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RESEARCH ARTICLE

INTRA-ORAL IMPLANTS IN GHANA- EARLY IMPRESSION

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ABSTRACT

Aim: To evaluate the success of intra-oral implants as replacement restorations for missing teeth in two clinics in Ghana from January 2000 to December 2010.

Patients and Method: A retrospective study carried out on patients who have had missing teeth replaced with implant-borne restorations. The age, sex, indications for treatment, radiographic records, date of implant placement, the type of luting agent used, the state of the implant if still presentand radiographic assessment were retrieved from their medical records, followed by a clinical examination.The data was analysed using Microsoft Excel spreadsheet.

Findings:65implants wereplaced in 30 patients with 41.54 % (N=27) in the maxilla and 58.46% (N=38) in the mandible. The lower left sextant (N=18) was the commonest site. The average age was 52.67years. The male: female ratio was2.33:1. Most of the patients requested this treatment to help improve mastication ("chew meat"). Using Misch's criteria, three implants (4.62%) have failed and 62 (95.38 %) are so far classified as successful up till 2013. All three failed implants were Trans mucosal.

Conclusion: This study shows that the success rate of implants as an alternative restorative technique in Ghana is comparable to that of several other countries.

INTRODUCTION

The replacement of missing dental units using intra-oral implants has now become well established in dentistryand its benefits are well known (Brånemark *et al.*, 1969; Brånemark *et al.*, 1977; Schroeder *et al.*,1981) Since the early pioneering clinical studies of osseointegration by Brånemark *et al.* (1969,1977) and Schroeder *et al.* (1981) the technique and technology has advanced dramatically in the last few years and with it the success rate (Schroeder *et al.*,1981). Its use to help retain intra-oral and extra-oral prostheses is now also becoming common place in ear nose and throat surgery (Tjellstrom *et al.*, 1981), craniofacial surgery (Toljanic *et al.*, 2005), orthopaedics (Wilson Wang *et al.*, 2011), as well as in orthodontics (Shapiro and Kokich 1988). Theindications for intra-oral implants include improvement or restoration of mastication, occlusion, aesthetics, speech as well asjaw and facial morphology (Adell *et al.*,1990). There are also medical and psychological benefits of this mode of treatment (Lindsay *et al.*, 2000). There has been an explosion of research workon the subject of implantology recently (Hämmerle *et al.*,2012). This will continue to grow to fill the pages of several journals.The technique engages the attention of several clinicians from different parts of the world. The consensus is that it is safe, predictable and a sound method of restoring missing dental units (Hämmerle *et al.*, 2012), however the criteria for a successful implant still sometimes provoke controversy (Hämmerle *et al.*, 2012; Misch *et al.*, 2008; Papaspyridakos *et al.*, 2012). In Ghana,the general population is increasingly becoming aware and knowledgeable of the benefits of being treated using this technique and the demand and need has started to rise. There are also a growing number of practitioners in the country who have undergone training and are ready to practise implant dentistry. The availability of the technique to the wider population is acutely limited byfinancial constraints; nevertheless many international implant companies have recently launched free courses to promote their products.There is the potential for growth, but as at now the numbers will continue to be limited and studies can only be done on small samples.Presented here is the analysis of the clinical state of65 intra-oral implantsplaced in patients in Ghanaas well as the age, sex of the patients and reasons for requesting the treatment over a 12 year-period.To the best of our knowledge, no such study has yet been conducted in Ghana. The aim of this study is to evaluate the success of intra-oral implants as replacements for dental units in two clinics in Ghana from January 2000 to December 2010.

MATERIALS AND METHODS

A retrospective study of all records of patients who received intra-oral implants placed by one surgeon from January 2000 to December 2010 at two geographic locations in Ghana- a government run hospital and a private dental clinic in Accra was carried out. There were no exclusions. All patients were

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treated using the Association of Dental Implantologists (ADI, UK) protocol (http://www.adi.org.uk). Two implant systems were randomly used- International Team for Implantology (ITI) (Straumann AG, Waldenburg, Switzerland) solid implants and Lifecore(Stage 1) single stage implant system (Lifecore Biomedical, Inc., Chaska, MN, USA). The age, sex, date of surgical placement of implant, the approximate alveolar location of the implant, the superstructure placement date and luting agent/cement used type of bone graft used if any and then the state of the implant as at Dec 2012. A full medical history was recorded as demanded by the protocol before treatment.Patients with sickle cell trait were monitored. All implants were placed after complete bone healing (4 months or longer post extraction).

The pre-operative bone assessment for all patients was an orthopantomogram, a study model and plaster model bone mapping. Computerised tomography scan facility was available but was not needed.Surgery in all cases involved a full flap and placement of the implant under local anaesthetic as prescribed by the manufacturers and ADI with or without intravenous sedation. Bone grafts were used when necessary and also formaxillary sinus floor elevation. The suture material used was polyglactin 910 (Vicryl, Ethicon, USA) in all cases. Reviews were carried out after 7 days, 4 weeks and 8 weeks. Impressions were taken for the construction of the superstructure (abutment and crown) after an average interval of 10 weeks. All prosthetic work was carried out by one laboratory and by one senior technician.

restorations. Two were restored by two senior practitioners, one at the government hospital and the other at the private clinic. Only those implants placed 2years before the examination date or longer were included.Misch's criteria, (Table 1), and questionnaire to tick satisfied or not satisfied by the patients were used to measure success.

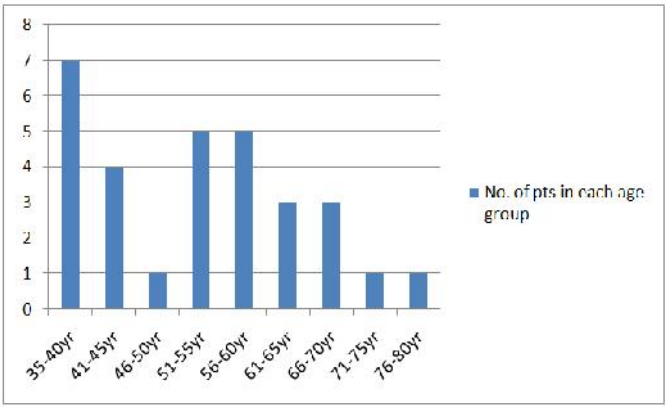

Figure 1. Age distribution of patients

Findings

There were in all 65 implants placed in 30 individuals (Table 2). These supported 69 restorations. 57 supported single unit crowns and 8 supported multiple units. Two of the latter supported two 2-unit restorations and six supported three 3-unit

Implant Quality Scale Group	Clinical Conditions
I. Success (optimum health)	a) No pain or tenderness upon function b) 0 mobility c)<2 mm radiographic bone loss from initial surgery d)No history of exudates
II. Satisfactory Survival	a) No pain on function b) 0 mobillity c)2-4 mm radiographic bone loss d) No history of exudates
III. Compromised Survival	a) May have sensitivity on function b) 0 mobility c)>4 mm radiographic bone loss (less than ½ of implant body) d) Probing depth > 7mm e) May have history of exudates
IV. Failure (clinical or absolute failure)	a) Any of the following: b) Pain on function c) Mobility d) Radiographic bone loss > ½ length of implant e) Uncontrolled exudates f) No longer in mouth

Table 1. Health Scale for Dental Implants (Misch's criteria).

For this study, arrangements were made to see all these patients in the last month of 2012, twelve years after the first implant was placed. This was not possible for three patients who had to be interviewed on the phone though they had been examined earlier in 2012. All examinations were carried out by the same surgeon who was also responsible for placing nearly all the restorations.One implant had to be removed after seven days because of extreme mobility and pain and another after 6 weeks because of extreme mobility and suppuration. A third implant with its superstructure had to be removed after 9months due to extreme mobility. All three were trans-mucosal. The average age of the patients was 52.6 years. The

youngest was 36 and oldest 78 (Table 2). Age distribution is shown in Figure 1. There were 9 women and 21 men (M: F ratio 2.33:1). 25 were of West African descent (one Sierra Leonean, two Nigerians and 22 Ghanaians). There was one patient each from South Africa, France, Russia, China and Scotland.The main reason why most sought treatment was to help improve their masticatory efficiency (Fig. 2). 50(76.92%) implants were placed in the buccal segments with 15 (23.08%) in the anterior region. 38 (58.46%) were placed in the mandible, 27 (41.54%) in the maxilla (Fig. 3). The commonest location was lower left sextant (N=18). All patients were ASA(American Society of Anesthesiology) I or ASA II. No special effort was made to exclude patients on health grounds. Patients who gave a medical history of sickle cell trait were specially monitored. They were seven in all. No identifying features were observed during surgery and the stages thereafter of these patients. All the implants in this group were classified as successful on the examination date.55 wereStraumann solid implants of which 11 were trans-mucosal and 44 bone level implants. The other 10 were Lifecore implants which were all transmucosal. Six patients had intravenous sedation as well at surgery. Two had maxillary sinus lift procedures both on the right side. Bone graft was used in 9 patients (including the two sinus elevation cases). Four were xenografts only (Bio-Oss, GeistlichPharma AG, Switzerland), three were autogenous grafts from the mental area and two were a mix of the two. Bone quality assessment was carried out at the time of surgery. 6 patients had bone which was deemed soft (type III) when probed using a ball ended periodontal probe.

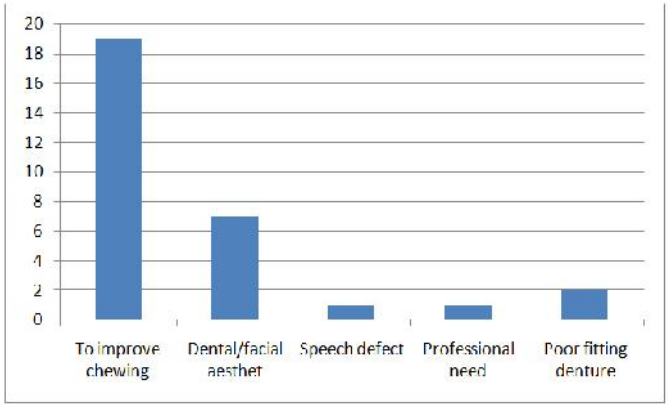

Figure 2. Frequency of reason for seeking implant treatment

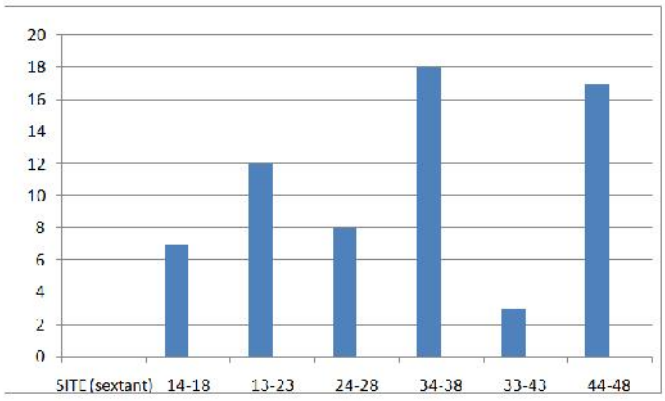

Figure 3. Distribution of implants in various sextants

All the multiple units had custom made abutments. Of the 57 single units, 29 had custom made abutments. The approximate interval for cementing or loading the implant after surgery was 11 weeks (conventional loading). Bone grafted implants were routinely loaded after 12 weeks. The commonest luting agent/cement was zinc phosphate-(21 single units and all multiple units). Others were glass ionomer cement, and polycarboxylate cement. Where the manufacturer-made abutment had not been modified by the laboratory, some crowns (N=12) could not be removed for final cementation after try in. There was no implant supported overdenture.The age of the implants at the time of examinationis as displayed in Table 2. Only those that fell into Misch's category I were classified as successful implants. 62 (95.38%) of the implants were in place and could be classified as successful whilst three (4.62%) failed. Generally patients' expectations were met. All patients whose implants were successful were satisfied.

DISCUSSION

Osseointegration as originally described by Brånemark isthe basis of implant dentistry (Brånemark *et al.,* 1969; Brånemark *et al.,* 1977). In his early work he showed that when titanium is placed in close proximity to living bone, after some time there was no separation between the bone and the titanium. Since his finding, there have been countless studies to confirm this (Schroeder *et al.,* 1981). The first practical application of this concept was used to retain a palatal obturator and the patient lived with it for more than forty yearsstill with the implants in place (The History of Dental Implantation, implantru.com, accessed 2013-06-13). The very high success rate of intra oral implants is now well established (Brånemark *et al.,* 1969; Brånemark *et al.,* 1977; Adell *et al.,* 1990; Hämmerle *et al.,* 2012). In thisstudy we retrospectively examined 30 patients whohad implant restorations for missing dental units over a twelve year period. The sample size is small compared to other studies (Buser *et al.,*1997). The high cost of implants may explain the small size of the sample. With time this number may rise as education improves, the cost to patients for implant treatment becomes affordable andthe demand increases.

The ages of the three patients whose implants failed were 42, 53 and 78 years.The 78 year old did not attend review appointments until 6weeks after the initial surgery; the 53 year old traumatised the implant by wearing his temporary denture over aprotruding healing cap, though he was advised to keep the denture out until his review appointment and the 42 year old smoked in spite of promises to abandon the habit. The latter was the implant that failed after nine months and he was the only smoker in the study.These factorsmay have heavily influenced their failure though not conclusive.That age is not a significant factor has been welldiscussed (Meijer *et al.*,2001; Bryant and Zarb1998). All patients with enough healthy maturedbone may be candidates. However blood supply and primary stability are very important in all bone healing.One of thepatients whose implants failed was female and the other two male. Neither gender nor osteoporosis in females has been associated with implant success or failure in the present literature (Dao *et al.,* 1993; Romeo *et al.,* 2002). Our sample

size is very small and a bigger samplemay be needed to come to a conclusion.Radiographic examination revealed an average cervical bone loss of 1.2mm and a range of 0.5mm to 2mm over the period of consideration with regards to the successful implants. The oldest implant was 12 years old and the latesttwo. The timing of the failed implants did not follow any discernible pattern (Table 2). The age of the implant appeared not to have been a factor in the failure rate.The commonest luting agent usedwas zinc phosphate cement. This was followed by a hygienist'sappointment within a week. This additional treatment made sure that there was no residual cement left in the tissues or overhanging. The luting agent was not always needed especially where the crown fitted closely to the abutment. The main reason was that the crowns could not be retrieved after try-in (with or without petroleum jelly). All implants were conventionally loaded (Esposito *et al.*, 2007). This method is well supported by other workers for increased success rate (Susarla *et al.*,2008).For most of the patients the reason for requesting implants to restore missing units was to help improve mastication (Fig 1). The expectations of all the patients with successful implants were met with the exception

Table 2. Age, sex and site of individual implants placed in each patient

Age	Sex	Yr of insertion	No. Implants	Bone graft	Location of implant	Age of implant(2012)
36	M	2000	1	NIL	26	12 yr
54	M	2000	4	NIL	11,36,46,47	12 yr
78	F	2000	1	NIL	36	Failed(6weeks)
69	M	2001	4	NIL	32, 36, 37, 46	11 yr
40	M	2001	1	XENOGRAFT	27	11 yr
53	M	2002	2	NIL	22, 11	1 Failed (1week)
70	M	2002	1	AUTOGENOUS/XENOGRAFT	11	10yr
61	M	2003	2	AUTOGENOUS	11,12	9yr
71	M	2003	1	NIL	46	9yr
41	F	2003	2	NIL	36,45	9yr
65	F	2003	4	NIL	14,25,45,46	9yr
42	F	2004	4	NIL	35,37,45,46	8yr
53	M	2004	4	NIL	14,15,26,46	8yr
59	M	2005	2	XENOGRAFT	11,36	7yr
58	M	2005	2	NIL	21,26	7yr
54	F	2006	3	SFE/XENOGRAFT	16,15,14	6yr
36	F	2006	3	NIL	35,37, 11	6yr
36	F	2007	1	SFE/XENOGRAFT	16	5yr
38	F	2007	1	NIL	37	5yr
38	M	2007	1	NIL	47	5yr
69	M	2007	1	XENOGRAFT	31	5yr
59	M	2007	1	NIL	25,46	5yr
48	M	2007	1	NIL	43	5yr
57	M	2008	6	AUTOGENOUS	21,23,24,26,35,36	4yr
65	M	2009	3	NIL	46,35,36	3yr
52	M	2009	2	NIL	35	3yr
41	M	2009	1	AUTOGENOUS	21	3yr
42	M	2009	1	NIL	46	Failed (nine months)
58	F	2010	1	NIL	47	2yr
37	M	2010	4	NIL	34,36, 45,46	2yr
		Total number of implants	65	Key: SFE=Sinus Floor Elevation		

Table 3. Annual and cumulative success rate of implants

Year	Number of implants placed	Number of surviving implants	Number of failed implants	Annual success rate (%)	Cumulative success rate (%)
2000	6	5	1	83.33	83.33
2001	5	5	0	100.00	90.91
2002	3	3	0	100.00	92.86
2003	9	9	0	100.00	95.65
2004	8	8	0	100.00	96.77
2005	4	4	0	100.00	97.14
2006	6	6	0	100.00	97.61
2007	7	6	1	85.71	95.83
2008	6	6	0	100.00	96.30
2009	6	5	1	83.33	95.00
2010	5	5	0	100.00	95.38

of one who wanted a bigger biting table than was provided for her posterior molar tooth. The drift of the adjacent tooth did not allow this and she had to be convinced.Though mastication is not an essential component of digestion in modern day diet, for most of these patients enjoying their meals included an element of mastication which added to their improved lifestyle. There have been several criteria and schemes proposed for assessing implant success (Hämmerle *et al.,* 2012; Misch *et al.*,2008; Papaspyridakos *et al.,* 2012; Buser *et al.,* Albrektsson). In our case we used Misch's criteria to assess all the implants (Table 1). The number of implants which could be described as successful was 62 out of the 65 (95.38%) (Table 3). This finding confirmed an acceptable level of performance ofboth implant systems and is comparable to other previously reported short-term and long-term success and survival rates(Buser *et al.*,1997; Wedgwood *et al.*,1992; Gokcen-Rohlig *et al.*,2009; Arlin2007). Two of the failed implants were placed in the mandible and one in the maxilla. This is different from most studies. The small number however makes it difficult to compare our results to thosewith large numbers (Buser *et al.,* 1997; Romeo *et al.,* 2002; Wedgwood *et al.,* 1992). The two implants which were placed after sinus floor elevation with bone graft (single procedure) were successful. The technique has been given a high score by several workers (Pjetursson *et al.*,2008). The circumstances in Ghana are such that the number of patients having intra-oral implants will continue to be suppressed for a long time to come due mainly to economic factors mentioned above. The small number offers a window into the possible potential for the use of this technique in treating edentulousjaw areas in dental practice in Ghana. The success rate is comparable to that in several studies and hopefully will serve to encourage practitioners to consider this option with their patients. The potential exists to include implant therapy in maxillofacial reconstruction in the future after jaw resection.

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