Original Article

Comparative Evaluation Of Measurement Of Gingival Thickness Using Different Techniques

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Abstract

Introduction: Gingival thickness is a crucial factor that is that is considered throughout the process of treatment. The techniques for measurements of gingival thickness are mainly divided into two categories qualitative and quantitative measurements. The periodontal probe method is the most commonly used in clinical practice. In recent years CBCT can not only be used to evaluate the hard tissue but also to assess the thickness of soft tissue with some modifications in technique.Objectives:The objective of this study was to compare and evaluate gingival thickness using five different measurement techniques. Methodology: A total of ten patients were included in this study. The procedure was explained to each patient and informed consent was obtained. Measurements of gingival thickness were made in the maxillary central incisors. The individuals in the study were all in good general health and had no crowding of teeth. The gingival thickness was measured using five distinct methods named as Transparency Method, Paralleling technique, Transgingival Probing, CBCT method and Digital superimposition method. Patients were categorized into five groups based on different techniques of measurement of gingival thickness.Results:One-way ANOVA (Analysis of variance) is a statistical method for comparing the means of two or more samples. In our study One Way, ANOVA test showed that there is no statistical difference between all the techniques. Conclusion: No significant difference between different techniques. However, CBCT has come out to be most effective in terms of being non-invasive method and accuracy. The most expensive method was Digital superimposition followed by CBCT and the most invasive method was transgingival probing.

Keywords: Gingival thickness, Gingival Biotype,

Introduction

The effectiveness of restorative therapies may be influenced by various tissue biotypes. Thus, gingival thickness appears to be important. According to studies, the so-called "thick-flat" gingival biotype is a predictor of implant aesthetic success (Kois, 2004) and predictable outcomes after recession coverage (Baldi et al. 1999), In 1969, Ochsenbein & Ross identified flat and heavily scalloped gingival morphology as the two primary categories. According to the investigators, tapering tooth forms were connected with scalloped gingiva, whereas square tooth forms were associated with flat gingiva. The authors also suggested that the alveolar bone under the gingiva closely resembles the gingival shape. Later, Seibert & Lindhe adopted the phrase "periodontal biotype" to describe how the gingiva was either thin-scalloped or thick-flat. In a study by De Rouck et al., women made up one-third of the study population and exhibited the thin gingival biotype most frequently, whereas males made up two-thirds of the study population and exhibited the thick gingival biotype most frequently. Weisgold found that there was a higher prevalence of recession in those with thin, scalloped gingiva. There are three types of scalloped gingiva: high, regular, and flat.[1] . In a healthy periodontium, the alveolar crest replicates the scallop of the cementoenamel junction (CEJ) and is situated about 2 mm further apically. There is more tissue coronal to the interproximal bone than the facial bone in the normal and high scalloped gingival forms. As a result, gingival loss following a tooth extraction is more likely in people with more scalloped gingiva. [2]

Various periodontal procedures can all be affected by the gingival biotype. Even after a nonsurgical approach for the periodontal treatment – Phase 1 therapy , those with thin gingival biotypes showed more gingival recession.[3]

To evaluate soft tissue thickness around teeth and implants, various approaches have been described. One of the Commonest approach is through the examination. It Can easily be traced with naked eyes.[4] .Visual evaluation of probe transparency through the gingival sulcus[5], cone beam computed tomography (CBCT)[6], nonionizing ultrasonography [7], horizontal transmucosal probing, or use of a calliper for measuring thickness after extraction of tooth [8] are the methods to evaluate gingival thickness. Even various digital approaches have been discovered. CBCT has been a boon to the dentistry. Superimposing the DICOM files of CBCT along with StereoLithography (STL) files, thus provide ease of assessment of examination of the biotypes at various locations[9].
Therefore, the goal of this study is to assess the dependability and duplicability of gingival thickness measurement using different techniques.

Methods and Materials

This entire study was done with 10 periodontally healthy patients. The patients included in this study were within an age group of 18–60 years visiting the department of periodontology and implantology of our institute between August 2022 & September 2022. The study protocol was explained to patients and written informed consent was obtained from them.
Transparency Method (Figure 2):
Biotypes of gingiva were classified grounded on the distinguishability of a periodontal probe. The gingival biotype was classified as "thick" when the distinguishability of the probe and the tissue is difficult. In contrast, gingiva was classified as "thin" when the probe can be differentiated. The probe used for this study is - University of North Carolina-15 (UNC-15) periodontal probe.
2.2
Paralleling technique(Figure 3):
Each patient's radiograph was taken perpendicular to the axis of the crown of the central maxillary incisors, using the paralleling technique with a periapical film holding system , labial to the gingiva. A radiopaque material was placed on the labial side of the gingiva. To keep the lip away from touching, a lip retractor was used. Before placing a radiopaque material, the air was blown over the attached gingiva, as saliva could displace it before the exposure. A composite material was kept 3mm apically from the gingival margin at the long axis of the central incisor. Gingival thickness was considered thick when >1.5mm and gingival thickness was considered as thin when <1.5mm.

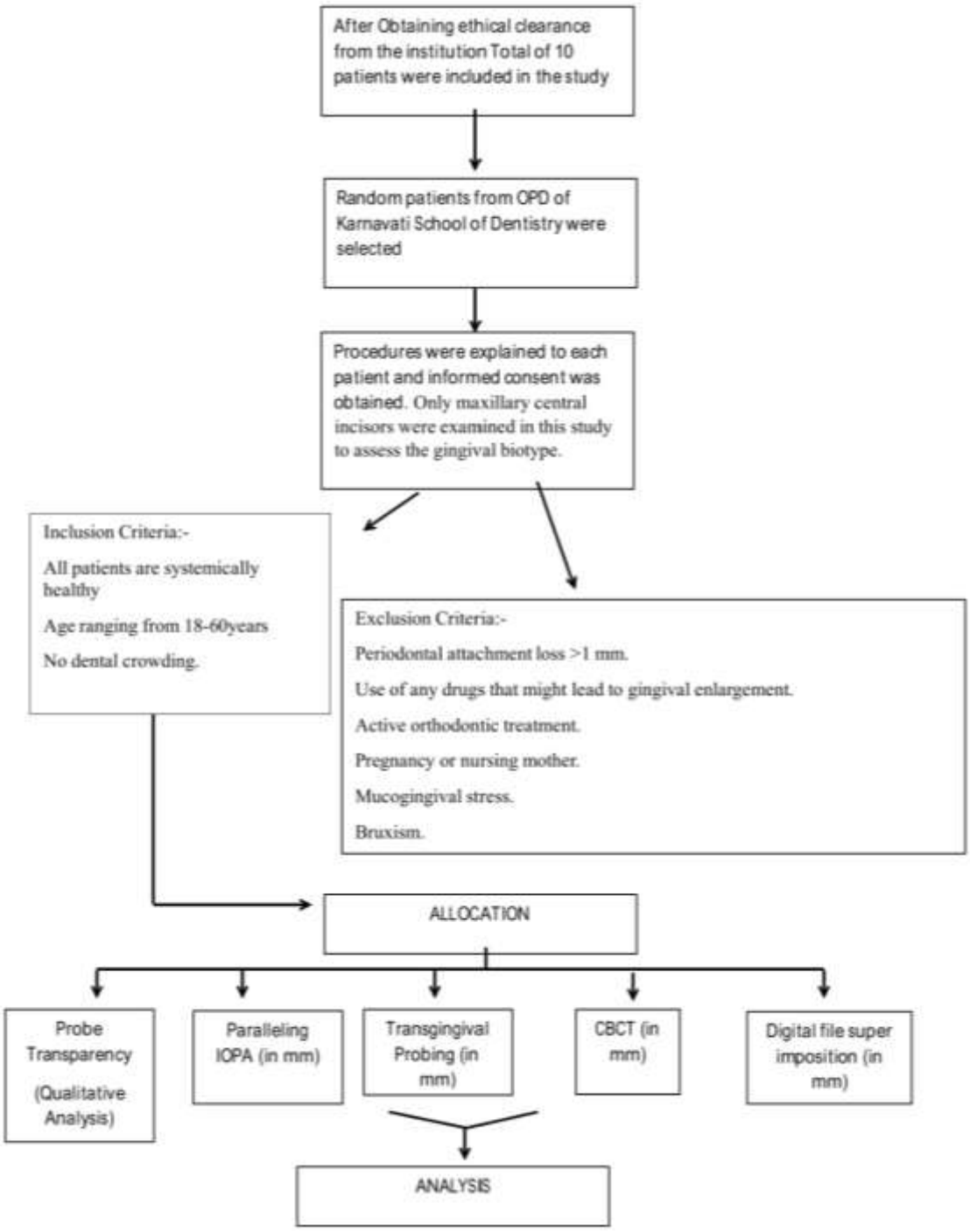
After Obtaining ethical clearance from the institution Total of 10 patients were included in the study
Random patients from OPD of Karnavati School of Dentistry were selected
Procedures were explained to each patient and informed consent was obtained. Only maxillary central incisors were examined in this study to assess the gingival biotype.
Inclusion Criteria:-
All patients are systemically healthy
Age ranging from 18-60years
No dental crowding.
Exclusion Criteria:-
Periodontal attachment loss >1 mm.
Use of any drugs that might lead to gingival enlargement.
Active orthodontic treatment.
Pregnancy or nursing mother.
Mucogingival stress.
Bruxism.
ALLOCATION
Probe Transparency (Qualitative Analysis)
Paralleling IOPA (in mm)
Transgingival Probing (in mm)
CBCT (in mm)
Digital file super imposition (in mm)
ANALYSIS

Figure 1

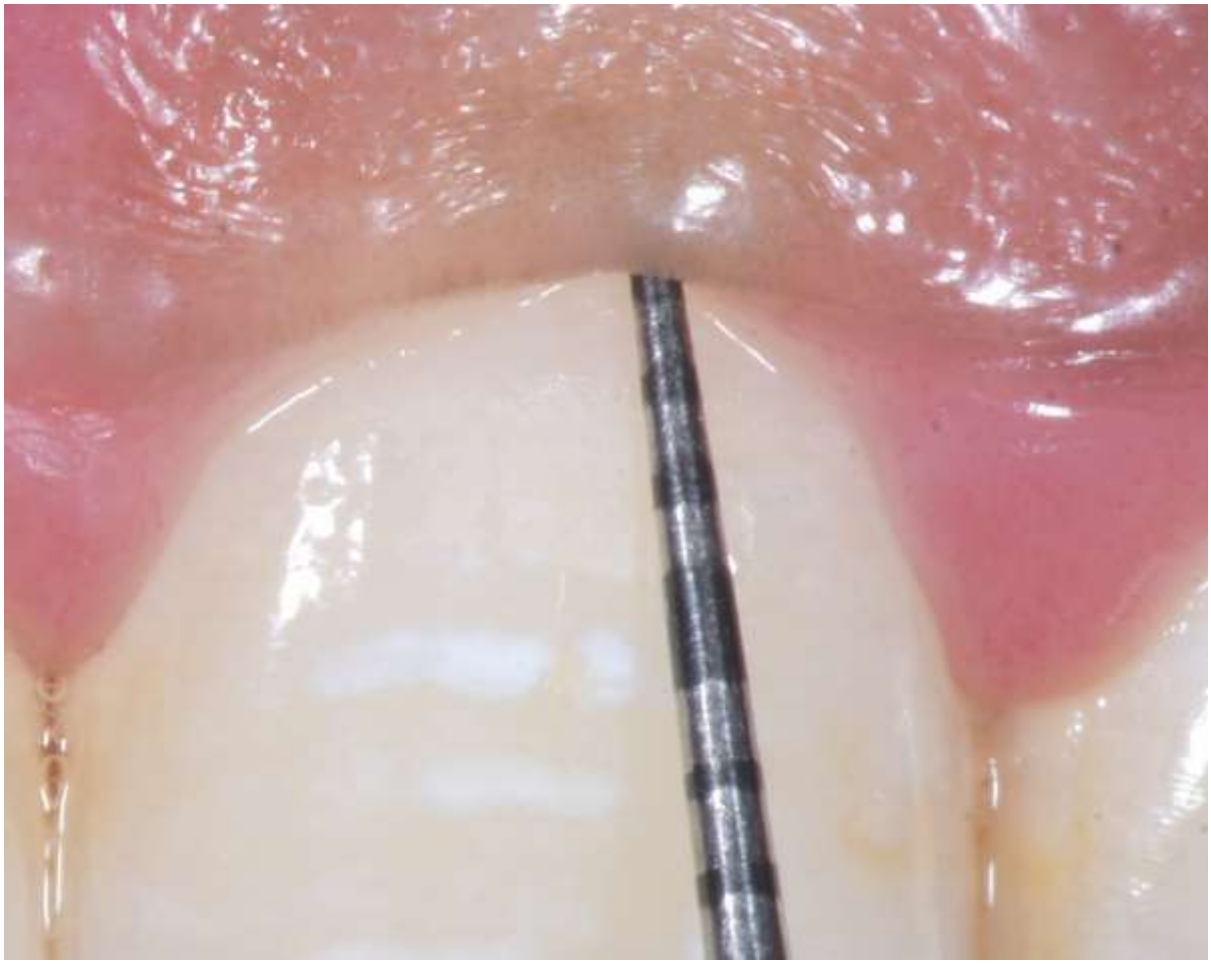

Figure 2

2.3

Transgingival Probing (Figure 4):

A 15 K endodontic file was taken. The file was then placed 3 mm apically to the gingival margin, and into the bone until a hard surface was felt. It was placed perpendicularly. The silicon disc- stopper of the endodontic file was pressed and secured with a drop of cyanoacrylate adhesive. Marking was done at k file and it was measured with a digital calliper. Gingival thickness was considered thick when >1.5mm and gingival thickness was considered as thin when <1.5mm.

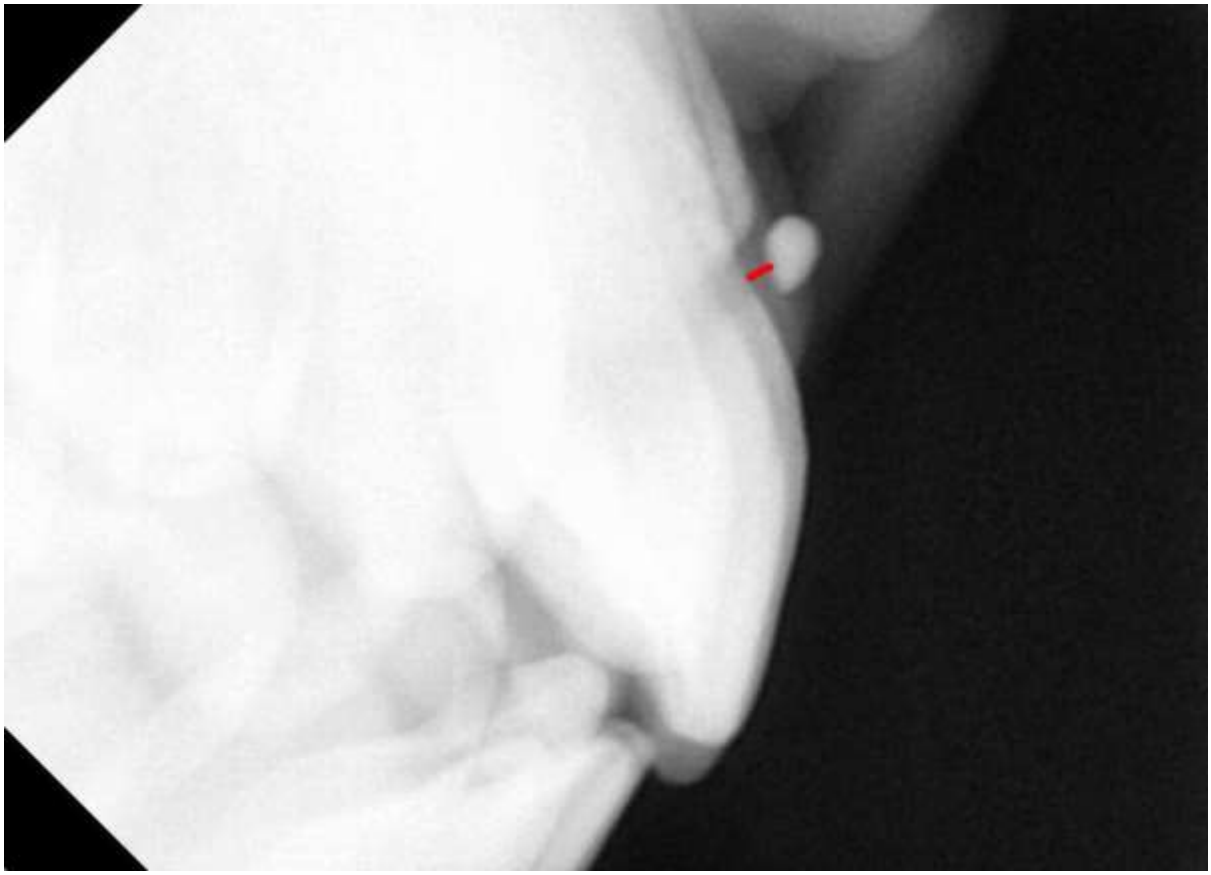

Figure 3

2.4

CBCT method(Figure 5):

With the Newtom Italy CBCT device, cone-beam computed tomography scans were carried out. The scanning was the proceeded by using the standardized protocols. Also the parameters of CBCT such as - exposure at 80 kVp in 3.5 mA.. The voxel size was 75 m, the FOV was 8x8 cm. Also, the scans obtained were of stcaked slices of approximately 1 mm thickness. Gingival thickness was considered thick when >1.5mm and gingival thickness was considered as thin when <1.5mm.

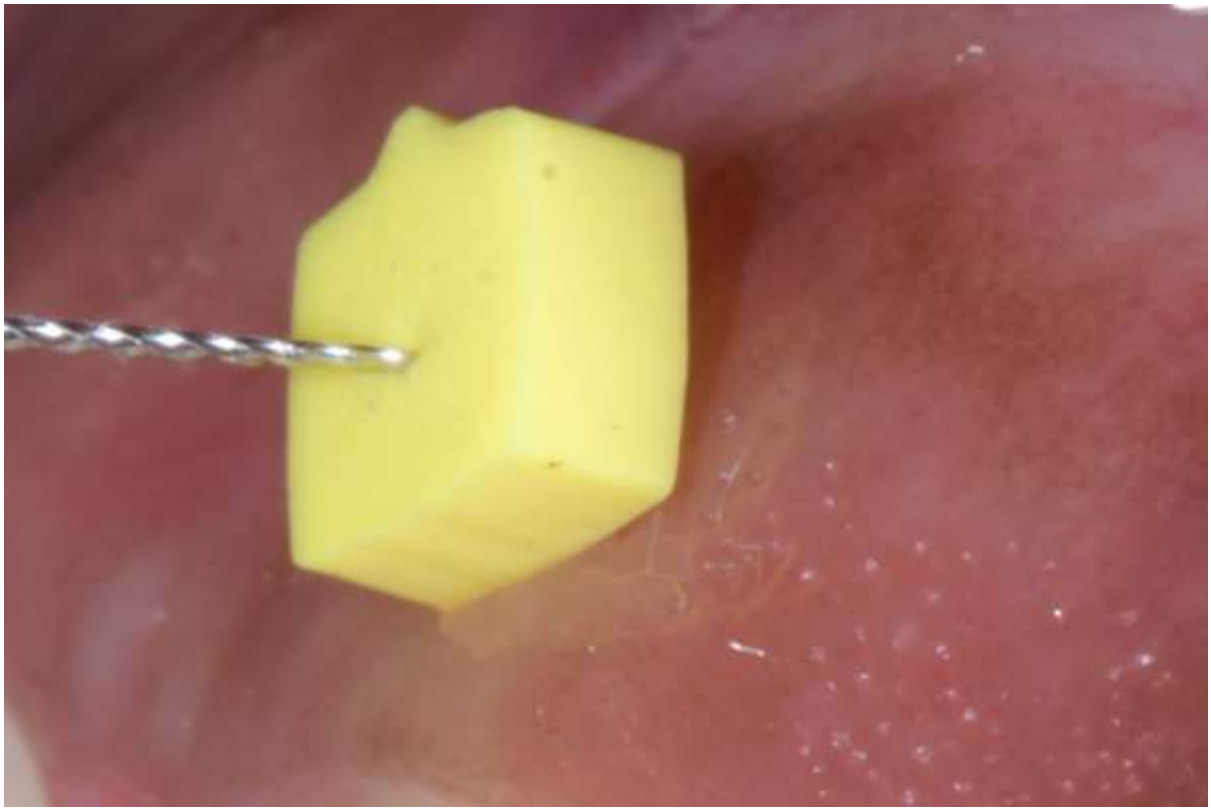

Figure 4

2.5

Digital Method superimposition (Figure 6):

All participants underwent a preoperative CBCT scan. To limit radiation exposure to the patient. The CBCT data that was obtained was superimposed on the data obtained through scanning. This was dome through a software. In AIS software both the files were merged now distance from the buccal bone to the labial side of soft tissue is calculated at 3mm apically to the gingival margin. Gingival thickness was considered thick when >1.5mm and gingival thickness was considered as thin when <1.5mm.

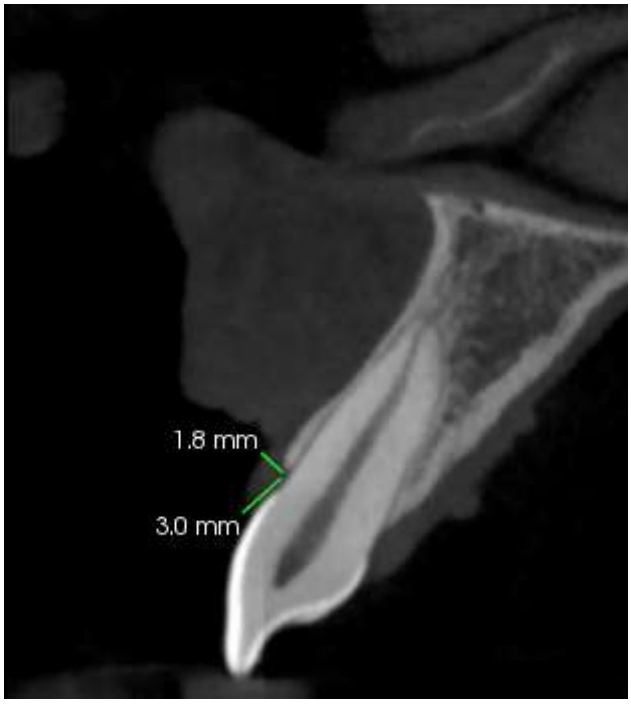

Figure 5

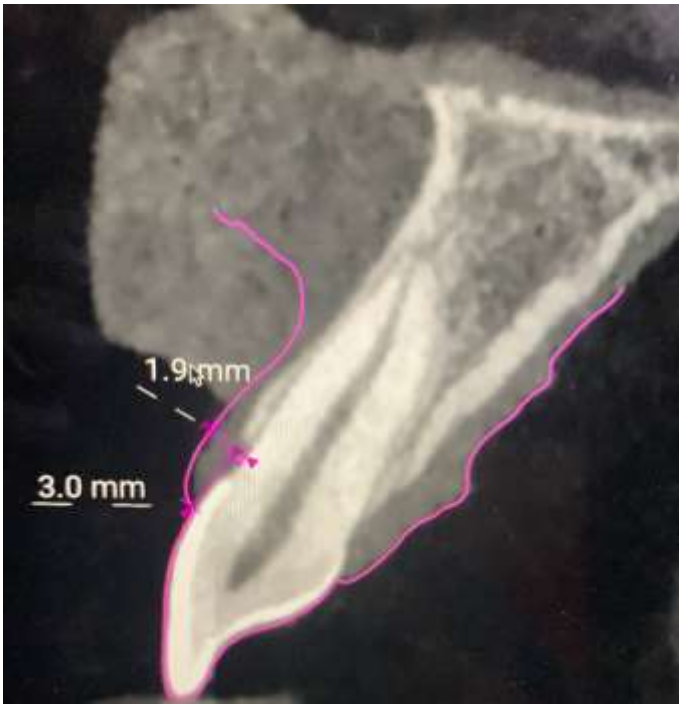

Figure 6

Results

One-way ANOVA (Analysis of variance) is a statistical method for comparing the means of two or more samples. Here, in our study One Way ANOVA test showed that there is no statistical difference between all the five-technique used to measure the gingival thickness.

In table 1, according to the statistical analysis done, there was no statistical difference between all the groups. While CBCT showed the highest mean value i.e. 1.80 ± 0.53 & the least mean value is for X-ray with paralleling technique I.e. 1.72 ± 0.49. Thus, CBCT shows the most accurate results compared to all the other techniques but

CBCT is not cost-effective. Here, the values of transgingival probing and superimposition are nearer to that of CBCT.

Transgingival probing was considered the gold standard for measuring gingival thickness. And as revolutionization is occurring, a new era of digitalization has come up with more advanced techniques. But this technique of digital superimposition came out to be the most expensive of all. Furthermore work is required in this area to make technique more cost effective.

Gingival Thickness										
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		ANOVA			
					Lower Bound	Upper Bound	df	F Value	P Value	Partial Eta Sqaured
X-ray with Parallelling technique	10	1.72	.156	.049	1.61	1.83	3	0.464	0.709 (NS)	0.037
Transgingival Probing	10	1.79	.173	.055	1.66	1.91				
CBCT	10	1.80	.167	.053	1.68	1.92				
Digital Superimposition	10	1.78	.174	.055	1.66	1.91				

However, out of all the five techniques used for the measurement of gingival thickness, four were quantitative and one was a qualitative technique. The majority of the patients were having thick gingival phenotypes and hence the probing was not visible.

VAR00001 * Visibility Crosstabulation

			Visibility		
			Not Visible	Visible	Total
VAR00001	Probe Transparency	Count	8	2	10
		% within VAR00001	80.0%	20.0%	100.0%
Total		Count	8	2	10
		% within VAR00001	80.0%	20.0%	100.0%

Discussion

The treatment planning plays an important role. But more than that proper diagnosis is the key to success.[10] Thus for the post-operative success new and advanced diagnostic techniques have been developed. Gingival thickness is an important predictor of the clinical outcome of root coverage procedures and plays an important role in the development of gingival recession[11] ,wound healing [12] and flap management during regenerative surgical procedures. There have been few studies comparing invasive and non-invasive methods of measuring gingival thickness. [13].

In the study by Olsson and Lindhe in their study 85 % of people who participated in their study were having thick phenotypes. Likewise, in our, 20% of people were having thin phenotype in our study. The transparency method for evaluating gingival thickness gives us qualitative data. Accurate measurement of gingival thickness is not possible with the probe transparency method. Stein et al 2014 suggested probe transparency is not the best technique to measure attached gingiva, it is useful to check free gingiva as it is located more coronally [14]. The proposed radiographic technique is sensitive to experience; as a result, errors made during the treatment may change the outcome. A decent image cannot be acquired unless careful attention is paid to each step of the procedure to ensure that the radiopaque material is in the proper position and the projection is exactly perpendicular.

The transgingival probing is the steady way to determine the gingival biotype. [15] Greenberg et al. 1976 [16].El Khalifa M et al. 2022 reported with hardly any discrepancies from the transgingival approach, CBCT showed great diagnostic accuracy for measuring gingival thickness.[17] . The transgingival probing method is considered a gold standard method for measuring the gingival thickness. But it can cause some discomfort to the patient as it is an invasive method whereas CBCT method for measuring gingival thickness that gives similar results. But it causes greater exposure to radiation in the patients and less cost-effective technique.

However, with all due limitations of this study, a precise assessment method and a precise definition is required. In this study, an attempt was made to compare the different methods of gingival thickness evaluation and analyse them individually. This in-vivo study was done in a blinded manner to rule out the chances of the error caused by any bias. The limitation of this study is the insignificantly lesser sample size and consideration of only anterior teeth.

Conclusion:

Within the limitation of this study, it can be said that there was no significant difference between different techniques. Of which the most expensive method was Digital superimposition followed by CBCT and the most invasive method was transgingival probing.

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