



Comparative Evaluation Of Accuracy Parallel Profile Radiographs With Clinical Probing And Transgingival Probing For Assessment Of Gingival Biotype In Subjects With Healthy Periodontium

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Abstract

Aim

To compare and evaluate the accuracy of Parallel Profile Radiographs with clinical probing for assessment of Gingival Biotype in subjects with Healthy periodontium.

Background

Gingival biotype is important for the practitioner to employ appropriate periodontal and surgical procedures and maintain optimal gingival health and for better esthetic outcome. To exactly determine the soft tissue, transgingival probing is a routinely used method. Although simple and straight forward it is an invasive

procedure that requires local anaesthesia and may result in distortion of gingival tissues during probing. Considering the drawback of transgingival probing, there is need to find out a method which is non-invasive. This study is therefore planned to compare and evaluate the accuracy of Parallel Profile Radiographs with clinical probing for assessment of Gingival Biotype in subjects with Healthy periodontium.

Methods

The study consist of 40 subjects whose detailed case history and clinical examination was performed. Written informed consent was taken from each subject. Subjects fulfilling the inclusion and exclusion criteria were subjected to radiographic and clinical evaluation. The width of attached gingiva, biologic width and gingival thickness was assessed radiographically and by clinical probing. Result: No significant difference was seen with width of attached gingiva, biologic width and gingival thickness when measured radiographically and clinical and transgingival probing. Conclusion: From our study it can be concluded that parallel profile radiograph method and transgingival probing both methods can be used to assess the gingival biotype.

Keywords

Gingival Biotype, Width of attached gingiva, Biologic width, Transgingival Probing

Introduction

A deeper knowledge of the biological structure and morphological quality of healthy periodontal tissue helps us to establish the diagnosis and prognosis of periodontal diseases¹.

Esthetic periodontal procedures prior to dental rehabilitation have become very common. Periodontal plastic surgeries have been recommended aiming to improve gingival contours, increase the amount of

keratinized tissue and improve its quality and correct gummy smile. Clinical appearance of normal gingiva reflects the underlying structure of epithelium and lamina propria. Gingiva is the portion of the oral mucous membrane bound to the tooth and alveolar arches of maxilla and mandible. The term "Gingival biotype" refers to the quality of the soft tissue profile surrounding the tooth. It has also been described as the thickness of the gingiva in the labiolingual dimension²⁻⁴.

Thick gingival biotype corresponds to a tooth with squared facial form, tooth with distinct cervical convexity, more apically located contact areas. Thick biotype has large amount of attached gingiva and a thick underlying osseous form. It is resistant to acute trauma. Thin gingival tissue has been suggested to be associated with tapered crown form, subtle cervical convexity. Thin gingival tissue is more delicate and almost translucent in appearance; the tissue appears friable with a minimal zone of attached gingiva which escalates the risk of recession following the crown preparation and periodontal or implant surgery. The gingival biotype includes keratinized tissue width (mostly the attached gingiva), biologic width and gingival thickness (buccolingually)³. Surgical improvement of gingival width and thickness prior to interdisciplinary approaches would be a good decision making plan. Measurement of gingival dimension is clinically meaningful for both academicians and periodontists biotype to predict the prognosis of the treatment and decrease the chances of failure

Different methods have been used to measure the gingival thickness.⁵ They are the direct method or transgingival probing^{7,9}. probe transparency method, measurement with Vanier caliper, visual inspection, use of ultrasound^{4, 10,11} and Soft Tissue- Cone-Beam Computed Tomography (ST-CBCT)^{12,13} There are few

limitations of each method. Transgingival probing although accurate and simple, presents limitations due to the low precision of periodontal probes with millimeter indentations and because it is an invasive procedure which also needs local anesthesia[9]. Ultrasound although [4,10,11,14] seems to be an effective method [16], it is difficult to determine a correct and reproducible position to calibrate the equipment. Visual examination has the disadvantage of high variability, the probe transparency method is a well-known method but it had the major disadvantage that pigmented gingiva cannot be studied. Although ST-CBCT has proved to be an accurate method it has a disadvantage of higher cost, less availability and more exposure to radiation. It has been mentioned in the literature that the parallel profile radiograph can be used for evaluation of gingival thickness[19,20]. Parallel Profile Radiograph compared to other methods is a non-invasive, simple, accurate, economical and requires less radiation exposure. This study was therefore planned to evaluate the gingival biotype by the method of parallel profile radiographs and compare it with clinical probing and transgingival probing in healthy periodontium. Transgingival probing although accurate, simple, cost-effective presents limitations due to the low precision of periodontal probes with millimeter indentations. It is time consuming and an invasive procedure which also requires local anesthesia[9]. So a non-invasive, simple, easily available technique for clinicians should be used to assess the thickness of gingiva.

If parallel profile radiograph is found to be an effective method to measure the gingival thickness and biologic width. It can be said to be the best method as it is a non-invasive, simple, accurate, economical and requires less radiation exposure.

Materials and Methods

A total of 40 subjects were selected from those visiting Out Patient Department of Periodontology, Bharati Vidyapeeth (Deemed to be University) Dental College And Hospital, Pune. The inclusion criteria was subjects of age group ranging from 20-50 years, subjects presenting all maxillary anteriors, subjects having good oral hygiene without any clinical signs of inflammation or attachment loss, subjects who do not have caries or restorations in maxillary anteriors. The exclusion criteria was pregnant or lactating women. subjects taking medications with any known effect on periodontal soft tissue, medically compromised patients, subject with deleterious habits like smoking, tobacco chewing.

Study Protocol

In all 40 subjects who were explained about the study and detailed case history was recorded and clinical examination was performed. Written informed consent was taken from each subject. Subjects fulfilling the inclusion and exclusion criteria were subjected to radiographic and clinical evaluation.

Method of Collection of Data

Group 1 (Parallel Profile Radiograph)

For evaluation of width of attached gingiva, lead foil was placed on the outer surface of the gingiva from the crest of the gingiva to the mucogingival junction. Lead foil was cut accordingly. For evaluation of biologic width, gutta purcha (no 15) was dipped in barium sulphate and then placed in sulcus till resistance was felt. For evaluation of gingival thickness, the third point was taken as the midpoint of the width of the attached gingiva. Parallel profile radiograph was then taken using long cone parallel technique.

Group 1 (Parallel Profile Radiograph)

1. Radiographic Measurement of Width of Attached Gingiva

The width of attached gingiva was measured from the tip of the guttupurcha point at the base of the sulcus till the radiopaque end of lead foil at the mucogingival junction.

2. Radiographic Measurement of Biologic Width

The length of biologic width was measured from the radiopaque tip of the guttupurcha point seen at the base of the sulcus till the crest of alveolar bone.

3. Radiographic Measurement of Gingival Thickness

The gingival thickness was evaluated in a horizontal direction by measuring the distance from third point (already mentioned above) on the outer surface of alveolar bone.

Group 2 (Clinical/Transgingival Probing)

Maxillary anterior tooth which had to be evaluated was anaesthetized. The labial soft tissue of the maxillary anterior tooth of all the subjects was then explored clinically by using UNC-15 graduated probe.

1. Clinical Measurement of the Width of Attached Gingiva

The width of attached gingiva was determined by measuring the distance from the crest of gingival margin to the mucogingival junction and subtracting the depth of the sulcus from the total width.

2. Clinical Measurement of Biologic Width

By using UNC-15 graduated probe the length of biologic width was measured by first measuring the depth of the sulcus and then inserting the probe from the base of the sulcus further till the crest of the alveolar bone was felt (vertical transgingival probing). The sulcus depth was then subtracted from the total depth, thus obtaining the biologic width.

3. Clinical Measurement of Gingival Thickness

The Gingival thickness was measured by horizontal transgingival (bucco-lingual) probing from the third point on the outer surface of the gingiva upto

the outer surface of the alveolar bone. Oral prophylaxis was carried out for all the patients after radiographic and clinical evaluation. The data was collected and then statistically analyzed.

Results

The morphologic characteristics of the gingiva depend on several factors like the dimension of the alveolar process, the form of the teeth and the position of the fully erupted teeth. It is observed that the buccolingual thickness determines gingival recession at sites during orthodontic treatment. Different methods have been used to assess the gingival biotype however all the methods have their own limitations. Parallel profile radiographs have been used to evaluate the gingival biotype, but none of the studies have mentioned the accuracy of parallel profile radiographs. This study was therefore planned to compare and evaluate the accuracy of parallel profile radiographs with clinical probing and transgingival probing for assessment of gingival biotype (width of attached gingiva, biologic width, gingival thickness) in subjects with healthy periodontium.

A total of 40 subjects of age group ranging from 20-50 years were selected for the study. Subjects who fulfilled the criteria and who consented for the study were included in the study. Detailed case history was recorded. Radiographic and clinical evaluation was then carried out. After oral prophylaxis subjects were recalled for checkup.

In Group 1 (parallel profile radiographs) the mean width of attached gingiva was 3.81 with a standard deviation of 0.34.

In Group 2 (Clinical evaluation) the mean width of attached gingiva was 3.87 with standard deviation of 0.33. Using independent sample 't' test , p-value was > 0.05 , thus there was no significant difference

between mean width of attached gingiva in group 1 and group 2. There are no studies in literature which compared the width of attached gingiva clinically and radiographically but there are some studies which measured the width of attached gingiva clinically. . Similar studies were conducted by Shaju Jacob P1, Zade R (2009), Hari Padmini et al (2018). The authors concluded that the width of attached gingiva varies with age, gender and in different areas of the mouth and there is no significant correlation was seen between width of attached gingiva or vestibular depth and gingival inflammation and oral hygiene maintenance.

In Group 1 (parallel profile radiographs) the mean biologic width was 1.70 with the standard deviation of 0.31. In Group 2 (transgingival probing) the mean biologic width was 2.07 with the standard deviation of 0.26. Using independent sample t-test, p-value was < 0.05 , thus there was statistically highly significant between mean biologic width in group 1 and group 2. Similar studies were carried out by O Stein JM et al, Sushama R Galgali, Gauri Gontiya, the authors concluded that the biologic width of the dentogingival unit in humans can be measured with the parallel profile technique. Thus, parallel profile technique offers a simple, concise, noninvasive, and reproducible method that can be used in the clinical setup to measure both the length and thickness of the dentogingival unit with accuracy. The value of biologic width was found to be more precise in fractions of millimeters in parallel profile radiographs as compared to transgingival probing.

In Group 1 (parallel profile radiographs) the mean gingival thickness was 1.31 with standard deviation of 0.32. In Group 2 (transgingival probing) the mean gingival thickness was 1.25 with the standard deviation of 0.44. Using independent sample t-test p-

value was > 0.05 , thus there was no significant difference between mean gingival thickness in group 1 and group 2. In our study the value of gingival thickness was more in parallel profile radiographs when compared to transgingival probing in our study.

Similar studies were conducted by Stein JM et al, Carrasco, Laura, R. G. Shiva Manjunath, Anju Rana, Arijit Sarkar (2015) and the authors concluded that the periodontal probe is an accurate mean to measure gingival thickness and clear thick gingiva was found in more than two-third of the male subjects whereas majority of female subjects showed thin biotype. Also, it was seen that in females, the gingival biotype varies with age unlike in male.

Discussion

Thus from the above studies and our results, it can be observed that gingival biotype is an important parameter that affects the outcome of periodontal and restorative treatments. Knowledge about the gingival biotype helps to better assess the need of any periodontal procedure and avoid failures or complications in the aesthetically critical area. Various methods are used to measure the gingival biotype but they have certain limitations.

So from our study it can be proven that parallel profile radiograph is a simple, reliable, easy, accurate technique requiring minimal radiation and is more comfortable to the patient. It is also a non-invasive technique and does not require local anesthesia when compared to transgingival probing. Knowledge of the gingival biotype is of fundamental importance to an oral clinician because the anatomical characteristics of the periodontium, such as gingival thickness, gingival width and alveolar bone morphology, will determine the behavior of periodontium during therapeutic procedures such as periodontal surgeries, implant and orthodontic

treatment. There is a considerable intra and inter-individual variation in both width and thickness of the facial gingiva, giving rise to the assumption that different gingival biotypes might exist in any adult population. Therefore, an accurate diagnosis of gingival tissue biotype is of utmost importance in predicting an appropriate treatment plan and achieving a predictable esthetic outcome.

Conclusion

From above observations, it can be concluded that parallel profile radiograph method and transgingival probing both methods can be used to assess the gingival biotype. However parallel profile radiographs gave measurements in fractions of millimeters and therefore can be considered more accurate or better method to determine the gingival thickness, attached gingiva and the biologic width when compared to clinical and transgingival probing. It is also simple and non-invasive (less traumatic) and does not require use of local anaesthetic agent. It is feasible and has less radiation exposure as compared to CBCT. It is also cost effective. This technique used lead foil which was fixed on the labial surface of gingiva which decreased the chances of variability by two observers or even when measured at two different time intervals. Thus this technique proves to be better than clinical / transgingival probing method.

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Table 1: Comparison of the Width of attached gingiva by parallel profile radiograph (Group 1) and clinical evaluation (Group 2) in subjects with healthy periodontium.

Group	Number of patients	Width of attached gingiva		p-value
		Mean	SD	
GROUP 1 (Parallel profile radiographs)	40	3.81	0.34	0.409
GROUP 2 (Clinical evaluation)	40	3.87	0.33	

p value by independent sample t-test (p-value > 0.05 is considered to be statistically non - significant)

GRAPH 1: Bar graph showing comparison of the Width of attached gingiva by parallel profile radiograph (Group 1) and clinical evaluation (Group 2) in subjects with healthy periodontium.

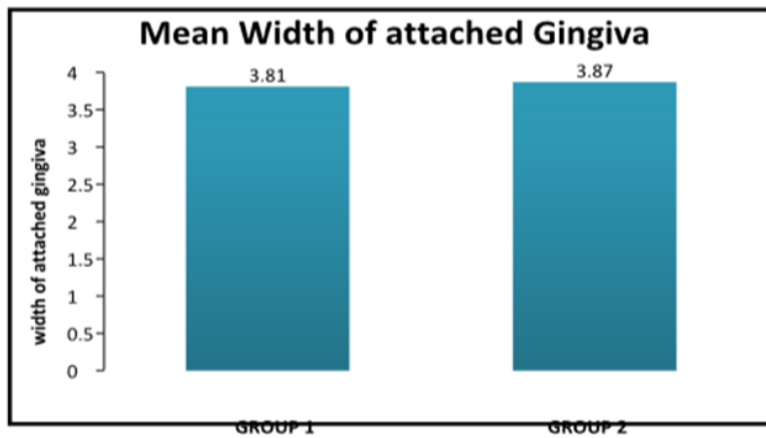


Table 1. Graph 1 shows comparison of the width of attached gingiva in both the groups. In Group 1 (parallel profile radiographs) the mean width of attached gingiva was 3.81 with a standard deviation of 0.34. In Group 2 (Clinical evaluation) the mean width of attached gingiva was 3.87 with standard deviation of 0.33. Using

independent sample 't' test , p-value was > 0.05, thus there was no significant difference between mean width of attached gingiva in group 1 and group 2.

Table 2. Comparison of Biologic width by parallel profile radiograph (Group 1) and transgingival probing (Group 2) in subjects with healthy periodontium.

Group	Number of patients	Biologic width		p-value
		Mean	SD	
Group 1 (Parallel profile radiographs)	40	1.70	0.31	< 0.001***
Group 2 (Clinical evaluation)	40	2.07	0.26	

p value by independent sample t-test (p-value < 0.05 is considered to be statistically highly significant.)

Graph 2. Bar graph showing comparison of Biologic

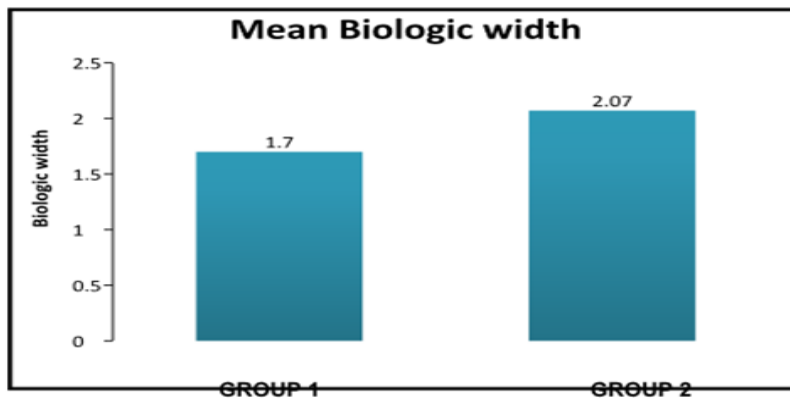


Table 2. Graph 2 shows comparison of biologic width in both the groups. In Group 1 (parallel profile radiographs) the mean biologic width was 1.70 with the standard deviation of 0.31. In Group 2 (transgingival probing) the mean biologic width was 2.07 with the standard deviation of 0.26. Using independent sample t-

width by parallel profile radiograph (group 1) and transgingival probing (group 2) in subjects with healthy periodontium.

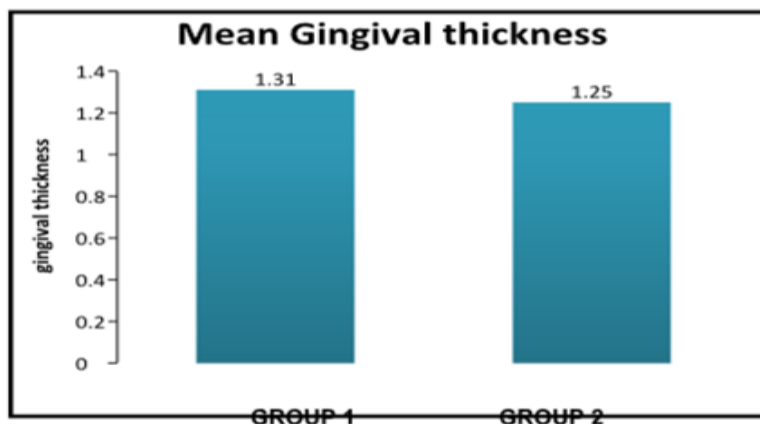
test, p-value was < 0.05, thus there was statistically highly significant between mean biologic width in group 1 and group 2

Table 3. Comparison of gingival thickness by parallel profile radiograph (Group 1) and transgingival probing (Group 2) in subjects with healthy periodontium.

Group	Number of patients	Gingival thickness		p-value
		Mean	SD	
GROUP 1 (Parallel Profile Radiographs)	40	1.31	0.32	0.466
GROUP 2 (Clinical Evaluation)	40	1.25	0.44	

p value using independent sample t-test was > 0.05 which was considered to be statically non-significant.

Graph 3. Bar graph showing comparison of the gingival



thickness by parallel profile radiograph and transgingival probing in subjects with healthy periodontium

Table 3. Graph 3 shows comparison of gingival thickness in both the groups. In Group 1 (parallel profile radiographs) the mean gingival thickness was 1.31 with standard deviation of 0.32. In Group 2 (transgingival probing) the mean gingival thickness was 1.25 with the

standard deviation of 0.44. Using independent sample t-test p-value was > 0.05 , thus there was no significant difference between mean gingival thickness in group 1 and group 2.

Figures For The Study

Figure 1. Extra-Oral Image of Parallel Profile Radiographs.



Figure 2: Intra Oral Image Of Parallel Profile Radiographs

Gingival Thickness (Yellow): 0.8mm

Width of attached gingiva (Blue): 4mm

Biologic Width (Black): 1.9 mm



Figure 3. Distance Measured From Crest of Gingiva To Mucogingival Junction



Figure 4. Probing depth measured



Figure 6. Horizontal Transgingival probing (to measure gingival thickness)

