

PATIENT'S RISK FACTORS FOR DENTAL IMPLANT SUCCESS AND FAILURE (A RETROSPECTIVE STUDY)

Mohammad Abdelhamied Shuman*

ABSTRACT

Aim: To detect the odds ratios of the various risks influencing the dental implant success and failure retrospectively.

Methods: In this retrospective study the clinical and radiographic data of the patients who underwent dental implant procedures at the department of oral and maxillofacial surgery Al-Azhar university since year 2015 were reviewed. Two hundred cases were selected for this study, data were recorded including smoking, periodontal diseases history, diabetes, hypertension, osteoporosis and number of implants in each patient. Periapical digital radiograph was used immediate after implant, at the loading time and in annual basis for five years for measuring radiographic bone loss (RBL). Criteria for implant success and failure were also collected and recorded and all these data were statistically analyzed. The odds ratio (ORs) and RBL were determined and the significance level was considered to be a p value of 0.05.

Results: The success rate at the level of 200 patients in this study was 93.5 percent (187 patients) and at least one implant failed in the remaining 6.5 percent (13 patients). Patients who were not smokers, without neither diabetes nor history of periodontitis and patients who received only single implant recorded higher significant ORs associated with implant success (OR = 3.66, 5.96, 7.24 & 3.56) respectively. The average RBL was minimal with 0.08mm annually for the success implants.

Conclusion: Data review of this study showed that the effectiveness of the dental implant was adversely affected by smoking, diabetes, history of periodontal diseases and multiple placements of implants.

INTRODUCTION

Dental implants become a common practice in the management of partial and complete edentulous patients for oral rehabilitation. The think of osseointegration was first described by Branemark defined as “direct structural and functional relationship be-

tween functional loaded implant and ordered living bone”¹. This concept has more influenced the development of dental implant regarding the surgical technique, implant surface treatment, loading protocol and prosthetic principles. Many studies show that after 5 years of loading, more than 95 % success rate was expected^{2,4}.

* Oral and Maxillofacial Surgery Faculty of Dentistry Al-Azhar University Assiut Branch.

Although the recent evolution of the implant dentistry, many factors still contribute to early and delayed implant failure ⁵. According to the International Congress of Oral Implantologists (ICOI), a survival implant is one that has stayed in the mouth without being extracted, without any discomfort in operation, mobility or loss of bone surrounding it, more than half of the duration of the implant ⁶.

Effective implants must have no pain or discomfort, no mobility, no infection and bone loss of less than 0.2 mm / year in the first year of loading ⁷. The early implant failure might due to local factors like, poor quality and quantity of bone, overheating, infection or contamination, more bone compression necrosis and low primary stability or systemic factors like, patient medical conditions and smoking⁸. While delayed implant failure mainly related to periimplant diseases or prosthetic problems as, improper design, overloading, long cantilever and occlusion problems ^{9,10}. This retrospective study was designed to evaluate the odds ratio for the patients systemic and local risk factors associated with dental implant success.

MATERIALS AND METHODS

Study Design and Patients

This retrospective study analyzed the clinical and radiographic data of patients who underwent dental implant procedures in the oral and maxillofacial surgery department Al-Azhar university since year 2015 were reviewed and used in this retrospective study.

Data Collection Procedures

The patient data were reviewed chronologically starting from February 2015 by the same examiner until 200 out of 360 cases selected according to inclusion and exclusion criteria. Subjects who are at least 18 years of age who have had at least one implant implanted have been included, with

periapical x-rays for the implant being followed up for at least one year. Data and parameters of the study including study number, age, sex, smoking status, diabetes, osteoporosis, hypertension, history of periodontal diseases, deepest periimplant propping depth were reported. (Fig. 1), the number of implants in each case and radiographic bone loss after implant loading and bone remodeling. Periapical digital radiograph was used immediate after implant, at the loading time and in annual basis for five years for measuring RBL using Kodak[®] software digital measurements (Fig. 2). Implant considered failed when removed for any reason during follow up period and considered successes when there no progressive pain, mobility, infection, RBL after loading (less than 0.2mm/year).



Fig. (1) Periimplant probing depth.

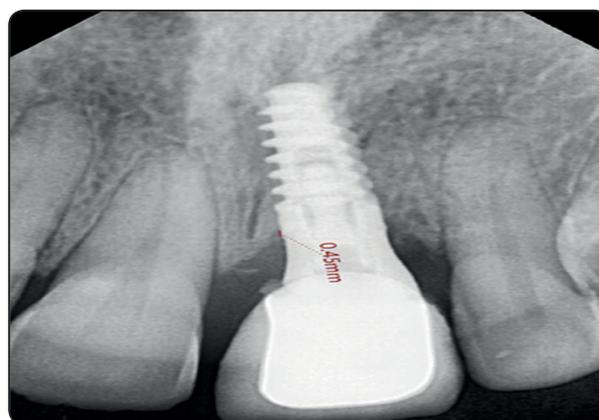


Fig. (2) Digital measurement of RBL.

Statistical Analysis

The statistical analyses were employed using SPSS software using SPSS version 22.0 for Windows. Implant success / failure rate, Odds ratio (ORs) and RBL were tested using the Pearson Chi-square and Fisher exact test (a p value of 0.05 was considered to be a significance level).

RESULTS

In this analysis, 200 cases were implanted with 550 implants between 2015 and 2020, with an average follow-up time of 2.25 years. The mean age of the sample population, with 110 males and 90 females, was 60.8 ± 7.95 years (ranging from 22 to 81). In (Tab. 1), demographic and clinical data were identified in (Tab. 1).

TABLE (1): Demographic data of the selected participants:

Total: 200 patients (100%)		
Age	60.8 ± 7.95 Y., ranging 22 to 81	
Sex	Male: 110 (55%)	Female 90 (45%)
Smoking	Yes: 70 (35.0%)	No: 130 (65.0%)
Diabetes	Yes: 55 (27.5%)	No: 145 (72.5%)
Osteoporosis	Yes: 23 (11.5%)	No: 177 (88.5%)
Hypertension	Yes: 75 (37.5%)	No: 125 (62.5%)
History of periodontal disease	Yes: 124 (62.0%)	No: 76 (38.0%)
Probing depth	Average 0.79 ± 1.41mm, ranging 0 - 8.9	
Total number of implants	Average 2073 ± 1.44 implants/ subjects, ranging 1 - 9	

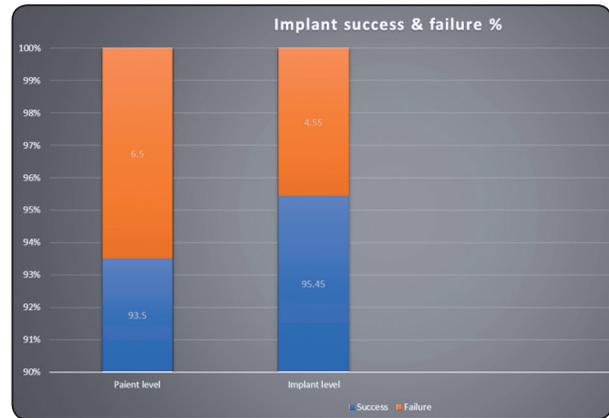


Fig. (3) Implant success and failure outcome:

At the patient number level 93.5 percent (187 patients) were assessed as success and the remaining 6.5 percent (13 patients) had at least one implant failure. 95.45 percent (525 implants) of the implants were determined as successful at the number of implants level and 4.55 percent (25 implants) were failed and removed (Fig. 3).

For a successful implant, the average RBL was small, and the linear regression analysis showed an estimated annual RBL of 0.08 mm. For the implants, the average test depth was 3.63 ± 0.93 mm, ranging from 0 to 8.9 mm, and the success criteria were met. In terms of implant success factors, substantially higher implant success-related ORs were observed in patients who were not smokers at the time of implant placement (OR= 3.66) (OR= 3.66) , Patients without diabetes (OR= 5.96), patients with no prior history of periodontal disease (OR= 7.24), patients with a single implant only (OR= 3.56) and patients with the shallowest depth of inspection (OR= 3.49), And the significance amount was (< 0.001). The success rate of implants was not influenced by factors like patient age (OR=1.81), gender (OR=1.40),

patients with a history of osteoporosis (OR=1.30) and patients with hypertension (OR=1.05). ORs and estimated RBL data were presented in the (Tab. 2).

TABLE (2): ORs, p values and approximate implant success-related RBL.

Factor	ORs	P values	RPL (mm)
Age	1.81	0.7270	0.0007
Sex	1.40	0.0809	0.1560
Smoking	3.66	<0.0001*	0.7040
Diabetes	5.96	<0.0001*	0.5620
Osteoporosis	1.30	0.1380	0.0534
Hypertension	1.05	0.0610	0.0370
History of periodontal diseases	7.24	<0.0001*	0.7208
Number of implants	3.56	0.0001*	0.6690
Probing depth	3.49	<0.0001*	0.4336

* After regression modification, the variables displayed statistically significant differences.

DISCUSSION

In this retrospective analysis, 200 patients with 550 implants were examined to determine the risk factors for implant success and failure, respectively. Smoking has been generally known as a peri-implant disease risk factor^{11,12}. Smoking as a risk factor affecting the effectiveness of the implant with OR 3.66 was shown by the results of this analysis. It registered an OR varying from 3.6 to 4.6¹³. Smoking also induces peripheral vasoconstriction, leading to local ischemia and reduced nutrient flow, as smoking causes a decline in polymorphonuclear neutrophils (PMN) chemotaxis and phagocytosis. Compared to non-smokers, these traits were shown to have elevated levels of periodontal pathogens in smokers.¹⁴

Another risk factor for peri-implant disease was also reported as the history of periodontal disease¹⁵.

It represents the highest risk (OR= 7.24) of all the factors found, based on the outcome of the current analysis. The association between the history of periodontal disease and peri-implantitis has also been discussed by many systematic reviews.¹⁶⁻¹⁸ For the newly mounted sterile implants, it was assessed that periodontal microorganisms recognized in residual periodontal diseases of the remaining natural dentition could be sources of infection. Also, when pathogenic bacteria are detected, the sensitivity of the human host can be altered.¹⁵

The role of diabetes as a risk factor affecting dental implant success is controversial, with many studies refuting diabetes as a risk factor for peri-implantitis and implant failure,¹⁵ and it may be due to the fact that most of the participants in these chosen studies were patients with well-controlled diabetes^{19,20}. Prolonged hyperglycemia contributes to the thickening of the capillary basement membrane, resulting in reduced peripheral effusion, impaired diffusion of oxygen and elimination of waste. There is also a decline in PMN chemotaxis, which impairs host immunity to infection. Furthermore, due to hyperglycemia, the development and accumulation of advanced glycation end products results in the release of more proinflammatory cytokines that result in tissue destruction.^{21,22} As a result of the current research, it can be hypothesized that during the research era, the population of diabetic patients was not well controlled, so an OR of 5.96 was found, suggesting a significant association between diabetes and implant failure. Another important result of this study outcome is the number of implants in the same patient, so the lower implant success rate is associated with an increased number of implants inserted in a single patient. This result was in line with the outcome stated by Baumer et al.²³. For patients who have obtained multiple implants, a more meticulous maintenance procedure may be helpful.

REFERENCES

1. Branemark P. Osseointegration and its experimental background. *J Prosthet Dent.* 1983; 50:399-410.
2. Del Fabbro M, Testori T, Kekovic V, Goker F, Tumedei M, Wang HL. A Systematic Review of Survival Rates of Osseointegrated Implants in Fully and Partially Edentulous Patients Following Immediate Loading. *J Clin Med.* 2019;8: 2142-50.
3. Fobbe H, Rammelsberg P, Lorenzo Bermejo J, Kappel S. The up-to-11-year survival and success of implants and abutment teeth under solely implant-supported and combined tooth-implant-supported double crown-retained removable dentures. *Clin Oral Implants Res.* 2019;30: 1134- 41.
4. Pieralli S, Kohal RJ, Rabel K, von Stein-Lausnitz M, Vach K, Spies BC. Clinical outcomes of partial and full-arch all-ceramic implant-supported fixed dental prostheses. A systematic review and meta-analysis. *Clin Oral Implants Res.* 2018;29: 224-36.
5. Lin G, Ye S, Liu F, He F. A retrospective study of 30,959 implants: Risk factors associated with early and late implant loss. *J Clin Periodontol* 2018 ;45:733-43.
6. Misch C, Perel M, Wang H, et al. Implant success, survival, and failure: the International Congress of Oral Implantologists (ICOI) Pisa Consensus Conference. *Implant Dent* 2008; 17:5-15.
7. Sunil L, Ashok D, Dhanraj D. Criteria for Success in Dental Implants: A Systematic Review. *IJSR* 2017; 6:715 -18.
8. Mantena S, Gottumukkala S, Sajjan S, Raju A, Rao B, Iyer M. Implant Failures – Diagnosis and Management. *Int J Clin Imp Dent.* 2015; 1:51-9.
9. Güven S, Cabbar F, Güler N. Local and systemic factors associated with marginal bone loss around dental implants: a retrospective clinical study. *Quintessence Int.*2020; 51:128-41.
10. Bertl K, Ebner M, Knibbe M, Pandis N, Kuchler U, Ulm C, Stavropoulos A. How old is old for implant therapy in terms of early implant losses? *J Clin Periodontol.* 2019; 46:1282-93.
11. Javed F, Rahman I, Romanos G. Tobacco-product usage as a risk factor for dental implants. *Periodontol 2000.* 2019; 81:48-56.
12. Adler L, Buhlin K, Jansson L. Survival and complications: A 9- to 15-year retrospective follow-up of dental implant therapy. *J Oral Rehabil.* 2020; 47:67-77.
13. Naseri R, Yaghini J, Feizi A. Levels of smoking and dental implants failure: A systematic review and meta-analysis. *J Clin Periodontol.* 2020; 47:518-28.
14. Alahmari F, Javed F, Ahmed Z, Romanos G, Al-Kheraif A. Soft tissue status and crestal bone loss around conventionally-loaded dental implants placed in cigarette- and waterpipe (narghile) smokers: 8-years' follow-up results. *Clin Implant Dent Relat Res.* 2019;21:873-78.
15. Daubert D, Weinstein B. Biofilm as a risk factor in implant treatment. *Periodontol 2000.* 2019; 81:29-40.
16. Lin C, Chen Z, Pan W, Wang H. Is History of Periodontal Disease Still a Negative Risk Indicator for Peri-implant Health Under Supportive Post-Implant Treatment Coverage? A Systematic Review and Meta-analysis. *Int J Oral Maxillofac Implants.*2020 ;35:52-62.
17. Lee C, Huang Y, Zhu L, Weltman R. Prevalences of peri-implantitis and peri-implant mucositis: systematic review and meta-analysis. *J Dent.* 2017; 62:1-12.
18. Dreyer H, Grischke J, Tiede C, Eberhard J, Schweitzer A, Toikkanen S, Glöckner S, Krause G, Stiesch M. Epidemiology and risk factors of peri-implantitis: A systematic review. *J Periodontal Res.* 2018; 53:657-81.
19. Monje A, Catena A, Borgnakke W. Association between diabetes mellitus/hyperglycaemia and peri-implant diseases: Systematic review and meta-analysis. *J Clin Periodontol.* 2017; 44:636-48.
20. Shi Q, Xu J, Huo N, Cai C, Liu H. J Does a higher glyce-mic level lead to a higher rate of dental implant failure? A meta-analysis. *Am Dent Assoc.* 2016; 147:875-81.
21. Genco R, Borgnakke W. Diabetes as a potential risk for periodontitis: association studies. *Periodontol 2000.* 2020; 83:40-5.
22. Javed F, Romanos G. Chronic hyperglycemia as a risk factor in implant therapy. *Periodontol 2000.* 2019; 81:57-63.
23. Bäumer A, Toekan S, Saure D, Körner G. Survival and success of implants in a private periodontal practice: a 10-year retrospective study. *BMC Oral Health.* 2020; 20:92-102.