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Assessment of Smoking Effect on Dental Implant Survival Rate

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ABSTRACT

Introduction: Dental implants are most commonly used nowadays for the replacement of missing teeth. The survival rate of the implant can be depending on several factors such as bone quality, implant material used, and personal oral habits such as smoking and oral hygiene.

Objectives: This clinical study was conducted to evaluate the outcome of smoking on dental implant survival rate.

Methods: This prospective study was done from 2008 to 2018. Information about implant type, radiographic and clinical findings and smoking habits were noted. The data were statistically assessed using Statistical Package for the Social Sciences (SPSS) software by International Business Machines Corporation (IBM) 20 version with Chi-square test at $P \leq 0.01$.

Results: In our study, there were 125 (62.5%) male and 75 (37.5%) female participants, in that 50% were nonsmokers and 50% were smokers. Of 200 patients, 80 were successful and 20 were failures. The success of implant was significantly more in nonsmokers than smokers ($P > 0.05^*$). The mobility was higher in smokers compared to nonsmokers which were statistically significant ($P > 0.001$). The failure rate of the implant was more with increased frequency and duration of smoking, which was statistically significant ($P > 0.05$).

Conclusion: The present study indicated that a greater risk of implant failure was related to increased frequency and longer duration of smoking habit due to bone resorption.

Key Words: Bone Quality, Dental Implant, Failure, Mobility, Smoking

INTRODUCTION

Dental implants are nowadays commonly followed for replacement of missing teeth. Various reported studies the long-term success of implant treatment; however, still, implants are predisposed to failure which become difficult to patients as well as the dentist.¹ Generally, implant failure is defined as the mobility of the implant during osseointegration or post-operative loading.² The risk factors for the implant are due to surgical procedure (location, type of implant, the time lapse between tooth removal and implant placement, and loading) and patient characteristics (smoking, uncontrolled diabetes, oral hygiene, and alcohol consumption).^{1,3} Success rate of implant is influenced by many causes including operator skill, oral hygiene, implant material (type and length) used,

occlusal load, bone quality and quantity, absence of medical conditions, and smoking habit.²⁻⁴ For implant success, immunological and genetic factors such as tumour necrosis factor- α and interleukin- 1β have been recognized as markers. Formerly, the success of implant was evaluated by the absence of mobility and apical radiolucency. However, presently, associated medical problems, implant type, and smoking habit can be considered as key factors in measuring the outcome of implant. Goutam et al. from the systematic review found that smokers have higher probabilities of implant failure and complications associated with nonsmokers.³

Studies have shown that smokers have a greater risk of loss of the tooth, periodontal disease, and oral cancer.⁵ It has been found that smoking is related to reduced bone loss, bone

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height, poor bone quality, and peri-implantitis.¹ Bain and Moy stated that both systemic and local injury to the tissues follows with smoking and which is a conjoint cause for the reduction in tissue oxygenation, which intern affects wound healing.⁶ Heitz-Mayfield and Huynh-Ba from systematic review observed a greater than before risk of peri-implantitis in smokers over nonsmokers.⁷ It has been found that 1.69 times greater implant failures in smokers than in nonsmokers. Increased quantity and duration of smoking enhances the risk of implant failure. Nicotine content of tobacco is the key factor which affects bone health and cellular proliferation.¹ DeLuca et al. from their ten-year follow-up study observed a significantly greater failure rate in smokers than nonsmokers.⁸ However, some researchers concluded that smoking is not measured as an outright contraindication in dental implant cases.¹

The present prospective study was done to evaluate the effect of smoking on dental implant survival rate.

MATERIALS AND METHODS

This prospective study was done in the Department of Prosthodontics and Oral Implantology after obtaining approval from Institutional ethics committee. The study was done from June 2008 to August 2018. Information's for each patient, rated to implant characteristics (implant region, type, implanted jaw, bone quality and bone augmentation) was noted. The informed agreement was obtained from all participating patients. 200 participants were included from the data and divided into Group I (smokers) and Group II (nonsmokers) based on the history of the smoking habit. The patients' age range was between 35 and 58 years. Smoking habit details such as the number of cigarette smoking/ day and year of smoking were recorded based on self-administered questions.

Patients having missing teeth along with sufficient bone thickness for the placement of implant were selected for the study, whereas patients with psychological problems, systemic conditions, radiation history, and cases requiring bone grafts were excluded from the study. Two trained investigators placed all dental implants in implant centre. All patients after implant placement recalled for periodic check-ups. Implant success was evaluated during each visit based on radiographic findings and clinical evaluation for implant mobility. The implant status was defined either as survival or failure. Survival was defined when an implant was satisfactorily functioning with no evidence of suppuration, pain, or inflammation; otherwise, it was defined as failure.

The data were statistically evaluated using SPSS statistical software from IBM 20 version (IBM Corp., Armonk, NY) with the Chi-square test. The association between smoking and implant failure was also evaluated.

RESULTS

In our study, the age range of patients was between 35 and 58 years. There were 125 (62.5%) male and 75 (37.5%) female participants, in that 50% were nonsmokers and 50% were smokers. Implant placed more in maxillary (121, 60.5%) than in mandibular region (79, 39.5%) (Table 1).

Of 200 patients, 80 were successful and 20 were failures. The success of implant was significantly more in nonsmokers than smokers ($P>0.05$). The implant failure rate was higher in smokers due to increased cigarette smoking frequency and duration (Table 2). Table 3 showed the role of mobility in the success of the dental implant. The mobility was higher in smokers compared to nonsmokers which were statistically significant ($P>0.001$). The failure rate of the implant was more with increased frequency and duration of smoking, which was statistically significant ($P>0.05$).

DISCUSSION

It has been observed from previous studies that success of a dental implant depends on patient-related factors like medical conditions, smoking habit and implant-related factors and bone quality. Hence the present study was done to evaluate the smoking effect on implant survival rate. Vaidya and Kumar evaluated dental implants prognosis in smokers and diabetic patients and concluded that higher implant failure in patients with diabetes with smoking habit.⁹ Goutam et al. from the literature review on the effects of smoking on dental implants success concluded that smokers have a higher probability of implant failure and more possibility for complications.¹⁰

Takamiya et al. evaluated the effect of smoking on the survival of dental implants with the systematic review from 41 studies and concluded that smoking habit may signify an additional risk factor for implant therapy; nevertheless, cigarette smoking should not be the main contraindication for implant treatment.¹ Twito and Sade assessed the effect of cigarette smoking habits on the outcome of dental implant treatment. The study was done on 7,680 implants and in that 7,359 (95.8%) survived and 321 (4.2%) did not survive. They concluded that smoking influences implant survival.⁴ These findings are in association with our findings. Saleem et al evaluated the outcome of smoking on survival of dental implant and they concluded that greater implant failure with increased duration and frequency of the smoking habit.¹¹ Arora et al. also found higher failure rate in smokers compared to a nonsmoker.¹² These findings are in association with our results.

Bain and Moy from meta-analysis compared implant success among smokers over nonsmokers, and they observed 11.28% failure in smokers in comparison to 4.76%

in nonsmokers which is following our study.⁶ Shenava et al. found 69.05% survival of implant in patients with more than 10 years over 30.95% in less than 10 years of smoking habit. They also found that failure rate was greater with cigarette consumption more than 20 packets/year compared to lesser than 20 packets/year, which was statistically non-significant and concluded no significant variance between smokers and nonsmokers.² We observed greater failure rate of an implant in patients with cigarette smoking >20 packets/day as well as in patients with >10 years of smoking history.

Bone healing around implant includes coordination of synthesis and activation of growth factors, antigenic stimulation, matrix proteins, and cytokines in the restoration of the bone surrounding the peri-implant interface.² The particular mechanism by which smoking distresses in implant failure is yet not agreed upon. It has been specified that cigarette smoking distresses cell differentiation of pluripotent mesenchymal cells into fibroblast and osteoblast and thus healing of implant and bone border can be compromised. The cigarette has more than 400 bioactive components, in that nicotine is the chief factor which disturbs bone healing. There is a great nicotine permeability of gingival epithelium around the dental implant, and thus osteoblastic activity is hampered. Nicotine reduces proliferation of macrophages, and defensive mechanism of monocytes and neutrophils thus upsurges probabilities of infection at the surgical site of implant placement.^{1,4} Smoking can disturb osseointegration by lowering blood flow rate due to raised peripheral resistance and platelet aggregation.⁴

The outcome of this study was that; implant failure was more amongst smokers related to nonsmokers, greater implant failure with increased frequency of cigarette smoking of >20 packets/day, and increased risk with increased duration of smoking over 10 years of duration. The drawback of the study was; it lacks long-term clinical study with a smaller sample size. Further studies are required on larger samples size to ascertain the adverse effect of smoking on dental implant failure. This study data help to recognize the risk factor of smoking habit on oral health and implant success which can be used to educate the patients to quit the habit.

CONCLUSION

Our study indicated that increased smoking frequency and duration related to a reduced implant survival rate as compared to nonsmokers. Patients should be educated about the harmful consequence of tobacco smoking.

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Author contribution

1. BK- Investigation
2. AS- Manuscript preparation
3. AS- Editing
4. TA- Analysis
5. SS- Editing
6. MST- Data collection

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Table 1: Patient's profile with respect to gender, jaw type, and smoking habit

Type	N %	P*
Gender		
Male	125 (62.5 %)	0.001
Female	75 (37.5%)	
Jaw		
Maxilla	121 (60.5%)	0.001
Mandibles	79 (39.5%)	
Smoking type		
Smoker	100 (50%)	
Non smoker	100 (50%)	

P*=0.001

Table 2: Smoking habit in relation to implant survival over number of cigarette/day and year of smoking habit

Smoking habit	Variables	Failure of implant	Survival of implant	P
Smoker	Yes	18 (18 %)	82 (82%)	0.05*
	No	2 (2 %)	92 (92%)	
No. of cigarette per day	<20	6 (6%)	44 (44%)	0.042
	>20	12 (12%)	38 (38%)	
	Non smokers	2 (2%)	92 (92%)	
Years of Smoking	<10 years	7(7%)	45 (45%)	0.021
	>10 years	11(11%)	37 (37%)	

P=0.05* significant

Tables 3: Implant mobility with respect to smoking habit (number of cigarette/day and year of smoking habit)

Smoking habit	Variables	Mobility	P*
Smokers	Yes	18 (18%)	0.001**
	No	2 (2%)	
No. cigarette per day	<20	6 (6%)	0.05*
	>20	12 (12%)	
Years of smoking	<10	7 (7%)	0.05*
	>10	11(11%)	