Research Article

JRAD Journal of Research and Advancement in Dentistry

J Res Adv Dent 2020;10:3:299-305.

A Retrospective Evaluation of Different Factors Affecting the Survival Rate of Osseointigrated Dental Implants: An Original Research Study

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ABSTRACT

Background: With the emerging boon in dental implantology, their eventual failures also reported. Nonetheless, implant therapy has, as every surgery, numerous complications that can happen and should be known in order to manage them. The success of any implant related rehabilitation depends upon different factors and parameters. This retrospective study was conducted to evaluate different factors affecting the survival rate of osseointegrated dental implants.

Materials & Methods: The study incorporated evaluation of the data of 30 patients those have been rehabilitated by dental implants during the study period. Demographic records of all selected patients included age, sex, implant diameter, length, location, bone quality. Single tooth replacements (by implant) done in both maxillary and mandibular arches were considered in the study. Authors had not chosen already failed cases rather they had selected patients randomly to calculate the authentic rates of survival.

Results: Statistical analysis was completed using statistical software Statistical Package for the Social Sciences version 21. Out of 30 patients, males were 20 and females were 10. Maximum 15 implants were survived in middle aged patients of range 41-50 years. More than half of the survived implants were noticed in male patients. The survival rate was maximum in implant of 10-11 mm lengths. Total 14 implants were survived those placed in posterior mandible. Only 2 implants were survived in posterior maxilla. The measured level of significant was 0.018.

Conclusion: Within the limitations of the study authors concluded that survival rate of osseointegrated implants was higher in males. In the studied patients, implant length and diameters has affected long term survival rates significantly. As a site, posterior mandibular region showed highest implant survival rates. Moreover, implants those placed in type II bone showed highest survival rates.

Keywords: Survival rate, Implant, Failure, Osteotomy, Maxilla.

INTRODUCTION

In the early nineteen fifties Branemark conducted an imperative study on healing processes of bone as seen from contemporaneous light microscope. He was the first person who claimed and informed the scientific community about bone and titanium surfaces.[1,2] This discovery eventually attracted the

Received: May. 3, 2020**: Accepted**: June. 16, 2020
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pISSN 2278-0076
eISSN 2321-9270

attention of dental implant manufacturers across the world. Researchers have started its animal trails judiciously to achieve some imperative results. Subsequent human trails and clinical experiments proved the phenomenon of Osseointegration. Many of the researchers in the literature stated this even as birth of endosseous and Osseointegrated implants.[3,4] By definition osseointegration is the direct structural and functional connection between living bone and the surface of a load-bearing artificial implant. Furthermore, osseointegration was also defined as direct connection between living bone and a load-carrying endosseous implant at the light microscopic level.[5,6] With the ever increasing advancements in materials and equipments, researchers have started studying about the finer details of the implant such as surface details, implant length, diameter and shape. Implications of these innovative concepts resulted in higher success rates in the patients. However, eventual failures of implant were also reported in the similar proportions. These failures were keep on increasing with time and become a serious issue for clinicians and professionals.[8,9,10] Now days, it has become a routine tendency of clinicians to advice implant therapy to replace missing teeth. Classic research papers of implant successes showed very clear indications and contraindication for initiating implant treatment. The reported contraindications of implant therapies are epileptic episodes, pediatric patients, endocarditis, osteo-radionecrosis, history of smoking, and diabetic, blood dyscrasia.[11,12] Few of the absolute contraindications are myocardial infarction, cardiac transplant, immune-suppressive drugs, malignancy, and psychiatric infirmity. Estimation of survival rate is a very crucial for such circumstances. In literal words, survival rate is the method of describing prognosis in certain disease conditions.[13] Albrektsson and colleagues stated that an implant is successful when a) radiograph does not show any indication of peri-implant radiolucency b) when the vertical bone loss be less than 0.2 mm yearly following the implant's first year of service c) when individual implant performance be characterized by an absence of persistent and/or irreversible signs and symptoms such as pain, infection, neuropathies, paresthesia, or violation of the mandibular canal. Pioneer workers have also stated that, in the context of the above, a successful rate of 85% at the end of a 5 year observation period and 80% at the end of a 10 year period be a minimum criterion for success.[14] For estimating survival of dental implants, researchers have explored different methodologies. Many of them are focusing upon the comprehensive categorization of failures of dental implants.[15,16] Host associated factors include age, sex, overall health, smoking and oral hygiene. Surgical site associated entities include implant positioning on bone, available bone quality, available bone amount. Osteotomy associated parameters are usually primary stability. Other miscellaneous factors include surface irregularity, length of implant, diameter of implant, implant prosthesis form, screw retained, cement retained, proposed occlusal designing.[5,8,11,13] This retrospective study was attempted to evaluate different factors affecting the survival rate of osseointegrated dental implants.

MATERIALS & METHODS

This study was conducted in the in the Department of Prosthodontics of the institute. The aim was to retrospectively evaluate different factors affecting the survival rate of osseointegrated dental implants. Authors also ensured genuinely and transparency throughout the study. The follow up records of the patients were analyzed genuinely. These records were obtained from departmental archives or cases sheets of last fifteen month. Total 30 patients were targeted in which single tooth rehabilitation was performed using osseointegrated dental implant. Patients were contacted on phone to inform about the study. Privacy policy and rights were ensured for all participating patients. Replacements done in both maxillary and mandibular arches were considered in the study. This is to be noted here that we had not chosen already failed cases rather we selected patients randomly to calculate the authentic rates of survival. Exclusion criterion included patients with epileptic episodes, pediatric patients, endocarditis, osteoradionecrosis, history of smoking, and diabetic, blood dyscrasia. Initially, we focused to extract the descriptive information related to age and sex of patients, implant length, implant diameter, bone quality, bone quantity, prosthesis type, surface treatments and implant types. After the data collection, all these factors were arranged systematically in logical manner. This indicated us to focus our study on analyzing age and sex of patients, implant length, implant diameter, bone quality and implant locations. For

relative ease of calculations, only the number of survived implants has been taken in to the consideration for particular factor. The number of placed implants for particular factor was not calculated e.g. only survived implants were explored rather than total installed implants of length of >11 mm. All these factors were noted down comprehensively to draw an inference. Results thus obtained were subjected to statistical analysis wherein. P value less than 0.05 was considered significant.

RESULTS

Responses which observed from questionnaire work out were sent for statistical analysis using statistical software Statistical Package for the Social Sciences version 21 (IBM Inc., Armonk, New York, USA). The resulting data was subjected to suitable statistical tests to obtain p values, mean, standard deviation, chi- square test, standard error and 95% CI. Table 1 and Graph 1 showed that out of 30 patients, males were 20 and females were 10. Maximum 17 patients (more than half) were noted in the age group of 41-50 years. P value was significant here. Maximum 15 implants were survived in middle aged patients of range 41-50 years. P value was significant (0.028) for this evaluation. Minimum standard deviation (0.362) was present in patients with age range 31-40 (Table 2). More than half of the survived implants were noticed in male patients. This indicates about higher survival rate of osseointegrated implants in males as compared to females. The measured level of significant was 0.012. It was significant too. Level of significant evaluation for females revealed no significant values (Table 3). Statistical description with level of significance evaluation for survival rate of implant [as related to implant length] showed very imperative results. The apparent survival rate was highest in implant of 10-11 mm lengths. The measured level of significant was 0.010. It was significant as well. Therefore, implants of this particular length range seem to be more successful as compared to other dimensions (Table 4). Evaluation of implant diameter illustrated very significant results. We categorized the installed implants in-to three groups as per their diameter. More than 63% of implants (diameter 3.5-4 mm) were survived. So, it is advisable to prepare osteotomy site for implant diameter of range 3.5-4 mm. The measured level of significant was not significant as well (Table 5). Fundamental statistical description with level of significance evaluation for survival rate of implant was attempted (as related to their location). Total 14 implants were survived those placed in posterior mandible. Only 2 implants were survived in posterior maxilla. The measured level of significant was 0.018. It was significant as well. This information could be very crucial in pre-osteotomy planning for single tooth replacement (Table 6). Evaluation of bone quality showed very significant inferences. More than half of osseointegrated implants those placed in type II bone showed maximum survival. Only two implants survived in type III bone. The measured level of significant was 0.010. It was significant also (Table 7).

Graph 1: Age & gender wise distribution of patients.

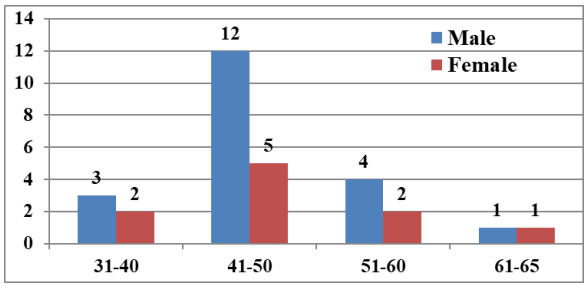

Table 1: Age & gender wise distribution of patients.

Age Group (Yrs)	Male	Female	Total %	P value
31-40	3	2	5 [16.7 %]	0.06
41-50	12	5	17 [56.7 %]	0.01*
51-60	4	2	6 [20 %]	0.08
61-65	1	1	2 [6.6 %]	0.10
Total	20	10	30 [100%]	*Significant

***p<0.05 significant**

Table 2: Basic statistical description with level of significance evaluation for survival rate of implant [factor: age]

Survival Rate of Implant [Factor: Age]							
Age	Implants survived [Absolutely]	Std. Deviation	Std. Error	95% CI	Pearson Chi-Square Value	df	Level of Significance (p value)
31-40	4	0.362	0.360	2.36	2.451	1.0	0.487
41-50	15	1.288	0.050	1.96	2.287	1.0	0.028*
51-60	5	1.900	0.861	1.96	2.745	1.0	0.080
61-65	2	0.675	0.085	2.45	1.598	2.0	0.760

***p<0.05 significant**

Table 3: Basic statistical description with level of significance evaluation for survival rate of implant [factor: sex].

Survival Rate of Implant [Factor: Sex]							
Sex	Implants survived [Absolutely]	Std. Deviation	Std. Error	95% CI	Pearson Chi-Square Value	df	Level of Significance (p value)
Males	17	0.632	0.634	2.82	2.634	1.0	0.012*
Females	9	1.982	0.058	1.88	2.630	1.0	0.067

***p<0.05 significant**

Table 4: Basic statistical description with level of significance evaluation for survival rate of implant [factor: implant length].

Survival Rate of Implant [Factor: Implant Length]							
Length	Implants survived [Absolutely]	Std. Deviation	Std. Error	95% CI	Pearson Chi-Square Value	df	Level of Significance (p value)
Up-to 10 mm	6	0.630	0.487	2.43	2.328	1.0	0.490
10-11 mm	15	0.221	0.129	1.96	2.287	1.0	0.010*
>11 mm	5	1.890	0.344	1.38	2.660	1.0	0.090

***p<0.05 significant**

Table 5: Basic statistical description with level of significance evaluation for survival rate of implant [factor: implant diameter].

Survival Rate of Implant [Factor: Implant Diameter]							
Diameter	Implants survived [Absolutely]	Std. Deviation	Std. Error	95% CI	Pearson Chi-Square Value	df	Level of Significance (p value)
Up-to 3.50 mm	4	0.450	0.157	2.90	2.098	1.0	0.900
3.50-4.0 mm	19	0.980	0.129	1.96	2.907	1.0	0.210
>4.0 mm	3	1.122	0.904	1.54	2.230	1.0	0.090

Table 6: Basic statistical description with level of significance evaluation for survival rate of implant [factor: implant location].

Survival Rate of Implant [Factor: Implant Location]							
Implant Location	Implants survived [Absolutely]	Std. Deviation	Std. Error	95% CI	Pearson Chi-Square Value	df	Level of Significance (p value)
Ant. Maxilla	6	0.392	0.089	1.65	2.234	1.0	0.675
Ant. Mandible	4	1.455	0.036	1.76	1.265	2.0	0.567
Post. Maxilla	2	0.329	0.083	2.65	2.287	1.0	0.018*
Post. Mandible	14	0.676	0.034	2.45	1.568	2.0	0.780

***p<0.05 significant**

Table 7: Basic statistical description with level of significance evaluation for survival rate of implant [factor: bone quality].

Survival Rate of Implant [Factor: Bone Quality]							
Bone Quality	Implants survived [Absolutely]	Std. Deviation	Std. Error	95% CI	Pearson Chi-Square Value	df	Level of Significance (p value)
Type I	6	0.675	0.085	2.45	1.598	2.0	0.760
Type II	17	1.343	0.035	1.96	2.521	2.0	0. 472
Type III	2	0.362	0.360	2.36	2.675	1.0	0.010*
Type IV	1	1.287	0.050	1.96	2.287	1.0	0.060

DISCUSSION

Implant surface treatment is something which was totally unaware in primary budding stage of dental implant. There was only roughly cut metal surfaces of implant without any surface coating or layering. With the progressive advancements in biomechanical sciences and microcopies, researchers have developed the dental implants with coated surface.[17,18] This surface coating was actually invented to enhance bonding between bone and implant. This literally led the foundation stone of the discovery of osseointegration phenomenon. Consequently, surface treated implants illustrated high prevalence rates. In these days, dental implants have been extensively utilized for replacements of single or multiple teeth, fixation of full mouth bridges and retention of overdentures.[19] Currently, dental implant related rehabilitations are in high demand. Conversely, in the same ratio failures are also noticed. Many of the pioneer workers in the past studied these failures and stated that they are of two types: early and late. Few of the prominent workers were Renvert et al, Marrone et al, Koldsland et al.[20,21,22] Early failure is one that failed Failure of complete osseointegration within few months is categorized as early failure. Literature has showed that demographic factors, health, smoking and oral hygiene affect implant survival to the greatest extent. Daubert and co-workers was key people in regards. Other imperative survival determinants were apparently implant-bone angulations, bone quality, bone quantity surface unevenness, implant length, implant diameter and occlusal designing.[23] Our study was attempted to evaluate different factors affecting the survival rate of osseointegrated dental implants. The region of the study was Northern Indian region therefore we have noticed few contradictory results as compared to European and American studies.[24,25,26] However, study results of Howe and associates were quite comparable to ours.[27] Our study showed that survival rate of osseointegrated implants was higher in males. In the studied patients, implant length and diameters has affected long term survival rates significantly. Posterior mandibular region showed highest implant survival rates. Moreover, implants those placed in type II bone showed highest survival rates.

CONCLUSION

As we all know that implant survival rate is affected by multiple factors, it is relatively not easy to investigate a cause of failure objectively. Within the limitations of the study authors concluded that survival rate of osseointegrated implants was higher in males. In the studied patients, implant length and diameters has affected long term survival rates significantly. Posterior mandibular region showed highest implant survival rates. Moreover, implants those placed in type II bone showed highest survival rates. Hence, all the studied factors had significant effects on the implant survival. Our inferences should be considered as suggestive for predicting outcomes of implant therapies done for single tooth replacements. Authors expect some future studies with larger sample size and newer survival determinants.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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