EUROPEAN JOURNAL OF INFLAMMATION Vol. 10, no. 2 (S), 17-20 (2012)

EDITORIAL

WIDE DIAMETER IMPLANTS: ANALYSIS OF A CASE SERIES

L. CONFALONE[1], M. A. LOPEZ[1], M. ANDREASI BASSI[1], S. FANALI[2], V. CANDOTTO[3], F. CARINCI[3]

[1]*Private practice, Roma, Italy*
[2]*Department of Oral Science, Nano and Biotechnology, University "G. D'Annunzio", Chieti, Italy*
[3]*Department of D.M.C.C.C., Section of Maxillofacial and Plastic Surgery, University of Ferrara, Ferrara, Italy*

In the last decade the use of wide diameter implants (WDI, i.e. diameter › 3.75 mm) has increased especially in posterior jaws because it is generally accepted that WDI: 1- improve the ability of posterior implants to tolerate occlusal forces, 2- create a wider base for proper prosthesis, and 3– avoid placing two standard-size implants (SSI = 3.75 mm) at one site to obtain a double-root prosthetic tooth. Since no report is available on a new type of implants, a retrospective study was performed. A total of 124 two-piece implants (FMD srl, Rome, Italy) were inserted, 56 in female and 68 in males. The median age was 59 ± 12 (min-max 28-75 years). Implants were inserted 59 in the maxilla and 65 in the mandible; they replaced 7 incisors, 4 cuspids, 23 premolars and 90 molars. One implant was lost, survival rate = 99.20%. Among the studies variables immediate loaded implants (p=0.05) and upper jaw (p=0.005) have a statistically significant worse outcome. Then peri-implant bone resorption (i.e. delta IAJ) was used to investigate SCR. Among the remaining 123 implants, 2 fixtures have a crestal bone resorption greater than 1.5 mm (SCR = 97.54). Statistical analysis demonstrated that single crown have a higher peri-implant crestal bone resorption if compared with bridge supported by 2 or more implants (p=0.03). In conclusion FMD implants are reliable devices for oral rehabilitation with a very high SCR and SVR.

Nowadays treatment with endosseous implants continues in permanent development, and questions still remain unanswered (1).

Initially, implants were mainly used in anterior edentulous areas both in the maxilla and in the jaw; subsequently, their indications for use were extended to posterior areas, with varying results being found in a number of studies. It is considered that factors such as implant length, bicortical anchorage, long periods of osseointegration will contribute to the long term success of implants placed in these areas (2). Use of wide diameter implants (WDIs) implies greater bone surface contact than standard platform implants, therefore representing a clear indication for posterior areas. However, heat production above the indicated level in the bone bed would be one of the main disadvantages (3).

Following tooth avulsion, there are a series of biological processes that take place: bone reabsorption both vertically and horizontally, with changes in alveolar bone height and thickness; gingival collapse; migratory movements of the adjacent teeth; compact bone collapse and alveolar bone marrow formation.

During the interval of time that passes between tooth avulsion and the placement of implants, the majority of the amount of bone reabsorption and gingival remodelling is verified, and cause biological, aesthetic and functional damage (4).Once the remodelling process has been completed, the alveolus is unlikely to present an adequate diameter for the implant, thus sometimes hindering the possibility of implant treatment.

Osseointegration is a well-documented consequence of implant placement. However, there continue to be failures that can be occur early after surgery, or later in the life of the prosthesis (5).

After an implant is inserted, the initial healing involves bone remodelling in its vicinity, resembling the repair of a fractured bone. Factors influencing the amount of BIC (Bone/implant contact) include original bone density, the

Key words: Two-pieces, implant, fixture, bone, loading.

Corresponding author:
Prof. Francesco Carinci, M.D
Department of D.M.C.C.C Section of Maxillofacial and Plastic Surgery University of Ferrara
Corso Giovecca 203, 44100 Ferrara ITALY
E-mail: crc@unife.it Web: www.carinci.org
Phone: +39.0532.455874 Fax: +39.0532.455876

1721-727X (2012)

amount of forces applied to the implant through function, implant material and shape, surface roughness, implant length and width. However, one of the main factors determining stress distribution is implant diameter.

WDIs were first introduced to expand implant placement in areas of poor bone density and limited availability of height. One suggested advantage is that, for the same height, a WDI presents a greater total surface; consequently the total BIC may be greater, compensating for the lack of height or bone density (5).

Here we analyses a large series of two-pieces implants (FMD srl, Rome, Italy) in order to evaluate their survival (i.e. total number of fixtures still in place at the end of the follow-up) and success rate (i.e. peri-implant bone resorption).

MATERIALS AND METHODS

A) Study design/sample

To address the research purpose, the investigators designed a retrospective cohort study. The study population was composed of patients admitted at the private practice for evaluation and implant treatment by M.A.L. and M.A.B. between January 1996 and October 2011.

Subjects were screened according to the following inclusion criteria: controlled oral hygiene and absence of any lesions in the oral cavity; in addition, the patients had to agree to participate in a post-operative check-up program.

The exclusion criteria were as follows: bruxists, consumption of alcohol higher than 2 glasses of wine per day, localized radiation therapy of the oral cavity, antitumor chemotherapy, liver, blood and kidney diseases, immunosupressed patients, patients taking corticosteroids, pregnant women, inflammatory and autoimmune diseases of the oral cavity.

B) Variables

Several variables are investigated: demographic (age and gender), anatomic (tooth site, jaws), implant (length, diameter and type), related pathologies (diabetes, smoke, periodontal disease, edentulness), surgical (surgeon, post-extraction, guided bone regeneration - GBR), and prosthetic (immediate loading, number of crowns) variables.

The predictor of outcome are the percentage of implants still in place at the end of the follow-up period (i.e. survival rate – SVR) and the peri-implant bone resorption. The latter is defined as implant success rate (SCR) and it is evaluated according to the absence of persisting peri-implant bone resorption greater than 1.5 mm during the first year of loading and 0.2 mm/years during the following years (6)

C) Data collection methods

Before surgery, radiographic examinations were done with the use of intra-oral radiographs and orthopantomographs.

Peri-implant crestal bone levels were evaluated by the calibrated examination of intra-oral radiographs and orthopantomograph x-rays after surgery and at the end of the follow-up period. The measurements were carried out medially and distally to each implant, calculating the distance between the implant's neck and the most coronal point of contact between the bone and the implant. The bone level recorded just after the surgical insertion of the implant was the reference point for the following measurements. The measurement was rounded off to the nearest 0.1 mm. The radiographs were performed with a computer system (Gendex, KaVo ITALIA srl, Genova, Italia) and saved in uncompressed TIFF format for classification. Each file was processed with the Windows XP Professional operating system using Photoshop 7.0 (Adobe, San Jose, CA), and shown on a 17" SXGA TFT LCD display with a NVIDIA GÈ Force FX GO 5600, 64 MB video card (Acer Aspire 1703 SM-2.6). By knowing dimensions of the implant, it was possible to establish the distance from the medial and distal edges of the implant platform to the point of bone-implant contact (expressed in tenths of a millimeter) by doing a proportion.

The difference between the implant-abutment junction and the bone crestal level was defined as the Implant Abutment Junction (IAJ) and calculated at the time of operation and at the end of the follow-up. The delta IAJ is the difference between the IAJ at the last check-up and the IAJ recorded just after the operation. Delta IAJ medians were stratified according to the variables of interest.

D) Surgical protocol

All patients underwent the same surgical protocol. An antimicrobial prophylaxis was administered with 1 g Amoxicillin 875 mg+ Clavulanic acid 125 mg twice for 5 days starting 1 hour before surgery. Local anesthesia was induced by infiltration with articaine/epinephrine and post-surgical analgesic treatment was performed with 600 mg Ibuprofen twice daily for 3 days. Oral hygiene instructions were provided.

Two-piece implants (FMD srl, Rome, Italy) were inserted with a flap elevation approach. The implant neck was positioned at the alveolar crest level. Guided bone regeneration could be performed in the same surgical step. A second operation was then performed after four months to loading by means a provisional prosthesis. The final restoration was usually delivered within 8 weeks. All patients were included in a strict hygiene recall.

E) Data analysis

Pearson-chi square test was used to detect those variables statistically associated to SVR and SCR.

RESULTS

A total of 124 wide-diameter (i.e $x \geq 4.20$ mm) two-piece implants (FMD srl, Rome, Italy) were inserted, 56 in female and 68 in males. The median age was 59 ± 12 (min-max 28-75 years). Implants were inserted 59 in the maxilla and 65 in the mandible; they replaced 7 incisors, 4 cuspids, 23 premolars and 90 molars. Implant' length was shorter than 10 mm, $10.30 \leq x \leq 12.30$, equal to 13 mm and longer than 13 mm in 52, 57, 10 and 5 fixtures, respectively. Implant' diameter was wider than 4 mm.

Fig. 1. *Dental implant*

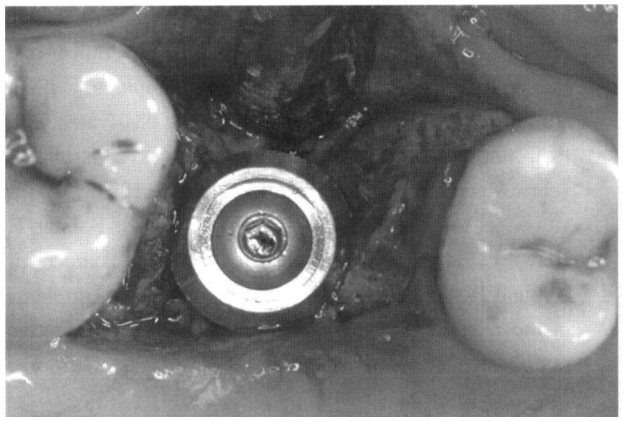

Fig. 2. *Surgical procedure*

There were 36, 14 and 74 Elisir, I-fix and Shiner implant types. All the implant bodies received the same surface treatments (i.e. sand blasting and acid etching) while the neck was les smooth in Elisir,Shiner storm types. I-fix received the same surface treatment involving the neck too.

Six diabetic patients were enrolled, 69 had periodontal disease and 47 were smokers. Two surgeons performed operation. Fixtures were placed in one totally edentulous patient, 6 single missing teeth and 117 partially edentulous subjects. Twenty three implants were placed in post-extraction sockets; GBR was performed onto 13 fixtures and 3 were immediately loaded. There were 49 single crowns and 74 implants bearing 2 or greater bridges.

The overall mean follow-up was± 63 months.

One implant was lost, survival rate = 99.20%.

Among the studies variables immediate loaded implants (p=0.05) and upper jaw (p=0.005) have a statistically significant worse outcome.

Then peri-implant bone resorption (i.e. delta IAJ) was used to investigate SCR.

Among the remaining 123 implants, 2 fixtures have a crestal bone resorption greater than 1.5 mm (SCR = 97.54).

Statistical analysis demonstrated that single crown have a higher peri-implant crestal bone resorption if compared with bridge supported by 2 or more implants (p=0.03).

DISCUSSION

The clinical use of several endosseous oral implants designs has become highly predictable in recent decades. However, their use may be restricted where there are limitations imposed by the geometry and volume of the alveolar bone. These restrictions are more common in the posterior regions of the maxilla and the mandible.

It is generally claimed that the best treatment in these situations is surgical modification of the patient's anatomy by bone grafting, alveolar distraction, inferior alveolar nerve transposition to allow the placement of longer and wider implants. However, the adaptation of the implant to the existing anatomy through the use of short or narrow or wide diameter implants (WDIs) should now be considered as a more appropriate procedure (7).

Treatments which target aesthetic and function replacement after tooth loss through osseointegrated implants have undergone enormous improvement over the last few years. Above all, this situation reduces the negative effect that occlusal loads produce in posterior areas of the maxilla and the jaw, resulting in a more favourable response to treatments in these areas (8).

Henry et al. (9), whose study at 5 years after insertion of 107 implants, resulted in 96,6% and 100% success rates in maxilla and jaw, respectively. Martinez-Gonzalez et al. reported 96,27 % success rate after 2 years follow up (10). Van Steenberghe et al. (11) refer to marginal bone loss around the implants; in their work bone loss never exceeded 1 mm for dental implant at 5 years after insertion.

However, despite the considerable success rates, there are various manuscripts in which wide platform implants do not produce results as favourable as those of the standard platform. The study of Attard et al. (12) shows that the WDIs failure rate is 4-fold that of standard

diameter implants. Ivanoff et al. (13) reported wide platform implants failure rates of up to 25,81%, compared to 5,13% or 13,3% for narrow or standard platform implants. However, in this last study was suggested that the increased failure rate of 5-mm diameter implants was associated with the operators' learning curves, poor bone density (WDIs were used as a "rescue" implant in 45% of implant sites), implant design, site preparation and the use of this implant diameter when primary stability could not be achieved with a standard diameter implant (7). This view was supported by the study of Hultin-Mordenfeld et al. (14) that reported a higher implant failure rate with WDIs in the maxilla, but these type of implants were placed in unfavourable situations, such as poor bone density, and compromised bone volume.

The results of failure in these works contrast with those provided in Barona-Dorado et al. (1) work about 67 wide platform implants in which pre-load survival was 98,5%, and post-load survival was 100%.

More recent studies which have used surgical preparation adapted to the bone density, textured surfaced implants, and modified case selection have reported survival rates for WDIs which are comparable with standard diameter implants (7) .

In the present report only one implant was lost, survival rate = 99.20%. Among the studies variables immediate loaded implants (p=0.05) and upper jaw (p=0.005) have a statistically significant worse outcome. Then peri-implant bone resorption (i.e. delta IAJ) was used to investigate SCR. Among the remaining 123 implants, 2 fixtures have a crestal bone resorption greater than 1.5 mm (SCR = 97.54). Statistical analysis demonstrated that single crown have a higher peri-implant crestal bone resorption if compared with bridge supported by 2 or more implants (p=0.03).

In conclusion FMD implants are reliable devices for oral rehabilitation with a very high SCR and SVR.

REFERENCES

1. Barona-Dorado C, Martinez-Rodriguez N, Torres-Lear F, Martinez-Gonzalez JM. Observational study of 67 wide platform implants treated with avantblast surface. Results at three year. Med Oral Patol Oral Cir Bucal 2009; 14:E183-7.
2. Bahat O. Branemark system implants in the posterior maxilla: clinical study of 660 implants followed for 5 to 12 years. Int J Oral Maxillofac Implants 2000; 15:646-53.
3. Lee JH, Frias V, Lee KW, Wright RF. Effect of implant size and shape on implant success rates: a literature review. J Prosthet Dent 2005; 94:377-81.
4. Chaushu G, Chaushu S, Tzohar A, Dayan D. Immediate loading of single-tooth implants: immediate versus non-immediate implantation. A clinical report. Int J Oral Maxillofac Implants 2001; 16:267-72.
5. Brink J, Meraw SJ, Sarment DP. Influence of implant diameter on surrounding bone. Clin Oral Implants Res 2007; 18:563-8.
6. Albrektsson T, Zarb GA. Determinants of correct clinical reporting. Int J Prosthodont 1998; 11:517-21.
7. Renouard F, Nisand D. Impact of implant length and diameter on survival rates. Clin Oral Implants Res 2006; 17 Suppl 2:35-51.
8. Langer B, Langer L, Herrmann I, Jorneus L. The wide fixture: a solution for special bone situations and a rescue for the compromised implant. Part 1. Int J Oral Maxillofac Implants 1993; 8:400-8.
9. Henry PJ, Laney WR, Jemt T, Harris D, Krogh PH, Polizzi G, Zarb GA, Herrmann I. Osseointegrated implants for single-tooth replacement: a prospective 5-year multicenter study. Int J Oral Maxillofac Implants 1996; 11:450-5.
10. Martinez-Gonzalez JM, Barona-Dorado C, Cano-Sanchez J, Florez-Rodriguez M, Cantero-Alvarez M. Clinical and radiographic behaviour of 290 dental implants with a surface treated with hydrofluoric acid and passivated with hydrofluoric and nitric acid: early loading results after 2 years. Med Oral Patol Oral Cir Bucal 2005; 10:355-61.
11. van Steenberghe D, Lekholm U, Bolender C, Folmer T, Henry P, Herrmann I, Higuchi K, Laney W, Linden U, Astrand P. Applicability of osseointegrated oral implants in the rehabilitation of partial edentulism: a prospective multicenter study on 558 fixtures. Int J Oral Maxillofac Implants 1990; 5:272-81.
12. Attard NJ, Zarb GA. Implant prosthodontic management of partially edentulous patients missing posterior teeth: the Toronto experience. J Prosthet Dent 2003; 89:352-9.
13. Ivanoff CJ, Grondahl K, Sennerby L, Bergstrom C, Lekholm U. Influence of variations in implant diameters: a 3- to 5-year retrospective clinical report. Int J Oral Maxillofac Implants 1999; 14:173-80.
14. Mordenfeld MH, Johansson A, Hedin M, Billstrom C, Fyrberg KA. A retrospective clinical study of wide-diameter implants used in posterior edentulous areas. Int J Oral Maxillofac Implants 2004; 19:387-92.