

SMOKING AND SUCCESSFUL DENTAL IMPLANT OSSEO INTEGRATION

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ABSTRACT

Objective: To know the outcome of Implant osseo integration in Smokers and non Smokers.

Material and Methods: This study was employed the observational research method, carried out at Islamic International Dental College and Hospital, Islamabad, Pakistan. Several inclusion and exclusion criteria were established in order to refine the results. The patients qualifying the inclusion criteria of missing/failing teeth, sufficient quality and quantity of bone to support the implant were required to sign consent forms. Cases with documentation of uncontrolled metabolic diseases, immunosuppressed status (post renal, liver, and bone marrow transplants), chemotherapy and head and neck radiation, psychological disorders and patients on bisphosphonates medication were excluded from the research.

Results: In this study, 307 implants placed in 170 patients (92 females, 78 males). 301 implants were successfully Osseo integrated while 6 failed. Out of the unsuccessful 6, 2 belonged to patients smoking more than 5 cigarettes a day qualifying as smokers according to our inclusion criteria. 301 (98%) implants were successfully Osseo integrated while 6 (2%) implants failed and had to be removed adding up to the total of 307 mentioned cases. Out of the 6 failed implants (all observed during the early phase of Osseo integration) 2 belonged to tobacco smokers while 4 failed implants were observed in non-smokers. Implant failure occurred in 3 females and 3 males equally, all being observed in the posterior quadrants of maxilla and mandible (UL6, UL4, LR6, LR4, LR5, LR6).

Conclusion: Tobacco smoking is a significant risk factor for implant placement and may lead to failure of implant osseo integration.

Key Words: Smoking, Implant, Osseo integration.

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INTRODUCTION

The purpose of dental interventions is to restore form, functionality and aesthetics to the patients. Dental implants have proven to be one of the most unswerving remedy for tooth loss for decades¹. Failure of endosseous implants is encountered in merely 5 to 10% of the patients but the dependence on this technique makes this insignificant percentage a matter encouraging a great amount of research and study^{2,3}. Complications during or after the procedure, along with local and systemic factors may result in failure of Osseo integration of the implant⁴. Implant failure is characterized by radiographic radiolucency, pain, discomfort, infection at the site of implant and mobility of the implant. Failure

may be encountered in the Osseo integration period or in the postloading period^{5,6}.

Reviewing literature provides us with evidence that smoking has been considered to have contradictory significance as a factor effecting Osseo integration of dental implants. Individuals who smoke tobacco show compromised resistance to infection and inefficient wound healing, accounting to decreased leukocyte activity and low chemotactic migration rate, low mobility and low phagocytic activity. Calcium absorption is another process that appears to be impaired in tobacco smokers^{7,8}. Stated facts are enough to establish smoking as a key player in the failure of dental implants. On the contrary, there is abundant literature to challenge the establishment and account the failure of Osseo integration of dental implants to several other factors such as inferior bone quality, lack of clinical expertise, placement technique, medically compromised patients, type of the implant, and its surface characteristics^{9,10}.

The objective of this study is to determine the dependence of failure of Osseo integrated dental implants

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on tobacco smoking by analyzing 307, consecutively placed implants in men and women belonging to various age groups over a period of 7 years at Islamic International Dental College and Hospital. Placement site (mandible and maxilla) and bone grafting were also considered as data defining factors.

MATERIAL AND METHODS

This clinical survey employed the observational research method, carried out at Islamic International Dental College and Hospital, Islamabad, Pakistan. Several inclusion and exclusion criteria were established in order to refine the results. The patients qualifying the inclusion criteria of missing/failing teeth, sufficient quality and quantity of bone to support the implant were required to sign consent forms. Cases with documentation of uncontrolled metabolic diseases, immunosuppressed status (post renal, liver, and bone marrow transplants), chemotherapy and head and neck radiation, psychological disorders and patients on bisphosphonates medication were excluded from the research.

The sample size of this research comprised of a total of 307 implants in 170 consecutive patients (92 females, 78 males), while mean age was 44.87 with a standard deviation of 16.59. 82.9% (141) patients did not smoke while 17.1% (29 patients) were identified as smokers (smoking >5 cigarettes/day).

Prophylactic antibiotics were administered (Capsule Augmentin 2g, 1 hour before the procedure). Surgery was performed under local infiltration and block anaesthesia (2% lidocaine with 100,000 epinephrine), some procedures were also performed under intravenous sedation. Raising the Mucoperiosteal full thickness flap, implant site was exposed and prepared, bone was drilled with constant irrigation with sterile saline solution to avoid over heating of bone which may lead to necrosis. After closure of the flap and placement of sutures, patients were instructed to follow post-operative instructions, take a soft diet for 2 weeks, prescribed suitable antibiotics (Capsule 1g Augmentin, twice daily for five days after procedure) and analgesia (Tablet An-said 100 mg, twice daily and Tablet Panadol three times daily), along with Enziclor mouth rinses twice daily for two weeks.

The implants chosen ranged from 3.5 mm to 5.8 mm in diameter and 10.5 mm to 12 mm in length. Patients were recalled for clinical examination 1 week post implant placement, while they were radiographically evaluated after 4 weeks and the implant was assessed for Osseo integration after a period of 2 months. The implant was deemed successfully Osseo integrated if signs of pain, discomfort, mobility, infection or allergy were absent along with no radiolucency around the implant. Data from 170 patients with 307 surgically placed implants was analyzed and evaluated using the software SPSS Statistics 17.0. Age, gender, the

tooth replaced, quadrant, Osseo integration outcome (success or failure) and smoking status served as the input variables. The software calculated the P value employing the chi-square test. P value determined the significance of tobacco smoking as a factor influencing the process of Osseo integration of dental implants.

RESULTS

Sample size (N) comprises of 307 implants placed in 170 patients (92 females, 78 males). 301 implants were successfully Osseo integrated while 6 failed. Out of the unsuccessful 6, 2 belonged to patients smoking more than 5 cigarettes a day qualifying as smokers according to our inclusion criteria. Table 1 enlists and summarizes the predictors of implant success and failure. The frequency of placement of implants is shown in Table 2. Sample size is presented as cross tabulation between implant success and smoking status in Table 3.

301 (98%) implants were successfully Osseo integrated while 6 (2%) implants failed and had to be removed adding up to the total of 307 mentioned cases. Out of the 6 failed implants (all observed during the early phase of Osseo integration) 2 belonged to tobacco smokers while 4 failed implants were observed in non-smokers. Implant failure occurred in 3 females and 3 males equally, all being observed in the posterior quadrants of maxilla and mandible (UL6, UL4, LR6, LR4, LR5, LR6). P value, 0.043 indicates that tobacco smoking does have a significant effect on Osseo integration of dental implants and may result in implant failure. The frequency of placement of implants in the 4 quadrants is shown in figure 1 .



Figure 1: The bar chart illustrates the frequency of placement of implants in the 4 quadrants. Maximum implants were placed in the lower right quadrant.

DISCUSSION

Research and literature divides the dental community into the preachers and followers of two schools

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Table 1: The positive factors contribute to implant success and the negative factors are responsible for implant failure.¹¹

Positive factors	Negative factors
Bone Type (Types 1 and 2)	Bone Type (Types 3 and 4)
High bone volume	Low bone volume
Clinician experience (more than 50 cases)	Osteonecrosis
Mandibular placement	Patient is more than 60 years old
Single tooth implant	Limited clinician experience
Implant length >8.0mm	Systemic disease (for example, uncontrolled disease)
Fixed partial denture with more than two implants	Auto-immune disease (for example, lupus or HIV)
Axial loading of implant	Chronic periodontitis
Regular postoperative recalls	Smoking and tobacco use
Good oral hygiene	Unresolved caries, endodontic lesions, frank pathology
	Maxillary placement, particularly posterior region
	Short implants (<7.0mm)
	Acentric loading
	Inappropriate early clinical loading
	Bruxism and other parafunctional habits
	Fixed partial denture with two implants

Table 2: The frequency of placement of an implant at the tabulated sites.

Implant Site Valid	Frequency	Percent	Valid Percent	Cumulative Percent
1	38	12.4	12.4	12.4
2	42	13.7	13.7	26.1
3	37	12.1	12.1	38.1
4	29	9.4	9.4	47.6
5	38	12.4	12.4	59.9
6	95	30.9	30.9	90.9
7	28	9.1	9.1	100.0
Total	307	100.0	100.0	

Table 3: Summary of the implant success and corresponding smoking status of the patient.

Count		Implant success		Total
		No	Yes	
Smoking status	No	4	274	278
	Yes	2	27	29
Total		6	301	307

of thought based on the significance of tobacco smoking as a factor leading to failure of Osseo integration of dental implants. Dental implants are made from Titanium attributing to its biocompatibility with the oral environment. The placement of the dental implant to replace a missing tooth is a surgical procedure followed by a healing period allowing Osseo integration¹². Osseo integration is the formation of a strong biomechanical association between the implant surface and surround-

ing bone^{13,14}.

The results of our study suggest that there is a greater chance of implant failure in smokers compared to non-smokers. This establishment coincides with the results of several other studies^{15,16}. Based on our results and supporting literature, it can be determined that tobacco smoking possibly will represent an added threat to the success of the dental implant. Nonetheless, the results are suggestive of the theory and lack absolute

confidence^{7,15}. Haas R et al. conducted a similar study in which 366 implants were placed in 107 consecutive patients and 1000 implants placed in 314 non-smokers and concluded that smokers are susceptible to a greater possibility of implant failure due to peri-implantitis. For these reasons, sterility at the time of implant placement procedure and prescribing the use of antibiotics and anti-microbial mouthwash as critical for the success of implants¹⁶.

Harmful chemicals in cigarette smoke such as nicotine, Carbon monoxide, aldehydes, nitrosamine, benzene, ammonia, carbon dioxide may cause poor healing, increased rate of bone loss, reduced host defense to ward off infections. There may be vasoconstriction of the vessels and the high affinity of Carbon monoxide with Hemoglobin that inhibits oxygen transport to all tissues results in tissue hypoxia. Levin et al. established that the high temperature and harmful by-products from cigarette smoking impairs healing and thus the success of implants. Increased plaque formation and tar deposits due to smoking may also be significant contributors.^{11,17}. Bain et al. assessed the dependence of failure of dental implants on smoking by evaluating 2194 implants placed in 540 patients. 5.92% implants failed to Osseo integrate and had to be removed. Further analysis proved that failure amongst smokers was 11.28% while only 4.76% implants failed in non-smokers¹⁸. De Bruyn H et al. worked with a 208 cases of implant placement to establish the impact of cigarette smoking on implant failure. Early implant failure was observed in 9% smokers and 1% nonsmokers¹⁹. Sanchez-Perez A et al. determined tobacco as a key risk element for the Osseo integration and complete healing of the implant. The success rate of implants in non-smokers was significantly greater (98.6%) the success rate of implants in smokers (84.2%)²⁰.

Schwartz-Arad D et al. investigated the survival of 959 implants placed in 261 patients over a span of 3 years. Only 2% of implants received by non-smokers failed to Osseo integrate while 4% implants failed to Osseo integrate in patients who were smokers. The results established smoking as a risk factor leading to complications and higher rate of failures of dental implants²¹. The contribution of smoking towards failure of dental implants cannot be denied although its significance is debatable. Smoking independently has also been documented to have insufficient data supporting its substantiality as a failure causing factor. Equally substantial research and literature suggests no clinical relevance between the effect of smoking and implant success. Lambart PM et al. studied 2900 dental implants received by 800 patients. The results of the investigation suggested that smoking did not essentially lead to early implant failure. Rather smoking posed a threat at the later stage by increasing the risk of development of peri-implantitis and can therefore be encountered by avoiding smoking, prophylactic/ peri-operative antibiotics and antimicrobial mouthwash²².

Wahid Terro et al. concluded that smoking did not pose a threat to the survival of dental implants. A retrospective study analyzed the data from 54 patient who had received a total of 162 implants over a period of 4.9 years. 97.5% implants survived and the p value ($p=0.8577$) determined that smoking did not contribute to the failure of dental implants²³. Alexander Tadeu Sverzut et al. also weighed the significance of smoking as a factor causing failure of dental implants in the early stages of Osseo integration. Analyzing 1628 implants placed in 650 patients, over 8 years, determined that smoking cannot be held responsible for the failure of dental implants. 3.32% of the failures were observed in non-smokers and 2.81% in smokers²⁴. This contradiction in the results of the various studies mentioned is because the success of implants depends on multiple patient and operator related factors. It can not be attributed to cigarette smoking alone.

Results of the current study establish that for achievement of ideal Osseous integration between the bone and implant, patients should be strongly advised to quit smoking before the procedure for better results and for the benefit of their general health. Nevertheless, Cigarette smoking should not be considered a contraindication for dental implant placement. However, these results may be predisposed to inaccuracy due to constrain in our approach, methodology and diversity of the data²⁵. The existing study can be revised and authenticated by diversifying our sample size. Patients can be divided into age groups to assess age and its contributing resilience. The success of implants can also be studied with relevance to gender specific factors. Obtaining patient data from other institutes and practicing clinicians will establish factors such as clinical expertise as constants further substantiating our results. Irrespective of the school of thought our results support, it is the responsibility of a practicing clinician to educate and advice all patients on the detrimental effects of smoking on general and oral health. With careful treatment planning and procedure, along with maintenance of general health and oral hygiene, dental implants can be placed with the aim of survival to support the prosthesis planned.

CONCLUSION

Tobacco smoking is a significant risk factor for implant placement and may lead to failure of implant osseointegration.

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AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

Khan A: Main Idia
Saeedullah M: Collection of Data
Khan K: bibliography
Qureshi B: manuscript writing

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.