types. Many features are genetically determined, and others seem to be influenced by tooth size, shape and position and biological phenomena such as gender, growth and age. Many authors have discussed the importance of thick vs. thin gingiva in restorative treatment planning and their different pathological responses when subjected to inflammatory or traumatic insult.

Thick gingival tissue represents the periodontal health with underlying thick osseous forms. Whereas thin gingival tissue is delicate, friable and translucent with very minimal amount of attached gingiva. The osseous architecture associated with such gingival biotype is mostly characterized by fenestration and dehiscence.

Since studies have concluded that the thickness of the gingiva plays a vital role in development of mucogingival problems and in the success of treatment for

gingival recession<sup>8</sup> and wound healing<sup>9</sup> hence assessment of gingival thickness is relevant to clinical periodontics.

Although several studies have previously investigated the thickness of palatal mucosa by transgingival probing, only a few reported the thickness of facial gingiva using the soft tissue CBCT method, the present study was undertaken to evaluate the association between soft tissue thickness of mandibular anteriors and underlying bone using transgingival probing and soft tissue CBCT.

In the present study, analysis of gingival thickness was done at 2 points for each tooth. Among the 60 teeth examined, 20 teeth had a thin gingival biotype. The variable results can be attributed to the factors which affect the gingival thickness such as age, gender, crown form, and location of the teeth in the arch. Results of the current study are in accordance with the study done by Stellini et al.<sup>10</sup> in the year 2011 to evaluate the relationship between different tooth shapes and periodontal phenotype, which showed that with varying shapes, height and thickness of keratinized mucosa changes. It was also noticed that gingival thickness varied along with the underlying bony architecture. Cook et al.<sup>11</sup> in the year 2011 concluded that periodontal biotype is significantly related to labial plate thickness, alveolar crest position, keratinised tissue width, gingival architecture and probe visibility but unrelated to facial recession.<sup>12</sup> To the best of our knowledge this is the first study comparing ST-CBCT with transgingival probing. Even though results have concluded that ST-CBCT is a beneficial method for measuring both hard and soft tissue thickness, there are few limitations with this technique. It is a quantitative analysis and cannot differentiate between healthy and inflamed gingiva, various types of soft tissues like epithelium and connective tissue cannot be distinguished.

## CONCLUSION

Within the limitations of the present study it can be concluded that gingival thickness varies according to the underlying bone morphology. On comparison of transgingival probing with ST-CBCT, ST-CBCT is non-invasive and gives much accurate values without overestimation. One of limitation in using ST-CBCT is, it is cost effective and may not be affordable by all the patients. However, no studies in the literature can be retrieved to support or refute this finding and hence further clinical trials with larger sample size are required to confirm the above findings.

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