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European Journal of Inflammation

Supplement



Official Journal of the Italian Society
of Oral Pathology and Medicine



Lorenzo Costa - "The Fall of Man"



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ONE-PIECE IMPLANTS INSTALLED IN RESTORED MANDIBLE: A RETROSPECTIVE STUDY

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One-piece implants became more and more popular in the last few years. They incorporate the trans-mucosal abutment as an integral part of the implant. Since no report specifically focus on one-piece implants inserted in mandible is available, a retrospective study was performed. Eleven patients (7 females and 4 males) were enrolled in the present study. A total of 93 one-piece implants (Diamond, BIOIMPLANT, Milan, Italy) were inserted. Cox analysis was used to detect if any of the studied variables (i.e. diameter, length, replaced tooth position and welding) has an impact both on failures (SVR, i.e. lost fixtures) and/or on success (SCR, i.e. crestal bone resorption around implants lower than 1.5 mm). In our series SVR and SCR were 100 (i.e. no implant lost) and 97.8 (i.e. 2 failed implants), respectively. Cox analysis demonstrated that no studied variables (i.e. diameter, length, replaced tooth position and welding) have direct impact on survival (i.e. lost implants) as well as on clinical success (i.e. crestal bone resorption) ($p > 0.5$). In conclusion one-piece implants are reliable devices for mandible rehabilitation.

A submerged healing of dental implants for about 3 to 6 months has been considered to be an essential prerequisite to obtain mineralized tissues at the interface. Immediate loading (IL) of dental implants has been proposed in order to minimize the delay between surgical and prosthetic phases; it is, however, necessary to define the exact protocol for the use of this technique in different clinical and anatomic conditions. Immediate loading is defined as an implant loaded with a prosthetic superstructure in occlusal contact, the same day of surgery. In addition, functional (or occlusal) and not-functional (or esthetic) IL should be distinguished. Several studies have reported on immediately or early loaded implants used for full arch rehabilitation in completely edentulous mandibles. High survival rates (SVR, i.e. total implants still in place at the end of the follow-up) or success rate (SCR, i.e. good clinical, radiological and/or aesthetic outcome) have been reported (1-10).

In 1997, Schnitman and coll. (1) published an

investigation where 63 implants were placed into mandibular sites in 10 patients and followed for up to 10 years. Twenty-eight implants were IL at implant placement, providing support for fixed provisional prostheses, while 35 adjacent implants were allowed to heal submerged and stress-free. Following a 3-month healing period, the submerged implants were exposed and definitive reconstruction was accomplished. Of these 28 implants placed into immediate function, 4 ultimately failed. The 10-year SVR was 84.7% for IL implants and 100% for submerged implants. The same year, Tarnow et coll. (2) evaluated 69 IL implants (minimum length 10 mm) on 10 patients who refused to wear dentures. The study included 6 mandibles and 4 maxillae. Only 2 of the implants were lost. A series of 27 partially and fully edentulous jaws, 23 of which were mandibles, were reported by Jaffin and coll. (3) A minimum of 4 implants (10 mm long) were inserted in the mandible, and the rehabilitation was performed within 72 hours (i.e. early loading) obtaining a SVR of

Key words: One-piece, implant, fixture, welding, bone, immediate loading.

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95%. The subsequent year, Ganeles et al. (4) published a study on IL of fixed restorations in 27 patients. Five to 8 implants were placed in each patient. One hundred sixty-one of the 186 implants were IL, and SVR was 99.5% with a mean period of follow-up of 25 months.

In 2003, Wolfinger et al. (5) reported the 5 years results of IL implants in edentulous mandibles; in this study it was demonstrated that it was essential to splint the implants during the healing period (3 months) to obtain a SVR of about 97%. Similar results (i.e. SVR=96.7) were obtained also by Malo et al. (6) in a retrospective clinical study including 44 patients with 176 IL implants, placed in the anterior region, supporting fixed complete-arch mandibular prostheses.

More recently, larger series with longer follow-up have been published. Testori et al. (7) presented preliminary data from a clinical study of IL, full-arch, screw-retained prosthesis with distal extensions (hybrid prosthesis) supported by implants placed in the edentulous mandible. A cumulative SVR of 98.9% was achieved for up to 48 months of follow-up. The authors concluded that rehabilitation of the edentulous mandible by an IL hybrid prosthesis supported by 5 to 6 implants may represent a viable alternative treatment to the classical delayed loading protocols. Subsequently, Testori et al. (8) reported a prospective study on IL lower full-arch screw-retained prostheses. Sixty-two patients were enrolled and 325 implants were inserted and occlusally loaded. The SVR was 99.4% for a mean period of 28 months. A large retrospective study on 750 early loaded implants with a 1-year SVR of 97.5% was presented by Friberg et al. (9) The outcome was compared with that of a study that used the two-stage surgical technique. These authors reported a worse prognosis for the IL implants. Finally, Ibanez et al. reported 41 consecutive patients who needed full-arch restorations and were treated with 343 implants (10). Twenty-three mandibular and 26 maxillary cases were treated, loading implants within 48 hours; the follow-up was 12 to 74 months with a SVR of 99.42%.

Since one-piece implants became more and more popular (11-14) and no report is available on these implants inserted in the mandible we therefore decided to perform a retrospective study.

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 at the Dental Clinic, University of Chieti, Italy for evaluation and implant treatment by S.F. between January and December 2010. The study design was similar to those of previously reported study (11-14).

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, smoking more than 20 cigarettes/day, 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, immunosuppressed 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), implant (length and diameter), and prosthetic (welding procedure) variables.

Primary and secondary predictors of clinical outcome are used. The primary predictor is the presence/absence of the implant at the end of the observation period. It is defined as survival rate (i.e. SVR) that is the total number of implants still in place at the end of the follow-up period.

The second predictor of outcome is the peri-implant bone resorption. It 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 (15).

C) Data collection methods

Before surgery, radiographic examinations were done with the use of orthopantomographs and CT scans.

Peri-implant crestal bone levels were evaluated by the calibrated examination of 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' 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 GE 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

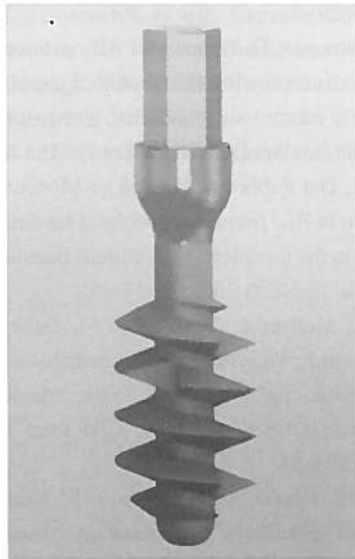


Fig. 1. Wide diameter one-piece implant

antimicrobial prophylaxis was administered with 1g 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.

One-piece implants (Diamond, BIOIMPLANT, Milan, Italy) (Fig. 1) were inserted with a trans-mucosal approach. The implant neck was positioned at the alveolar crest level. Welding procedure was performed by using an intra-oral welding machine Dent Weld (Swiss & Wegman S.r.l., Ponte San Nicolò (PD) Italy). A provisional prosthesis was immediately provided and the final restoration was usually delivered within 8 weeks. All patients were included in a strict hygiene recall.

E) Data analysis

Cox analysis was used to detect if diameter, length, welding and replaced tooth position have an impact both on failures (i.e. lost fixtures) and/or on success (i.e. crestal bone resorption around implants lower than 1.5 mm).

RESULTS

Eleven patients (7 females and 4 males) have the inclusion criteria and were enrolled in the present study. The mean implant follow-up was 6 months.

A total of 93 one-piece implants (Diamond, BIOIMPLANT, Milan, Italy) were inserted in the mandible. Implants were inserted to replace 29 incisors, 17 cuspids, 27 premolars and 20 molars. Implant length was shorter than 13 mm, equal to 13 mm and longer than 13 mm in 19, 20 and 54 fixtures, respectively. Implant diameter was narrower than 4 mm, equal to 4 mm and wider than 4 mm in 6, 46 and 41 fixtures, respectively.

Sixty-four implants were welded. Fifty-two were placed in females and 41 in males.

No implant was lost in the post-operative period, SVR = 100%.

Then peri-implant bone resorption (i.e. delta IAJ) was used to investigate. Two fixtures have a crestal bone resorption greater than 1.5 mm (SCR = 97.8) and thus were used for statistical purpose. Cox analysis demonstrated that no studied variables (i.e. diameter, length, replaced tooth position and welding) has direct impact on clinical success (i.e. crestal bone resorption) ($p > 0.5$).

DISCUSSION

An unloaded healing period was thought to be an essential prerequisite for obtaining mineralized tissues at the interface of dental implants (16). Some clinicians, however, immediately loaded implants for the purpose of inserting a provisional prosthesis, and they obtained positive results with high percentages of osseointegration of those implants. Starting with few IL implants (1, 2) the concept of IL evolved to loading multiple implants in fixed prosthodontics (7, 9, 10).

Retrieved IL implants after 8 to 9 months of loading from a human mandible showed a high percentage of bone-to-implant contact (17). Micromotion is a subclinical level of movement of the implant relative to the bone. The degree of micromotion, which is deleterious for osseointegration, is difficult to quantify or measure. Some researches have studied bone healing around implants subjected to different magnitudes of load. These studies put the tolerated threshold of micromotion at about 100 μm (18, 19). This fact lead to the following conclusions: 1- premature loading per se does not lead to fibrous tissue encapsulation and 2- it is the absence of micromotion at the bone-implant interface that is critical for obtaining implant osseointegration (18, 19).

The splinting of IL implants is then of relevant importance to obtain good clinical results.

In addition, all the variables which usually influence the final result in two-stage-surgery play also a relevant role in IL: these variables are grouped as (1) surgery-, (2) host-, (3) implants-, and (4) occlusion-related factors.

The surgery-related factors comprise several variables such as an excess of surgical trauma like thermal injury, bone preparation, drill sharpness and design. Bone quality and quantity are the most important host-related factors, while design, surface coating and length are the most important implants-related factors. Finally, quality and quantity of force and prosthetic design are the variables of interest among the occlusion-related factors. All these variables may affect the clinical outcome.

IL for full-arch rehabilitation in completely

edentulous mandible has been reported in several studies with good SVR and SCR (1-10). Starting with a few implants immediately loaded with a bar overdenture in the mandible (20), the concept of IL evolved to loading multiple implants in both the maxilla and mandible.

The number of implants used for rehabilitation of completely edentulous mandibles ranged from 3 (1, 20) to 10 (2); the provisional restoration was performed the same day (immediate loading) (7) or within 3 days (early loading) (3, 9); the recommended minimum implant length was 10 mm (3). The SVR ranged from the 85% reported in early studies (1) to the over 99% of the recent literature (7, 10). Few reports have evaluated large series of implants with a significant follow-up (10), and only one has analyzed IL implants (7). In the present study, a series of 93 IL implants with a mean follow-up of 6 months and a SVR of 100% was reported. An evaluation of the crestal bone resorption was performed to analyze the effects of host-, surgery-, and implants-related factors on the clinical outcome.

In our series, SVR and SCR were extremely high and no studied variables (i.e. diameter, length, replaced tooth position and welding) has direct impact on survival (i.e. lost implants) as well as on clinical success (i.e. crestal bone resorption) ($p > 0.5$). Thus we concluded that one-piece implants are reliable devices for mandible rehabilitation.

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Volume 10 No. 1 (S2), January - April, 2012 - CONTENTS

✓ G. Brunelli, F. Carinci, I. Zollino, V. Candotto, A. Scarano, D. Lauritano. Peri-Implantitis: A case report and literature review.....	1
✓ G. Brunelli, F. Carinci, I. Zollino, V. Candotto, A. Scarano, D. Lauritano. SEM evaluation of 10 infected implants retrieved from man.....	7
✓ A. Scarano, B. Palmieri, G.L. Bertuzzi, A. Di Cristinzi, F. Carinci, D. Lauritano. Perioral rejuvenation and lip augmentation with hyaluronic acid.....	13
✓ A. Scarano, G. Murmura, F. Carinci, D. Lauritano. Immediately loaded small-diameter dental implants: evaluation of retention, stability and comfort for the edentulous patient.....	19
✓ A. Scarano, D. D'Andria, G. Fippi, F. Di Carlo, F. Carinci, D. Lauritano. Treatment of perioral rhytides with voltaic air dermoabrasion.....	25
✓ A. Scarano, G. Iezzi, A. Di Cristinzi, G.L. Bertuzzi, F. Carinci, D. Lauritano. Full-facial rejuvenation with autologous platelet-derived growth factors.....	31
✓ S. Fanali, F. Carinci, I. Zollino, C. Brugnati, D. Lauritano. One-piece implants installed in restored mandible: a retrospective study.....	37
✓ A. Scarano, G. Murmura, L. Artese, F. Carinci, D. Lauritano. Schwannoma of the posterior tongue in a thirteen-year old child.	43
✓ A. Scarano, B. Sinjari, D. Di Iorio, G. Murmura, F. Carinci, D. Lauritano. Surface analysis of failed oral titanium implants after irradiated with ErCR:YSGG 2780 laser.....	49
✓ S. Fanali, F. Carinci, I. Zollino, C. Brugnati, D. Lauritano. A Retrospective study on 83 one-piece implants installed in resorbed maxillae.....	55
✓ A. Scarano, A. Quaranta, B. Feragalli, A. Di Cristinzi, F. Carinci, D. Lauritano. Haemostasis control in dental extractions with calcium sulphate: a case series.....	59
✓ V. Sollazzo, F. Carinci, D. Lauritano. The biophysical stimulation of osteogenesis: A Review.....	65
✓ C. Riberti, F. Carinci, I. Pezzini, L. Moretti, M. Candiani, V. Loconte, I. Zollino, C. Bleve, A. Franchella, G. Brunelli. Versajet hydroscaapel: a new surgical approach for the treatment of giant congenital melanocytic nevus in the first month of life...	71
✓ A. Franchella, S. Pellegrinelli, F. Carinci, I. Zollino, G. Carnevali, V. Candotto, S. Franchella, G. Denotti, V. Piras, G. Brunelli. Thyroglossal duct cysts: A retrospective study.....	75
✓ A. Franchella, S. Pellegrinelli, F. Carinci, I. Zollino, G. Carnevali, V. Candotto, S. Franchella, G. Denotti, V. Piras, G. Brunelli. Infantile hemangiomas of the face: A case series evaluation.....	79
✓ A. Franchella, S. Pellegrinelli, F. Carinci, I. Zollino, G. Carnevali, V. Candotto, S. Franchella, G. Denotti, V. Piras, G. Brunelli. Head and neck pyogenic granulomas in children.....	83
✓ A. Franchella, S. Pellegrinelli, F. Carinci, I. Zollino, G. Carnevali, V. Candotto, S. Franchella, G. Denotti, V. Piras, G. Brunelli. Dermoid cysts: a case series of pediatric patients.....	87
✓ F. Carinci, A. Girardi, A. Palmieri, M. Martinelli, L. Scapoli, A. Avantiaggiato, G.M. Nardi, D. Lauritano. Lab-test 1: peri-implantitis and bacteriological test.....	91
✓ F. Carinci, A. Girardi, A. Palmieri, M. Martinelli, L. Scapoli, A. Avantiaggiato, G.M. Nardi, D. Lauritano. Lab-test 2: microflora and periodontal disease.....	95
✓ F. Carinci, A. Girardi, A. Palmieri, M. Martinelli, L. Scapoli, A. Avantiaggiato, G.M. Nardi, D. Lauritano. Lab-test 3: genetic susceptibility in periodontal disease.....	99