Tikrit Journal for Dental Sciences 13(1) (2025) 127-140
https://doi.org/10.25130/tjds.13.1.14

Tikrit Journal
for
Dental Sciences
https://tjds.tu.edu.iq
ISSN:2073-1213

Evaluation the Success Rate of Short Dental Implant in Kurdish Population

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Keywords:
Short dental implants, Kurdish population, implant success, patient satisfaction, diabetes mellitus, hypertension, rheumatoid arthritis.

Article Info.:

Article History:
Received: 11/2/2024
Received in revised form:7/4/2024
Accepted: 14/4/2024
Final Proofreading: 14/4/2024
Available Online: 1/6/2025

Citation: Jumaa BK, Muhammed NA. Evaluation the Success Rate of Short Dental Implant in Kurdish Population. Tikrit Journal for Dental Sciences. 2025; 13(1): 127-140.
https://doi.org/10.25130/tjds.13.1.14

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Abstract

Background: Dental implants play a pivotal role in restoring lost dentition, and short dental implants (equal or <8mm) have emerged as an alternative to traditional bone augmentation procedures. This study aims to evaluate the success rates of short dental implants in the Kurdish population, considering various factors such as patient demographics, implant characteristics, and their impact on satisfaction levels.

Materials and Methods: Seventy patients who received short implants in both jaws were included, with a minimum follow-up period of 1 year. Implant length, diameter, location, and patient demographics were analysed. Success criteria were based on Misch et al.'s definition, and marginal bone loss was assessed via orthopantomograms obtained 12 months post-implantation. Statistical analyses, including chi-square tests and correlation assessments, were conducted.

Results: The study found a link between patient age and implant success, with younger patients having higher success rates. Gender disparities were observed in satisfaction outcomes, with smoking status having a significant impact. Although the site of the implant had no significant impact on satisfaction rates, patients with diabetes mellitus had lower levels of satisfaction. Longer and wider implants were associated with higher success rates.

Conclusion: This study sheds light on short dental implant success in the Kurdish population, stressing the multivariate character of outcomes. Tailored treatment regimens, particularly for diabetic patients, can improve predictability and success rates during implantation procedures. Future research should go deeper into these characteristics to gain a better understanding of short dental implant success.

Introduction:

Dental implants are a popular treatment option for repairing missing teeth in both completely and partially edentulous patients. Over time, implant therapy has demonstrated very high success rates in replacing lost teeth. (1) .

The loss in vertical bone height makes it harder to position dental implants in the posterior regions of the upper or lower jaw. As a result, procedures such as guided bone regeneration, bone block grafting, and sinus augmentation are frequently required to enable the stable placement of regular dental implants in such patients (2). These approaches usually result in poor adherence among patients undergoing therapy prior to implant placement, owing to variables such as high prices, lengthy treatment durations, graft-related infection concerns, procedural invasiveness, and the use of bone substitutes in grafting materials. Consequently, there is a pressing demand for alternative interventions that enable individuals to leverage contemporary dental implant advancements. Short dental implants, measuring 6 mm in length, have emerged as a solution, facilitating placement in regions with inadequate vertical bone volume (3) .

Hence, in contemporary practice, short dental implants are increasingly regarded as a viable substitute for bone augmentation interventions in the posterior areas of both the maxilla and mandible (4,5) .

For a number of years, abbreviated dental implants (measuring less than 8 mm) have emerged as a viable, encouraging, and dependable therapeutic avenue for reconstructing deficient mandibular and maxillary regions, offering an alternative to traditional vertical ridge augmentation procedures in orofacial rehabilitation (6–8) . The anticipated prognosis for short dental implants and the corresponding satisfaction levels among patients undergoing this treatment have demonstrated a reliably positive outlook (8–11) .

Biomechanical research indicates that crestal bone experiences primarily strain when subjected to both axial and extra-axial loading conditions (12) . The precise manner in which stress is dispersed within the peri-implant bone can differ depending on anatomical and prosthetic factors, as outlined in several pertinent research findings (12–18) . Research findings indicate that opting for a larger diameter is advisable when employing short implants. Finite element analyses have demonstrated that enlarging the implant diameter leads to reduced stress levels and concentrated areas around the implant in the cortical bone(14) Additionally, augmenting the diameter of the implant exhibited a more pronounced reduction in crestal strain when contrasted with enhancing the implant's length, with a ratio of 3.5-fold decrease versus 1.7-fold decrease, respectively (16) .

Consequently, there is a need to refine both the macroscopic and microscopic configurations of abbreviated dental implants to enhance their efficacy and enduring steadiness. This encompasses bolstering primary stability upon immediate insertion, fortifying secondary stability post-osseointegration, and reinforcing tertiary stability under loading stresses. These advancements hold significant promise for a broad spectrum of individuals, particularly older patients grappling with concurrent medical conditions and medication regimens (19) .

As demonstrated earlier, the period of healing subsequent to implant insertion results in a diminished quality of life pertaining to oral health(20) , Particularly in instances where augmentation procedures are deemed necessary, this holds particular significance (8). Several cohorts of compromised patients, such as those afflicted with conditions like oral lichen planus and bone disorders, may experience advantageous outcomes through the utilization of abbreviated implants, facilitating graftless restoration and minimized invasiveness during rehabilitation procedures. (21,22) .

According to Anjan Kumar Shah et. al (23) ,the factors affecting success of short dental implant are ;

1-Bone-type: Research indicates that short dental implants tend to achieve higher success rates when placed in the mandible compared to the maxilla. This discrepancy is attributed to the inferior bone density and consequent reduced bone-to-implant contact in the posterior maxilla. It is recommended that whenever feasible, bicortical fixation of the sinus floor should be pursued to enhance the longevity of short implants in the maxilla. (24) .

2-Implant diameter: In a prospective multicentre investigation, the utilization of five 7-mm implants with a diameter of 3.75 mm, which were immediately inserted, was examined. In the maxilla, three implants were installed, all of which failed, while two were situated in the mandible, with one experiencing loss. The study's findings indicated an 80% failure rate for the 7-mm implant under these experimental conditions, as concluded by the authors(25) .

3-Surface texture of implants: The existing body of literature on short implants is complicated by studies involving both machined surfaces and a variety of surface modifications. Roughened surface implants seem to enhance implant survival rates, particularly in cases of compromised bone height and in the maxilla. Telleman et al.'s systematic review indicated that machined surface implants could elevate the failure rate of short implants by up to 29% (25) .

4-**Implant thread design**: Abuhussein, in his examination of thread design, highlighted three significant variations:

A. A reduction in thread pitch has a beneficial effect on implant stability.

B. Augmenting the helix angle, despite facilitating faster insertion, may compromise implant stability.

C. Greater thread depth significantly enhances implant stabilization, particularly in softer bone substrates (26) .

5-Platform switching and short implants: Atieh's literature review indicates a noteworthy statistical contrast in the marginal bone levels when comparing platform-matched and platform-switched implants. (26) .

6-Linking of implants: The application of splints to implants demonstrates apparent advantages, especially in cases where a shorter implant is connected to a longer adjacent one, which appears to enhance its durability. Varied rates of success were observed between the groups with splinted implants (97.7%) and those without (93.2%) (27) .

7-Avoiding immediate loading: The immediate loading of short implants has been shown to negatively impact their long-term survival. The choice between a one-stage or two-stage surgical approach does not significantly affect the success of short implants, according to a retrospective study. It is advisable to exercise caution when considering immediate loading of threaded implants with a length of 10 mm or less and a rough surface, based on findings from this review. However, there is a lack of research investigating the immediate loading of implants shorter than or equal to 7 mm, as noted in this review (26,28) .

8-Smoking; The benefits of a nicotine-free period around the time of surgery have been supported by the results of several animal studies (29) .

In this study, we aim to highlight the critical factors influencing the success of short dental implants, providing insights that can guide clinicians in optimizing treatment outcomes and improving oral health-related quality of life for patients, particularly those with compromised alveolar ridges.

Material and Methods

This retrospective study, conducted at the University of Sulaimani/College of Dentistry, received ethical approval from the esteemed ethics committee of the institution. All participating subjects graciously provided their written, informed consent.

Among patients who underwent implant placement in Kurdish population, 70 patients (42 males and 28 females , mean age 46.66 +- 13.68 years) who received short implants , where selected. The inclusion and exclusion criteria are as follows.

Inclusion criteria

1-Patients who have received short dental implants (equal or less than 8mm in length) in the both jaws.
2-Patients who have received implant-supported overdentures, fixed dental prostheses, or single implant restorations.
3-Patients who have a minimum follow-up period of 1 year.

Exclusion criteria

1- Implants longer than 8mm in length.
2- Inappropriate cases of medical records and radiographs.
3-Patients who have not completed a minimum follow-up period of 1 year.

Seventy implants, inserted by various practitioners representing different companies, underwent scrutiny. The assessment encompassed implant dimensions, site of placement, marginal bone loss, and success rate. This comprehensive review involved meticulous examination of patients' medical files and radiographs, coupled with clinical evaluations focusing on mobility, as well as inquiries into the presence of exudate or pain symptoms.

Successful implant placement was defined according to misch et.al as shown in the table 1 (30) .

Marginal bone loss was assessed by comparing orthopantomogram OPG obtained 12 months after the placement of the implant.

Statistical analysis

The study employed descriptive statistical analysis to summarize the outcomes, providing mean and standard deviation for variables with continuous distributions, along with maximum and minimum values. Categorical variables were presented with counts and percentages. Hypotheses regarding associations among categorical variables were evaluated using the chi-square test. Differences in measurements within variables, based on satisfying scales, were assessed using the Kruskal-Walli's test for non-parametric variables and one-way ANOVA for those with a normal distribution. Spearman correlation was utilized to measure the correlation between variables. Prior to statistical analysis, the normal distribution assumption was confirmed using the Shapiro–Wilk and Kolmogorov–Smirnov tests. This ensured that variables included in the analysis followed a normal distribution, satisfying the assumption for employing the One-way ANOVA. Statistical significance was determined with a threshold of a p-value less than or equal to 0.05. A p-value of 0.05 or lower was considered statistically significant in all tests. The analysis was conducted using version 27.0 of the SPSS program for Windows.

Results

In this section, we illustrate the outcomes derived from the current study along with their interpretations.

Table 2 displays the descriptive statistics for continuous variables pertaining to seventy patients. The average age of patients is 46.66 years with a standard deviation (SD) of 13.68 years, ranging from twenty to eighty-five years. Short implants were uniformly employed in all cases, with lengths ranging from 6 to 8 mm and an average length of 7.21 mm (SD 0.83). The mean (SD) implant diameter is 3.85 mm (0.49), and bone loss, crucial for success assessment, has an average value of 2.81 mm (SD 0.89).

Table 3 provides a comprehensive overview of the dataset, revealing that out of the 70 recorded patients, 42 are male and 28 are female. The age distribution shows that the majority, 31 cases, fall within the 45 - 64 years range, followed by 30 cases in the 20 - 44 years range, and only 9 patients are over 60 years old. Of the total, 23 patients are current smokers, constituting nearly 32.8% of the dataset. Approximately 67% of patients do not have a medical history. Implant location distribution shows that 60% are in the maxillary region and 40% in the mandibular region. The majority of implants are located in the Molar region (48.6%), followed by Premolar (20%), Canine (17.1%), and Incisor (14.3%).

Only 13 cases reported pain or tenderness, while 90% of cases did not exhibit mobility after dental implant procedures. The overall trend in the level of satisfaction with short implant treatment leans towards success or satisfaction, with more than 70% of cases expressing contentment with the outcomes. Approximately 18.6% report a compromised level of satisfaction, while 7% claim to have experienced failure in the treatment. Table 4 illustrates the distribution of short implant satisfaction levels concerning demographic factors. In the "20 - 44 Years" age group, the majority of cases are categorized as "Success" (43.30%) and "Satisfactory" (40.00%). For the "45 - 64 Years" age group, "Satisfactory" is the prevalent category at 51.60%. In the "65 Years and more" age group, categories are evenly distributed among "Success," "Satisfactory," and "Compromised," with no reported failures. Among males, "Satisfactory" is the most common outcome, accounting for 50.00%, followed by "Success" at 21.40%. In females, "Success" and "Satisfactory" outcomes are evenly distributed, each at 39.30%. for non-smokers, the most frequent outcome is "Satisfactory “and "Success" (40.00%) for each. For ex-smokers, "Satisfactory" is the predominant outcome at 57.10%. Among current smokers, "Satisfactory" is the most prevalent outcome (52.20%), followed by "Compromised" at 26.10%. According to the chi-square test, there is no statistically significant association between age group, gender, smoking status, and short implant success scale rate at the level of (α= 0.05). The P-values (Sig.) of the Chi-square tests for these variables are reported as (0.125, 0.197, and 0.196), respectively, which are greater than the level of significance (α = 0.05). This indicates that there is no statistically significant relationship between these variables and the satisfaction rate of short dental implantation. Table 5 reveals the relationship between implant location and the short implant success scale rate. Among cases located in the Maxillary region, "Satisfactory" is the most prevalent outcome, accounting for 48.80%, followed by "Success" at 23.30%. In cases located in the Mandibular region, outcomes are evenly distributed, with "Success" and "Satisfactory" each representing substantial percentages. Among cases located in the Molar, "Satisfactory" is the most common outcome at 41.20%, followed by "Success" at 32.40%. For cases located in the Canine, "Satisfactory" is the predominant outcome, representing a significant majority at 58.30%. In cases located in the Incisor, "Satisfactory" is again the most common outcome, accounting for 60.00%. Among cases located in the Premolar, "Success" is the most common outcome at 42.90% as shown in figure 1. According to the chi-square test, there is no statistically significant association between implant location and satisfaction scale rate at the level of (α= 0.05). It's important to note that the P-values (Sig.) of the Chi-square tests are reported as (0.466 and 0.561), which are greater than the level of significance (α = 0.05). This indicates that there is no statistically significant relationship between implant location and the satisfaction rate of short dental implantation.

Table 6. clearly illustrates the connection between the medical history of patients and their satisfaction levels with short dental implants. Patients with medical history specially with DM have great chance to get compromised scale for short implantation as shown in figure-2. Based on the results of the chi- square test, a statistically significant association exists between a patient's medical history and their rating on the short implant satisfaction scale at a significance level of α=0.05. Notably, the p-value (Sig.) of the chi-square test is reported as 0.001, which is less than the specified level of significance (α = 0.05). This indicates a statistically significant relationship between a patient's medical history and short implant success scale rate.

Table 7 displays the results of the normality test for continuous variables conducted using the Kolmogorov-Smirnova and Shapiro-Wilk tests. The p-values for age in both tests are reported as (0.059 and 0.106), exceeding the significance level alpha=0.05. This implies that we accept the null hypothesis (H0: the variable distributed normally), indicating that age is normally distributed. However, for implant length and implant diameter, the p-values in both tests are smaller than the significance level alpha=0.05. As a result, we reject the null hypothesis, suggesting that these variables are not normally distributed.

Table 8 presents the mean and standard deviation of continuous variables within groups based on short implant scale rate, and hypotheses regarding differences were assessed. For patients with successful short implants, the average age is 39.2 (11.72) years, while for those with compromised and failed short implants, the average ages are 56.69 (15.89) and 44.4 (5.5) years, respectively. Utilizing the one-way ANOVA test, the p-value of the F-test is reported as 0.003, which is smaller than the significance level (α = 0.05). This suggests a statistically significant difference in age between groups. According to the Kruskal-Walli's test, there is a statistically significant difference in implant diameter between groups, as the p-value is 0.025, smaller than α = 0.05. However, there is no statistically significant difference in implant length between groups, as the p-value is 0.187, greater than α = 0.05.

Table 9 displays the correlation between short implant success rate and patient age, implant length, and implant diameter. The findings reveal a negative correlation between patient age and short implant satisfaction level (r = -0.352). This denotes a significant intermediate negative correlation, indicating that a lower age is associated with an increased likelihood of success. In contrast, the satisfaction level of short implants is positively correlated with both implant length and implant diameter. There is a significant weak positive correlation between the success scale and implant length (r = 0.262), implying that as implant length increases, the chance of success also increases. Furthermore, there is an intermediate positive association (r = 0.359) between the success scale and implant diameter, implying that increasing implant diameter is associated with a higher likelihood of success.

Discussion

The study's findings shed insight on the success rate of short dental implants, specifically those measuring 8 mm or less, among the Kurdish community. The data, provided in Tables 1-8, provide a comprehensive analysis of several factors influencing the outcomes of brief dental implantation, including patient demographics, implant features, and the relationship to patient satisfaction. In this section, we will look at the significance of the primary findings and their possible impact on measuring short dental implant success rates in the Kurdish community.

Primarily. Age, gender, and smoking status were investigated as potential predictors of short-term dental implant success. The study found that age may play an important role in the effectiveness of short implants, as there is a negative association between patient age and implant success. According to the study, shorter dental implants are more effective for younger people. This finding is consistent with previous research (31) and emphasizes the significance of age as a predictor of implant efficacy, possibly due to superior overall health and faster healing processes in younger people.

The gender-based study uncovers interesting trends, with males demonstrating a higher number of "satisfactory" results, while females show a more balanced distribution between "Success" and "Satisfactory" categories. In evaluating the literature, conflicting conclusions of gender outcomes were discovered. Some research suggest that males have better outcomes than females.

These variations may stem from differences in sample characteristics, methodologies, and contextual factors (32) . Although the chi-square tests did not identify a statistically significant association between gender and short implant success, these observations hint at potential gender-specific factors that may influence satisfaction levels, warranting further investigation.

Smoking status is another noteworthy factor influencing short dental implant success. Current smokers showed a higher prevalence of "Satisfactory" outcomes, but with a notable proportion reporting a "Compromised" level of satisfaction. This aligns with existing literature emphasizing the negative impact of smoking on implant success (29) .While the chi-square tests did not establish a statistically significant association, the trends observed underscore the importance of considering smoking habits in the assessment of short implant outcomes.

The analysis of short dental implant outcomes across various locations reveals interesting patterns. While specific regions show varying percentages of success and satisfaction, the chi-square test indicates no statistically significant association between implant location and satisfaction rates (α = 0.05). Notably, "Satisfactory" outcomes predominate in Maxillary, Molar, Canine, and Incisor regions, while the Mandibular region displays a more balanced distribution. The Premolar region stands out with "Success" as the most common outcome at 42.90%. These findings suggest that, despite regional variations, implant location alone does not significantly impact the satisfaction rate of short dental implantation, these results are consistent with the findings reported in other literature within the same field (33). Further exploration may consider additional factors to enhance our understanding of implant success.

A critical finding emerged from the analysis of patients' medical history, particularly with diabetes mellitus (DM). The study identified a statistically significant association between a patient's medical history, specifically DM, and the short implant success rate. Patients with DM were more likely to experience compromised satisfaction levels, The results correspond with previous studies on this association (34) , underscoring the need for tailored treatment approaches and closer monitoring in this subgroup.

Regarding the other medical conditions, most hypertensive cases (85.70%) had good outcomes, but 14.30% faced issues, stressing personalized treatment planning. The single rheumatoid arthritis case with problems underscores the need to manage systemic conditions affecting implants, The findings align with earlier research on this correlation (35,36) .

Additionally, positive correlations between implant length/diameter and success indicate that longer and wider implants may contribute to improved outcomes , these findings are consistent with those observed in other research investigations (37) .

In conclusion, the results of this study contribute significantly to the understanding of short dental implant success rates in the Kurdish population. The findings emphasize the multifactorial nature of implant success, with age, gender, smoking status, medical history, and implant characteristics playing crucial roles. The identification of a significant association between DM and compromised satisfaction levels underscores the importance of thorough patient assessment and tailored treatment strategies. The study provides a foundation for future research, encouraging a more nuanced exploration of these factors to enhance the predictability and success of short dental implantation in the Kurdish population.

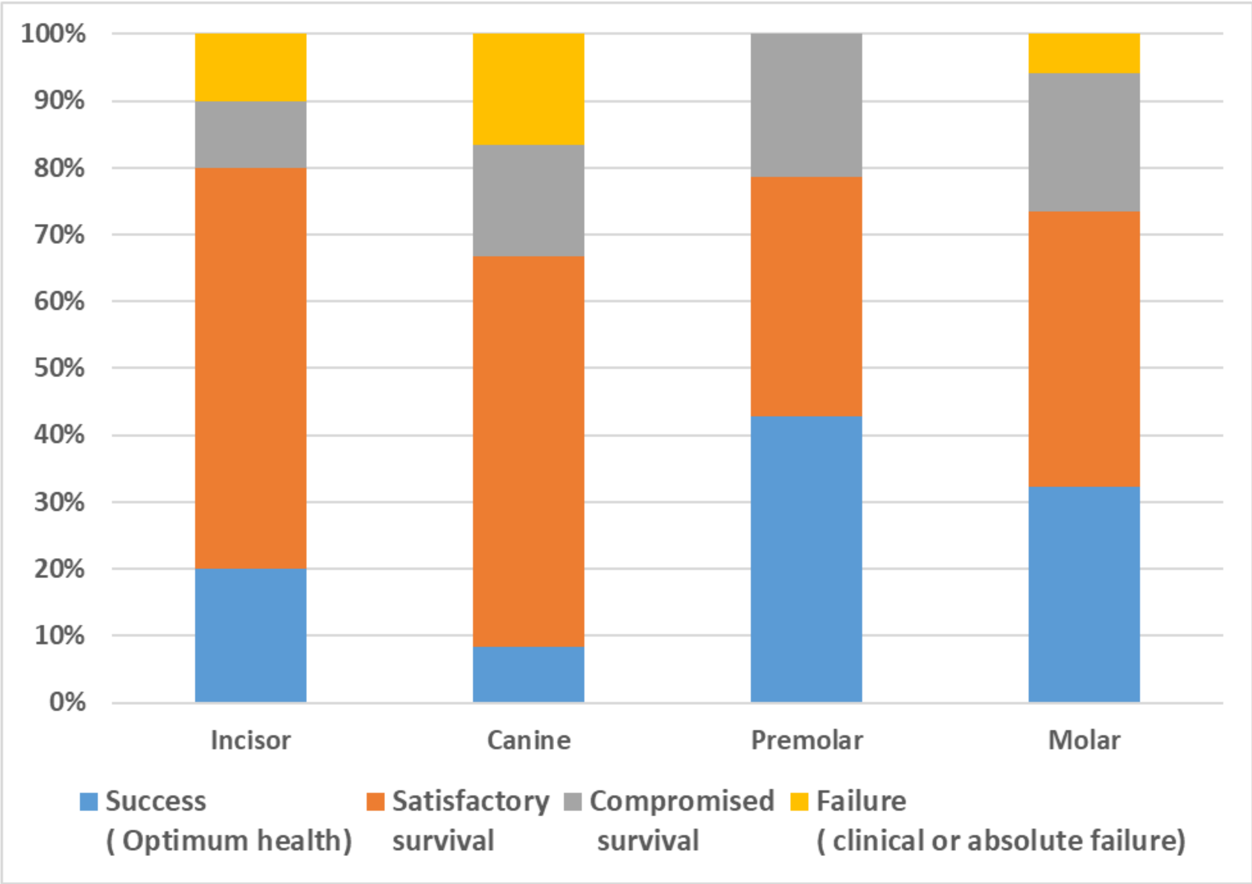

Figure-1. Distribution of short implant success rate in relation to implant location.

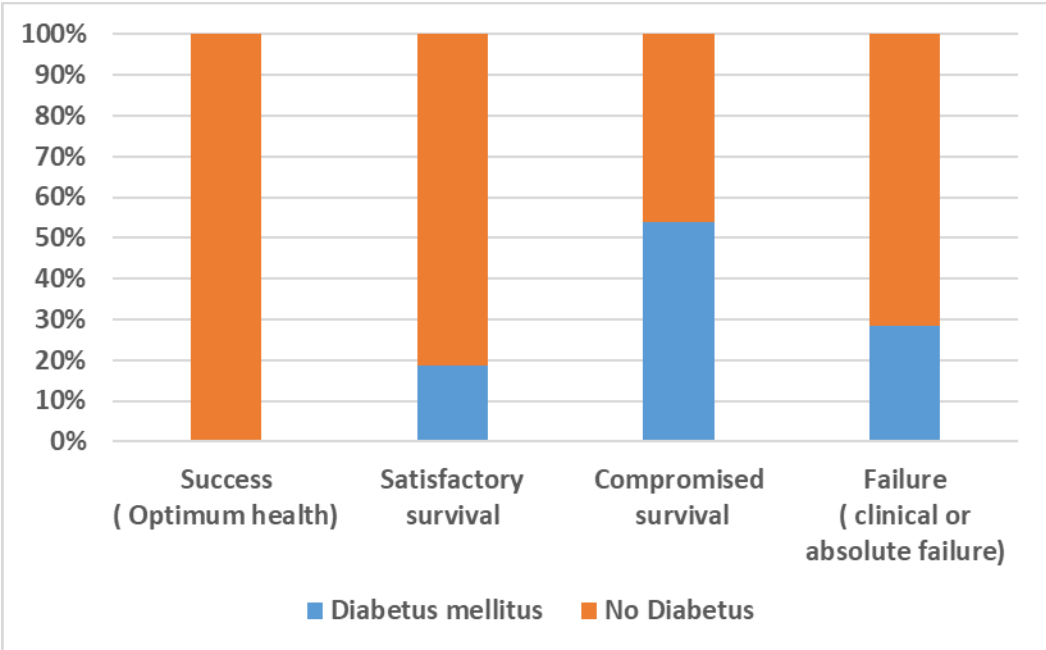

Figure-2. Distribution of short implant success rate in relation to the Diabetes Mellitus

Table 1 Implant success evaluation criteria according to the Health Scale for Dental Implants as classified by Misch et al.

Implant quality Scale group	Clinical condition	prognosis
1.success (optimum health)	(a)no pain or tenderness upon function (b)0 mobility (c)< 2mm radiographic bone loss (d)no exudate history	Very good to excellent
2.satisifactory survival	(a)no pain on function (b)0 mobility (c)2-4 mm radiographic bone loss (d)no exudate history	Good to very good, depending on the stable condition of the crestal bone.
3.compromised survival	(a)may have sensitivity on function (b)no mobility (c)radiographic bone loss>4 mm (less than1/2 implant length) (d)probing depth >7 mm (e)may have exudate history	Good to guarded. Depending on the ability to reduce and control stress
4, failure (clinical or absolute failure)	Any of following; (a)pain on function (b)mobility (c)radiographic bone loss >1\2implant length (d)uncontrolled exudate (e)no longer in the mouth	Failure in all statistical data.

Table 2. Descriptive statistics of continuous variables

Variables	**N**	**Minimum**	**Maximum**	**Mean**	**SD**
Age	70	20	85	46.66	13.68
Length(mm)	70	6	8	7.21	0.83
Diameter(mm)	70	3	5	3.85	0.49
Bone loss	70	1.5	5	2.81	0.89

Table 3. Distribution of categorical variables

Variables	Category	Frequency	Percent
	20 - 44 Years	30	42.9
Age group	45 - 64 Years	31	44.3
	65 Years +	9	12.9
Gender	Male	42	60.0
	Female	28	40.0
	None	47	67.1
Medical Hx	DM	15	21.4
	HT	7	10.0
	RA	1	1.40
Smoking Hx	No smoker	40	57.1
	Smoker now or past	30	42.9
	Non Smoker	40	57.1
Smoking Status	Ex-smoker	7	10.0
	Current smoker	23	32.8
Location	Maxillary	42	60.0
	Mandibular	28	40.0
	Molar	34	48.6
Location 2	Canine	12	17.1
	Incisor	10	14.3
	Premolar	14	20.0
Pain or tenderness	No	57	81.4
	Yes	13	18.6
Mobility	No	63	90.0
	Yes	7	10.0
Exudate Hx	No	57	81.4
	Yes	13	18.6
	Success	20	28.6
Scale	Satisfactory	32	45.7
	Compromised	13	18.6
	Failure	5	7.10
	Total	70	100

Table 4. Distribution of short implant success rate in relation to demographic factors.

Variables	Category	Statistic	Scale				p-value*
			Success	Satisfactory	Compromised	Failure	
Age group	20 - 44 Years	Count	13	12	3	2	0.125
		%	43.30%	40.00%	10.00%	6.70%	
	45 - 64 Years	Count	6	16	6	3	
		%	19.40%	51.60%	19.40%	9.70%	
	65 Years +	Count	1	4	4	0	
		%	11.10%	44.40%	44.40%	0.00%	
Gender	Male	Count	9	21	10	2	0.197
		%	21.40%	50.00%	23.80%	4.80%	
	Female	Count	11	11	3	3	
		%	39.30%	39.30%	10.70%	10.70%	
Smoking status	Non-Smoker	Count	16	16	6	2	0.196
		%	40.00%	40.00%	15.00%	5.00%	
	Ex-smoker	Count	2	4	1	0	
		%	28.60%	57.10%	14.30%	0.00%	
	Current smoker	Count	2	12	6	3	
		%	8.70%	52.20%	26.10%	13.00%	
Total		Count	20	32	13	5	
		%	28.60%	45.70%	18.60%	7.10%	

*: chi-square test

Table 5. Distribution of short implant success rate in relation to implant location.

Variables	Category	Statistic	Scale				p-value
			Success	Satisfactory	Compromised	Failure	
Location	Maxillary	Count	10	21	9	2	0.466
		%	23.30%	48.80%	20.90%	7.00%	
	Mandibular	Count	10	11	4	3	
		%	37.00%	40.70%	14.80%	7.40%	
Sub location	Molar	Count	11	14	7	2	0.561
		%	32.40%	41.20%	20.60%	5.90%	
	Canine	Count	1	7	2	2	
		%	8.30%	58.30%	16.70%	16.70%	
	Incisor	Count	2	6	1	1	
		%	20.00%	60.00%	10.00%	10.00%	
	Premolar	Count	6	5	3	0	
		%	42.90%	35.70%	21.40%	0.00%	
Total		Count	20	32	13	5	
		%	28.60%	45.70%	18.60%	7.10%	

Table 6. Distribution of short implant success rate in relation to the medical history

Variables	Category	Statistic	Scale				p-value
			Success	Satisfactory	Compromised	Failure	
Medical Hx	None	Count	20	20	4	3	0.001
		%	42.60%	42.60%	8.50%	6.40%	
	DM	Count	0	6	7	2	
		%	0.00%	40.00%	46.70%	13.30%	
	HT	Count	0	6	1	0	
		%	0.00%	85.70%	14.30%	0.00%	
	RA	Count	0	0	1	0	
		%	0.00%	0.00%	100.00%	0.00%	
Total		Count	20	32	13	5	
		%	28.60%	45.70%	18.60%	7.10%	

Table 7. Normality test for continuous variables

Variables	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Age	0.104	70	0.059	0.971	70	0.106
Length mm	0.299	70	0.000	0.76	70	0.000
Diameter mm	0.234	70	0.000	0.901	70	0.000

Table 8. Comparison of short implant success rate with continuous variables

Variables	Statistic	Success (20)	Satisfactory (32)	Compromised (13)	Failure (5)	Total (70)	P-value
Age	Mean	39.2	47.59	56.69	44.4	46.66	0.003 [a]
	SD	11.73	12.27	15.89	5.50	13.67	
Length mm	Mean	7.5	7.19	7	6.8	7.21	0.187 [b]
	SD	0.76	0.86	0.82	0.84	0.83	
Diameter mm	Mean	4.08	3.81	3.73	3.5	3.85	0.025 [b]
	SD	0.49	0.424	0.38	0.87	0.49	

a: one-way ANOVA (F-test)

b: Kruskal Wallis test

Table 9. Spearman correlation between short implant success rate and continuous variables

Variable	Statistic	Age	Length mm	Diameter mm
Correlation Coefficient		-0.352**	.262*	.359**
Scale	P-value	0.003	0.028	0.002

**: Correlation is significant at the 0.01 level *: Correlation is significant at the 0.05 level

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