COMPARISON BETWEEN LONG AND STANDARD LENGTH IMPLANTS

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Long implants (LI, i.e. longer than 13 mm) are thought to give longer survival than standard length fixtures. The aim of this study is to evaluate the survival rate of 780 LI. 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). One thousand seven hundred and fifty-three fixtures (EDIERRE Implant System SpA, Genoa, Italy) were evaluated in the present study, 780 15 mm long (LI) and 972 13 mm long (i.e. standard length implants). 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 97.8% since only 38 fixtures were lost from a total of 1,752 implants. Cross-tabulation between failures and jaws had a statistical significant value (p= 0.027) with worse results fox maxilla (23 failures out of 768 implants). Also tooth position has an impact (p= 0.027) since incisors plus canines had 18 failures out of 550 implants whereas premolars and molars had 20 lost fixtures out of 1,202. LIs give a small but significative advantage in oral rehabilitation.

The replacement of lost teeth by dental implants has become a common technique during the last decade. For healthy jawbones with sufficient height and width, conventional two-phase metallic dental implants with the diameter more than 3.5 mm are used. Such implants were introduced in the mid-1960s after Brånemark demonstrated the possibility of osseointegration, i.e. a structural integration of a biocompatible metal into the living bone at biochemical level (1). Later, it was found that the changes of shape, length and width of implants could influence the level of the implant osseointegration. The application of this theory to dental implants reduced the dependence on mechanical interlocking and enabled the development of implant systems in more versatile design (2-6). However, the application of dental implants in special situations still remains a challenging task. This is because massive atrophic changes often occur after teeth removal or due to aging (4).

Generally, it is believed that longer implants (LI) (i.e. length > 13 mm) have higher success rates than standard ones (i.e. 13 mm long), because LIs have higher bone-implant contact and a better crown-height/implant-length ratio.

Since few reports are available in the English literature on LI, we decided to perform a retrospective study on 780 LIs (EDIERRE Implant System SpA, Genova, Italy) and compare them to 972 standard length fixtures.

MATERIALS AND METHODS

Patients

In the period between January 2008 and December

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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). One thousand seven hundred and fifty-two fixtures are included in the present study, 780 15 mm LIs and 972 13 mm long (i.e. standard length implants). 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 any lesions in the oral cavity, sufficient residual bone volume in order to receive implants of at least 3.3 mm in diameter and 13.0 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, immunosuppression, corticosteroid treatment, pregnancy, inflammatory and autoimmune diseases of the oral cavity, poor oral hygiene.

Data collection

Before surgery, radiographic examinations were carried out by 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. 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 1,752 fixtures were inserted: 984 (56.2%) in the mandible and 768 (43.8%) in the maxilla. Nine hundred and seventy-two (55.5%) implants were 13 mm long whereas 780 fixtures (44.5%) were 15 mm long. There were 91, 815, 534, 231 and 81 implants with 3.3, 3.75, 4.2, 4.5 and 5.0 mm wide, respectively. Six hundred and forty were immediate loaded whereas 317, 478, 258 and 59 were loaded after 3, 4, 6, 8 months, respectively. Implants were inserted to replace 338 incisor (19.3%), 212 cuspids (12.1%), 730 premolars (41.7%) and 472 molars (26.9%). One thousand five hundred and fifty-nine fixtures were inserted with 35 N torques whereas the remaining 193 with a lower torque.

Statistical analysis

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 97.8% since only 38 fixtures were lost from a total of 1,752 implants. Cross-tabulation between failures and jaws had a statistically significant value (p= 0.027) with worse results fox maxilla (23 failures out of 768 implants). Also tooth position had an impact (p= 0.027) since incisors plus canines had 18 failures out of 550 implants whereas premolars and molars had 20 lost fixtures out of 1,202. Implants were lost for peri-

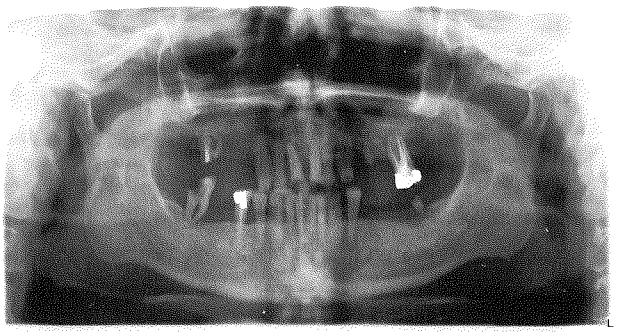

Fig. 1. *Pre-surgical radiograph.*

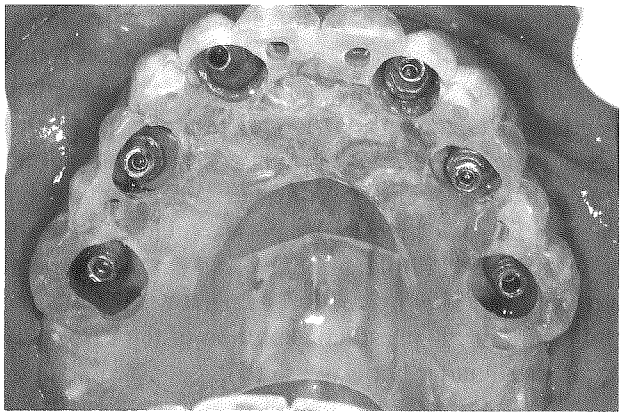

Fig. 2. *Upper maxillary stent for implant placement.*

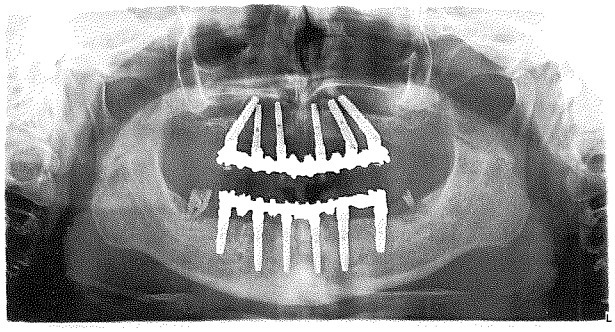

Fig. 3. *Radiograph performed 1 year after surgery.*

implantitis (7, 8), caused by the same bacteria of periodontitis (9-11). Immediate loading in respect to delayed did not influence SVR (12).

DISCUSSION

Long implants are thought to give longer survival than standard length fixtures. Recently, Ivanoff et al. (2) found that, regardless of the length of the implant, the stress generated in the implant with bi-cortical fixation is slightly higher than in mono-cortical fixation. They also reported up to four times more frequent failures of bi-cortical screws compared to mono-cortical implants due to enhanced non-axial forces in the neck zone of the implant. These results seem to be contradictory to the general expectation that bi-cortical fixation generates lower stress in the upper cortical bone due to additional support of the implant tip.

Implant length was investigated for a long time as an important factor in determining survival and, although 8-mm implants had no difference in survival rate when compared to 10-mm implants, it has been seen that the 6-mm implants tended to have a lower survival rate, though the differences were not found to be statistically significant (13). Research in implant dentistry has shown that longer implants guarantee better success rates and prognosis; and that shorter implants have statistically lower success rates due to reduced stability, which can be explained in terms of less bone to implant contact and smaller implant surface (14). However, short or narrow implants are preferred for the prosthetic solution of the extremely resorbed alveolar bone areas (15).

The concept of osseointegration, i.e., the direct anchorage of endosseous implants made of commercially pure or titanium alloy to the bone caused a breakthrough in oral rehabilitation. The identification of factors for long-term survival and success rate are the main goal of the recent literature.

Misch et al. (13) reported that fixed prostheses can enhance the predictability and success of rehabilitation of partially edentulous patients by increasing the number of implants and increasing the surface area on which the occlusal force is transmitted. Thus, one can assume that short implants can lead to higher stress concentration at the contact bone-implant and may contribute to biomechanical complications in dental implant therapy, as mentioned by Chang et al. (16).

Our results demonstrated that LI give some advantages as regards jaws (better results for mandible) and implant position (better results for premolars and molars). It is well known that mandible has a more compact bone in respect to maxilla and this could explain the better results (17, 18). Also, in the case of high alveolar crest able to receive 13-mm implants (or more) the wider dimension of the posterior alveolar crest (and thus the biological width) can explain the better results (19).

Our results give additional strength to the fact that long implants can give slightly but statistically significant better results compared to standard length fixtures and that fixtures from EDIERRE Implant System SpA, Genova, Italy are reliable devices for oral rehabilitation.

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RERERENCES

1. Branemark PI, Breine U, Adell R, Hansson BO, Lindstrom J, Ohlsson A. Experimental studies on intra-osseous anchorage of dental prosthesis]. Arsb Goteb Tandlak Sallsk 1970:9-25.
2. Ivanoff CJ, Grondahl K, Bergstrom C, Lekholm U, Branemark PI. Influence of bicortical or monocortical anchorage on maxillary implant stability: a 15-year retrospective study of Branemark System implants. Int J Oral Maxillofac Implants 2000; 15(1):103-110.
3. Pierrisnard L, Hure G, Barquins M, Chappard D.

Two dental implants designed for immediate loading: a finite element analysis. Int J Oral Maxillofac Implants 2002; 17(3):353-362.

4. Wang K, Li DH, Zhou JX, Zhang CJ, Liu BL, Li YL. [Influence of bicortical anchorage on the natural frequencies of dental implant]. Hua Xi Kou Qiang Yi Xue Za Zhi 2006; 24(1):86-88.
5. Danza M, Lauritano D, Carinci F. Successful rehabilitation of partial edentulous maxilla and mandible with new type of implants: molecular precision implants. Case Rep Med 2014; 2014:307364.
6. Fogli V, Camerini M, Lauritano D, Carinci F. Success and high predictability of intraorally welded titanium bar in the immediate loading implants. Case Rep Dent 2014; 2014:215378.
7. Brunelli G, Carinci F, Zollino I, Candotto V, Scarano A, D. L. Peri-implantitis: a case report and literature review. European Journal of Inflammation 2012; vol.10:1-5.
8. Brunelli G, Carinci F, Zollino I, Candotto V, Scarano A, D. L. Sem evaluation of 10 infected implants retrived from man. European Journal of Inflammation 2012; vol. 10:7-12.
9. Carinci F, Scapoli L, Girardi A, Cura F, Lauritano D, Nardi GM, Palmieri A. Oral microflora and periodontal disease: new technology for diagnosis in dentistry. Ann Stomatol (Roma) 2013; 4(2):170-173.
10. Scapoli L, Girardi A, Palmieri A, et al. Microflora and periodontal disease. Dent Res J (Isfahan) 2012; 9(Suppl 2):S202-206.
11. Scapoli L, Girardi A, Palmieri A, Carinci F, Testori T, Zuffetti F, Monguzzi R, Lauritano D. IL6 and IL10 are genetic susceptibility factors of periodontal disease. Dent Res J (Isfahan) 2012; 9(Suppl 2):S197-201.
12. Scarano A, Murmura G, Carinci F, D. L. Immediately loaded small-diameter dental implants: evaluation of retention, stability and comfort for the edentulous patient. European Journal of Inflammation 2012; vol. 10:19-24.
13. Misch CE, Steignga J, Barboza E, Misch-Dietsh F, Cianciola LJ, Kazor C. Short dental implants in posterior partial edentulism: a multicenter retrospective 6-year case series study. J Periodontol 2006; 77(8):1340-1347.
14. LJ. S. History and development of dental implants. In: Narim L, Wilson HF, eds. Implantology in general dental practice. 2005:19-41.
15. Mandhane SS, AP. M. A review: evaluation of design parameters of dental implant abutment. Inter J Emerging Sci Eng 2014; 2:64-67.
16. Chang SH, Lin CL, Hsue SS, Lin YS, Huang SR. Biomechanical analysis of the effects of implant diameter and bone quality in short implants placed in the atrophic posterior maxilla. Med Eng Phys 2012; 34(2):153-160.
17. Lauritano D, Palmieri A, Vinci R, Azzi L, Taglabue A, Carinci F. Adipose derived stem cells: basic science fundaments and clinical application. An update. Minerva Stomatol 2014; 63(7-8):273-281.
18. Sollazzo V, Carinci F, D. L. The biophysical stimulation of osteogenesis: a review. . European Journal of Inflammation 2012; vol. 10:65-70.
19. Sullivan RM. Implant dentistry and the concept of osseointegration: a historical perspective. J Calif Dent Assoc 2001; 29(11):737-745.