

CLINICAL OUTCOME OF 2,560 IMPLANTS AFTER A MEAN OF 30-MONTH FOLLOW-UP

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The advantage of implantology is to replace dental loss with a fixed prosthesis even in cases of partial or total edentulism without damaging the natural teeth. 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). Two thousand five hundred and sixty out of 2,657 implants had a complete record and were evaluated in the present study. The implants were of different diameters and length, inserted both in mandible (1,327) and in maxilla (1,233) with immediate or delayed loading, and with graft, split crest, post-extraction, osteo-condensation, small and big sinus lift techniques, respectively. Fifty-nine out of 2,560 implants were lost (i.e. SVR = 97.7%). Cross-tabulation between failures and timing of loading (p= 0.008) had a statistically significant value, with a worse result for immediate loading (28 failures out of 783). In other comparisons between lost implants and diameter (p= 0.074), length (p=0.293), jaws (i.e. maxilla vs mandible, p=0.208), replaced teeth (incisors plus cuspids vs premolars plus molars, p=0.074), insertion torque (p=0.528), surgeons (p=0.452) and additional surgical procedures (i.e. split crest, post-extraction, graft, osteo-condensation, transposition, small and big sinus lift techniques, p= 0.713) no statistically significant difference was detected. EDIERRE Implant System SpA (Genova, Italy) implants have a high SVR (97.7%) allowing more simple surgical procedures for oral rehabilitation of partially or totally edentulous jaws.

Implant dentistry has had great success in recent decades among dentists and patients (1, 2). The advantage of implantology is to replace lost teeth with a fixed prosthesis, even in cases of partial or total edentulism, without damaging the remaining natural teeth. Implant success depends on many factors: the patient's general health, the quality and quantity of jaw bone, smoking status and alcohol consumption, the type of implant and surgical techniques (3-6). The type of implant, and in particular the design of the implant, affect the survival rate (SVR) (7). In fact, although implant dentistry has had great success for

a long time, the complicated surgical procedures, infiltration of bacteria in the microgap between abutment and implant, and peri-implantitis after loading, are considered complications that could be overcome by the use of a new type of implant (7-12). In addition, the prosthetic procedure should be facilitated by a special design of implant-abutment connection (13). The better understanding of the biological mechanisms of osseointegration, the pathogenesis of peri-implantitis and knowledge of the physiology of occlusion have allowed a more accurate study of implant design and increased implant success rates.

Key words: bone, graft, implantology, peri-implantitis, sinus

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23(S1)

0393-974X (2015)
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Moreover, the changes in surgical techniques both in basic as well as in advanced implant surgery have increased the number of patients who want a fixed oral rehabilitation, even in cases of severe bone atrophy or advanced age or systemic diseases (osteoporosis, cardiovascular disease, diabetes, Parkinson disease) (14). These new techniques resulted in a better patient compliance, in particular totally edentulous patients, versus implant therapy. Therefore, a frequent question asked by implantologists was: which is the preferred best number of implants to be used for the support of a fixed prosthesis in the edentulous maxilla or mandible? To date, there is little evidence from randomized clinical trials (RCT) or systematic reviews about this question, and no consensus has been reached. Therefore, the reviewed articles published in the past 30 years concluded that standard surgical procedures to rehabilitate edentulous jaws uses 4 to 6 implants (15). Since implant dentistry has become a widely used procedure for rehabilitation of edentulous patients, we decided to perform a retrospective study on 2,560 implants (EDIERRE Implant System SpA, Genova, Italy) inserted in partially and totally edentulous jaws.

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).

Subjects were screened according to the following inclusion criteria: controlled oral hygiene, the absence of any lesions in the oral cavity, sufficient residual bone volume (autologous eventually plus graft) to receive implants of 3.3 mm in diameter and 9 mm in length; in addition, the patients had to agree to participate in a post-operative check-up program.

Exclusion criteria were as follows: insufficient bone volume, a high degree of bruxism, smoking more than 20 cigarettes/day and consumption of more than one glass/day of wine, localized radiation therapy of the oral cavity, antitumor chemotherapy, liver, blood and kidney diseases, immunosuppression, ongoing corticosteroid treatment, pregnancy, inflammatory and autoimmune diseases of the oral cavity, poor oral hygiene.

Data collection

Before surgery, radiographic examinations were carried

out with the use of orthopantomograph and CT scans.

Implants

Two thousand five hundred and sixty out of 2,657 implants had a complete record and were evaluated in the present study. All fixtures were provided by EDIERRE Implant System SpA (Genova, Italy). Diameter was as follow: 112 (4.4%) 3.3 mm, 1234 (48.2%) 3.75 mm, 764 (29.8%) 4.2 mm, 326 (12.7%) 4.5 mm and 124 (4.8%) 5 mm. Length was as follow: 119 (4.6%) 9 mm, 689 (26.9%) 11 mm, 972 (38%) 13 mm, 780 (30.5%) 15 mm.

Surgical and prosthetic technique

All patients underwent the same surgical protocol. An antimicrobial prophylaxis was administered with 500 mg Amoxicillin twice daily 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 100 mg Nimesulid twice daily for 3 days. Oral hygiene instructions were provided.

After making a crestal incision, a mucoperiosteal flap was elevated. Implants were inserted according to the procedures recommended. The implant platform was positioned at the alveolar crest level. Sutures were removed 7 days after surgery. After different periods (see below) from the implant insertion, a provisional prosthesis was provided and the final restoration was usually delivered within the following 8 weeks. All patients were included in a strict hygiene recall (Fig. 1 to Fig. 3).

One thousand three hundred and twenty-seven implants were inserted in the mandible and 1,233 in maxilla. They replaced 372 (14.5%) incisors, 226 (8.8%) cuspids, 993 (38.8%) premolars and 969 (37.9%) molars. Two thousand two hundred and thirty-seven (87.4%) were inserted with a torque of 35 Nm, whereas the remaining 323 (12.6%) with a lower force. Surgeons inserted 1,987 (77.6%, U.D.D.), 486 (19%, W.B.) and 87 (3.4%, G.C.) fixtures. Eight hundred and eleven (31.7%) implants had immediate loading, whereas 575 (22.5%), 695 (27.1%), 393 (15.4%) and 86 (3.45) were loaded after 3, 4, 6 and 8 months, respectively. Eleven (0.4%), 710 (27.7%), 33 (1.3%), 4 (0.2%), 13 (0.5%), and 200 (7.8%), 26 (1.0%) implants were inserted with split crest, post-extraction, graft, osteo-condensation, small and big sinus lift techniques, inferior alveolar nerve transposition, respectively. Fifty-nine (2.3%) implants were lost with a survival rate (SVR) of 97.7% (i.e. 2,501 fixtures were still in place after the observation period).

Statistical analysis

The SPSS statistical program was used. Cross tabulation between variables and Pearson Chi-square test was used to detect those variables potentially associated

with implant lost.

RESULTS

Only 59 out of 2,560 implants were lost (i.e. SVR = 97.7%). Cross-tabulation between failures and immediate loading ($p=0.008$) had a statistically significant value, with a slightly worse result for IL (i.e. 28 over 783 IL vs 31 out of 1,718 delayed loaded implants). In the other comparisons between lost implants and diameter ($p=0.074$), length ($p=0.293$), jaws (i.e. maxilla vs mandible, $p=0.208$), insertion torque ($p=0.528$), replaced tooth ($p=0.074$), surgeons ($p=0.452$) and additional surgical procedures (i.e. split crest, post-extraction, graft, osteo-condensation, small and big sinus lift techniques, inferior alveolar nerve transposition, $p=0.068$), no significant statistical difference was detected.

DISCUSSION

Implant dentistry, a widely used technique in recent



Fig. 1. Intraoral occlusal lower jaw.



Fig. 2. Implant placement.

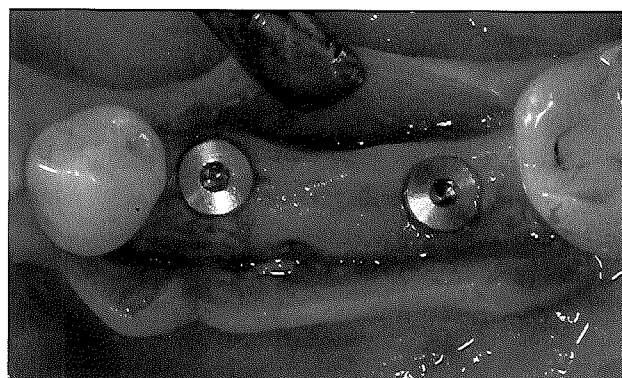


Fig. 3. Radiograph after 1-year follow-up.

decades, has been shown to have success rates of over 90%. EDIERRE Implant System SpA (Genova, Italy) implants have been demonstrated to have a high SVR allowing simple surgical procedures for oral rehabilitation of partially or totally edentulous jaws. Only immediate loading has a slight worse outcome in respect to delayed loading (i.e. 28 out of 783 IL vs 31 out of 1,718 delayed loaded implants).

Our data show that the implant diameter and length did not influence SVR ($p=0.074$ and $p=0.293$, respectively). Our findings can be explained by the fact that in all clinical situations the dimension of the implant, the surgical technique and prosthetic rehabilitation were most appropriate. Similar data are reported by Monje et al.: neither implant length nor width seemed to significantly affect the survival rate of implants (16).

Good outcome was obtained for jaws (i.e. maxilla vs mandible, $p=0.208$). Here we reported an SVR = 97.5% (i.e. 32 failures out of 1233) in maxilla and 97.9% (i.e. 27 failures out of 1,327) in mandible which is compatible with literature data on implants inserted in upper and lower jaws, respectively (17).

Immediate loading has been presented in the literature with promising outcome. In our study we found a significant difference between immediate vs delayed loading ($p=0.008$). Likewise Shimmel et al. reported survival rates for immediately loaded implants between 81.6% and 100% (3, 18). Papaspyridakos et al., in a recent systematic review, concluded that immediate loading with fixed prostheses in edentulous patients results in similar survival and failure rates as early and conventional loading. The estimated 1-year

implant survival was over 99% with all three loading protocols (4). In addition, a recent review by Esposito et al. reported insufficient evidence to determine the possible advantages or disadvantages of immediate, immediate-delayed or delayed implant loading (19). Other authors have found similar results (20).

Insertion torque did not affect SVR ($p=0.528$), such as additional surgical procedures (split crest, post-extraction, graft, osteo-condensation, small and big sinus lift techniques $p=0.068$).

We inserted eleven (0.4%) implants with split crest and SVR 100% (i.e. no failures) was quite high due to the small number of fixtures. Split crest procedure is mainly indicated in cases with presence of reduced crestal width and adequate height. Garcez-Filho et al. reported that implants installed immediately after split-crest procedure in posterior maxilla, may successfully support prosthetic rehabilitations after long intervals of time (21).

In our study, 710 (27.7%) implant were placed post-extraction, 11 of which were lost with an SVR = 98.4%. Tarazona et al., in a retrospective study evaluating the survival rate of a series of immediate implants after 3 years of follow-up, found a total implant success rate of 93.8% (22).

Thirty-three (1.3%) implants were placed with graft surgery without failures. Likewise Nkenke et al. reported that implant survival seems to be independent of the biomaterial used in maxillary small and big sinus lift and alveolar ridge augmentation (23).

Thirteen (0.5%) implants were inserted with small sinus lift, and 200 (7.8%) with big sinus lift. In literature there is insufficient reliable evidence supporting or refuting the hypothesis of a worst SVR of implants placed with augmentation procedures or whether any of the augmentation techniques is superior to the others or different to SVR without augmentation surgery (24, 25).

In our retrospective study 26 (1.0%), implants were inserted with inferior alveolar nerve transposition technique and none was lost. Transposition is a useful surgical procedure for managing severely atrophic edentulous or partially edentulous mandibles with dental implants. The risk of neural dysfunction appears to be low (26).

Fifty-nine out of 2,560 implants were lost (i.e. SVR = 97.7%) for peri-implantitis *versus* SVR 82.4% according to the data in literature of (27-29).

Similarity to gingivitis and periodontitis, mucositis and peri-implantitis are the result of the inflammatory destruction of the implant-supporting tissues, caused by bacterial leakage in implant-abutment connection (30-32). Our better results can be explained thanks to a new implant-abutment connection design, which reduces bacterial penetration.

The studied implants (EDIERRE Implant System SpA, Genova, Italy) are reliable devices for oral rehabilitation.

ACKNOWLEDGEMENTS

We thank Prof. Francesco Carinci for statistical support and manuscript revision.

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