

Nicotine, the Predictor of Success or Failure of Dental Implants: A Retrospective Study

Abstract

Background: Dental implant therapy is a treatment of choice in missing teeth. However, certain conditions such as smoking, hypertension, and diabetes have negative influence on success of dental implants. Nicotine is found to cause osteoclastic changes. The present study was conducted to assess the relationship between nicotine and implant failure. **Materials and Methods:** The present retrospective study included 2570 patients of both genders. They were divided into two groups. Group I consisted of 1250 patients with a history of smoking and Group II were nonsmokers and comprised 1320 patients. The presence of pain, mobility, and inflammation was considered positive signs for implant failure. **Results:** The results showed that in Group I, males had 6.13% and females had 5% dental implant failure. Overall failure rate in Group I was 5.56%. In Group II, males had 2.98% and females had 0.9% failure. Overall failure rate in Group II was 2.35%. The difference between both groups was statistically significant ($P < 0.05$). In Group I, maximum (56), and in Group II, 18 patients had habit of >10 years of smoking. Maximum patients had habit of consumption of >20 cigarettes/day (Group I) and Group II had only 10 patients with this frequency. Maximum dental implant failures were observed in maxillary arch (70) than in mandibular arch (32). The difference was statistically significant ($P < 0.05$). **Conclusion:** Smoking influences the survival rate of dental implants. Thus, patient should be educated to discontinue the habit before implant placement.

Keywords: Dental implant, nicotine, smoking

Introduction

Dental implants have emerged as a new treatment modality for replacing missing teeth. This has been proved very effective in patients with edentulism. Dental implants' survival rate has been reported as high as 95% in 10 years long span. Its ability to unite with bone through the process of osseointegration has made this famous among all. Apart from its popularity among patients and dentists, it has few limitations also. There are few contraindications such as epilepsy, psychiatric disorders, osteoradionecrosis, smoking and diabetes, and mental retardation.^[1] Dental implant failure rate is seen which can be early failures and late failures. Absolute contraindications are patients with a history of myocardial infarction, Cardiovascular abnormalities, bleeding disorders, heart transplantation, active treatment of malignancy, drug abusers, and immunosuppression. Early failures are due

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to failure in osseointegration, while late failures are due to occlusal overload. There is decreased life of dental implants and thus leads to patient and operator unsatisfaction.^[2]

Smoking is one of the deleterious habits which have harmful effect on survival rate of the dental implants. Cigarette smoking contains nicotine, carbon monoxide, nitrogen, carbon dioxide, ammonia, hydrogen cyanide, benzene, anabasine, etc. There has been well-established correlation between periodontal health and smoking. Smoking has direct effect on osseointegration by decreasing blood flow to the implant site, leading to hypoxia of the area via increased aggregation of platelets, and enhancing the peripheral resistance. Studies have shown that the tobacco products inhibit proliferation of cell and hence wound healing.^[3,4]

Strietzel *et al.*^[5] in their study revealed that smoking interferes with the prognosis of dental implant treatment by causing peri-implantitis. Bain *et al.*^[6] in their study of association between the failure of dental

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implants and cigarette smoking found more dental implant failure (11.3%) in smokers as compared to nonsmokers where failure rate was 4.8%. The present study was conducted to assess the relationship between nicotine and implant failure.

Materials and Methods

The present retrospective study was conducted in the Department of Prosthodontics. It included 2570 patients of both genders. All were informed regarding the study and written consent was obtained. Ethical clearance was taken from the institutional ethical committee.

General information such as name, age, and gender was recorded. Based on history of smoking and nonsmoking, they were divided into two groups. Group I consisted of 1250 patients with a history of smoking, and Group II were nonsmokers and comprised 1320 patients. In smokers, the history of number of cigarettes smoking per day and year of smoking was recorded. Implants were inserted depending on the edentulous site. To maintain the uniformity and to avoid bias, single manufacturer implant (Nobel) was inserted in all patients. Cases where there were pneumatization of maxillary sinus, lifting of sinus was performed, and where bone was lacking, vertical or lateral bone grafting was done.

Following implant surgery, all patients were prescribed 0.2% chlorhexidine mouthwash rinse T.D.S for a week and antibiotic augmentin 500 mg (amoxicillin + clavulanic acid) thrice daily for 5 days. In all cases, nonabsorbable silk suture was used. The patients were instructed to be on soft diet for at least 1 week. The patients were recalled periodically for follow-up for 5 years at the interval of 6 months. The presence of pain, mobility, and inflammation was considered positive signs for implant failure. Results were subjected to statistical analysis using Chi-square test. $P < 0.05$ was considered statistically significant.

Results

Group I comprised smokers with 1010 males and 240 females, and Group II consisted of nonsmokers with 770 males and 550 females. The difference was statistically significant ($P = 0.01$) [Table 1]. Graph 1 shows that in Group I, 62 males (6.13%) and 12 females (5%) had failure. Overall failure rate in Group I was 5.56%. In Group II, 23 males (2.98%) and 5 females (0.9%) had failure. Overall failure rate in Group II was 2.35%. The difference between both the groups was statistically significant ($P < 0.05$). In Group I, of 74 patients, 56 had >10 years of habit of smoking and 18 had <10 years, and in Group II, 18 had >10 years of habit of smoking and 18 had <10 years. In Group I, 45 patients had frequency of >20 cigarettes consumption per day while 29 had <20. In Group II, 10 patients had frequency of >20 cigarettes consumption per day while 18 had <20. The difference

was statistically significant ($P < 0.005$) [Table 2]. Graph 2 shows that maximum dental implant failures were observed in maxillary arch (70) than mandibular arch (32). In Group I, 48 failures were seen in maxilla while 26 were in the mandible, whereas in Group II, maxillary arch had 22 implant failures and mandibular arch showed six dental implant failures. The difference was statistically significant ($P < 0.05$).

Discussion

Dental implants are now need of the hour. The successful implant therapy may be judged by its ability to perform all functions such as mastication and speech. The failure leads to highly unsatisfaction among patients as well as in operators. Pain, suppuration, and mobility are the signs of failures. With the advent in dentistry, dental implants have gained popularity. The osseointegration which is the key to success of implant depends on enhanced osteoblastic activity around the implant promoting direct union between implant and bone. Nicotine, the active constituents of tobacco, leads to osteoclastic activity which in turns cause bone loss. The harmful effects of nicotine can be so deadly that it alters wound healing and subsequently affecting the implant osseointegration.^[7]

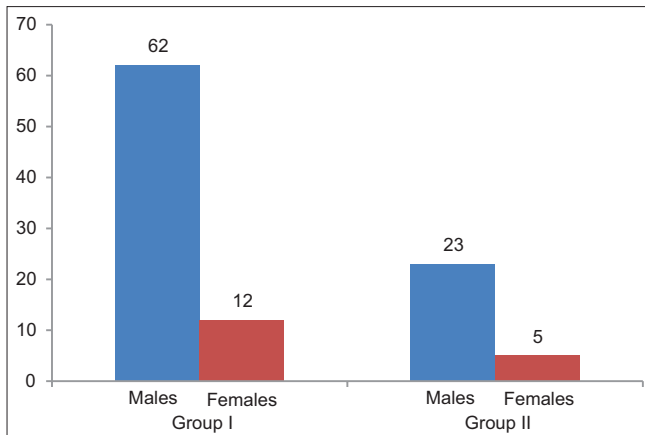
Haas *et al.*^[8] in their retrospective study of relationship of smoking on peri-implant tissues recorded higher pocket depth around implants, signs of peri-implantitis, and excessive bleeding. Balshe *et al.*^[9] in their study of the effects of smoking on the survival of smooth and rough surface dental implants found that the complications were significantly higher in smokers as compared to nonsmokers. In this study, we included 2570 patients of dental implants. A study by Kumar *et al.*,^[10] where authors assessed the effect of smoking on achieving osseointegration of surface-modified implants, included 1183 implants in 461 patients. A study by Twito and Sade^[11] included 7680 dental implants and evaluated failure rates.

Table 1: Distribution of patients

Groups	Total (n=2570)		P
	Group I (n=1250)	Group II (n=1320)	
Gender, n			
Male	1010	770	0.01
Female	240	550	

Table 2: History of smoking

	Group I	Group II	P
Year of smoking			
>10	56	12	0.01
<10	18	16	
Cigarettes/day			
>20	45	10	0.05
<20	29	18	



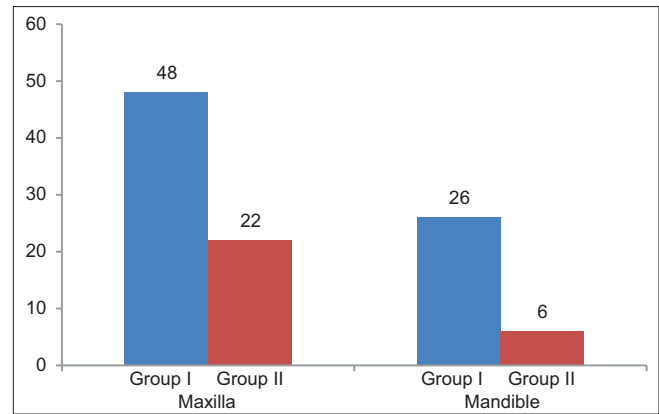
Graph 1: Failure rates in both groups

In the present study, we divided patients into two groups. Group I had smokers and Group II had nonsmokers. Peleg *et al.*^[12] also divided patients into smokers and nonsmokers. We found that implant failure was more in Group I as compared to Group II. In smokers, implant failure rate was 5.56% (males-6.13% and females-5%). In Group II, the failure rate was 2.35% (males-2.35% and females-0.98%). Similarly, Arora *et al.*,^[13] in their study of comparative evaluation of effect of smoking on survival of dental implant, found 121 dental implant failures out of 3721 implants. Peleg *et al.*^[12] reported higher failure rates in smokers as compared to nonsmokers.

Henemyre *et al.*^[14] in their study revealed that nicotine stimulates osteoclast resorption in a porcine marrow cell model and loss of calcium phosphate component of the bone. Ma *et al.*^[15] in their study of effect of nicotine on the biological activity of osteoblasts suggested that nicotine the active tobacco component has an inhibitory effect on the expression of bone matrix-related genes, which is considered to be essential for bone integration. Lindquist *et al.*^[16] in their 10-year retrospective study found 1 mm of mean marginal bone loss mandibular implants in patients with a history of smoking.

A study by Patrick *et al.*^[17] of a 5-year study on longitudinal clinical efficacy of core-vent dental implants found higher implant failures in the maxilla as compared to mandible. Goodacre *et al.*^[18] in a study of clinical complications with implants and implant prostheses also found higher implant failures in the maxilla than the mandible. In the present study, maxilla (54) had more implant failures than mandible (20).

Truhlar *et al.*^[19] in their study of second-stage failures related to bone quality in patients receiving endosseous dental implants concluded that maximum number of implant failures is seen in patients having D1 type bone as there is less blood supply in this type of bone and hence contributing to the implant failures. DeLuca *et al.*^[20] assessed the effect of smoking on osseointegrated dental



Graph 2: Dental implant failure rates based on arch

implants and concluded that smoking is one of the leading factors of implant failure. Smokers observed higher failure rates (23.08%) than nonsmokers (13.4%).

In the present study, we found that in Group I, maximum (56) patients had >10 years of habit of smoking, and in Group II, only 18 patients had >10 years of habit of smoking. We observed that in Group I, maximum (45) patients had frequency of >20 cigarettes consumption per day, and in Group II, only 10 patients had frequency of >20 cigarettes consumption per day. This is in agreement with the study by Schwartz-Arad *et al.*^[21] of smoking and complications of endosseous implants and found that heavy smokers (>10 cigarettes/day) had higher implant failure rates.

We found that maximum failures were seen in maxilla (70) than mandible (32). Twito and Sade^[11] found that maximum failures were seen in maxillary implants than mandibular implants. Ma *et al.* in their study observed that expression of osteogenic and angiogenic growth factors may be affected by nicotine consumption in the form of cigarettes. César-Neto *et al.*^[22] in their study of the effect of nicotine administration and cigarette smoke inhalation on bone healing around titanium implants found negative effect of nicotine on implant–bone contact point and bone area filling the implant threads. The authors suggested that smoking one of the deleterious habits has been documented in contributing factor that initiates implant failures.

Conclusion

Smoking is the contributing factor of dental implant failure. Nicotine in cigarettes is considered to induce osteoclastic activity in the bone around dental implants, thus influencing the survival rates.

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Conflicts of interest

There are no conflicts of interest.

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