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## Comparative evaluation of gingival thickness in smokers and non-smokers

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### ABSTRACT

*Smoking has its effects on the periodontium, which is reflected by morphologic and histologic changes in the gingiva. Gingival thickness is one among the factors, which has become a subject of considerable interest in periodontics both from the epidemiological and therapeutic point of view. By taking gingival thickness into consideration during treatment planning, more appropriate strategies for periodontal management may be developed, resulting in more predictable treatment outcomes. The purpose of the study was to estimate the gingival thickness in different regions of the mouth in smokers and non-smokers. The study group included 40 age-matched smokers and non-smokers with and without periodontitis. Gingival thickness assessment was done on 6 index teeth; 6 sites on each tooth by transgingival probing using 15 sizes endodontic reamer and thickness was measured using vernier caliper. A statistically significant difference in gingival thickness was observed in different sextants of mouth in smokers and non-smokers.*

**Keywords**— Smoking, Periodontium, Gingival thickness

### 1. INTRODUCTION

Smoking is a known risk factor for several diseases. Clinical and epidemiological investigations have found that there is strong correlation between cigarette smoking and periodontal health. The by-products originating from tobacco oxidation modify the clinical manifestation and the progression of periodontal diseases, and smoking is described as a risk factor for periodontal disease (1) smoking plays an important role in initiation and progression of periodontal disease and results in reduced oxygen tension, altered gingival inflammation and bleeding, impaired gingival vasculature and gingival blood flow.(2) .These changes may be attributed to the presence of cotinine a nicotine metabolite which has a peripheral constrictive action on gingival blood vessels and functional alteration brought about by altered chemotaxis phagocytosis and oxidative burst caused due to cigarette smoking.

The immunologic effect of smoking on initiation and progression of periodontal disease can be attributed to suppression of host immune response due to defective neutrophil functions, decreased serum IgG production as well as the effect altered levels of various cytokines and inflammatory mediators (3). There is also an alteration in normal microbial flora compared to healthy non-smokers.

Smokers are also associated with deeper periodontal pockets, increased clinical attachment loss and probing depth and radiographic evidence enhanced alveolar bone loss. Smoking has shown to adversely affect the outcome of various surgical and non-surgical periodontal therapeutic procedures. (4)Clinical appearance of gingiva generally correlates with the inflammatory status of the periodontium. In spite of increased production of inflammatory mediators and periodontal tissue destruction, smokers exhibit thick fibrotic gingiva with reduced bleeding. (5)

Gingival thickness is a significant factor in aesthetic and functional outcome of the periodontal, restorative and orthodontic therapy. Thick and thin biotype shows different pathologic response when subjected to different inflammatory change. Thick gingiva is more vulnerable for development of periodontal pocket whereas thin gingival biotype responds by apical migration of marginal gingiva. Thus thickness as well as a biotype of gingiva has to be taken into consideration while planning treatment in different areas of mouth especially in case of mucogingival procedures, restorative procedures as well as implant therapy.

Though several studies have evaluated the thickness of gingiva in smokers there is no clear consensus regarding the average thickness of gingiva in different areas of the mouth in smokers and non-smokers. So the aim of the present study is to assess the gingival thickness in different sextant of mouth in smokers and non-smokers.

## 2. MATERIALS AND METHODS

The present study was conducted in the department of periodontics, PMS College of Dental Science and research, Trivandrum. Only male patients aged between 18 and 55 were included in the study. Study subjects were divided into two groups consisting of 20 subjects in each group.

Control group consisted of subjects who are non- smokers and clinically healthy. The test group consisted of 20 subjects who are current smokers selected according to CDC criteria. Smokers with gingivitis as well as periodontitis were included in the test group. Exclusion criteria included patients using any medications possibly affecting the periodontal tissues, individuals with systemic and immunologic abnormalities and Orthodontic patients

### 2.1 Procedure

The patients were informed about the study, its purpose, the degree of discomfort that might occur before conducting the procedure After getting informed consent a briefcase history was recorded and periodontal clinical parameters such as Plaque index, gingival index, probing depth, gingival recession/ enlargement were assessed followed by scaling and polishing.

### 2.2 Gingival thickness assessment

Various invasive, as well as noninvasive methods, are available for assessing gingival thickness. Invasive methods include the use of periodontal probes, injection needles, endodontic reamers whereas non-invasive methods include the use of ultrasonography and cephalometric radiographs. In this study, gingival thickness assessment was done on six sites per tooth including mesiobuccal, mid-buccal, distobuccal, mesiolingual, mid-lingual and distolingual aspect of six index teeth (16, 11, 26, 36, 31, 46). If any of index tooth is missing adjacent tooth was substituted and measurement was taken 3 mm from marginal gingiva. The attached gingiva and interdental papilla of the selected tooth were anaesthetized using LA spray (lignocaine). A 15 size endodontic reamer is held perpendicular to tooth and inserted until the hard surface is contacted. Measurements were recorded using digital vernier calliper (Figure 1). The data were subjected to statistical analysis. Mean values and standard deviations were calculated. Estimation and comparison of gingival thickness among the two groups were done using unpaired t-test.

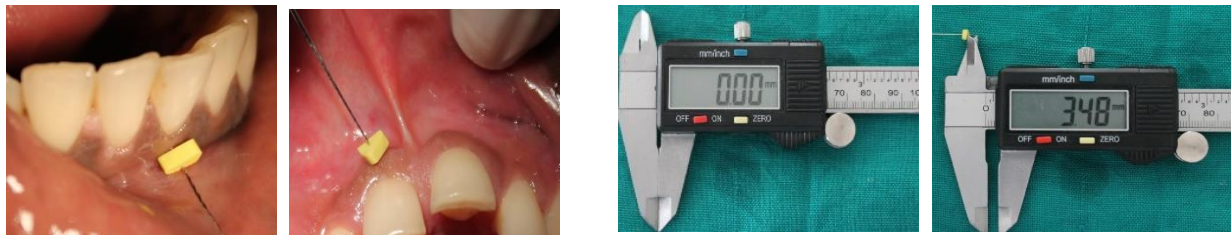


Fig. 1: Gingival thickness assessment

## 3. RESULTS

40 male subjects of mean age  $41.8 \pm 6.82$  were included in the study. The age among the sample ranged from 22 – 55 years. Plaque index did not show any significant difference among the smokers and non-smokers (p-value of 0.89). The sulcus-bleeding index showed a significant difference between the two groups (p-value < 0.05) [Table 1].

Table 1: Mean plaque index of smokers and non-smokers

	Smokers	Non-smokers	P value
Plaque index	$2.14 \pm 0.1957$	$2.145 \pm 0.179$	0.8999 NS
Sulcus bleeding index	$0.68 \pm 0.231$	$1.43 \pm 0.36$	0.032 S

The average thickness of gingiva shows a statistically significant difference between smokers and non-smokers in different areas of the mouth. Thickness in buccal and interdental areas was higher in smokers compared to non-smokers and dental areas showed more thickness. (Table 2 and 3).

Table 2: Average gingival thickness in smokers and non-smokers in different areas (mm)

		Mesio Buccal	Mid buccal	Disto buccal	Mesio-lingual	Mid lingual	Disto lingual
16	Smoker	4.72	3.04	4.33	4.53	3.677	4.53
	Non smoker	2.22	1.82	2.85	3.46	2.63	3.24
11	Smoker	4.23	2.81	4.28	4.66	3.57	4.52
	Non smoker	2.57	1.84	2.37	3.03	2.54	3.12
26	Smoker	4.32	3.07	4.261	3.94	3.51	4.01
	Non smoker	2.82	2.02	2.82	2.207	2.45	2.19
36	Smoker	4.23	2.81	4.28	4.66	3.57	4.61
	Non smoker	2.57	1.84	2.37	3.03	2.54	3.12
31	Smoker	3.24	2.92	3.11	3.58	2.3	3.612
	Non smoker	1.92	1.33	1.88	2.44	1.54	2.3
46	Smoker	4.2	2.8	4.1	4.78	3.48	4.81
	Non smoker	2.51	1.79	1.79	3.2	2.41	3.01

**Table 3: Intergroup comparison of gingival thickness in smokers and non-smokers**

	Maxillary molar		Maxillary incisor		Mandibular molar		Mandibular incisor	
	Buccal	Inter dental	Buccal	Inter dental	Buccal	Inter dental	Buccal	Inter dental
Smoker	3.5± 0.483	6.5± 1.03	2.5± 0.33	4.5± 0.89	3.5± 0.72	5.5±0.33	2.5 ± 0.23	3.5 ± 0.46
Non smoker	2.5± 0.46	3.5± 0.67	2.0± 0.52	3.0± 0.58	2.0±0.33	3.5±0.51	1.5 ± 0.18	2.5 ± 0.39
P value <0.005 S								

The average thickness of gingiva in maxillary molar is 3.5-5.5mm in smokers and 2.5-3.5 mm in non-smokers. In mandibular molars the average thickness is 3.5 - 6.5 mm and 2.0 -3.5 mm in smokers and non-smokers respectively. The average thickness of gingiva in maxillary anterior range from 2.5-4.5 in smokers and 2.0-3.0 in non-smokers. In mandibular anterior thickness ranges from 2.5-3.5 in smokers and 1.5-2.5 mm in non-smokers. [Table 4]

**Table 4: Average gingival thickness in smokers and non-smokers in mm**

	Smokers	Non-smokers
Maxillary molar	3.5-6.5	2.5 – 3.5
Maxillary incisor	2.5-4.5	2.0-3.0
Mandibular molar	3.5 – 5.5	2.0- 3.5
Mandibular incisors	2.5-3.5	1.5 – 2.5

#### 4. DISCUSSION

Tobacco smoking affects the oral environment, the gingival tissues and its vasculature. Smoking is associated with impaired host immune inflammatory response. Alteration in neutrophil functions, macrophage abnormalities and alteration in subgingival microflora has been elucidated unanimously in several studies (6,7). Adverse therapeutic outcome following nonsurgical and surgical periodontal therapy as well as implant therapy has been reported in smokers compared to non- smokers.

Considering the effects of smoking on various periodontal tissues, gingival thickness has been least focused. A direct correlation exists between gingival thickness and development of periodontal defects. The response to any traumatic events or any periodontal procedures depends on gingival thickness. Therefore, an accurate diagnosis of gingival thickness is of the utmost importance in devising an appropriate treatment plan and achieving a predictable esthetic outcome(8).

Although many studies have been conducted measuring gingival thickness majority have assessed gingival thickness in buccal/labial aspect of maxillary anterior and most of them have measured the thickness of gingiva using histological methods and ultrasonographic methods and clinically by transgingival probing .(9,10) Histologic studies have shown that smoking patients showed increased epithelial base and stratum corneum thickness. The increased epithelium thickness can contribute to the reduction of inflammatory clinical signs in the gingival tissue.

In a previous study by Ankita et al (11) assessed the gingival thickness in maxillary anterior and found that gingiva is similar in thickness in interdental areas and midbuccal areas both in smokers and non-smokers. Both midbuccal and interdental areas were thicker among smokers when compared to non-smokers.

In this study, we have assessed and compared gingival thickness in different areas of mouth both in buccal/ labial and lingual and palatal aspect of smokers and non-smokers. Thus the impact of tobacco smoke on gingival thickness in different areas were evaluated which has not been conducted previously.

In the present study, plaque levels showed similar values in smokers and non-smokers. The sulcus-bleeding index showed a significant difference between the two groups. This is in agreement with previous studies which have shown that gingival bleeding is less in smokers than in non-smokers as smoking causes vasoconstriction of peripheral vessel induced by the actions of nicotine-stimulated adrenaline and noradrenaline on  $\alpha 1$ - adrenergic receptors. Such a constructive action on gingival vessels would result in the suppression of vascular properties of inflammation such as bleeding, redness, and exudation.

Intergroup comparison showed that gingival thickness was higher in smokers compared to non- smokers. Interdental areas showed more thickness compared to mid buccal/lingual sites and the differences were statistically significant ( $p = >0.05$ ). In smokers, the highest thickness was noted in the maxillary molar region [3.5-6.5] compared to [2.5 – 3.5] in non-smokers and in the mandibular molar region [3.5 – 5.5] compared to non- smokers [2.0- 3.5]. The average thickness in maxillary and mandibular anterior regions correspond to 2.5-4.5 and 2.5-3.5 respectively as compared to non-smokers 2.0-3.0 and 2.0- 3.5 respectively. Gingival thickness in Smokers and non-smokers with periodontitis did not show any significant difference in gingival thickness (P Value  $>0.05$ ).

Our study is in agreement with a similar study by Jayashree et al 2012 where the gingival thickness was assessed by transgingival probing in smokers and non-smokers and showed that anatomically, interdental gingiva is found to be thicker than the midbuccal gingiva in both smokers and non-smokers. Both midbuccal and interdental areas were thicker among smokers when compared to non-smokers at the similar plaque and gingival bleeding levels (12). In our study thickness were assessed using endodontic reamer and digital Vernier calliper which provided an accurate measurement and were less invasive.

Intergroup comparison among smokers showed that thickness was higher in the interdental region compared to mid-buccal/ mid-lingual regions and highest thickness were noted in maxillary molar buccal aspect and mandibular molar lingual aspect. Minimal thickness was noted in maxillary and mandibular anterior.

The probable mechanism for increased thickness can be due to the effect of nicotine which increases the rate of proliferation of gingival epithelium and stimulation of collagen production by nicotine. Stratum corneum thickness was more marked in smokers. (13,14) Signs of gingival inflammation are less pronounced in smokers. Reduced clinical signs of inflammation can be due to both the vasoconstrictor effect of cotinine. Increase in gingival thickness can be a contributing factor. The decreased response of smokers to various non-surgical periodontal therapy may also be due to an increase in gingival thickness. The assessment of gingival thickness in different areas may benefit site-specific monitoring in periodontal diagnosis and treatment planning especially in the management of localized periodontal lesions. Type of surgical procedures and type of incisions planned should also consider the thickness of gingiva Thickness of gingiva plays a vital role in the development of mucogingival problems and in the success of treatment for recession and wound healing (15)

## 5. CONCLUSION

Smoking can be an important factor in determining the gingival biotype. Duration and frequency of smoking, age and gender of the patient, diseased status etc can also influence the gingival thickness. Site-specific assessment of gingival thickness should be carried out for proper periodontal treatment planning. The main limitation of the present study is the small sample size. Therefore, the findings related to a gingival thickness in smokers and non-smokers could not be reflective of the true and general picture of the situation in the regional and national scenario. There is, therefore, the need for extensive work on the topic so as to give a broader view of the subject.

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