



Comparative Evaluation of Smoking on Primary Stability and Mucosal Health of Implants During and after Osteotomy Phases: An Original Research Study

Dr. Aashima Bajaj¹, Dr. Kashish Rathi², Dr. Vartika Verma³, Dr. Pooja Mishra⁴, Dr. Shylendar V⁵, Dr. Rahul Shah⁶

¹Professor, Department of Periodontology and Oral Implantology, Kalka Dental College, Meerut, Uttar Pradesh, India (Corresponding Author)

²Reader, Department of Periodontology and Oral Implantology, Kalka Dental College, Meerut, Uttar Pradesh, India

³Assistant Professor, Department of Periodontology and Oral Implantology, Kalka Dental College, Meerut, Uttar Pradesh, India

⁴Assistant Professor, Department of Periodontology and Oral Implantology, Kalka Dental College, Meerut, Uttar Pradesh, India

⁵Post Graduate Student (Third Year), Department of Periodontology and Oral Implantology, Kalka Dental College, Meerut, Uttar Pradesh, India

⁶Private Practitioner (Periodontist & Oral Implantologist), Pragya Polyclinic, Indirapuram, Ghaziabad, Uttar Pradesh, India

Correspondence to: Dr. Aashima Bajaj

(Received: 27 October 2023)

Revised: 22 November

Accepted: 26 December)

KEYWORDS

Dental Implant, Osteotomy, Smoking, Mucosa, Stability, Gingiva

ABSTRACT:

Background and Aim: Failure of dental implants are apparently unavoidable in the clinically since it is directly affected by several factors. Smoking is one of the prominent factors which decreases the periodontal health and hence implant longevity. This study was planned and conducted to assess and explore the effects of smoking on primary stability during and after osteotomy phases. Authors also planned to assess the effects of smoking on mucosal health of implants during and after osteotomy phases.

Materials and Methods: Total 24 patients were studied including both male and female subjects using threaded and osseointegrated implants of identical dimensions. Only one implant per patients was studied in details. Implant primary stability was checked by using electronically driven device Periotest M. Assessment of the effects of smoking on mucosal health of implants was done during and after three month of osteotomy procedure. Clinical signs of periodontal health were checked carefully for it. Statistical analysis was conducted to outline the inferences and results. P value less than 0.05 was taken as significant.

Statistical Analysis and Results: Results confirmed that out of 24 studied patients, 14 were males and 10 were females. In Group 1, effects of smoking on primary stability during osteotomy phases in which mild, moderate and severe effects were notices equally in all three severities. P value was highly significant for severe (n=2). Assessment amongst all studied questions using one-way ANOVA was done. P value was highly significant for evaluation done within groups (0.001).

Conclusion: Authors concluded smoking has clear and deleterious effect on primary stability during and after osteotomy phases. Findings were significant in patients with severe effects of smoking. Likewise authors also have seen noticeable harmful effects of smoking on mucosal health of implants during and after osteotomy phases.



Introduction

Literature has well evidenced that over 4.12 million people worldwide died in 2005 as a result of their addiction to smoking. This number is more than enough to explain the loss being caused by smoking.¹⁻³ Tobacco seems to be as old as human civilization and was introduced into India during AD 1500. Clinical trials researches show consistently high success rate for threaded dental implants in partially and completely edentulous patients. Implant failures happens at a low rate, but tend to augment in patients with risk factors.⁴⁻⁷ By Definition, risk factor is anything that increases chances or possibility of failure. Many pioneer workers have stated that implant success and failure are generally based on patient related factors like smoking habits. Effects of smoking on implant survival and success are more obvious in region of poor density trabecular bone. In smokers, maxillary implants have been shown to have more failure rate as compared to mandibular implants.⁸⁻¹² This could be possibly based on the basic bony trabecular patterns and nature of mandibular bone. Perhaps, maxillary bone is of lower quality and therefore more vulnerable to the destructive effects of smoking. Vasoconstriction is also seen during smoking habits. This is basically due to the local inclusion of nicotine into the bloodstream.¹³⁻¹⁵ In view of all these interesting facts and information, this study was planned and conducted to assess and explore the effects of smoking on primary stability during and after osteotomy phases. Authors also planned to assess the effects of smoking on mucosal health of implants during and after osteotomy phases.

Materials and Methods

This study was abstracted and conducted to address the predetermined set objectives. They were; assessment of effects of smoking on primary stability during osteotomy phases, assessment of effects of smoking on primary stability after osteotomy phases, assessment of the effects of smoking on mucosal health of implants during osteotomy phases, assessment of the effects of smoking on mucosal health of implants after osteotomy phases. To ensure the standardization, authors utilized single identical clinical team for all implant surgical procedure. Total 24 patients were studied in detail in the study. All subjects were selected by simple random procedure of sample selection or sampling. Both male and female subjects were included in the study. Only threaded and osseointegrated implants of identical dimensions were included in the study. Inclusion criteria included; patients with known history of smoking, all active smokers, patients with missing mandibular first molar those requiring prosthetic rehabilitation (either side right/left). The study design was prospective in which authors monitored the

patients from cause to effects. Exclusion criteria included patients without smoking habit, patients with any type of follow up problem, patients on heavy medication for other diseases (can interfere with data quality), and patients below 25 years of age and patients with ongoing/underlying systemic critical diseases. Only one implant per patients was studied in details. Informed consent was obtained from all participating patients. Implant primary stability was assessed by using electronically driven device Periotest M (Stomshop Inc., Germany). The assessment was performed for each individual implants during and after three month of osteotomy procedure. Similarly, assessment of the effects of smoking on mucosal health of implants was done during and after three month of osteotomy procedure. This evaluation was performed by two individual experts by clinical examination and symptomatic evaluation of mucosal health. Clinical signs of periodontal health like existence of pocket, bleeding gingival, fenestrations, dehiscence, attachment loss and other relevant signs were checked carefully. Statistical analysis was conducted to outline the inferences and results. P value less than 0.05 was taken as significant.

Statistical Analysis and Results

All the observed data were checked for any possible incorporated error. Thereafter data was subjected to basic statistical analysis with SPSS statistical package for the Social Sciences version 22 for Windows. Nonparametric test, namely, chi-square test, was used for further data analysis; p-value. Out of 24 studied patients, 14 were males and 10 were females [Table 1, Graph 1]. p-value was highly significant for age group 26-30 years. It was 0.01. Maximum 8 patients was noticed in this group. Table 2 depicted about the fundamental statistical description with level of significance evaluation using "Pearson Chi-Square" test. It was for Group 1 for Objective 1: Effects of smoking on primary stability during osteotomy phases. Mild, moderate and severe effects were noticed equally in all three severities (2,2,2). P value was highly significant for severe (n=2). It was 0.01. Table 3 demonstrated about the basic statistical description with level of significance evaluation using "Pearson Chi-Square" test for Group 2. It was for Objective 2: Effects of smoking on primary stability after osteotomy phases. Mild, moderate and severe effects were noticed in 1,2,3 patients respectively with significant p value (0.02) in 3 patients. Table 4 showed about the basic statistical description with level of significance evaluation using "Pearson Chi-Square" test (Group 3). It was for Objective 3: Effects of smoking on mucosal health of implants during osteotomy phases. Mild, moderate and severe effects were noticed in 3,2,1 patients respectively with significant p value (0.01) in 1 patients. Table 5 demonstrated about the fundamental



statistical description with level of significance evaluation using “Pearson Chi-Square” test (Group 4). It was attempted for objective 4: Effects of smoking on mucosal health of implants after osteotomy phases. Mild, moderate and severe effects were noticed in 1,1,4

patients respectively with significant p value (0.01) in 4 patients. Table 6 showed about the assessment amongst all studied questions using one-way ANOVA. P value was highly significant for evaluation done within groups (0.001).

Table 1: Age & gender based statistical description of contributing patients

Age Group (Yrs)	Male	Female	Total	P value
26-30	5	3	8	0.01*
31-35	4	2	6	0.30
36-40	3	1	4	0.90
41-45	1	2	3	0.20
46-50	1	2	3	0.50
Total	14	10	24	*Significant
*p<0.05 Significant				

Graph 1: Patients demographic allocation and related details

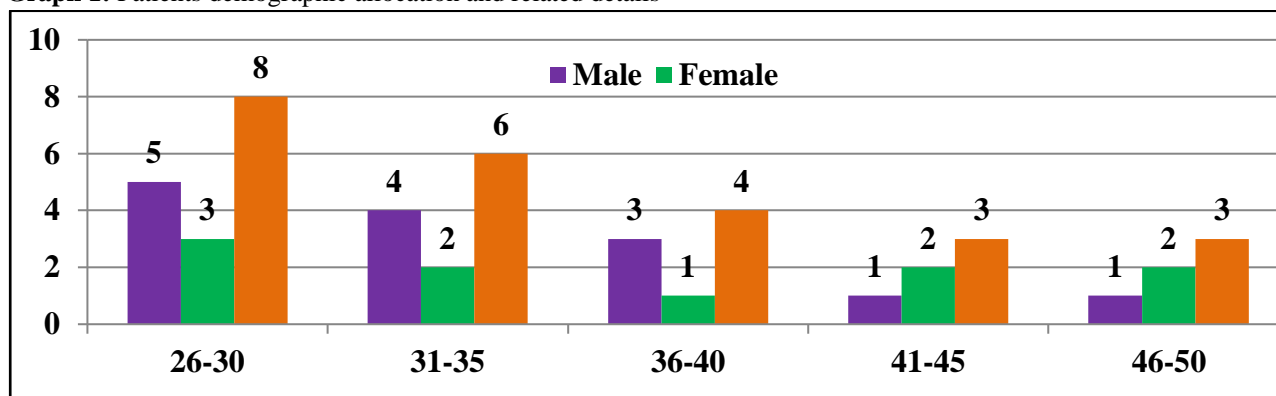


Table 2: Fundamental statistical description with level of significance evaluation using “Pearson Chi-Square” test (Group 1 for Objective 1: Effects of smoking on primary stability during osteotomy phases)

Severity	Stat. Mean	Std. Dev.	Std. Error	95% CI	Pearson Chi-Square Value	df	p value
Mild (n=2)	1.02	0.029	0.835	1.96	1.049	1.0	0.08
Moderate (n=2)	1.12	0.321	0.028	1.02	1.637	2.0	0.09
Severe (n=2)	1.24	0.653	0.212	1.18	1.122	1.0	0.01*
*p<0.05 significant							

Table 3: Fundamental statistical description with level of significance evaluation using “Pearson Chi-Square” test (Group 2 for Objective 2: Effects of smoking on primary stability after osteotomy phases)

Severity	Stat. Mean	Std. Dev.	Std. Error	95% CI	Pearson Chi-Square Value	df	p value
Mild (n=1)	1.01	0.022	0.125	1.16	1.219	1.0	0.09
Moderate (n=2)	1.14	0.322	0.438	1.02	1.637	2.0	0.07
Severe (n=3)	1.26	0.603	0.492	1.28	1.242	1.0	0.02*
*p<0.05 significant							



Table 4: Fundamental statistical description with level of significance evaluation using “Pearson Chi-Square” test (Group 3 for Objective 3: Effects of smoking on mucosal health of implants during osteotomy phases)

Severity	Stat. Mean	Std. Dev.	Std. Error	95% CI	Pearson Chi-Square Value	df	p value
Mild (n=3)	1.30	0.122	0.103	1.26	1.212	1.0	0.06
Moderate (n=2)	1.23	0.952	0.238	1.12	1.622	2.0	0.08
Severe (n=1)	1.11	0.233	0.342	1.78	1.234	1.0	0.01*
*p<0.05 significant							

Table 5: Fundamental statistical description with level of significance evaluation using “Pearson Chi-Square” test (Group 4 for Objective 4: Effects of smoking on mucosal health of implants after osteotomy phases)

Severity	Stat. Mean	Std. Dev.	Std. Error	95% CI	Pearson Chi-Square Value	df	p value
Mild (n=1)	1.10	0.493	0.165	1.16	1.222	1.0	0.09
Moderate (n=1)	1.13	0.267	0.294	1.52	1.262	2.0	0.50
Severe (n=4)	1.21	0.231	0.242	1.08	1.734	1.0	0.01*
*p<0.05 significant							

Table 6: Assessment amongst all studied questions using one-way ANOVA

Variables	Degree of Freedom	Sum of Squares Σ	Mean Sum of Squares $m\Sigma$	F	Level of Sig. (p)
Between Groups	2	2.940	1.647	1.2	0.001*
Within Groups	18	2.546	0.387		-
Cumulative	123.10	11.994			*p<0.05 significant

Discussion

Many of the researchers in the recent past have extensively worked out on the implant success in its post operative phases. Several postulations have been worked out. Mostly, researches were focused around the mucosal health and extent of bony union between implant and alveolar bone.¹⁶⁻¹⁹ Literature has well evidenced that smoking has deleterious effects on the overall health of periodontium. It includes soft tissues like gingival and periodontal ligament and hard tissues like cementum and residual alveolar ridge. Periodontal activities are directly related to the prostaglandin activities and its production.²⁰⁻²² Prostaglandins are frequently produced during inflammation procedure and are mediators of inflammation process. However production of prostaglandin is known to be inhibited by NSAID. These over the counter NSAID are therefore prescribed by many clinicians during apparent alveolar bone loss. Smoking is known to have prominent effects on the overall gingival or mucosal health. Smoking usually suppresses the signs of inflammations like bleeding on probing and redness. However, several

searchers have confirmed that smoking increase overall periodontal attachment loss by 4 to 5 times.²³⁻²⁴ Therefore smoking must be avoided in patients with high risk of periodontal attachment loss. Our study results were in accordance with many previous significant studied wherein authors recommended similar inferences.

Conclusion

Within the limitations of the study, authors concluded highly noteworthy inferences and results. They confirmed that the smoking has clear and deleterious effect on primary stability. This stands true for assessments made during and after osteotomy phases. Findings were significant in patients with severe effects of smoking. Similarly authors have also identified noticeable deleterious effects of smoking on mucosal health of implants during and after osteotomy phases. Findings were significant in patients with severe effects of smoking. Authors also expect some other long term future studies so as to establish other remarkable guidelines in these prospects.



References

1. Benegal V, Isaac M, Murthy P, Rekha D, Joseph J, Sahoo S, *et al.*, editors. Manual for Tobacco Cessation. New Delhi: Ministry of Health and Family Welfare, Government of India; 2005. p. 7.
2. Gupta PC, Subramoney S. Smokeless tobacco use and risk of stillbirth: A cohort study in Mumbai, India. *Epidemiology* 2006;17:47-51.
3. Travis J, Pike R, Imamura T, Potempa J. The role of proteolytic enzymes in the development of pulmonary emphysema and periodontal disease. *Am J Respir Crit Care Med* 1994;150:S143-6.
4. Synder HB, Caughman G, Lewis J, Billman MA, Schuster G. Nicotine modulation of in vitro human gingival fibroblast beta1 integrin expression. *J Periodontol* 2002;73:505-10.
5. Baig MR, Rajan M. Effects of smoking on the outcome of implant treatment: A literature review. *Indian J Dent Res* 2007;18:190-5.
6. Al-Belasy FA. The relationship of "shisha" (water pipe) smoking to postextraction dry socket. *J Oral Maxillofac Surg* 2004;62:10-4.
7. Bostrom L, Linder LE, Bergstrom J. Influence of smoking on the outcome of periodontal surgery. A 5-year follow-up. *J Clin Periodontol* 1998;25:194-201.
8. Meechan JG, Macgregor ID, Rogers SN, Hobson RS, Bate JP, Dennison M. The effect of smoking on immediate post-extraction socket filling with blood and on the incidence of painful socket. *Br J Oral Maxillofac Surg* 1988;26:402-9.
9. Ma L, Zheng LW, Cheung LK. Inhibitory effect of nicotine on bone regeneration in mandibular distraction osteogenesis. *Front Biosci* 2007;12:3256-62.
10. Porter JA, von Fraunhofer JA. Success or failure of dental implants? A literature review with treatment considerations. *Gen Dent* 2005;53:423-32.
11. Chuang SK, Cai T, Douglass CW, Wei LJ, Dodson TB. Frailty approach for the analysis of clustered failure time observations in dental research. *J Dent Res* 2005;84:54-8.
12. Sanchez-Perez A, Moya-Villaescusa MJ, Caffesse RG. Tobacco as a risk factor for survival of dental implants. *J Periodontol* 2007;78:351-9.
13. De Bruyn H, Collaert B. The effect of smoking on early implant failure. *Clin Oral Implants Res* 1994;5:260-4.
14. Lambert PM, Morris HF, Ochi S. The influence of smoking on 3-year clinical success of osseointegrated dental implants. *Ann Periodontol* 2000;5:79-89.
15. Fartash B, Tangerud T, Silness J, Arvidson K. Rehabilitation of mandibular edentulism by single crystal sapphire implants and overdentures. 3-12 year results in 86 patients. A dual center international study. *Clin Oral Implants Res* 1996;7:220-9.
16. Lindquist LW, Carlsson GE, Jemt T. A prospective 15-year follow-up study of mandibular fixed prostheses supported by osseointegrated implants. *Clin Oral Implants Res* 1996;7:329-36.
17. Queiroz DA, Cortelli JR, Holzhausen M, Rodrigues E, Aquino DR, Saad WA. Smoking increases salivary arginase activity in patients with dental implants. *Clin Oral Investig* 2009;13:263-7.
18. Schwartz-Arad D, Samet N, Samet N, Mamlider A. Smoking and complications of endosseous dental implants. *J Periodontol* 2002;73:153-7.
19. Kan JY, Rungcharassaeng K, Lozada JL, Goodacre CJ. Effects of smoking on implant success in grafted maxillary sinuses. *J Prosthet Dent* 1999;82:307-11.
20. Nitzan D, Mamlider A, Levin L, Schwartz-Arad D. Impact of smoking on marginal bone loss. *Int J Oral Maxillofac Implants* 2005;20:605-9.
21. Levin L, Hertzberg R, Har-Nes S, Schwartz-Arad D. Long-term marginal bone loss around single dental implants affected by current and past smoking habits. *Implant Dent* 2008;17:422-9.
22. Lindquist LW, Carlsson GE, Jemt T. Association between marginal bone loss around osseointegrated mandibular implants and smoking habits: A 10-year follow-up study. *J Dent Res* 1997;76:1667-74.
23. Oates TW, Caraway D, Jones J. Relation between smoking and biomarkers of bone resorption associated with dental endosseous implants. *Implant Dent* 2004;13:352-7.
24. Bain CA. Smoking and implant failure-Benefits of a smoking cessation protocol. *Int J Oral Maxillofac Implants* 1996;11:756-9.