ORIGINAL RESEARCH

Long-term Retrospective Study based on Implant Success Rate in Patients with Risk Factor: 15-year Follow-up

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ABSTRACT

Aim: The purpose of this retrospective study is to assess implant success rates with various risk factors.

Materials and methods: Two hundred patients with a total of 650 implants were selected. Risk factors, such as smoking, antidepressants, bruxism, diabetes, and bone augmentation procedures were considered, and patients were followed up for a period of 8 to 15 years.

Results: Of 650 implants placed, the success rate was 88%, i.e., a total of 572 implants were successful. A total of 78 implants were considered failure; and out of 78, twenty implants were surgically removed.

Conclusion: Based on this study's results, it is concluded that risk factors, such as smoking, bruxism, diabetes, and bone augmentation play an important role in success rate of dental implants.

Clinical significance: Several factors, such as bruxism, diabetes, and supporting bone can play an important role in dental implant success.

Keywords: Bone height, Bruxism, Dental implant, Diabetes, Failure, Smoking.

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INTRODUCTION

Dentition in human includes primary or permanent dentition. Aging is a natural process and as age advances there comes a stage of incomplete dentition, i.e., missing teeth. Holm-Pedersen and Loe[1] reported that more than 50% of the elderly populations are edentulous in industrialized society. Being edentulous not only affects the person functionally, i.e., difficulty in eating and speech, but it can also lead to psychological problems due to low self-esteem in society. One of the best ways for rehabilitation of the incomplete dentition is by osseointegrated dental implants therapy, as it provides the advantage of conserving the residual dentition and prevents the use of removable appliances.

Implant material should be biologically acceptable to the body and should not evoke body's immune response. Implants consist of three parts: First being the osseous part which interacts with the bone, second is transmucosal components that interact with mucosa, and third is restoration. A 95 to 98% success rate has been reported in the literature.[2] Selection of patients and clinical and laboratory phases play a major role in success of implant therapy. Various risk factors, such as smoking, bruxism, periodontal disease, diabetes, bone density, bone augmentation, and implant design affect the success rate of implants.[3,4] Hence, the aim of our retrospective study is to assess the implant success rates with various risk factors.

Table 1: Patient's demographic value

Mean age	20–70 years
	47.5 years
Males	88
Females	112
Jaws	
Maxilla	100
Mandible	100
Prosthesis	
Removable	15
Fixed	185

Table 2: Analysis of single risk factors

Groups	Patients	Implants	Early failure	Late failure	Success (%)	p-value
A	20	78	8	2	87.17	0.004
B	18	55	7	1	85.45	0.004
C	10	42	3	1	90.47	0.314
D	10	40	5	–	87.5	0.423
E	14	62	1	–	98.38	0.238
F	12	30	4	2	86.6	0.319
Total	84	307	28	6	88.8	0.414

$p > 0.05$, not significant

MATERIALS AND METHODS

Two hundred patients aged between 20 and 70 years with a total of 650 implants were selected based on specific inclusion and exclusion criteria. Follow-up period for the study was 8 to 15 years.

Inclusion Criteria and Exclusion Criteria

- Patients with implant treatment, who had age ≥20 years were included.
- Patients with single or multiple risk factors, such as smoking, bruxism, periodontal disease, and diabetes were included in this study.
- Patients who have undergone bone augmentation procedure were excluded.
- Medically compromised patients were excluded.
- Patients with history of any psychiatric disorder were excluded.

Two hundred patients who meet inclusion and exclusion criteria were divided into six groups.

1. Group A: Smoking
2. Group B: Bruxism
3. Group C: Periodontal disease
4. Group D: Diabetes
5. Group E: Bone augmentation
6. Group F: Bone height.

In patients with multiple risk factors, groups were divided as AB, ABC, ABCD, BD, etc.

Written consent was obtained from patients before treatment. Treatment was performed in two phases.

1. Phase 1—surgical phase: Prophylactic antibiotic was given to the patient 1 hour before surgery. Guidelines and instruction as provided by the manufacturer were followed.
2. Phase 2—the second phase was performed after 3 to 6 months. Either fixed single or multiple crowns, both screw-retained and cemented-retained, were performed followed by removable overdentures.

Patients were analyzed based on Schnitman and Shulman[5] success criteria.

- Mobility <1 mm in any direction.
- Radiographically observed radiolucencies graded but no success criterion defined.
- Bone loss not greater than one-third of the vertical height of the bone.
- Gingival inflammation amenable to treatment.
- Functional service for 5 years in 75% of patients.

Statistical Analysis

Each variable was analyzed and $p < 0.05$ was considered statistically significant. Data were analyzed by Statistical Package for the Social Sciences statistical software (IBM SPSS, version 10; Statistics, IBM, Armonk, USA).

RESULTS

A total of 260 patients were screened and out of 260 patients, 60 of those who did not meet the inclusion and exclusion criteria were excluded from the study. The sample size for this study was a total of 200 patients with 650 implants. Of 200 patients, 88 were males and 112 were females (Table 1). The success rate was 88.8%, i.e., a total of 572 implants were successful with p-value of 0.414 (Table 2). A total of 78 implants were considered failures; out of 78 (Graph 1), 20 implants were surgically removed. Failed cases were divided into two categories: Early and late failure. In single risk factor group, a total of 28 implants
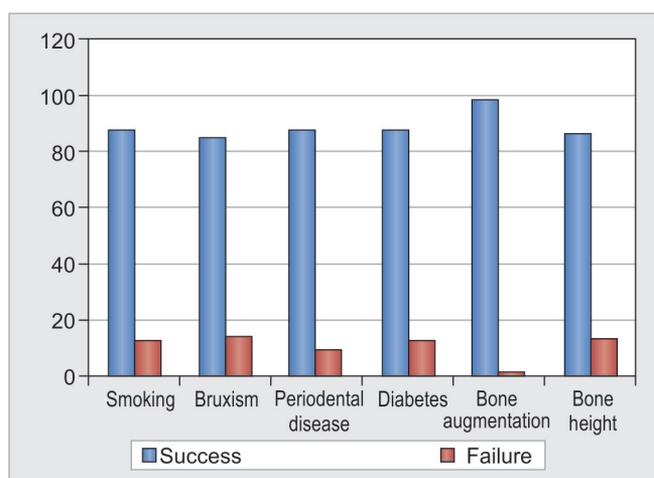
Graph 1: Success and failure factors

Table 3: Analysis of multiple risk factors

Groups	Patients	Implants	Early failure	Late failure	Success (%)	p-value
AB	25	88	3	2	94.3	0.360
AC	18	67	6	4	85	0.312
AD	22	45	5	5	77.7	0.296
BC	15	49	3	2	89.79	0.423
BD	5	10	1	1	80	0.445
CD	12	45	1	2	93.3	0.565
ABC	10	18	2	–	88.8	0.538
ABCD	9	12	1	1	83.3	0.497
ABCDE	10	10	2	2	60	0.002
Total 2	116	345	24	19	87.5	0.039
Total	200	650	52	26	88	0.543

p > 0.05, not significant

were considered as failure: Group A—12 cases, group B—8 implants, group C—4, group D—5, group E—1, and group F—6 implants, whereas 6 cases were reported as late failure (Table 2). Implant therapy in patients with multiple risk factors was also divided as early and late failure. Fifty-two cases were reported as early failure and 26 cases as late failure (Table 3). Implant failure due to smoking and bruxism was significant in our study ($p < 0.05$). In multiple risk factors, group ABCDE showed a failure rate of 40%, which is highly significant (Table 3); in our study, the early failure rate was more as compared with late failure. The failure rate was more in case of multiple risk factors than those of single risk factors.

DISCUSSION

The phenomenon of osseointegration of titanium implants was discovered by Brånemark, in 1952. Brånemark defined osseointegration as "a direct structural and functional connection between ordered living bone and the surface of a load-carrying implant.[6]" Implant success rate has been described by various authors in literature. Six years survival rate was reported by Charyeva et al[7] with 96% success rate, whereas Simonis et al[8] reported a success rate of 83%. The difference in two studies could be due to follow-up period and patients' response. In our study, the success rate was 88% which was similar to Simonis et al's[8] study.

In our study, the failure was divided into two stages: Early and late failure. The reason for early failures could be body's immune response or the occlusal load.[9] However, late failure can be due to the long-term effect of habits, such as smoking, bruxism, or fracture.[10] In this study, smoking and bruxism were the main single risk factors which lead to failure of implant. The possible reason behind is smoking interferes with wound healing, it irritates the soft tissue, and is also associated with bone loss, thus delays healing.[11] Bruxism is a parafunctional habit which leads to wear of occlusal surface of teeth and

further leads to loss in vertical dimension. It increases the load for temporomandibular joint and thus causes temporomandibular disorders. Thickness and height of the bone should be considered to prevent injury to adjacent tooth as well as other anatomical landmarks like maxillary sinus. The height and width can be measured by visual analysis and palpation. Hence, based on the success criteria, a total of 572 implants were considered successful and 78 implants were recognized as failure. Of 78 implants, failure due to smoking was in 12.83% ($p < 0.05$) of cases, which is similar to the study conducted by Bain and Moy,[12] who have reported a failure of 11.3% in smokers. Failure rate due to bruxism was 14.55% ($p < 0.05$), whereas in the case of multiple risk factors maximum failure was caused due to combination of group ABCDE, i.e., 40%, and group AD 22.23% (Table 3). The association of bruxism and smoking resulted in low failure rate (5.7%). Failure due to bone augmentation was minimum, i.e., 1.62%, which was similar to those reported by Busenlechner et al;[13] however, when bone augmentation was in association with smoking, periodontal disease, and diabetes, its failure rate was 40%, and p-value being 0.002, which is highly significant. A study conducted by Salvi et al[14] reported that poorly controlled diabetes is the reason for failure of implant. Infection of the oral cavity also causes implant failure; early sign of failure is peri-implantitis, which leads to inflammation of tissue around the osseointegrated implant which further leads to mobility, bone loss, and gingivitis.

McDermott et al[15] stated that risk factors can be modified by the clinician for success of dental implant. Chuang et al[16] suggested that modification of risk factors, such as tobacco use, immediate implants, and implant staging potentially may help in enhancing implant survival. Baig and Rajan[17] in their review on risk factors on implant survival mentioned that smoking is one of the potential risk factors and it causes significant marginal bone loss around implant; they also concluded that failure rate in smokers is double than in nonsmokers. Karoussis et al[18] compared the success and complication rates of implants between patients with periodontitis over teeth lost due to other reasons and observed lower success in patients with periodontitis in 10-year follow-up compared with teeth lost due to other reasons. Roccuzzo et al[19] compared the long-term success of implants in periodontally compromised over healthy ones and found lower success rate in patients with periodontitis with peri-implant bone loss. Romeo et al[20] evaluated the survival rate of different implant-supported prostheses for mean of 3.85 years and observed cumulative implant survival rates for implants supporting single-tooth prostheses of 95.6%, cantilever fixed partial prostheses for 94.4%, fixed partial prostheses for 96.1%, fixed complete prostheses for 100%, implant/tooth-connected prostheses

for 90.6%, and overdentures for 95.7%. Similar survival and success rates were documented for implants placed in maxillae and mandibles.

Bornstein et al[21] did a study to evaluate risk factor of systemic disease and medication on implant failure in 250 patients. The cumulative implant survival rate for implants supporting single-tooth prostheses was 95.6%, for cantilever fixed partial prostheses was 94.4%, for fixed partial prostheses was 96.1%, for fixed complete prostheses was 100%, for implant/tooth-connected prostheses was 90.6%, and for overdenture patients was 95.7%.

Thus, patient's oral hygiene, health conditions, and various other risk factors should not be neglected before implant therapy.

CONCLUSION

The success of implant depends on patient selection, so the risk factors should be evaluated before treatment. As per this study, even a single risk factor affects the success rate, but multiple risk factors have immense contribution in failure of implant. In this study, smoking, bruxism, and bone height were the risk factors responsible for failure. Smoking in association with diabetes, bruxism, periodontal disease, and bone augmentation can lead to implant failure.

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