

## Original Article

# Effect of Nicotine on the Thickness of Gingiva: A Pilot Study

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ABSTRACT

**Introduction:** Gingival thickness plays a very important role in framing the protocol in various dental treatments such as implantology, prosthodontics, and more importantly in periodontics. During periodontal management, it is important to consider the gingival thickness of the patient, which can result in more satisfactory treatment outcomes. Smoking has its effect on periodontium, affecting the physical and functional properties. Assessing the relation between these two entities is becoming important. This clinical study is sought to compare the thickness of gingiva in systemically healthy smokers and nonsmokers.

**Materials and Methods:** A total of 180 periodontally healthy patients were divided into smokers and nonsmokers, and subdivided into Group 1 (18–25 years), Group 2 (26–39 years), and Group 3 (>40 years). Gingival thickness was assessed 6mm from the gingival margin in the midbuccal area between maxillary central and lateral incisor. Statistical analysis was performed to assess the difference in gingival thickness among smokers and nonsmokers and correlated with age.

**Results:** The results showed the presence of changes in gingival thickness for all the age groups. But, a significant *P* value was not obtained for the age groups 18–25 and 26–39 years. In >40 years of age group, there was a statistically significant change in the *P* value (0.008) of the mean and standard deviation in smokers and nonsmokers (significance: *P* < 0.001). **Conclusion:** On the basis of the results of this study, gingival thickness was decreased with age among smokers and nonsmokers. This study also proved that smoking has a negative influence on the gingival thickness.

**KEYWORDS:** Gingival thickness, nicotine, smoking

## INTRODUCTION

The periodontium is subjected to physical, chemical, or bacterial insult during the course of periodontal disease as well as during therapeutic procedures such as periodontal surgeries,<sup>[1]</sup> dental implants,<sup>[2,3]</sup> and orthodontic treatment. It is essential to have a thorough knowledge of the anatomical characteristics of the periodontium such as gingival thickness, gingival width, and alveolar bone morphology as it affects the outcome of the treatment for periodontal disease.

A thin gingival biotype is susceptible to gingival recession following surgical procedures and restorative

therapy. To be precise, the response of the gingiva to inflammation, restorative trauma, and parafunctional habits varies according to the thickness of gingiva.<sup>[4]</sup>

A thin gingiva is more susceptible to trauma and this could cause various forms of periodontal defects. Therefore, it is of utmost importance to accurately assess the gingival biotype while planning the treatment

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for the patient and help to achieve predictable esthetic outcome.

Understanding the thickness and width of gingiva is mandatory as the gingiva in the anterior maxillary and mandibular sextants, which bear the maximum brunt of the recession and have great esthetic relevance.<sup>[5,6]</sup> It is well established that the inflammatory changes of the periodontium influences the appearance of gingiva clinically.<sup>[7]</sup> The effect of smoking (nicotine) reflects morphologic and histologic changes in the gingiva<sup>[8]</sup> including thickness of gingiva, which can influence the aesthetic and functional outcome of not only periodontal therapy but also restorative and orthodontic therapy. Although ample literature is available regarding the effect of smoking on periodontium, there is very little attention on the comparison of thickness of gingiva among smokers and nonsmokers.

Hence, the aim of this study is to assess the impact of nicotine on the gingival biotypes due cigarette smoking in periodontally healthy patients.

## MATERIALS AND METHODS

### Sample size and sampling

A total of 180 patients who attended the outpatient Department of Periodontics were included in this study. Power analysis was performed with  $\alpha$  error (5%) and power ( $1 - \beta$ ) 90%; the minimum sample size required for each group was 30 and a total of 90 in smokers and 90 in nonsmokers. The CDC (Centre for Disease Control) considers those patients who have smoked more than 100 cigarettes in their lifetime as smokers and nonsmokers are those who have not smoked more than 100 cigarettes in their lifetime.<sup>[9]</sup> An informed consent was obtained from the patients.

### Inclusion criteria

The inclusion criteria of the study included the following:

1. Smokers and nonsmokers according to CDC classification.
2. Presence of all anterior teeth in the maxillary arch.
3. Healthy periodontium with no loss of attachment.
4. No history of orthodontic treatment.
5. No history of periodontal treatment.

### Exclusion criteria

The exclusion criteria of the study included the following:

1. Patients with active periodontal disease.
2. Gingival recession in the anterior teeth
3. Extensive restorations in the anterior teeth.
4. Any systemic diseases that have an impact on the periodontal health.

5. Patients under any medication that would affect the periodontal tissues such as cyclosporine A, calcium channel blockers, or phenytoin.
6. Pregnant or lactating women.

The patients included in the study were divided into two groups:

Group A: smokers and Group B: nonsmokers.

In both groups, the patients were categorized into three age groups.

Group 1: 18–24 years

Group 2: 25–39 years

Group 3: 40 years and above

Each group had a population comprising 30 males under smokers and nonsmokers category, comprising a total of 180 patients.

### Measurement of gingival thickness

After anesthetizing the buccal gingiva with a 2% lidocaine spray, gingival thickness was measured midbuccally in the attached gingiva between maxillary central and lateral incisor 6mm from the gingival margin. An endodontic spreader fitted with a rubber stopper was used to measure and the thickness and the value recorded [Figure 1]. To minimize measurement errors, only one person performed the measurements and it was rounded off to the nearest millimeter.

### Statistical analysis

Thickness of gingiva was compared across different age groups by performing one-way analysis of variance (ANOVA). The unpaired *t* test was used to compare mean thickness of gingiva between smokers and nonsmokers.

## RESULTS

This study was performed to assess the changes in the gingival thickness among smokers and nonsmokers in periodontally healthy subjects and different age



**Figure 1:** Measurement of gingival thickness using endodontic spreader

groups categorized as age groups of 18–25, 26–39, and >40 years.

### Evaluation of changes in gingival thickness in smokers

The age group 18–25, 26–39, and >40 years had mean values of 3.03, 2.67, and 2.70, respectively. The results showed the presence of intragroup variation in the gingival thickness in smokers with a decrease in gingival thickness as the age increases. The ANOVA test shows that this change in thickness is statistically significant ( $P < 0.001$ ) [Table 1].

### Evaluation of changes in gingival thickness in nonsmokers

The age group 18–25, 26–39, and >40 years had mean values of 2.73, 2.47, and 2.10, respectively. The results showed the presence of intragroup variation in the gingival thickness in smokers with a decrease in gingival thickness as the age increases. The ANOVA test shows that this change in thickness is statistically significant ( $P < 0.001$ ) [Table 2].

### Comparative evaluation of changes in gingival thickness among smokers and nonsmokers

The results showed the presence of changes in gingival thickness for all the age groups. But, a significant  $P$  value was not obtained for the age groups 18–25 and 26–39 years. In >40 years of age group, there was a statistically significant change in the  $P$  value (0.008) of the mean and standard deviation in smokers and nonsmokers (significance:  $P < 0.001$ ) [Table 3].

### DISCUSSION

The gingival or periodontal biotypes have been classified as thin or thick, and the most prevalent gingival biotype is the thick biotype, which comprises flat soft tissue and dense bony architecture. This type of soft-tissue form is more resistant to gingival recession as they are fibrotic and have a large zone of attachment to the underlying bone. In contrast, thin gingival biotype is much more delicate with a highly scalloped soft tissue and a thin underlying bony architecture, which makes them prone to bony dehiscence and fenestrations. Hence, a thin gingival biotype is more prone to recession, bleeding, and inflammation.

**Table 1: Evaluation of changes in gingival thickness in smokers**

Parameter	Smokers			ANOVA— $P$ Value
	Mean	SD	$N$	
18–25 years of age GT (mm)	3.03	0.718	30	<0.001 <sup>a</sup>
26–39 years of age GT (mm)	2.67	0.711	30	
>40 years of age GT (mm)	2.70	0.885	30	
Mean	2.80	0.859	90	

SD = standard deviation, ANOVA = analysis of variance, GT = gingival thickness, GT = gingival thickness

<sup>a</sup>Statistically significant

**Table 2: Evaluation of changes in gingival thickness in nonsmokers**

Parameter	Nonsmokers			ANOVA— $P$ Value
	Mean	SD	$N$	
18–25 years of age GT (mm)	2.73	0.640	30	<0.001 <sup>a</sup>
26–39 years of age GT (mm)	2.47	0.507	30	
>40 years of age GT (mm)	2.10	0.885	30	
Mean	2.43	0.735	90	

SD = standard deviation, ANOVA = analysis of variance, GT = gingival thickness

<sup>a</sup>Statistically significant

**Table 3: Comparative evaluation of changes in gingival thickness among smokers and nonsmokers**

Parameter	Smokers		Nonsmokers		$P$ Value
	Mean	SD	Mean	SD	
18–25 years of age GT (mm)	3.03	0.72	2.73	0.06	0.093
26–39 years of age GT (mm)	2.67	0.71	2.47	0.51	0.215
>40 years of age GT (mm)	2.70	0.79	2.10	0.88	0.008

SD = standard deviation, GT = gingival thickness

The recognition of the gingival biotype is of utmost importance in clinical practice as the discrepancies in gingival and osseous architecture influences the outcome of periodontal therapy.

Thorough understanding of the tissue biotype enables the practitioner to incorporate appropriate periodontal surgical procedures, which minimize alveolar resorption to provide a more conducive environment for implant, restorative, or prosthetic placement. The periodontal literature till date proves that the gingival width has been discussed to great extent and the gingival recession occurrence has been widely associated with inadequate width of attached gingiva. The gingival thickness is another parameter that plays an equally important role in the position of the gingival margin. Unfortunately, the periodontal literature attributes limited importance to gingival thickness when compared to gingival width. The actual functions of attached gingiva such as resistance to masticatory/tensional/traumatic forces and inflammation are possibly directly related to thickness as much as width of gingiva. Hence, there is a need to measure gingival thickness along with other gingival parameters.

Results of this study show that the thickness of gingival decreases with age in both smokers and in nonsmokers. But the rate of thinning is not much prominent in smokers when compared to nonsmokers [Figure 2].

Many studies have substantiated that thickness of gingiva significantly decreases with age.<sup>[10-12]</sup> Similarly there is enough proof that nicotine increases the thickness of the gingiva.<sup>[13,14]</sup> The increase in thickness of gingiva is attributed by histopathological changes such as epithelial hyperplasia, increased keratinization, and also changes in the connective tissue and increase in the vascularity.<sup>[15]</sup> The gingival keratinocytes in smokers also show an increased mitotic rate when compared to nonsmokers.<sup>[16]</sup> These changes are responsible for the increase in thickness of the gingival tissue. The

primary function of the outer gingival epithelium is to provide a mechanical barrier and protect the gingiva from damage caused by masticatory forces and from bacterial infection.

Transmission electron microscopic evaluation of gingival tissue sample from smokers revealed that the cells of stratum basale were found to be resting on an irregular basement membrane. The intercellular space of the epithelial cells is wide and the attachment by desmosomes was disrupted. The micro ridges showed variation on the surface epithelial cells.<sup>[17]</sup> The effect of smoking on periodontal tissues are diminished oxygen tension, impaired gingival inflammation and bleeding, altered gingival vasculature, and gingival blood flow.<sup>[11]</sup> The aforesaid changes are due to cotinine, which has a vasoconstrictive action on gingival vessels. One literature proved that gingival thickness is increased in smokers, which was confirmed histologically.<sup>[18]</sup> Analysis by Jayashree and Vandana<sup>[12]</sup> presented that the gingival thickness was predominantly increased in the midbuccal and interdental region in smokers when compared to nonsmokers.

## CONCLUSION

Correlating the clinical finding of this study and histological findings in existing studies, it can be concluded that the thickness of gingiva is increased in smokers mainly because of the epithelial dysplasia and increased mitosis of the keratinocytes. This negatively influences the mechanical and protective function of the gingiva due to disruption of cell junctions in the keratinocytes. As the effect of smoking on periodontium is well established, the influence of smoking on gingival thickness according to pack years is of keen interest to be analyzed in further studies.

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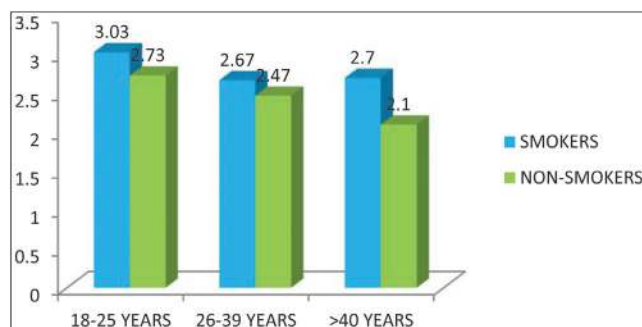
Nil.

## Conflicts of interest

There are no conflicts of interest.

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**Figure 2:** Graph representing gingival thickness among smokers and nonsmokers

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