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CORRELATION OF PERIODONTITIS AND LOOSENING OF DENTAL IMPLANTS IN TOBACCO SMOKERS A CASE CONTROL STUDY

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ABSTRACT

Background: In relation to dental implants, smoking has a number of detrimental consequences on the alveolar bone, such as decreased bone height, delayed bone healing, inadequate peri-implant bone production, increased bone loss, and peri-implantitis. Smoking has a strong correlation with delayed implant failure, which is often shown in the second stage of implant surgery.

Aim: The current clinical experiment set out to examine the impact of smoking on the marginal bone loss in dental implants and the survival rate of dental implants.

Methods: Using smoking as a criterion, two groups of the 86 patients were created. There were forty-three smokers in Group I and no smokers in Group II. At three, six, and twelve months following implant loading, radiographic assessments of marginal bone loss were made. By measuring the distance from the implant (widest section) to the crest of the alveolar bone mesially and distally on digital intra-oral periapical radiographs, radiographic bone loss was examined in order to determine the smoking impact. Additionally, the clinical attachment level was assessed.

Results: In the current study, the mean marginal loss seen in smokers at three months was 2.13±0.21, 2.46±0.09, 2.60±0.0.92, and 2.74±0.11 for the mandibular anterior, mandibular posterior, and maxillary anterior regions, respectively. At a year, the average bone loss rose to 2.6±0.10, 3.23±0.11, 3.30±0.075, and 3.20±0.093, respectively. A p-value of ~^0.00001 indicated that this difference was statistically significant. The 12-month follow-up visit revealed a greater percentage of smokers with implant movement. Implant mobility was present in 13.95% (n=6) of the research individuals who were smokers and 6.97% (n=3) of the non-smokers.

Conclusion: The length and frequency of smoking are closely correlated with the risk of long-term implant failure. Furthermore, smoking is bad for dental implants and the bone that surrounds them.

Keywords: Smoking, bone loss, dental implants, success, survival, smokers.

INTRODUCTION

Teeth loss eventually results in reduced aesthetics, which can cause functional disabilities and an incomplete grin look. These factors ultimately lower the quality of life for patients. The use of dental implants to replace lost teeth has transformed therapy thanks to developments in contemporary dentistry.[1]

Several issues related to single and multiple tooth restorations are resolved by using implant dentistry. Predictors of implant failure and success are often classified into two categories: patient-related variables (smoking, patient health, dental hygiene, amount and quality of alveolar bone) and implant features, placement, and physician experience. The overall success or failure of an implant is largely dependent on factors relating to the patient. Osteointegration provides the necessary bone support for an implant's long-term survival.[2]

Osseointegration causes the implant to become permanently integrated into the bone, forming a coating of titanium oxide that prevents the implant from breaking apart.4 Unlike natural teeth, dental implants do not have periodontal ligament. The connective tissue above the bone envelops the epithelial cells in the sulcular zone of dental implants.[3]

A variety of cellular and molecular processes have an impact on tissue stability.Sixth, the radiographic measurements of bone levels provide the most clinically predictive aspects of these molecular and cellular changes. The surrounding bone has a major role in the long-term survival of implants because of its dynamics.[4]

With regard to dental implants, smoking has a number of detrimental consequences on the alveolar bone, such as decreased bone height, delayed bone healing, inadequate peri-implant bone production, increased bone loss, and peri-implantitis.[5]

Smoking is strongly associated with delayed dental implant failure, which is often shown in the second stage after implant surgery. Implants put in the maxilla that is too short run an increased risk of failing. Implant mobility during osseointegration or postoperative loading is referred to as 10–12 implant failure. The primary component of smoking, nicotine, reduces blood flow to the bones and prevents the bone-forming cells from doing their regular jobs.[6]

Dental implants are extensively used to replace lost single and numerous teeth, despite the fact that smoking and the biological issues that follow cause bone loss and ultimately contribute to the failure of dental implants.15 The most reliable metric for determining the success or failure of an implant is marginal bone loss, regardless of the kind of prosthesis used—fixed or removable—after the implant is placed.[7]

After the first year of implant implantation, marginal bone loss of no more than 1 mm is deemed effective with dental implants.16 All oral surgical procedures, including implant implantation, are negatively impacted by smoking. Implant failure is more common in smokers than in non-smokers. In regards to smokers, the maxilla of smokers has a greater implant failure risk. Smokers are more likely to get peri-implantitis and marginal bone loss following implant implantation.[8]

A number of studies in the literature identify smoking as one of the main risk factors for implant failure. Various research reports range from 6.5% to 20% for the failure rate. Smokers had a greater rate of implant failure in locations with low trabecular bone quality.[9]

This may be the cause of the lower failure rate in the mandibular posterior area and the larger failure rate in the maxilla. Failure can be ascribed to the bloodstream's absorption of nicotine, which causes vasoconstriction. The current clinical experiment set out to examine the impact of smoking on the marginal bone loss in dental implants and the survival rate of dental implants.[10]

The goal of the current clinical experiment was to evaluate how smoking affected the marginal bone loss in dental implants as well as the implant survival rate.

MATERIALS AND METHODS

In this experiment, dental implants were implanted in 86 individuals, 22 to 67 years old, split equally between males and females. Using smoking as a criterion, two groups of the 86 patients were created. Group I had 43 patients who were smokers and Group II had non-smokers. Each patient's demographic information and comprehensive smoking history were documented. Group I like smokers comprised patients who had smoked more than ten cigarettes per day for at least two years. The institutional ethical committee granted ethical approval. Before being allowed to participate in the study, each included participant was required to complete a written informed consent form.

Patients who maintained good oral hygiene and had scores of plaque index and gingival index ≤1, stable and healthy periodontal teeth at the site of adjacent implant placement, no smoking history (for Group II), or more than 10 cigarettes a day for at least two years (for Group I) were the inclusion criteria for the study.

Patients with any systemic disease, a bone-affecting condition, medications that alter bone metabolism and function, poor dental hygiene, pregnancy, wasting disease, parafunctional habits, and instances of periodontitis were among the exclusion criteria for the research. Results for the plaque index were interpreted as follows: 0 indicates no plaque, 1 indicates plaque on the probe, 2 indicate visible plaque on the implant, and 3 indicate an excess of soft matter. The gingival index rated in the following manner and noted whether bleeding was present: 0 indicates no bleeding, 1 indicates isolated, visible bleeding patches, 2 indicates a confluent red line forming along the edge, and 3 indicates moderate or copious bleeding.

Following consideration of the inclusion and exclusion criteria, an extensive evaluation of the implant's features was carried out including type, site, location, quality of bone, and the need for augmenting bone was assessed. When placing an implant in the canine or incisor area, the implant placement was deemed anterior; for premolars and molars, the implant location was deemed posterior. The recall was planned to take place three, six, and twelve months after the implant was loaded. Reevaluation, data collecting, motivation, and education on effective plaque management strategies and risk factors related to implant failure were the main objectives of the recall visit. By measuring the distance from the implant (widest section) to the crest of the alveolar bone mesially and distally on digital intra-oral periapical radiographs, radiographic bone loss was examined in order to determine the smoking impact. Additionally, the clinical attachment level was assessed.

The difference in the parameters at each recall interval was examined and recorded. The recorded data for both the groups were statistically analyzed using one-way ANOVA keeping the level of significance at $p \leq 0.05$.

RESULTS

The goal of the current study was to assess how smoking affected the survival rate of dental implants and the bone loss that surrounded them. The participants who were included ranged in age from 22 to 67. There were 49 male research participants and 37 female study participants in total. The study comprised 50% smokers and 50% non-smokers in order to prevent bias. Table 1 summarizes the demographic characteristics that have been reported.

On the mesial and distal locations of the implants on digital intra-oral periapical radiographs, the amount of crestal bone loss was assessed. At three, six, and twelve months following implant loading—all recall intervals—the mean values of crestal bone loss for both groups were documented.

For the Maxillary Anterior implant placement site, the mean value for marginal bone loss in smokers at the three-, six-, and twelve-month recall periods was 2.13±0.21, 2.37±0.15, and 2.6±0.10, respectively. With a p-value of <0.00001, these values were statistically significant at all time periods. These values were 2.46±0.09, 2.73±0.10, and 3.23±0.11 for the maxillary posterior area. Once more, there was a substantial increase in bone loss from three months to six months, which increased considerably at twelve months' recall. A p-value of 0.00001 was observed in the mandibular anterior and posterior area, indicating the same finding. [Table 2] Patients who were classified as smokers showed higher (significant) bone loss at the implant margins.

With p <0.00001, the increased bone loss was unrelated to the amount of time after the implants were inserted. The posterior mandibular location showed less bone loss. Based on the mobility observed, the rate of implant failure in smokers and non-smokers was evaluated and is compiled in Table 2. Greater failure rates were correlated with longer and more frequent smoking. The marginal bone loss for maxillary anteriors at 3 months, 6 months, and 12 months recall was determined to be 1.17±0.095, 1.30±0.14, and 1.48±0.12 in Group II (Non-smokers). At various recall dates, the data showed a substantial increase in crestal bone loss. The same result was obtained with a p-value of <0.00001 for the remaining maxillary posterior and mandibular anterior and posterior locations (Table 2).

DISCUSSION

Smoking has broad systemic effects that further trigger a number of pathways that impede the effectiveness of implant therapy. Studies published in the literature indicate that smokers have 1.69 times more implant mobility than non-smokers. According to this research, smoking poses a significant risk for delayed implant failure. Heat from smoking and toxic chemicals (such as hydrogen cyanide and carbon monoxide) can hinder the healing process and cause problems after implant implantation, which can result in implant failure. It has been shown that smokers have a twice as high implant failure rate as non-smokers.

Additionally, smokers report experiencing higher difficulties following implant installation. A 2007 research by Baig and Rajan in the literature found that smokers had a noticeably greater incidence of peri-implantitis and implant failure. The results of this investigation supported the

conclusions that smokers had increased bone loss (marginal) across all recall intervals. To fight this, it is advised to stop smoking at least one week before to implant placement in order to allow for the reversal of the effects of smoking. This should be continued for two months following surgery in order to ensure osseointegration, as proposed by Moy et al. in 1993 and Barjanzi SA in 2018. Smoking has about 40,000 active biochemical elements and is harmful to several oral tissues, including alveolar bone. Additionally, smoking is linked to lower vitamin levels and higher reactive oxygen species, which might hinder osseointegration. The primary ingredient in cigarettes is nicotine.

When compared to non-smokers, smokers' saliva and plasma have a noticeably greater concentration of nicotine. Nicotine has a number of detrimental effects on the growth and repair of bones. The current study's mean loss (marginal bone) for smokers at three months was 2.13±0.21, 2.46±0.09, 2.60±0.0.92, and 2.74±0.11 for the mandibular anterior, mandibular posterior and maxillary anterior regions, respectively.

At a year, the average bone loss rose to 2.6±0.10, 3.23±0.11, 3.30±0.075, and 3.20±0.093, respectively. A p-value of ~^0.00001 indicated that this difference was statistically significant. The current study's results were in line with those of studies conducted in 2013 by Feloutzis et al., 1999 by Kan et al., 1996 by Lindquist et al., and 2018 by Gupta A et al., all of which found a statistically significant increase in smokers' marginal bone loss, particularly in heavy smokers.

The p-values for these investigations were, in order, <0.01, 0.027, and <0.01. These numbers were all lower when it came to non-smokers.

The impact of smoking on the long-term survival rate of dental implants was also assessed in the current clinical investigation. The 12-month follow-up visit revealed a greater percentage of smokers with implant movement.

Implant mobility was present in 13.95% (n=6) of the research individuals who were smokers and 6.97% (n=3) of the non-smokers. Furthermore, there was an association between the frequency of smoking and implant mobility: among non-smokers, only 1 individual experienced implant mobility, but 18.60% (n=8) of participants who smoked > 20 cigarettes/day did. Regarding duration, smokers with a history of ~5 years had a lower percentage of patients with mobility at 12 months recall (25.58%; n = 11), compared to smokers with a history of ~5 years (n = 2). With a p-value of <0.00001, all of these results were statistically significant. According to the results, smokers had more mobility at the 12-month recall interval than non-smokers did.

Additionally, the mobility and, thus, the incidence of implant failure were positively correlated with longer duration and higher cigarette smoking rates. These results came after studies by Arora et al. in 2017 and Gupta et al. (2018), which found that non-smokers had considerably superior long-term implant survival than smokers. According to a 2018 study by Gupta et al., the likelihood of implant failure was directly correlated with smoking frequency.

CONCLUSION

Smoking significantly lowers the long-term survival rate of dental implants, even though it's not regarded as an absolute contraindication for implant installation. The length and frequency of smoking are closely correlated with the risk of long-term implant failure. Furthermore, smoking negatively impacts the bone loss surrounding dental implants. Additionally, smokers experience greater marginal bone loss than non-smokers. Therefore, in order to ensure the long-term life of

dental implants, smoker patients should receive the necessary information and support to quit smoking. To get a firm conclusion, further research with a longer observation time is necessary.

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TABLES

Parameter	**Subgroup**	**N**	**%**
Age		22years- 67 years	
Gender	Male	49	56.97
	Female	37	43.02
Smoking Criteria	Smokers	43	50
	Non-smokers	43	50
Implant Site	Maxillary Anterior	21	24.41
	Maxillary Posterior	26	30.23
	Mandibular Anterior	15	17.44
	Mandibular Posterior	24	27.90
Smoking Frequency	<20 cigarettes/day	1	2.32
	> 20 cigarettes/day	8	18.60
Duration	<5 years	2	4.65
	>5 years	11	25.58

Table 1: Demographic parameters and Implant characteristics of study subjects

Variables	Implant Placement Site	3 months	6 months	12 months	p-value
Smokers	Maxillary Anterior	2.13±0.21	2.37±0.15	2.6±0.10	<0.00001
	Maxillary Posterior	2.46±0.09	2.73±0.10	3.23±0.11	
	Mandibular Anterior	2.60±0.0.92	2.81±0.090	3.30±0.075	
	Mandibular Posterior	2.74±0.11	2.66±0.116	3.20±0.093	
Non-smokers	Maxillary Anterior	1.17±0.095	1.30±0.14	1.48±0.12	
	Maxillary Posterior	1.20±0.08	1.39±0.11	1.69±0.19	
	Mandibular Anterior	1.34±0.129	1.79±0.165	2.0±0.453	
	Mandibular Posterior	1.57±0.151	2.01±0.429	2.240.437	

Table 2: Marginal Bone loss at different time intervals in smokers and non-smokers