Evaluation of 107 dental implant treatments at the restorative dentistry clinics of the Lagos University Teaching Hospital

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ABSTRACT

Objectives: Evaluation, review, and audit of dental implant treatment done in a hospital aids and contribute to improvement of treatment outcomes. This study reviewed dental implant treatment in a teaching hospital to develop a guide for successful future implant treatment.

Methods: Records of patients who received dental implant treatment between 2012 to 2020 in the teaching hospital were retrieved. Patient's sociodemographic data, location of teeth replaced, type of surgical and loading protocol, brand of implant, survival rate of implants at 3, 6, 9 months and 12 months after loading of implants were obtained, immediate or delayed loading protocols was used. Three systems were used, the survival of implant and complications recorded during the 12 months review period. Data entry and analysis was performed with SPSS version 22.

Results: A total of 75 participants comprised of 25(33.33%) males and 50(66.67%) females. The age range was 21 to 72 years. A total of 107 dental implant were placed Two thirds (72) implants were delayed loading, while 35 were loaded immediately. Delayed implant loading had a higher survival rate (87.5%) compared to immediate implant loading (80%). Mandibular implants had a significantly higher survival rate compared to maxillary implants (100% and 79.2% respectively; p value=0.387. Posterior implants had a higher survival rate than anterior implants, (91.3% and 80.3% respectively; p value=0.387

Conclusion: Loading protocol does not significantly affect implant survival rate. Implants placed in the mandible had a remarkably high survival rate because of quality of bone.

Keywords: Dental implants; implant survival

INTRODUCTION: Dental implant treatment is a widely accepted and reliable treatment option for tooth replacement. It is a rapidly developing aspect of dentistry in the developing countries. Dental implants also known as oral or endosseous implants are surgical components that interface with the mandible and maxilla to support a dental prosthesis such as a crown, bridge, denture, facial prosthesis or to act as an orthodontic anchor[1]. They are considered to be an important addition to dental prosthetics as they have revolutionized the method of replacing missing teeth, providing a higher success rate and patient satisfaction of dental prosthesis[2,3]. Due to these advantages, dental implant is now regarded as the gold standard for management of partial or full edentulous patient[4,5]. Factors that determine implant treatment success include operator skill, choice of implant placement protocol and loading

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protocol, and local and systemic patient related factors. Local factors include inadequate bone volume, unhealthy peri-implant soft tissue, periodontitis-related tooth loss with severe bone loss and gingival recession; limiting local anatomical structures and smoking history which has both local and systemic effect on implant success[6]. Systemic factors include presence of systemic disease like diabetes mellitus and osteoporosis; and recent radiotherapy of the head and neck[6]. However, these factors do not serve as absolute contraindications to dental implant placement; dental implants may be placed after these conditions are managed[6]. Evaluation of these factors will point to the potential reasons for failure and help in better treatment planning which will improve treatment outcome.

Management of local factors usually involves periodontal surgeries and other ridge preparation procedures to prevent implant failures[7]. These procedures include guided bone regeneration, bone grafting, distraction osteogenesis, and bone splitting for ridge expansion performed to augment a deficient alveolar ridge and correct gingival defects.[7] The application of biological materials such as autografts, allografts, xenografts, alloplasts and growth factors to the implant site combined with the ridge preparation procedures increase the success rate of implant treatment[8].

Despite their advantages and popularity, dental implants are associated with several risks and complications[9]. At the time of surgery, they can be associated with blood vessel damage or nerve damage if proper assessment is not done prior to osteotomy and surgical placement of implant[10]. Other complications like peri-implantitis (peri-implant soft tissue inflammation and bone loss), implant loss or failure, phonetic complications, and mechanical failures (crown fracture, implant fracture, abutment mobility) have also been reported[11, 12].

Although dental implants have been used to replace missing teeth for more than half a century [13] their use in developing countries only began to rise in the last decade[14]. Previous studies[15, 16] reported a high level of awareness of dental implants in developed countries ranging from 66.4% to 77% among patients and general public, while a low level of awareness of dental implants was reported in Nigeria among patients (20.2% to 39.8%) and healthcare workers (7.2%)[17-20]. However, the level of awareness amongst Nigerians, is on a steady rise[21].

Dental implants have become one of the most popular and reliable treatment options for restoring missing teeth in Nigeria[21]. Retrospective evaluation of implant treatment will identify the possible causes of treatment failure and guide the treatment provider on better treatment planning and areas where he needs to improve his skill through relevant training. Implant dentistry requires specialized training in the field of oral implantology and implant restoration. This training may be acquired through continuing professional development courses, master's degree in oral implantology or through one-on-one training mentorship with an Oral Implantologist.

An audit of implant treatment in a health facility is important to evaluate the success of the treatment and determine how to improve on the implant treatment rendered to the patients. Replacement of missing teeth with dental implants is performed at the Restorative Dentistry clinics of the Lagos University Teaching Hospital. As with all new advancements in treatment modalities, it is important to evaluate the success rate, complications and factors responsible for implant treatment failure at the Lagos University Teaching Hospital; hence the need to go back to patient records and systematically review patient's medical and dental history, the surgical protocol, loading protocol, and outcomes of the dental implant treatment. There is no study at the Lagos University Teaching Hospital on the evaluation of dental implant treatment. This study will thus form a baseline for future studies and help in treatment planning regarding implant therapy in the teaching hospital.

The aim of the study was to retrospectively evaluate dental implant treatments performed

at the Lagos University Teaching Hospital from January 2012 to December 2020. The objectives addressed were: to determine socio-demographics of patients treated with dental implants, to determine the sites of implant placement, to determine the ridge preparation procedures done before implant placement, complication associated with different brand of implant used and to establish one year survival rate of the implant treatment.

METHODS

The study was a retrospective study to evaluate dental implant treatment from January 2012 to December 2020 at the Restorative dentistry clinics, LUTH.

Records were retrieved from case notes and treatment books of all patients who had received dental implant treatment in the Restorative dentistry clinics, since the inception of dental implant treatment in 2012. Patients who received implant treatment in the restorative dentistry clinics, LUTH, and were followed up for a minimum of 12 months after implant loading were included. Patients whose implants were placed in other hospitals other than LUTH were excluded from the study.

A well structured close ended data collection checklist was used. The following information was extracted: age, sex, date of implant placement, tooth replaced, site of implant placement, ridge preparation procedure performed, surgical protocol used (implant placed either immediately after tooth extraction or delayed after healing of extraction site), loading protocol used (implant abutment loaded either immediately after implant placement or delayed after osseo-integration of implant with alveolar bone), implant system used, complications and status or survival of implant after one year post loading.

The approval for the study was obtained from the research and ethics committee of the Lagos University Teaching Hospital in January 2021. The study was carried out in accordance with the Helsinki declaration.

Data analysis was performed using the SPSS statistical analysis software (version. 22, IBM SPSS Statistics, Chicago, IL, USA). Descriptive analysis was carried out using frequency and proportion for categorical variables; and mean, and standard deviation for numeric variables. Data were statistically analyzed using Pearson's chi-square test and Fisher's exact test, where applicable. Statistical significance was inferred at p (0.01)

RESULTS

A total of 75 participants made up of 25 (33.33%) males and 50 (66.67%) females were treated during the study period. Their age range was 21 – 72 years with a mean of 43.1 $\pm$ 7.37 years. The majority had tertiary level education (96%)(fig. 1-3). A total of 107 dental implant treatments were performed on the 75 participants. Seven of these implants were placed immediately after extraction while 100 were placed after healing of extraction site. 72 implants were loaded using the delayed technique while 35 were loaded immediately. Number of implants placed per patient ranged from 1 – 9. More implants were placed in the maxilla (77 implants) than the mandible (30 implants). The maxillary central incisor was the most replaced tooth (40 implants) while the least replaced were the maxillary second molar and the mandibular canine (1 implant each) (Table 1). There were 25 immediate loaded implants and 52 delayed loading implants in the maxilla, while the mandible had 10 immediate loaded implants and 20 delayed loaded implants. (Table 1) Ten ridge preparation procedures were performed before implant placement (Table 2). Three different implant systems were used; Bicon implant system (30 implants), Blue Sky bio implant system (35 implants) and Sigma implant system (42 implants). The complications recorded included abutment dislodging (5 implants), peri-implantitis (4 implants), screw loosening (2 implants), crown cementation failure (8 implants), osseo-integration failure (15 implants) and prosthetic failure (1 implant). Bicon implants recorded significantly less complications compared to Blue Sky Bio and Sigma implants (p-value = 0.000). The implant length used range from 6mm to 13mm. 10 out of the 16 failed implants were 10mm in length. 7 out of 16 failed implants were diameter 4.2mm. Implant failure not associated with length or diameter. Table 3 shows complications observed during 1 year review period according to

implant type respectively. Only osseo-integration failure and prosthetic failure were considered as true failures of implant treatment. Table 4 shows distribution of implant treatment by implant type and 1-year failure rate. The success rate was seen to be very high at the inception of implant treatment in 2012 and 2013 (100%) but declined over the years to about 80% not until 2020, when it returned to a success rate of 100%. Delayed implant loading had a higher survival rate (87.5%) compared to immediate implant loading (80%). This difference however, was not statistically significant (p-value = 0.387). Mandibular implants had a significantly higher survival rate compared to maxillary implants (100% and 79.2% respectively; p-value = 0.005). And although posterior implants had a higher survivals rate than anterior implants, this difference was not statistically significant (91.3% and 80.3% respectively; p-value = 0.171). Table 5 shows 1-year survival of implants by location and loading protocol. The 3.0mm, 3.5mm, 4.0mm and 4.5mm diameter implants had 100% 1-year survival compared to the other implant diameter 3.3mm,3.75mm,4.1mm,4.4mm,4.7mm and 5.0mm used. This difference however, was not statistically significant (p-value = 0.225). Similarly, the difference between implant length at 1-year survival was not statistically significant although 7.0mm, 8.5mm, 11.0mm and 11.5mm length implants had 100% 1-year survival. Table 6 shows 1-year survival and failure of implants by implant diameter and implant length. The dimensions of the 16 failed implants (diameter by length in mm) include: 3.3 x 10.0 (2 implants), 3.7 x 10.0 (2 implants), 3.75 x 8.0, 3.75 x 10.0 (2 implants), 4.1 x 10.0 (2 implants), 4.1 x 13.0 (2 implants), 4.2 x 8.0 (2 implants), 4.2 x 10.0, 4.7 x 10.0, and 5.0 x 6.0.

DISCUSSION

The use of implant to replace missing teeth in partial and edentulous ridges is widely accepted due to the predictable outcome. This study aimed to evaluate the one year survival rate, failure rate, characteristics and complications associated with the dental implant systems used between 2012 and 2020 at the Restorative Dentistry clinics of a Nigerian teaching Hospital

In this study, the most commonly replaced tooth was the upper central incisor(40).This is because aesthetics is a primary concern of patients replacing missing teeth[22].

The one-year survival rate in this study was very high at the inception of implant treatment in 2012 and 2013 (100%) but declined to 81.3% in 2014 and 87.6% in 2015 when a new implant system and loading protocol was introduced. In the year 2020, a survival rate of 100% was recorded. This decline in survival rate could be attributed to case complexity, change in implant system and change in loading protocol and operator's learning curve. At the initial stage, simple and straightforward cases were treated with the use of a single implant system and delayed placement and loading protocol. As more complex cases with reduced bone volume were taken on, immediate loading and immediate implant placement was introduced, different implant systems were also introduced, we observed a decrease in the success rate of dental implant treatment. This observation is in agreement with a previous study by Mohajerani et al. 2019[23] who attributed high failure rate to the use of various implant brand ,technical errors and increase in the number of patients treated.

Survival rate of delayed loaded implants (87.5%) was higher than immediately loaded implants(80%) though the difference was not significant in this present study.

This finding is similar to results of a systematic review by Romanus et al [24] and the study of Grandi et al[25] that reported that the survival rates of immediately loaded implants are similar to the survival rates of conventionally loaded implants if primary stability is achieved in the immediately loaded implants. Mandibular implants in this study showed significantly higher survival rate(100%) than the maxilla. This result is in agreement with previous studies [26,27]that reported high survival rates of mandibular implants which can be attributed to the quality of bone in the mandible compared to the maxilla. Implant length and diameter did not have any significant association with implant survival in this study. This is in agreement with previous studies that reported no significant association between implant length, diameter and survival rate[28,29,30,31,32].

Bicon dental implants recorded significantly less complications and failure rate compared to Blue Sky Bio and Sigma classic implants. Bicon

Table 1: Location of implant by surgical protocol and loading protocol

Location		Surgical protocol			Loading protocol		
		Immediate placement	Delayed placement	Total	Immediate loading	Delayed loading	Total
Maxilla	Central incisor	4	36	40	13	27	40
	Lateral incisor	0	11	11	3	8	11
	Canine	0	3	3	1	2	3
	First premolar	1	7	8	4	4	8
	Second premolar	1	8	9	3	6	9
	First molar	0	5	5	1	4	5
	Second molar	0	1	1	0	1	1
Subtotal		**6**	**71**	**77**	**25**	**52**	**77**
Mandible	Central incisor	0	4	4	2	2	4
	Lateral incisor	0	2	2	0	2	2
	Canine	0	1	1	0	1	1
	First premolar	0	2	2	2	0	2
	Second premolar	0	3	3	1	2	3
	First molar	1	13	14	5	9	14
	Second molar	0	4	4	0	4	4
Subtotal		**1**	**29**	**30**	**10**	**20**	**30**
Total		**7**	**100**	**107**	**35**	**72**	**107**

Table 2: Ridge preparation procedure before implant placement

Ridge preparation procedure	Number of implant treatment	% Number of implant treatment
Bone graft and collagen membrane	8	7.5%
Bone spreading	2	1.9%
Total	**10**	**9.3%**

Table 3: Complications observed during 1 year review period according to implant type

Type of Implant	Abutment dislodging	Peri - implantitis	Screw loosening	Crown cementation failure	Osseo - integration failure	Prosthetic failure	Total
Bicon	5	1	0	0	0	1	7
Blue Sky bio	0	3	1	3	7	0	14
Sigma	0	0	1	5	8	0	14
Total	**5**	**4**	**2**	**8**	**15**	**1**	**35**

p-value = 0.000

Table 4: Distribution of implant treatment by implant type and 1 year failure rate

Type of Implant	Number of treatment	Failure rate after 1 year	% Failure rate after 1 year
Bicon (morse taper connection)	30	1	3.3%
Blue Sky bio (internal hex connection)	35	7	20.0%
Sigma (internal hex connection)	42	8	19.0%
Total	**107**	**16**	**15.0%**

p-value = 0.000

Table 5:-1 year survival of implants by location and loading protocol

Location		Immediate loading			Delayed loading		
		Placed	Survived	% Survived	Placed	Survived	% Survived
Maxilla	Anterior	17	12	70.6%	37	30	81.1%
	Posterior	8	6	75.0%	15	13	86.7%
Mandible	Anterior	2	2	100%	5	5	100.0%
	Posterior	8	8	100%	15	15	100.0%
p-							
Total		**35**	**28**	**80%**	**72**	**63**	**87.5%**

p = 0.387

Table 6: 1-year survival and failure of implants by implant diameter and implant length

Implant diameter (mm)	Outcome		Total (%)	P-value	Implant length (mm)	Outcome		Total (%)	P-value
	Survived (%)	Failed (%)				Survived (%)	Failed (%)		
3.0	1(100)	0(0)	1(100)	0.225	6.0	7(87.5)	1(12.5)	8(100)	0.778
3.3	4(66.7)	2(33.3)	6(100)		7.0	1(100)	0(0)	1(100)	
3.5	7(100)	0(0)	7(100)		8.0	33(91.7)	3(8.3)	6(100)	
3.7	9(81.8)	2(18.2)	11(100)		8.5	2(100)	0(0)	2(100)	
3.75	5(62.5)	3(37.5)	8(100)		10.0	38(79.2)	10(208)	48(100)	
4.0	20(100)	0(0)	20(100)		11.0	2(100)	0(0)	2(100)	
4.1	13(76.5)	4(23.5)	17(100)		11.5	1(100)	0(0)	1(100)	
4.2	10(76.9)	3(23.1)	13(100)		13.0	7(77.8)	2(22.2)	9(100)	
4.5	8(100)	0(0)	8(100)						
4.7	6(85.7)	1(14.3)	7(100)						
5.0	8(88.9)	1(11.1)	9(100)						
Total	91(100)	16(15.0)	107(100)		Total	91(850)	16(15.0)	107(100)	

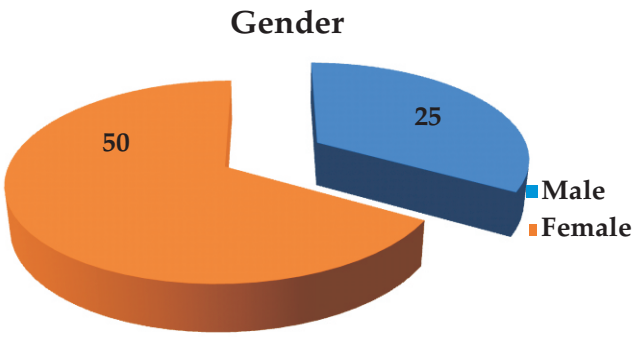

Figure 1: Distribution of participants by gender

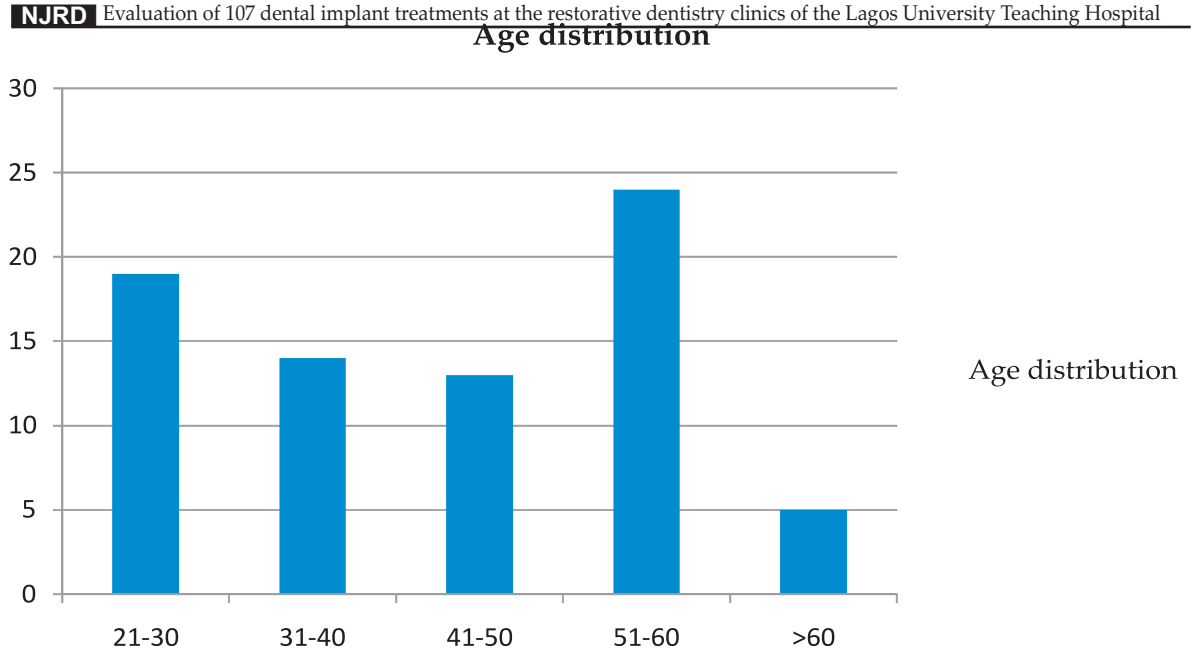

Figure 2: Distribution of participants by age

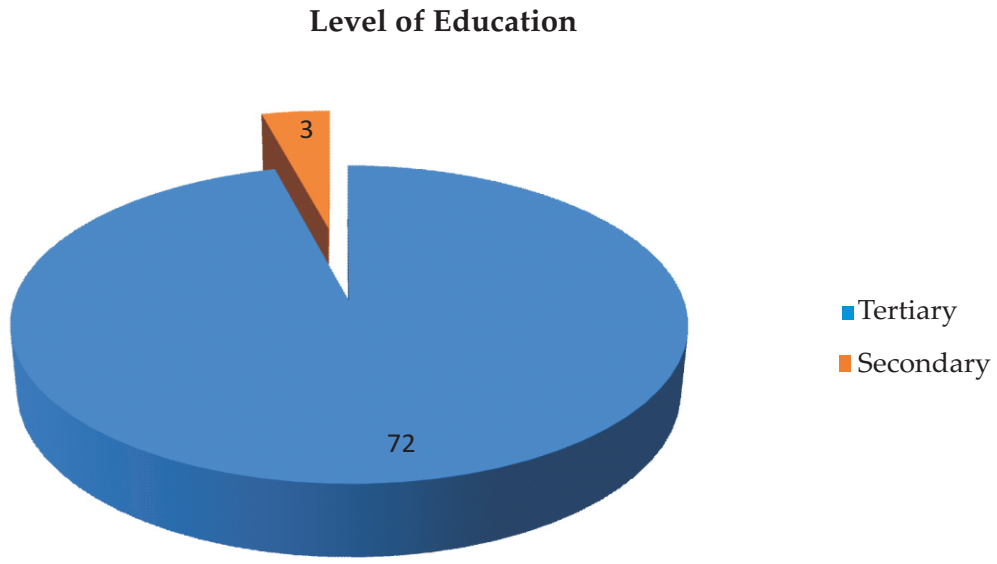

Figure 3: Distribution of participants by educational level

implants have fins with plateaus which adds 30% more surface area[33] than screw implant of the same size like Sigma classic and Blue sky bio . This added surface area increase the bone implant contact area and may be responsible for the Bicon implant higher survival rate.

CONCLUSION

Loading protocol and implant dimension does not significantly affect implant survival rate. Implants placed in the mandible exhibited a significantly high survival rate because of quality of bone. Morse taper connection implants has a significantly lower complication and failure rate compared to the internal hex implants.

Conflict of interest: The authors declare no conflict of interest.

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Data availability statement: The data sets collected and analyzed during the current study can be made available by the corresponding author upon reasonable request.

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