Research Article

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A Study to Assess Tobacco Effect in Orthodontics

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ABSTRACT

Background: Tobacco smoking is also linked to a harmful impact on oral health. Smoking is one of the most significant risk factors of periodontitis which causes severe attachment loss. The present study was conducted to assess the tobacco effects in orthodontics.

Material and methods: The present study was conducted to assess the tobacco effects in orthodontics. A total of 60 patients were included in the study of age group above 20 years. The patients were divided into three groups. : Group C (orthodontic movement without nicotine) and group NM (nicotine with orthodontic movement). The study was focused on the mesio-buccal roots of maxillary first molars. Orthodontic movement was induced by nickel- titanium closed-coil springs that applied a reciprocal force of 30 g/f magnitude. Statistical analysis was performed with IBM SPSS Statistics (International Business Machines Corporation (IBM), New York, USA), version 22 for Windows.

Results: In the present study total sample size was 260 in which 51.53% were males and 48.46% were females. This study showed that tooth movement was more in nicotine group in both males (0.85±0.65mm) and females (0.82±0.34mm) than group without nicotine. Tooth movement was more in males in nicotine group and tooth movement was more in females than males in group without nicotine.

Conclusion: The present study concluded that tooth movement was more in nicotine group. But Nicotine accelerated orthodontic tooth movement cause unbalanced bone resorption and apposition patterns around the moving teeth. The accelerated orthodontic tooth movement is expected due to increase in periodontal bone loss.

Keywords: Tobacco effect, orthodontics, periodontium, root resorption.

INTRODUCTION

Tobacco smoke has more than 7,000 harmful chemical compounds that enter a human body either directly through smoking, indirectly through second hand exposure to smoke exhaled by a smoker, or through downstream smoke released from a cigarette or pipe.[1] Nicotine (*Nicotiana tabacum*) is the most pharmacologically active component present in tobacco and directly or indirectly affects cellular metabolism, reducing angiogenesis;[2] osteogenesis;[3,4] fibroblasts proliferation and adhesion as well as collagen synthesis.[5] According to Hollinger et al[6] and Feitelson et al,[7] nicotine exhibits broad pharmacological action, of which the biggest effect is vasoconstriction. Zhu and Parmley[8] reported that the mechanisms that produce this vasoconstriction are associated with local or systemic catecholamine release, sympathetic neural stimulation, and endothelial dysfunction. Nicotine induces norepinephrine release from postganglionic sympathetic nerves, innervating blood vessels through a direct action on the nerve terminals.[9] Consequently, systemic and local actions occur, which can influence the biological processes that require higher metabolic activity.[2,10] Deleterious effects of nicotine and tobacco smoke are often investigated and discussed regarding their interrelationship with cancer as well as chronic

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conditions of the cardiovascular system such as atherosclerosis and respiratory diseases such as chronic obstructive pulmonary disease (COPD), which can affect adults and children all the same.[11] However, limited attention has yet been given regarding possible effects on the oral or stomatognathic system, in particular in association with orthodontic treatment.[12] The present study was conducted to assess the tobacco effects in orthodontics.

Table 1: Distribution of patients according to gender

Gender	N(%)
Males	134(51.53%)
Females	126(48.46%)
Total	260(100%)

Table 2: Effect of Tobacco on tooth movements.

Variable		Group NM	Group C
Tooth Movement	Male	0.85±0.65mm	0.25±0.58mm
	Females	0.82±0.34mm	0.28±0.45mm

MATERIAL AND METHODS

The present study was conducted to assess the tobacco effects in orthodontics. The present study was approved by the Ethical Committee of the institute and informed consent was obtained from the participants after explaining the study. A total of 260 patients were included in the study of age group above 20 years. The patients were divided into two groups: Group C (orthodontic movement without nicotine) and group NM (nicotine with orthodontic movement). The study focused on the mesio-buccal roots of maxillary first molars. The patients of groups C and CM received 0.9% saline solution at 0.5 ml/kg every 24 hours so as to simulate stress. Group NM received daily doses of 2 mg/kg nicotine solution (98% PA solution diluted in 0.9% saline solution), subcutaneously. Orthodontic movement was induced by nickel-titanium closed-coil springs that applied a reciprocal force of 30 g/f magnitude. During the study, all coil springs were evaluated. Data was collected and analysis was done. Statistical analysis was performed with IBM SPSS Statistics (International Business Machines Corporation (IBM), New York, USA), version 22 for Windows.

RESULTS

In the present study total sample size was 260 in which 51.53% were males and 48.46% were females. This study showed that tooth movement was more in nicotine group in both males (0.85±0.65mm) and females (0.82±0.34mm) than group without nicotine. Tooth movement was more in males in nicotine group and tooth movement was more in females than males in group without nicotine.

DISCUSSION

The early phase of orthodontic tooth movement always involves an acute inflammatory response, characterized by periodontal vasodilatation and migration of leucocytes out of the capillaries. These migratory cells produce various cytokines, the local biomechanical signal molecules that interact with the entire population of native paradental cells. Cytokines evoke the synthesis and secretion of numerous mediators by target cells, including growth factors, prostaglandins and other cytokines. Subsequent biological events occur and result in bone remodeling to accommodate movement of the tooth.[13,14]

Bone resorption and bone formation are parts of the remodeling process during orthodontic tooth movement. Bone is deposited on the alveolar wall on the tension side of the tooth with both heavy and light forces, and newly formed bone spicules follow the orientation of the periodontal fiber bundles. On the pressure side, with light forces, alveolar bone is directly resorbed by numerous osteoclasts in Howship's lacunae.[14]

In the present study total sample size was 260 in which 51.53% were males and 48.46% were females. This study showed that tooth movement was more in nicotine group in both males (0.85±0.65mm) and females (0.82±0.34mm) than group without nicotine. Tooth movement was more in males in nicotine group and tooth movement was more in females than males in group without nicotine.

Smokers are about 4 times more likely to present with periodontitis[15] through stimulating

inflammatory responses, thus impairing the host's protection and repair response mechanisms.[16] Nicotine and other cigarette components can alter peripheral vascularization, recruitment and function of immune system cells, proinflammatory cytokine increase and osteoclast activity, thus favoring bone tissue destruction.[17-19] Exposure to nicotine affects bone metabolism by modulating osteoblast proliferation and formation of bone resorption cytokines interleukin-1 and -6 at high levels.[20] In addition, smoking modulates gene expression in the periodontium, and the influence of smoking on periodontal disease may involve the effects of interleukin-6/interleukin-10 and ligand of the receptor activator of nuclear factor-kappaB (RANKL)/ osteoprotegerin (OPG) ratios.[21]

In the presence of periodontal inflammation, orthodontic forces can also speed up attachment loss and lead to angular bone defects.[22-25]

Nicotine has already been shown to cause an inflammation of the periodontal ligament (periodontitis) and subsequent loss of alveolar jaw bone with increased risk of tooth loosening.[26,17] This can increase the malposition and misalignment of permanent teeth by pathological tooth migration,[28] which at the same time also increases the need for orthodontic treatment.

Recently it has been shown by Akinkugbe *et al.*[29] that even environmental tobacco smoke (ETS) exposure is associated with periodontitis. As a result, even nonsmokers may be at risk to incur nicotine-associated deleterious effects regarding their teeth, the periodontal apparatus and thus orthodontic treatment.

CONCLUSION

The present study concluded that tooth movement was more in nicotine group. But Nicotine accelerated orthodontic tooth movement cause unbalanced bone resorption and apposition patterns around the moving teeth. The accelerated orthodontic tooth movement is expected due to increase in periodontal bone loss.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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