



## International Journal of Applied Dental Sciences

ISSN Print: 2394-7489  
ISSN Online: 2394-7497  
IJADS 2020; 6(2): 469-471  
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[www.oraljournal.com](http://www.oraljournal.com)  
Received: 22-02-2020  
Accepted: 24-03-2020

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### Role of diabetes mellitus and smoking as risk factors in prevalence of periodontal disease

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#### Abstract

**Introduction:** Diabetes mellitus and smoking modify host's immune response to microbial invasion and thereby progression of periodontal disease and have been identified as risk factors for the same. New Classification by AAP 2017 World Workshop on Classification Of Periodontal and Peri-Implant Diseases and Conditions has taken into consideration the effect of systemic (diabetes mellitus) and environmental factors (smoking) and put forward concept of staging and grading of periodontitis for effective diagnosis and management of an individual with periodontitis.

**Aim:** To evaluate periodontal status of Diabetic non-smokers, Smokers and Diabetic smokers suffering from periodontitis and stage, grade them as per the 2017 AAP Classification.

**Results:** Evaluation of periodontal clinical parameters highlighted that diabetic smokers had higher mean values for all the parameters than the other two groups, while the difference in mean values of clinical parameters for the diabetic non-smoker and smoker group did not show statistically significant difference.

**Keywords:** Periodontal disease, diabetes mellitus, smoking, risk factor

#### Introduction

Tobacco smoke contains various noxious chemicals such as carbon monoxide, ammonia, formaldehyde, hydrogen cyanide, and other toxic and irritant compounds, such as benzopyrene and dimethyl-nitrosamine<sup>[1]</sup>. According to the National Health and Nutrition Examination Survey III, smokers were four times as likely to have periodontitis as persons who had never smoked after adjusting for age, gender, race/ethnicity, education, and income/poverty ratio<sup>[2]</sup>. Effects of smoking on periodontium includes decreased gingival inflammation and gingival bleeding, increased proportion of sites with increased pocket depth, attachment loss and bone loss, severe periodontitis, tooth loss and the causal factor for the same is immunomodulation by the constituents of tobacco smoke resulting in altered neutrophil chemotaxis, phagocytosis and oxidative burst, increase in tumor necrosis factor- $\alpha$  and prostaglandin E2 in gingival crevicular fluid, production of prostaglandin E2 by monocytes in response to lipopolysaccharide and increased colonization of the subgingival area with periodontopathic bacteria due to anaerobic environment provided by the vasoconstrictive effect of the tobacco smoke<sup>[1]</sup>.

Diabetes mellitus, a common metabolic disorder characterized by elevated levels of blood glucose alters the microbial environment, results in immune alterations and the advanced glycation end products stimulate the fibroblast, endothelial cells and macrophages making them hyper-responsive and resultant increase in levels of secretion of pro-inflammatory mediators, vascular dysfunction and loss of effective tissue integrity, barrier function leading to increased periodontal destruction in diabetics<sup>[3]</sup>.

Therefore, Smoking and Diabetes Mellitus can be considered as risk factors for development and progression of periodontal disease. The new Classification put forward by AAP 2017 World Workshop on Classification Of Periodontal and Peri Implant Diseases and Conditions has taken into consideration the effect of systemic (diabetes mellitus) and environmental factors (smoking) as well as put forward concept of staging and grading of periodontitis and also highlighted smoking and diabetes as the major potential risk factors altering the staging of periodontal disease<sup>[4]</sup>.

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**2. Material and methods**

The study was carried out in the Department of Periodontics, Government Dental College and Hospital, Aurangabad. 120 subjects participated in the study who were selected from the out-patient department of the college.

Inclusion criteria: Individuals with a history of Diabetes mellitus or Smoking, and/or both and chronic periodontitis aged 40-60 years old, no history of previous periodontal therapy, no history of intake of antibiotics in the past 6 months.

Exclusion criteria: Presence of systemic diseases other than of diabetes mellitus/habit of smoking, pregnancy.

120 Patients including 40 Smokers, 40 Diabetic smokers and 40 Diabetic non-smokers with chronic periodontitis underwent periodontal examination. Parameters assessed were Clinical Attachment Loss (CAL), Probing Pocket Depth (PPD), Tooth Mobility, Recession, Case phenotype. Complexity factors were recorded and patients staged and graded as per the 2017 AAP classification.

**3. Results**

**3.1 Probing pocket depth (PPD)**

The mean probing pocket depth for the diabetic non-smokers was 5.2 +/- 1.5, for smokers 5.94 +/- 0.41, and diabetic smokers 6.32 +/- 1.2

The difference between diabetic non-smokers and smokers was not statistically significant but the difference between diabetic non-smokers and diabetic smokers was statistically significant. Also, the difference between diabetic smokers and smokers was statistically significant.

**3.2 Clinical attachment loss (CAL)**

The mean value for clinical attachment loss for the diabetic non-smokers was 2.4 +/- 1.3, for smokers 2.86 +/- 0.5, and diabetic smokers 3.4 +/- 0.85

The difference between diabetic non-smokers and smokers was not statistically significant but the difference between diabetic non-smokers and diabetic smokers was statistically significant. Also the difference between diabetic smokers and smokers was statistically significant.

**3.3 Mobility**

On evaluation of mobility of teeth of diabetic non-smokers, smokers and diabetic smokers it was found, out of 1100 total teeth evaluated of 40 diabetic non-smokers, 456 teeth had grade 1 mobility, 412 teeth had grade 2 mobility and 232 teeth had grade 3 mobility. (Chart 1)

Out of 1021 total teeth evaluated of 40 smokers, 356 teeth had grade 1 mobility, 354 teeth had grade 2 mobility and 311 teeth had grade 3 mobility. (Chart 2)

Out of 1007 total teeth evaluated of 40 diabetic smokers, 381 teeth had grade 1 mobility, 360 had grade 2 mobility and 266 teeth had grade 3 mobility. (Chart 3)

**3.4 Furcation involvement**

Out of 142 molars evaluated in diabetic non-smokers, 68 teeth had grade 1 furcation involvement, 44 teeth had grade 2 furcation involvement and 30 teeth had grade 3 furcation involvement. (Chart 4)

Out of 130 molars evaluated in smokers, 76 teeth had grade 1 furcation involvement, 40 teeth had grade 2 furcation involvement, 14 teeth had grade 3 furcation involvement. (Chart 5)

Out of 112 molars evaluated in diabetic smokers, 41 teeth had grade 1 furcation involvement, 46 teeth had grade 2 furcation

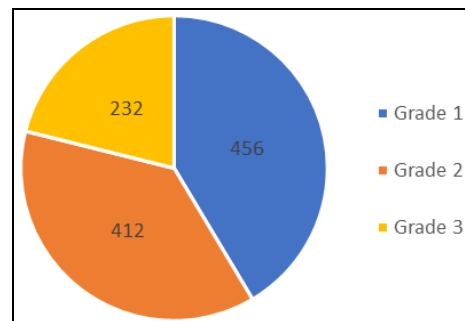
involvement, 25 teeth had grade 3 furcation involvement. (Chart 6)

**3.5 Classification of participants as per AAP 2017 classification**

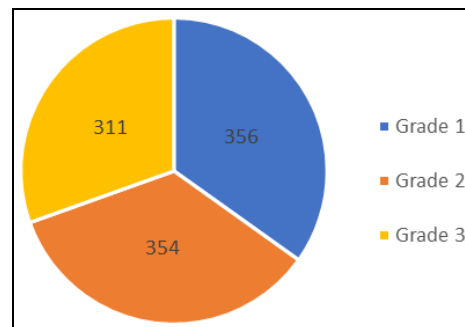
Out of 40 diabetic non-smokers, 13 individuals belonged to 2B, 16 individuals to 3B, 11 individuals to 3C.

Out of 40 smokers, 15 individuals belonged to 2C, 22 individuals to 3C and 3 individuals to 4C.

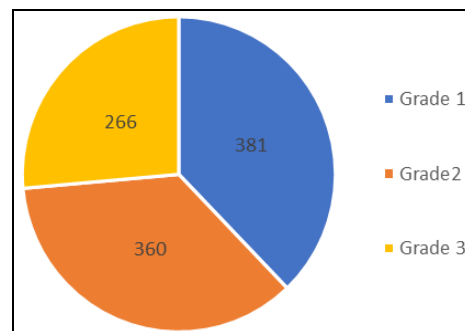
Out of 40 diabetic smokers, 8 individuals belonged to 2B, 26 individuals to 3B and 6 individuals to 4C.



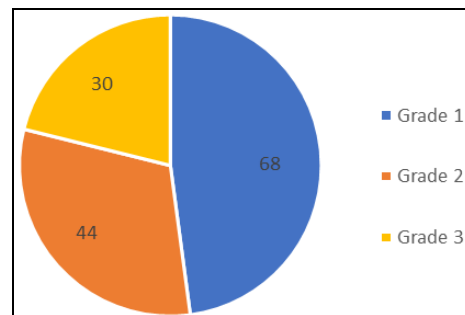
**Chart 1:** Evaluation of mobility of teeth among diabetic non smokers



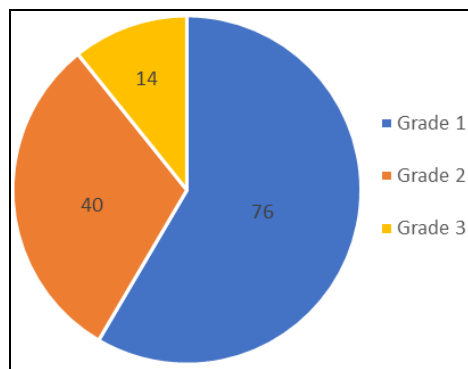
**Chart 2:** Evaluation of mobility of teeth among smokers



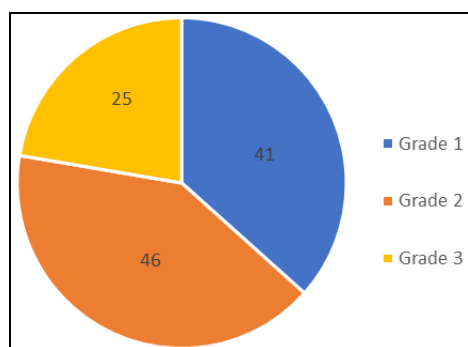
**Chart 3:** Evaluation of mobility of teeth among diabetic smokers



**Chart 4:** Evaluation of furcation involvement among diabetic non-smokers



**Chart 5:** Evaluation of furcation involvement among smokers



**Chart 6:** Evaluation of furcation involvement among diabetic smokers

#### 4. Discussion

Periodontitis is related to age, poor oral hygiene, smoking, obesity, socioeconomic status and chronic diseases such as cardiovascular disease, osteoporosis, and diabetes. The commonest risk factors for periodontal disease are: tobacco smoking, diabetes, pathogenic bacteria and microbial tooth deposits<sup>[5]</sup>.

Although smokers show less signs of clinical inflammation and gingival bleeding compared to non-smokers, there is strong dose dependent influence of smoking on periodontal tissues with increased severity in smokers.

Deeper periodontal pockets and greater loss of attachment was observed in diabetic-smokers as compared to diabetic non-smoker and smoker patients. Rationale for this could be that diabetes affects the defence mechanism of an individual by impairing phagocytosis and chemotaxis as there is premature death of neutrophils, and collagen production and degradation is also affected. Hyperglycemia causes fibroblast to synthesize decreased amount of collagen and newly formed collagen is more susceptible to degradation by matrix metalloproteinase's, leading to impaired wound healing. Smoking has also been found to have the same effects on neutrophils as well as collagen. These events taking place simultaneously can explain combined effect of diabetes and smoking on PPD and CAL found in our study. Also, smoking creates an environment suitable for the growth of periodontal microbes in shallow periodontal pockets but such occurrence is not seen in patients with diabetes alone<sup>[6]</sup>.

The results of this study are also in agreement with the results of study carried out by Obradović *et al.* who found that periodontal disease is more advanced in diabetic smokers as compared to diabetic non-smokers<sup>[7]</sup>.

Another study by Javed *et al.* demonstrated that periodontal parameters were comparable among smokers and non-smokers with type 2 DM, which is similar to results obtained in our study<sup>[8]</sup>.

The AAP 2017 classification has identified smoking and

diabetes as the major potential risk factors that can alter the staging of periodontal disease. Introduction of staging and grading, for periodontal disease similar to being used in oncology will allow easy multidimensional periodontal diagnostic classification allowing the clinician to give individualized diagnosis and customised treatment plans for every patient. The severity and extent of disease is based on the measurable extent of destroyed, damaged tissue and complexity is determined by assessing factors that may influence disease control and managing long term function and aesthetics<sup>[4]</sup>.

To conclude, the study highlighted that periodontal clinical parameters were significantly higher in diabetic-smokers as compared to other groups under study and suggests that diabetes and smoking play an important role in the occurrence and severity of periodontal disease.

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