ARE WIDE DIAMETER IMPLANTS RELIABLE FOR JAW'S REHABILITATION? A RETROSPECTIVE STUDY ON 450 IMPLANTS

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The use of wide diameter implants (WDI) have had a great success, particularly in posterior jaws, because WDI can ensure an increased bone-implant contact, better withstanding occlusal forces and creating a wider platform for prosthesis. The aim of this study is to perform a study on 450 WDI to evaluate their survival rate. In the period between January 2008 and December 2013, 877 patients (498 females and 379 males) were operated at the BDD private Practice Clinic (Milan, Italy). The mean post-surgical follow-up was 30±17 months (max – min, 84 – 1). Four hundred and fifty WDI (EDIERRE Implant System SpA, Genoa, Italy) were included in the present study, 326 (72.4%) 4.5 mm and 124 (27.6%) 5 mm. All patients underwent the same surgical protocol and agreed to participate in a post-operative check-up program. SPSS program was used for statistical analysis. Survival rate (SVR) was 97.3% since only 12 fixtures were lost from a total of 450 implants. Cross-tabulation between failures and immediate loading had a statistically significant value (p= 0.009) in respect to delayed loading. There were 8 failures out of 128 immediate loaded implants in respect to 4 failures out of 315 delayed loaded fixtures. WDI are reliable devices for oral rehabilitation with high SVR.

The use of wide diameter implants (WDIs) has had a great success, particularly in posterior jaws, as they can ensure an increased bone-implant contact, better withstanding occlusal forces and creating a wider platform for prosthesis (1). In addition, wide implants avoid placing two standard implants to replace one tooth with two or three roots. The limit of wide implants is related to the fact that fixtures have to be surrounded by at least 1 mm of bone. According to their diameter, implants can be classified as narrow ($x \leq 3.3$ mm) standard (3.75 mm) and wide ($X > 4$ mm). WDIs are usually inserted in posterior mandibular or maxilla, replacing molars. WDIs present many advantages: they increase bone-implant contact surface and need more torque forces to be removed, show a greater mechanical resistance and improve survival of prosthesis (2).

In a recent paper, Desai (3) compared stresses, strains, and displacements of double *versus* single implant, in immediate loading for replacing mandibular molars, using two 3D FEM models, concluding that micro-motion can be well controlled by both double implants and 6-mm single wide-diameter implant. Termeie (4) reported that models with WDIs, loaded axially, had a more symmetrical stress distribution compared to standard and narrow diameter implants, and implant diameter and ridge width had considerable influence on stress distribution.

A recent study, aimed to evaluate the stress

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distribution in a mandibular implant-supported prosthesis and peri-implant bone considering implant quantity, diameter and position using linear 3-D finite element analysis, concluded that a reduction in the number of implants associated with WDIs diminish the stress in the bone and prosthetic components (5).

Since WDI have become widely used for rehabilitation of edentulous patients, we performed a retrospective study on 450 implants from EDIERRE Implant System SpA (Genova, Italy).

MATERIALS AND METHODS

Patients

In the period between January 2008 and December 2013, 877 patients (498 females and 379 males) were operated at the BDD private Practice Clinic (Milan, Italy). The mean post-surgical follow-up was 30±17 months (max – min, 84 – 1). Four hundred and fifty WDI were included in the present study, 326 (72.4%) 4.5 mm and 124 (27.6%) 5 mm. All patients underwent the same surgical protocol and agreed to participate in a post-operative check-up program.

Subjects were screened according to the following inclusion criteria: controlled oral hygiene, absence of lesions in the oral cavity, sufficient residual bone volume in order to receive implants of at least 4.5 mm in diameter and 9 mm in length.

The exclusion criteria were as follows: insufficient bone volume, a high degree of bruxism, smoking more than 20 cigarettes/day and excessive consumption of alcohol, localized radiation therapy of the oral cavity, antitumor chemotherapy, liver, blood and kidney diseases, immunosupression, corticosteroid treatment, pregnancy, inflammatory and autoimmune diseases of the oral cavity, poor oral hygiene.

Data collection

Prior to surgery, radiographic examinations were carried out with the use of an orthopantomograph and CT scan.

The implant survival rate (SVR) was evaluated according to the following criteria: (1) absence of persisting pain or dysesthesia; (2) absence of peri-implant infection with suppuration; (3) absence of mobility; and (4) absence of persisting peri-implant bone resorption greater than 1.5 mm during the first year of loading and 0,.2 mm/year during the following years.

Surgical protocol

All patients followed the same surgical protocol. Anaesthesia of the jaw was obtained by the injection of articaine and post-surgical analgesic treatment was performed with 100 mg of ketoprophene 3 times a day, if necessary. An antimicrobial prophylaxis was administered with 500 mg Amoxicillin twice daily for 5 days starting 1 hour before surgery. WDIs were inserted in both jaws. Three surgeons (U.D.D., W.B. and G.C.) inserted all implants. Patients agreed to follow a strict oral hygiene protocol and recall (Fig. 1 to Fig. 3).

Implants

A total of 450 WDIs were inserted: 217 (48.2%) in the mandible and 233 (51.8%) in the maxilla. 326 (72.4%) implants had a diameter of 4.5 mm whereas

Fig. 1. *Intraoral photo.*

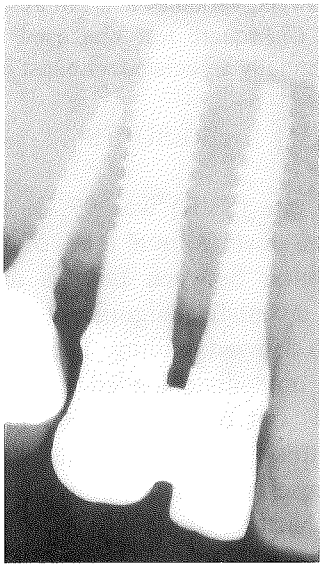

Fig. 2. *Radiograph performed after 1 year.*

Fig. 3. *Final restoration.*

124 fixtures (27.6%) hada diameter of 5 mm. There were 18, 120, 174, 138 implants with 9, 11, 13 and 15 mm length, respectively. One hundred and thirty-five were immediate loaded whereas 92, 128, 77 and 18 were loaded after 3, 4, 6, 8 months, respectively. Implants were inserted to replace 8 incisor (1.8%), 56 cuspids (12.4%), 140 premolars (31.1%) and 246 molars (54.7%). Three hundred and ninety-six fixtures were inserted with 35 N torques whereas the remaining 54 with a lower torque.

Statistical analysis

The SPSS statistical program was used. Cross tabulation between variables and failures was performed and Pearson *Chi*-square test was used to detect those variables potentially associated with lost implants.

RESULTS

Survival rate (SVR) was 97.3% since only 12 fixtures were lost from a total of 450 implants. Cross-tabulation between failures and immediate loading had a statistical significant value (p= 0.009) in respect to delayed loading. There were 8 failures out of 128 immediate loaded implants in respect to 4 failures out of 315 delayed loaded fixtures. Peri-implantitis, due to bacterial infections, was the main cause of implant failures (6, 7). It is well known that bacteria of peri-implantitis are the same of periodontitis (8, 9), and genetic risk factors are also similar (10). In addition, our results show that immediate loading in respect to delayed loading is another factor influencing SVR (11).

DISCUSSION

The idea that increased implant diameter is directly proportionate to SVR seems correct (12). The SVR is related to the osseointegration with the surrounding bone. Nowadays, implants with different diameters and designs are manufactured to improve the best choice for every clinical situation. Increasing implant diameter results in reduction of bone stress. It is thought that a single crown with greater diameter better resists to stress than two standard diameter implants. In addition, WDI can easily reach a primary stability. Primary stability of the implant is a situation of implant without movement at the moment of insertion and is due to perfect bone-implant contact. Diameter and implant length as well as bone quality are the main parameters for obtaining primary stability. Good primary stability allows immediate loading without compromising osseointegration and implant survival (13). Furthermore, a wider abutment allows to use a longer abutment which is important in immediate loading (14).

WDIs are especially indicated in posterior jaws because it is generally accepted that WDIs improve the ability of posterior implants to tolerate occlusal forces, create a wider base for proper prosthesis, and avoid placing two standard implants at one site to obtain a double-root prosthetic tooth. WDIs have a larger width contact surface with the bone, compared to the standard systems, reducing the risk of fractures of the screw, as well as improving the aesthetic component, the emergence profile of the gingiva and oral hygiene (15, 16). Initially used only in extreme situations, WDIs successively became a first choice in the case of post-extraction implants, poor bone quality, limited height of the ridge and in case of bruxism. Several medium-term studies on WDIs have been published, demonstrating favourable survival rates with two-stage procedures (17).

In general, length and diameter are considered to be relevant implant-related factors (18). In our series, implant length, diameter and type did not influence SVR. In addition, bone quality, a host-related factor, is believed to be one of the strongest predictors of implant outcome (19, 20). It is well known that the mandible has better bone quality than the maxilla, and this fact is probably the reason why several

reports are available regarding implant immediate loading in the mandible. Implant immediate loading is an example of a critical procedure in implantology.

Immediate loading is a major risk factor to determining WDI failures and thus it should be strictly evaluated before being carried out. WDI produced by EDIERRE Implant System SpA, Genova, Italy are reliable devices for oral rehabilitation with high SVR.

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