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SHORT REPORT

A 6-year Evaluation of 223 Tapered Dental Implants and associated prosthesis in 92 patients at a University Hospital

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Abstract

The aim of the retrospective study was to assess the clinical and radiographic outcome of the dental implant surgery and prosthetics. It was conducted at the Aga Khan University Hospital, Karachi, and comprised of medical charts and radiographic records of patients visiting between 2010 and 2015. Variables such as implant dimensions, final prosthesis, method of retention, loading protocol and patient factors were analysed. A total of 223 implants (143(64.1%) in maxilla and 80(35.9%) in mandible) were placed in 92 subjects (50(54.3%) males and 42(45.7%) females). All implants were Zimmer tapered screw-vent. Length of 108(48.4%) implants was 11.5mm and diameter of 84(37.7%) implants was 4.7mm. Besides, 6(2.7%) implants failed to osseointegrate, whereas 1(0.4%) implant failed at 12 months of loading. Among the 216(96.9%) successful implants, 140(64.8%) served as bridge abutments, 72(33.3%) were single crown abutments and 4(1.9%) were overdenture abutments. Also, 37(17.1%) implants were immediately loaded. The six-year survival rate of implants was 96.9%.

Keywords: Dental implants, Success, Failure, Surgery, Prosthetics.

Introduction

Dental implant-supported fixed crown and bridges have become a predictable treatment modality for the replacement of missing teeth. Success and survival of dental implants depend upon various factors. These include primary stability of implant at the time of placement, adequate bone volume and quality, prevention of excessive loading forces and an atraumatic execution of surgery.¹ The primary stability (achieving a torque resistance of over 30Ncm) has been considered as a critical factor for the clinical success of implant. As the primary stability decreases, the possibility of micro motion at implant-bone interface increases which may lead to a fibrous union instead of a bony union and eventually lead to the implant failure.

The success of implant prosthetics is additionally dependent on certain mechanical factors such as the presence of stable occlusal contacts, harmonious occlusion, prevention of

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masticatory overload, even distribution of load among implants etc.¹ Asystematic review on the implant-borne prosthesis has shown a high survival rate ranging up to 95% at 5-year interval.² In addition, several factors such as periodontal disease, smoking, poor oral hygiene, diabetes, etc. have been identified as potential risks for developing complications around dental implants and may lead to implant failure.

Since, implant dentistry is an evolving area of dental practice in Pakistan, it is imperative for the dentists who offer this service to record its outcome and to compare it with the outcomes at established centres of the world. The present study was planned to assess the clinical and radiographic outcome of the dental implants and associated implant prosthetics.

Methods and Results

This retrospective review was conducted at the Aga Khan

Table-1: Distribution of implant level factors (n=223).

Variables	Categories	n	%
Site	Edentulous	68	30.5
	Partially dentate	155	69.5
Arch	Maxilla	143	64.1
	Mandible	80	35.8
Bone grafting	No graft	176	78.9
	Minimal graft	37	16.6
	Substantial grafting	8	3.6
	Sinus elevation	2	0.9
Medical status of the subject (as per implant site)	Healthy	146	65.5
	Diabetes	24	10.8
	Hypertension	18	8.1
	Smokers	11	4.9
Diameter of implant	Diabetes + hypertension + smoking	24	10.8
	3.3mm	1	0.4
	3.7/4.1mm	125	56.0
	4.7mm	84	37.7
	6.0mm	13	5.9
Length of implant	8mm implant	17	7.6
	10mm implant	34	15.2
	11.5mm implant	108	48.4
	13mm implant	63	28.3
	16mm implant	1	0.4
Definitive prosthesis	single crown	72	32.3
	fixed bridge	141	63.2
	overdenture	4	1.8
Type of loading	immediate	38	17.0
	delayed	184	82.5

Table-2: Association of patient level factors with implant success or failure.

Variables	Categories	Implant success n (%)	Implant failure n (%)	Total	p-value
Gender	Male	90 (40.3)	5(2.3)	95 (42.6)	0.11
	Female	126 (56.5)	2 (0.9)	128 (57.4)	
Dental status	Partially edentulous site	152 (68.2)	3(1.3)	155 (69.5)	0.12
	Edentulous site	64(28.7)	4(1.8)	68 (30.5)	
Medical status	Healthy	141 (63.2)	5 (2.2)	146 (65.4)	0.66
	Diabetes	24 (10.8)	0 (0)	24 (10.8)	
	Hypertension	17 (7.6)	1 (0.4)	18 (8.0)	
	Smoking	10 (4.6)	1 (0.4)	11 (5.0)	
Bone grafting	Diabetes, HTN & smoking	24 (10.8)	0 (0)	24 (10.8)	0.48
	No graft or minimal graft	207 (92.8)	207 (92.8)	213 (95.5)	
Loading protocol	Considerable graft or Sinus lift	9 (4.0)	9 (4.0)	10 (4.5)	0.84
	Immediate	37 (16.5)	37 (16.5)	38 (17.1)	
Abutment type	Delayed	179 (80.2)	179 (80.2)	185 (82.9)	0.81
	Straight	205 (92.0)	205 (92.0)	212 (95.1)	
Definitive prosthesis	Angled	11 (4.9)	11 (4.9)	11 (4.9)	0.89
	Single crown	72 (32.3)	72 (32.3)	74 (33.2)	
	Abutment for bridge	140 (62.7)	140 (62.7)	145 (65.0)	
	Abutment for overdenture	4 (1.8)	4 (1.8)	4 (1.8)	

HTN: Hypertension.

University Hospital (AKUH), Karachi, and comprised of patients' medical charts and radiographic records from 2010 to 2015. Patients who received dental implants and associated prosthesis were included. Patients whose implants were placed under general anaesthesia, patients who received any bone grafting prior to the surgery, or patients who received part of the treatment (implant or prosthesis) outside the AKUH were excluded.

An Implant was considered successful if it was able to withstand occlusal load; had healthy peri-implant tissues, and <2mm crestalbone loss compared to the day of placement. An implant that did not exhibit the above was deemed a failure.

Data was analysed using SPSS 20. Frequency distribution of age, gender, dentate status, immediate or delayed loading of implants, and type of prosthesis were determined. Chi-square test was applied to determine association between different variables (patient level and implant level factors). $P < 0.05$ was considered statistically significant. The unit of analysis in the present report was individual implant.

A total of 223 implants (143(64.1%) in maxilla and 80(35.9%) in mandible) in 92 subjects (including 50(54.3%) males and 42(45.7%) females) were studied. The mean age of the participants was 53.4 ± 13.6 years. The mean follow-up time of implants was 29.2 ± 13.3 months (range:9-72 months).The number of dental implants placed among diabetics was 24(10.8%),

hypertensives18(8.1%) and smokers 11(4.9%). Similarly, 24(10.8%) implants were installed in subjects who had a combination of the aforementioned problems.

All implants were Zimmer tapered screw-vent type, placed manually under local anaesthesia. Besides, length of 108(48.4%) implants was 11.5mm and diameter of 84(37.7%) implants was 4.7mm (Table-1).

Moreover, 6(2.7%) implants failed to osseointegrate, out of which only 1(16.7%) exhibited peri-implantitis. Also, 1(0.4%) more implant failed at one year of service. In addition, 2(0.9%) cement retained crowns were dislodged and 1(0.4%) bridge exhibited ceramic fracture. Thus, the 6-year survival of implants turned out to be 216(96.86 %).Of them, 90(40.3%) were in males and 126(56.5%) were in females.

Among the successful implants, 140(64.8%) units served as bridge abutments, 72(33.3%) were single crown abutments and 4(1.9%) served as overdenture abutments. Besides, 37(17.1%) implants were immediately loaded. There was no statistically significant difference in immediate loading 37(16.5%) versus delayed loading 179(80.2%) ($p=0.84$) for implant survival. Similarly, no statistically significant associations were observed for implant survival with systemic conditions such as diabetes 24(10.8%), hypertension 17(7.6%) and smoking 10(4.6%) ($p=0.66$), (Table-2).

Conclusion

The present study assessed a large number of implants

and reported an overall survival rate of 96.8%, which is comparable to similar studies done at various developed centres of the world. The reported sample size (n) and associated survival rates in % as mentioned in these studies were: Guarnieri (n=46) 95.6%, Alfadda (n=180) 96%, Fradera (n=415) 95.38%, Babbush (n= 1,001) 97.4% and Ormainer (n=173) 99%.³⁻⁷

In our review, the success of single implants and implants as bridge abutments were 72(97.3%) and 140(96.5%). This is similar or in fact slightly better than the numbers reported in a systematic review by Pjetursson et al.⁸ which showed survival of implant-supported single crowns and abutment for fixed bridges as 94.5% and 95.2%, respectively.

Studies have consistently reported that posterior maxilla is the least favourable site for dental implant survival.³⁻⁸ A similar observation is made in the present report as 6 out of 7 failures in our study occurred in the posterior maxilla. Only one implant in the anterior maxilla was lost to peri-implant disease. Posterior maxilla is anatomically comprised of cancellous bone that gets reduced in volume after loss of tooth and hence serves as a poor site for implant placement and survival.

Immediate loading protocol has been advocated in recent years for its promise of reducing the number of surgeries and shortening the time between surgery and actual prosthesis placement along with promise of early occlusal rehabilitation and aesthetics. The proportion of immediately loaded implant in the present study was 36(17%). The survival of such implants in the present study is 36(97.3%). This is comparable to the implants that were done using conventional delayed loading protocol 173(96.6%) in the present study. These numbers are in agreement with a study by Tealdo et al.⁹ who reported implant survival rates of 93.87% for the immediate and 95.88% for the conventional loading. Similarly, Capabelli¹⁰ has also reported 5-year implant survival of over 95% in both the immediate and the early loading protocols groups.

There were 68% cement-retained and 32% screw-retained prosthesis in the present study. Of them, only two cement retained crowns were dislodged and one full arch bridge exhibited ceramic fracture. Since the magnitude of prosthetic failure in our study was substantially low (n=3), and the morbidity associated with such prosthetic failures is low, its overall significance is minimal. The predictable prosthetic success in our report can be attributed to two

factors: prudent use of digital radiography in the treatment planning of implant cases and availability of an in-house prosthodontics laboratory support.

The strengths of the study included availability of complete clinical and radiographic data of subjects and implants. The primary limitation of the present study was the absence of a comparison group. Single-arm longitudinal study could not yield any inferences on statistical associations with the clinically significant variables. Moreover, it was a single-centre study and patient satisfaction aspects of the treatment success were not taken into account. Failure of dental implant is a traumatic experience for both the patient and the dentist. Therefore, clinicians should carefully plan each case.

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