

Dental implant treatment: Experience in a tertiary hospital in Nigeria

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Abstract

Aims: To characterise the types of implants and implant supported restorations placed in a tertiary hospital as well as determine the outcome of the implant treatment.

Materials and methods: This was a retrospective study of patients who received dental implants. The socio-demographic characteristics, smoking and alcohol use, medical history, reason for missing teeth, missing teeth, type of implant, surgery, adjunctive procedure, postoperative complaints and outcome at one week, 6 months and one year after implant surgery.

Results: Data of 61 patients who received 111 implants were utilized for the study. The maxillary arch received 61.3% and 55.7% of the implants were single tooth implants. Anterior teeth made up 63.1% of the dental implants. Most (74.8%) were conventional implants while 25.2% were immediate implants. Cylindrical implants were placed in 76.6% of cases while tapered implants were placed in 23.4%. Single crown was provided in 59.5% of the cases while fixed partial dentures were provided in 40.5%. At 7 days post-op 81.1% of the cases had no complaints. At 6 months review 65.8% had no notable complications. At one-year review, favorable clinical outcome was recorded in 75.7% of the cases while favorable radiographic outcome was recorded in 72.1% of the cases. Clinically, periimplantitis was observed in 9.0% of cases.

Conclusions: The survival of implants can be influenced by site of placement, position of placement, arch and type of implant while not being compromised by the medical conditions, age gender, oral hygiene status prior to implant placement, adjunctive procedure and type of surgery.

Introduction

Dental implants provide predictable treatment outcome for the replacement of missing teeth that were not previously available [1]. The increase in its awareness as a replacement for missing teeth has led to an increase in its demand [2]. This increased patient awareness, expectations and demands have led to an explosion of the dental implant market [3].

The positive clinical results of implant treatments have been demonstrated in several studies [1,4], this ultimately have impacted positively on the quality of life of patients. The burden of tooth loss includes decreased satisfactory function, decreased social confidence, disturbed self-image, and self-esteem [5]. Tooth loss may be partial or complete and there are various options available for its management, these include the removable partial denture, fixed partial dentures and the use of dental implants. Dental implants offer the best replacement option because of its superior long-term results, better retention, stability, functional efficiency and better quality of life [6]. It dependably replaces missing teeth both aesthetically and functionally [7].

Dental implants have become the standard of care for some cases of tooth loss such as the single tooth replacement because it is predictable and more conservative than other forms of treatment such as crowns and bridges [8]. More patients are becoming aware of the use of dental implant as a form of tooth replacement therapy as a result of the unlimited information from the web and this has increased the demand for dental implants [9].

Implant therapy although accepted as a predictable treatment option for replacing missing teeth [10] is still yet to be a readily

available treatment in developing economies like Nigeria. Some studies have been done in this clime as regard implant treatment of patients with good outcome [2,11] however, these studies were done majorly in the South western region, there still appears to be paucity of studies in other regions hence the need for this study which characterised the types of implants and implant supported restorations placed in a tertiary hospital in the Federal Capital Territory (FCT) of Nigeria as well as determine the outcome of the implant treatment.

Methodology

This was a retrospective study of all patients who received dental implants at the Restorative Unit, Dental and Maxillofacial Department of the National Hospital FCT, Abuja from 2015 to 2020. All case notes numbers of patients who received dental implants over the study period were identified and the records available from the identified cases were retrieved. All the range of implant treatment (surgery and final prosthetic appliance) were placed by the first author. The implants were placed in accordance with manufacturer's instructions. The following information using a proforma were obtained: age, gender, marital status,

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occupation, smoking history, alcohol consumption, medical history of hypertension, diabetes mellitus, and any other medical condition of interest, reason for missing teeth, missing teeth replaced with implant, type of implant placed, type of surgery, adjunctive procedure like sinus lift, guided bone regeneration, postoperative complaints at one week recall after implant surgery, type of prosthesis provided and outcome of implant placement at one year recall. Specific deficiencies of the peri-implant tissues such as presence of gingival inflammation, periimplantitis, soft tissue defect, extrusion of bone substitute and specific deficiencies of the restoration such as implant fracture, loss of implant, mobile crown/cement failure, fractured abutment were recorded.

All data collated was analysed using the IBM SPSS version 21.0 (Chicago, IL, USA) and Microsoft Excel 2010. The analysis carried out were descriptive statistics with frequency and percentages used to describe the categorical variables while the mean and standard deviation of continuous variables was obtained. Chi-square test was used to determine association between categorical variables with the level of statistical significance set at 95% confidence interval.

Results

A total of 78 patients received dental implants over the study period however only 61 case notes were available and retrieved and the 61 patients received 111 implants. The patients age ranged from 19 years to 76 years with a mean age of 50.08±13.54 years and the most prevalent age group was 41-50years making up 24.6% (95% confidence interval 14.8-36.1) of the patients studied. The least represented age group were those 30 years and younger accounting for 9.8% (95% confidence interval 3.3-18.0) of the study population. There was a male predominance with males accounting for 54.1% of the study population. Skilled workers and professionals made up 62.3% and 26.2% of the study population respectively and 80.3% were married (Table 1).

Majority 80.3% (95% confidence interval 70.5-90.2) of the patients had fair oral hygiene while 8.2% (95% confidence interval 1.6-16.4) and 11.5% (95% confidence interval 3.3-19.7) had good and poor oral hygiene respectively prior to implant treatment.

More than half, 60.7% (95% confidence interval 49.2-72.1) had no medical condition of note while the remaining 39.3% (95% confidence interval 27.9-50.8) had a positive medical history. Hypertension was recorded in (12) 50.0% (95% confidence interval 33.3-70.8) of those with a positive medical history. Organ transplant and retroviral disease was recorded in 2 (8.3%) each. Hypertension in combination with diabetes mellitus was noted in 3(12.5%) of those that had positive medical history. Other medical conditions recorded were peptic ulcer diseases 2(8.3%), epileptic seizure 1 (4.2%), Parkinson’s disease 1 (4.2%) and allergies 1 (4.2%).

The most prevalent reason for seeking dental implant treatment was replacement of missing tooth represented by 56.8% (95% confidence interval 48.6-64.9), followed by broken teeth 19.8 (95% confidence interval 12.6-27.9) and badly broken-down teeth (95% confidence interval 2.7-12.6). The least prevalent reason was inability to chew 0.9% (Figure 1).

The most prevalent cause of the missing teeth that were replaced with dental implants was trauma accounting for 36.0% (95% confidence interval 27.0-45.0), followed by sequelae of dental caries accounting for 28.8% (95% confidence interval 20.7-37.8). Failed root canal treatment was noted in 13.5% (95% confidence interval 7.2-20.7) of the missing teeth. Fractured bridge abutment was observed in 5.4% (95% confidence

interval 1.8-9.9) of the cases and loss of teeth following periodontal disease was recorded in 8.1% (95% confidence interval 3.6-13.5) of the cases (Figure 2).

Of the 111 teeth replaced with dental implant, the maxillary arch received 61.3% (95% confidence interval 52.3-70.3) of the implants while the mandibular arch received the remaining 38.7% (95% confidence interval 29.7-47.7). More than half (55.7%) of the patients received a single implant, 29.5% received 2 implants, 6.6% received 3 implants and the remaining 8.2% received more than 3 implants.

Anterior teeth made up 63.1% (95% confidence interval 54.1-71.2) of the teeth that received dental implant while posterior teeth made up the remaining 36.9% (95% confidence interval 28.8-45.9). The most frequently replaced tooth with dental implant were the central incisors 48.6% (95% confidence interval 39.6-57.7) followed by the first molars 12.6% (95% confidence interval 6.3-19.8) and second molars 11.7% (95% confidence interval 6.3-19.8). the tooth with the least representation were the canines 3.6 (95% confidence interval 0.9-7.2) and the first premolars 4.5% (95% confidence interval 0.9-9.0) (Figure 3).

With regards to the type of implant placed 74.8% (95% confidence interval 65.8-82.9) received conventional implant while 25.2% (95% confidence interval 17.1-34.2) received immediate implants. Cylindrical implants were placed in 76.6% of cases while tapered implants were placed in 23.4%. Adjunct procedures were performed in 49.5% of cases with the most prevalent adjunct procedure being guided bone regeneration (94.5%). Single crown was provided in 59.5% of the cases while fixed partial dentures were provided in 40.5% (Table 2).

Table 1. Sociodemographic characteristics of the patients

Characteristics	Frequency n=61	Percent	95% Confidence interval
Age group (years)			
≤ 30	6	9.8	3.3-18.0
31-40	9	14.8	6.6-23.0
41-50	15	24.6	14.8-36.1
51-60	19	31.1	19.7-44.3
≥ 60	12	19.7	9.8-31.1
Gender			
Male	33	54.1	41.0-67.2
Female	28	45.9	32.8-59.0
Occupation			
Professional	16	26.2	16.4-37.7
Skilled worker	38	62.3	50.8-73.8
Unskilled worker	1	2.6	0.0-6.6
Dependent	6	9.8	3.3-18.0
Marital status			
Single	12	19.7	9.8-29.5
Married	49	80.3	70.5-90.2

Table 2. Characteristics of implant placed

Characteristics	Frequency n=111	Percent	95% Confidence interval
Type of implant			
Conventional implant	83	74.8	65.8-82.9
Immediate implant	28	25.2	17.1-34.2
Implant design			
Cylindrical	85	76.6	69.4-83.8
Tapered	26	23.4	16.2-30.6
Adjunct procedure			
Yes	55	49.5	40.5-59.4
No	56	50.5	40.6-59.5
Super structure placed			
Single crown	66	59.5	50.5-68.5
Fixed partial denture	45	40.5	31.5-49.5

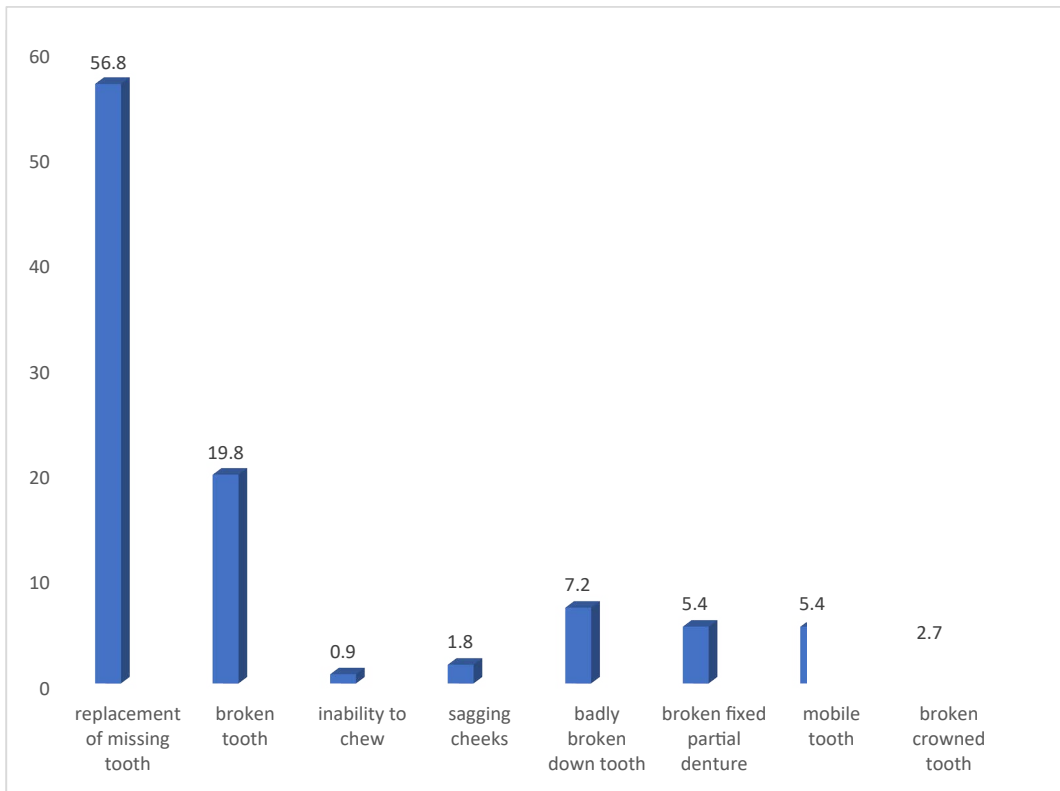


Figure 1. Reason for seeking dental implant treatment

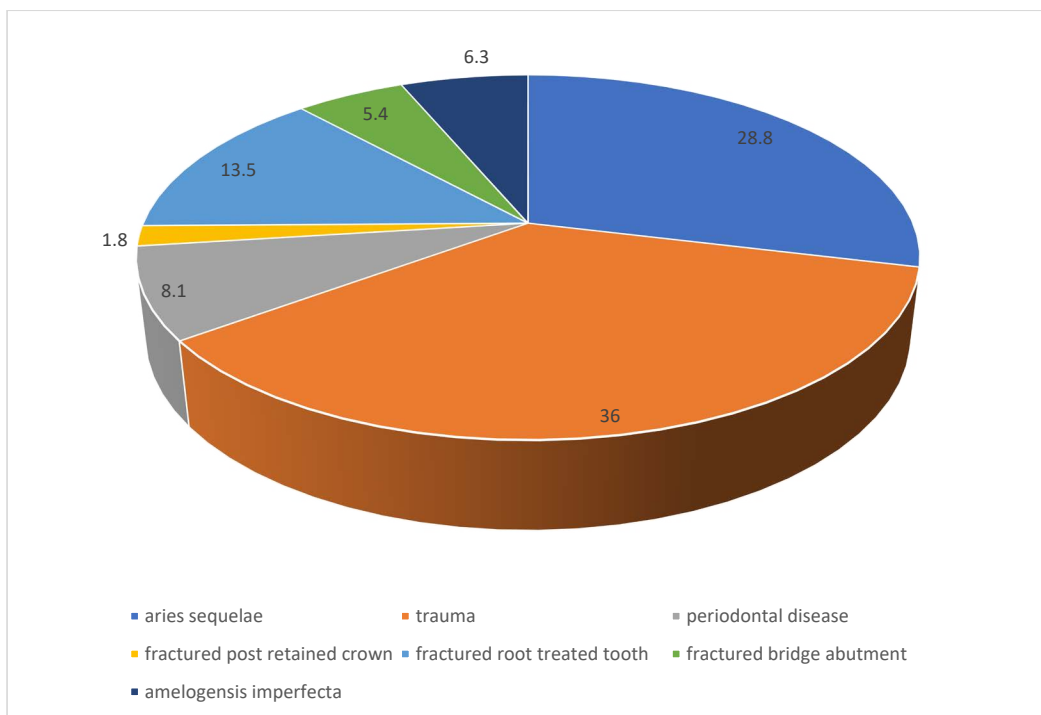


Figure 2. Reason for tooth loss

Guided bone regeneration made up 94.5% of the adjunct procedure carried out while soft tissue augmentation, bone augmentation, and open flap curettage accounted for 1.8% each.

At 7 days post-op 81.1% of the cases had no complaints, 4.5% had paraesthesia and inflammation and swelling around implant surgery site was observed in 2.7% of the cases.

At 6 months review 65.8% had no notable complications. Periimplantitis was the most prevalent complication recorded (34.2%), followed by failed osseointegration 21.1%, implant fracture 15.8%, paraesthesia 13.2%, soft tissue defect and loss of implant 5.3% each. All the restorations were cement retained

At one-year review, favorable clinical outcome was recorded in 75.7% of the cases while favourable radiographic outcome was recorded in 72.1% of the cases. Clinically, periimplantitis was observed in 9.0% of cases, soft tissue defect in 2.7%, fractured implant in 5.4%, loss of implant in 2.7%, fractured abutment and mobile crown in 0.9% each of the cases. Radiographically, complete failure of osseointegration was

observed in 3.6% of the cases, partial osseointegration in 16.2% and explantation in 8.1% of the cases.

Overall, 76 implants had neither clinical or radiographic complications giving an overall favorable outcome of 69.1%. The age group of the patients, gender, presence of medical history, oral hygiene status prior to placement of the dental implant, type of surgery whether conventional or immediate and performance of adjunct procedures had no significant influence of the outcome of the dental implant treatment at one year post operatively.

The type of tooth whether anterior or posterior was associated with the outcome of the dental implant with a higher proportion of posterior teeth exhibiting more favorable outcome ($P=0.015$). Similarly, implants placed in the mandibular arch had more favorable outcome compared to those placed in the maxilla and this was statistically significant ($p=0.025$). Furthermore, a higher proportion of tapered (root form) implants had favorable outcome compared to the cylindrical implants ($p=0.05$) (Table 3).

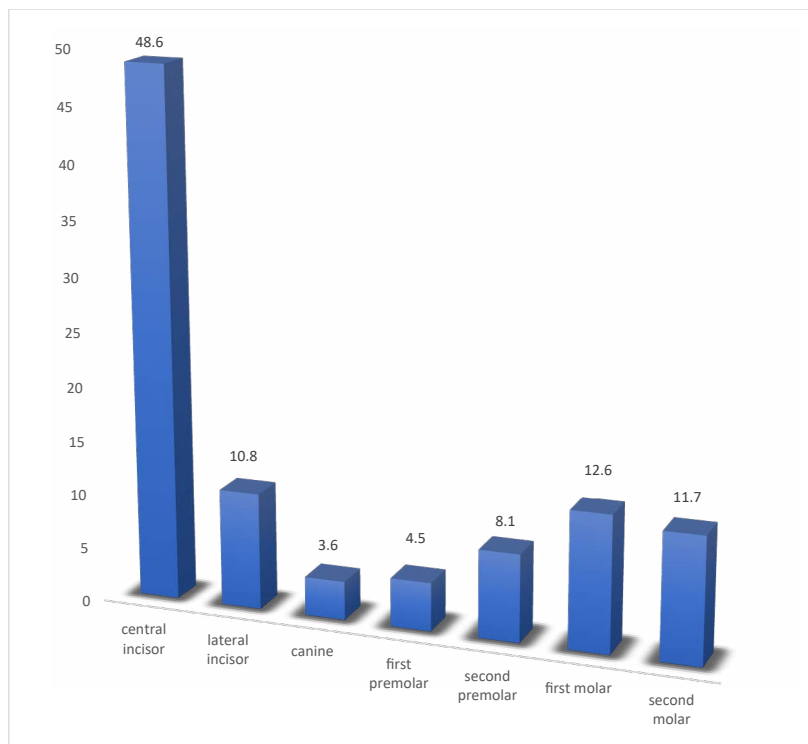


Figure 3. Distribution of teeth replaced with dental implant

Table 3. Association between implant site, arch and implant design and outcome one year post-operatively

Characteristics	Outcome		Total	P value
	Favorable	Unfavorable		
Implant site				
Anterior region	42 (60.9)	27 (39.1)	69 (100.0)	0.015
Posterior region	34 (82.9)	7 (17.1)	41 (100.0)	
Arch				
Maxillary	41 (61.2)	26 (38.8)	67 (100.0)	0.025
Mandibular	35 (81.4)	8 (18.6)	43 (100.0)	
Implant design				
Cylindrical	54 (64.3)	30 (35.7)	84 (100.0)	0.05
Tapered (root form)	22 (84.6)	4 (15.4)	26 (100.0)	
Total	76 (69.1)	34 (30.9)	110 (100.0)	

Discussion

Implant treatment, a not so nouveau protocol has gradually gained acceptance with the Nigerian populace. Patients and clinicians are embracing it as the new normal for replacement of missing teeth arising from trauma, sequelae of dental caries, failed root canal treatments etc apart from bridges and removable prostheses. This study describes the experience of dental implant treatment in a tertiary hospital in Nigeria.

The age range of patients (19 years to 76 years) in this study is similar to that reported in a previous Nigerian study [2] and an Australian study [12]. The mean (standard deviation) age of the patients 50.08 ± 13.54 years noted in this study is close to the 51.5 years reported in Australia [12] but lower than the 61.4 ± 12.2 years and 60.6 ± 12.7 years recorded in previous studies [10,13] and higher than the 48.4 ± 16.6 years recorded in a previous Nigerian study [2]. The most prevalent age group was 41-50 years in this study, a finding different from the most prevalent age group of 60-69 years reported in previous studies [12,14]. This shows that dental implant treatment cuts across a wide age range for varying reasons.

A male preponderance was observed in this study a finding in contrast to that reported in the United States [10], Germany [13] and Korea [14] where there was a female preponderance but similar to previous Nigerian studies [2,11]. The preponderance of males in this study may be attributed to the occupation of the male participants who tend to be easily given to trauma related events and contact sports than women leading to loss of teeth and possible more earning power of males in Nigeria as dental implants are not so cheap with females showing tendency to go for less expensive or cost-effective tooth replacement options in Nigeria [15].

Despite the high cost of dental implant, the occupation of the patients reviewed in this study shows that dental implant treatment protocol is not exclusive to the elites as there were skilled workers, professionals of varying cadre and otherwise. This may be because the center where this study was done allowed for dental implant treatment cost to be made in installments.

Majority of the patients in this study had fair oral hygiene a finding different from a previous report where majority of the patients had good oral hygiene [14]. Oral hygiene is an important factor in patient assessment prior to implant placement however the pre-operative oral hygiene status of a patient may not reflect on the prognosis. Although only few absolute contraindications to implant treatment exist [16], it has been thought that patients with a periodontal history are at higher risk for potential peri-implantitis leading to late implant failure [17].

The finding in this study portrayed more than half of the patients had no prior medical condition of note similar to a previous study [2]. Diabetes was recorded in this study a finding which corroborates a previous report of diabetics receiving dental implants [13]. Also, Hypertension alone and Hypertension in combination with diabetes mellitus were some of the medical conditions recorded in this study a finding similar to a previous study [2]. These medical conditions are not absolute contra-indications for dental implant treatment [18] as the level of evidence indicative of absolute and relative contraindications for implant therapy due to systemic diseases is low [19] making it feasible to perform the implant surgery with successive outcomes.

The most prevalent reason for implant placement was missing teeth following trauma (36.0%), a finding similar to that reported in previous studies [2,10], followed by sequelae of dental caries accounting for 28.8% (95% confidence interval 20.7-37.8). The prevalence of failed root canal treatment as a reason for implant treatment observed in this study

(13.5%) was far lower than that recorded in a study in the United States where failed endodontic treatment was noted in 25.1% of the study population [10] and a Nigerian study that recorded 21.74% [2].

There was a higher proportion of implants placed in the maxillary arch compared with the mandibular arch. This is in contrast to a previous study that recorded a higher proportion of implants placed in the mandibular arch [14] and another study that noticed no difference in the frequency of implant placement in the maxillary or mandibular arch [10] but in agreement with a previous Nigerian study² a German study¹³ and an Australian study [12]. The pattern of placement of implant by arch reflects the pattern of tooth loss in Nigeria where maxillary teeth are lost more commonly compared to mandibular teeth [20,21].

Most of the patients received a single implant a finding in agreement with a previous report that had 47.8% of the study population receiving a single implant [2]. This may be related to previous reports that demonstrated that implant-supported single-tooth replacement is a predictable procedure with higher survival rates [22,23].

Anterior teeth made up majority of the dental implants placed in this study. This is contrary to a German [13] and Korean [14] study where posterior teeth were in the majority. The most frequently replaced tooth with dental implant in this study were the central incisors followed by the first molars and second molars. A pattern similar to a previous report [2] but different from a report in the United States where the highest number of implants were placed in the mandibular molar followed by the maxillary premolar [10]. The tooth with the least representation in this study were the canines a finding similar to previous studies [2,10,14]. The pattern of dental implant placement seems to be a reflection of pattern of tooth loss with canine having the least representation. This can be attributed to the fact that the canines are the least prevalent missing teeth [20,21].

With regards to the type of implant placed, a far higher proportion of the implants placed were conventional implants compared to immediate implants. This distribution is different from that reported in a previous study [2] where only 4.8% of the implants placed were immediate implants.

Cylindrical implants were used more in this study compared with tapered (root form) implants. The reverse was the case in a previous study where more root-form implants were placed compared to the cylindrical form [10]. This difference may be due to the availability of implant form.

Guided bone regeneration was the most common adjunct procedure performed in this study which is different from the most prevalent adjunct procedure (bone grafts) placed in a previous study [10]. Guided bone regeneration is a procedure that assists with bone regeneration and entails the placement of mechanical barriers to protect blood clots and isolate the bone from surrounding connective tissue, by so doing encourages bone forming cells access for bone regeneration [24,25]. This is done to reduce or prevent post-extraction bone resorption to preserve ridge integrity [26]. In this study it was observed that guided bone regeneration constituted a major proportion of the adjunct procedures (94.5%), this observation contradicts that of a study done among private clinics where 35.9% was recorded, however the soft tissue augmentation was slightly more than that observed in this study [27].

Single unit restoration was provided in more than half of the cases in this study. This is far lower than the 83.6% recorded for single unit

restoration in a previous study [10] but close to the 56.93% reported in another study [12]. Dental implants are the standard of care for single missing tooth as placement of a single implant prevents the needless destruction of sound teeth adjacent to the edentulous area as would be required for a fixed partial denture, as well as avoids the pulpal, periodontal, and endodontic complications of the supporting abutments associated with the fixed dental prosthesis [28], hence the high prevalence of single unit restoration.

Despite its high success rate, dental implant treatment is not free of complications [29]. Majority of the patients had no complaint within the first week post-operatively. The most common complaint within a week of the dental implant placement was paraesthesia, inflammation and swelling around implant surgery site. This can be considered as early implant complications arising immediate post operatively.

Peri-implantitis is one of the most common biological complications affecting functional implants [30], associated with pocket formation and peri-implant bone loss [31] and a major cause of implant failure. At 6 months follow-up review, peri-implantitis was recorded as the most prevalent complication, this contradicts those of other studies [32,33]. This could be the result of limited number of patients that reached the follow-up period in one of the studies [32]. Other complications encountered in this study were failed osseointegration, implant fracture, paraesthesia, soft tissue defect and implant loss which compares with that of an earlier study [34].

Implant fracture has been observed to be one of the major reasons for late failure [29], however, in this study it was observed 6 months after implant surgery before loading of the implant in 15.8% of the cases with complications. Although the incidence of implant fractures may be low, it invariably affects the patient and also clinician [29].

All the restorations in this study were cement retained this is in contrast to a previous study where 93.1% of the restorations were cement retained and 6.9% were screw retained [10]. This is due to the type of implant available for use among the patients in this study.

Some of the notable reasons recorded as causes of implant failure include soft tissue defect, the peri-implant soft tissue are more vulnerable compared with the soft tissue around the natural teeth, this is due to deeper probing depth, weaker connective tissue attachment, faster inflammatory expansion and reduced vascular supply making the soft tissue susceptible to bacteria build-up and subsequent soft tissue defect [35]. Fractured implants could be caused by biomechanical overload leading to metal fatigue or lack of passive fit of the prosthetic screw [36,37].

At one-year review, favorable clinical outcome was recorded in 75.7% of the cases while favourable radiographic outcome was recorded in 72.1% of the cases. This is lower than that reported in a previous Nigerian study at one year follow up [2]. Radiographically, complete failure of osseointegration was observed in 3.6% of the cases, partial osseointegration in 16.2% and explantation in 8.1% of the cases. It has been postulated that absence of intimate bone to implant connection results in failure of osseointegration [13].

The prevalence of periimplantitis of 9.0% observed in this study is lower than reported in previous studies which ranged from 4.7% to 47.1%.³⁸⁻⁴⁰ This difference may be due to the timing of review as this study was a one-year review while the previous studies the review ranged from 6 to 9 years. It is possible that if the patients in this study are reviewed much later the prevalence may increase.

Overall, 76 implants had neither clinical nor radiographic complications giving an overall favorable outcome of 69.1%. The gender, presence of medical history, oral hygiene status prior to placement of the dental implant, and performance of adjunct procedures had no significant influence on the outcome of the dental implant treatment at one year post operatively. A previous report showed no association between the presence of diabetes and osseointegration despite diabetes being a metabolic disease that affects blood circulation [13].

Although, age has been considered as one of the important prognostic factors in implant success [41,42], the age of the patients in this study did not influence the outcome of the implant treatment.

The type of surgery whether conventional or immediate was not associated with increased risk in implant failure. A finding different from that reported in a previous study were immediate versus delayed implant placement were associated with an increased risk of implant failure [10]. However, the type of tooth whether anterior or posterior was associated with the outcome of the dental implant a finding similar to a previous report [10].

Mandibular implants had more favorable outcome when compared with the maxillary implant. This corroborates reports of other studies and it appears to be connected to the quality and quantity of the bones [43,44] but contradicts another study that reported higher prevalence of periimplantitis in mandibular implants [38].

It has been reported that the insertion torque of tapered implants is more than that of cylindrical implants resulting in better primary stability in tapered implants [45]. Furthermore, the screw threads are different in both types of implants whereby the thread geometry of tapered implants leads to a higher surface area in contact with host tissue [45,46]. This may be the reason for the observation in this study which was also reported in other studies [45,46]. However, this contradicts the reports of other studies where there was no difference in the outcome based on implant shape [47,48].

Conclusion

Anterior teeth implant, conventional implant, cylindrical implant and single tooth implant with single crown were prevalent. Review of patients is critical to implant success. Recall visits as early as 7 days post implant surgery is recommended as this will help to address any immediate issues. 6 months recall visits are also very important to review cases before placement of prosthetic restoration. Recall visit 1-year post implant surgery is critical as complications can be quickly identified and addressed to enhance longevity of the implant. Complications can arise from the implant fixture, surrounding soft tissue and prosthetic appliance. The survival of implants can be adduced to be influenced by site of placement, position of placement, arch and type of implant while not being compromised by the medical conditions of the patients, age of the patient, gender, oral hygiene status prior to implant placement, adjunctive procedure and type of surgery whether immediate or conventional.

Clinical implications: Single tooth implant is a viable replacement option for missing teeth. The type of implant (whether cylindrical or tapered) readily available influences the type of implant placed. Immediate implants are acceptable as a type of implant placement.

There is need for continuous monitoring and follow up of dental implant patients right from the first week of placement and 6 months post implant placement so that early complications can be identified and managed where possible. It is also recommended that 1-year follow up care be carried out for patients with dental implant.

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Conflicts of interest

The authors declare no conflicts of interest.

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