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Original Article

Extension implants in the atrophic posterior maxilla: 1-year results of a retrospective case-series

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Abstract *Background/purpose:* Blade implants account for one of the most debated dental implants design in scientific literature. They have been reconsidered by clinicians since their re-classification by Food and Drug Administration in 2014.
Materials and methods: The present study aimed to evaluate the outcome of newly manufactured extension implants in the treatment of moderate atrophic posterior maxillae. All the patients enrolled in the present retrospective case series study showed a moderate bone atrophy in the posterior maxilla with a maximum residual height ranging between 4 mm and 8 mm. Implants were inserted with the aid of an electro-magnetic device, and then they covered with screws and left healing. Three months after, implants were exposed and loaded.
Results: Difference between the marginal bone level at the 3-month evaluation (5.57 ± 0.67 mm) and that at baseline (5.67 ± 0.55 mm) appeared to be not significant (p-value = 0.63). At the 12-month evaluation, the marginal bone level (4.95 ± 0.45 mm) underwent significant decrease respect to baseline value as proven by significant change at marginal bone level (-0.62 ± 0.51 mm with a p-value = 0.01).
Conclusion: The results of the present study suggested a positive 12-month outcome for extension implants in the rehabilitation of the moderate atrophic maxilla, without the need of extensive reconstructive surgeries and grafting procedures.

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Introduction

Insufficient bone volume and closeness to important anatomical landmarks can prevent implant placement. The atrophic posterior maxilla is still a great concern among clinicians since it often lacks both in height and in thickness, thus preventing the placement of implants without adjunctive strategies.[1] In implant surgery, it would be important to minimize patients' morbidity: implant patients have become increasingly older; consequently, the therapeutic strategies need to be tailored on them and their ingrained characteristics — systemic diseases, pharmacological therapies, and functional sinus impairment due to sinus lift augmentation procedures.[2] Current guidelines for good clinical practice suggest choosing the most cost-effective treatment — being equal the clinical efficacy. Although the surgical reliability is well documented, there is still disagreement on which of those techniques owns the clinical and prosthetic primacy. Among different implant designs, blade-implants probably account for the most debated ones, even if the Food and Drug Administration (FDA) re-classified the blade-form implants from class III (high-risk devices) into class II (special controls) in 2014: the FDA pointed out that the advantages of blade-form implants outweigh their disadvantages.[3] This fact suggested that blade implants could be successfully used after a careful revision of the surgical technique and after the redefinition of the implant micro- and macro-structure.[4] The purpose of this retrospective case series was to evaluate conventionally loaded commercial newly-designed extension blade-form implants (Sweden & Martina s.p.a., Due Carrare, PD, Italy) survival and success rate at a 1-year evaluation in a population of patients in need of a single implant in the moderate atrophic posterior maxilla.

Materials and methods

Retrospective patients' selection

The present study was a retrospective case-series of patients treated between 2014 and 2016. Patients presented moderate bone atrophy in the posterior maxilla, defined by the authors as a minimal residual ridge height of 4 mm in the alveolar process.

Patients were included in the retrospective analysis if they fulfilled the following inclusion criteria:

- At least 18 years old;
- Presence of mesial tooth free from infections;
- Treatment for single edentulism in the posterior maxilla;
- Adequate bone volume for placement of extension implant;

Patients were excluded if the case sheets showed the following:

- Compromised general health conditions or use of drugs that would interfere with the osseointegration process;
- Severe inter-maxillary discrepancy;
- Severe parafunctional habits;
- Smoking more than 10 cigarettes/day.

The study was conducted according to the principles embodied in the Helsinki Declaration of 1975, and revised in the 2000, for biomedical research involving human subjects. Since the authors analyzed preexisting, and no identifiable data of patients, which were all informed about nature of the data treatment and their written consent was obtained prior to participation; present retrospective data analysis did not require approval by a review board.

Data regarding clinical aspects and periapical/panoramic radiographs of included subjects were gathered and evaluated.

Surgical protocol

All the implants used were extension blade-form implants. The implant had a platform with a 2.4 mm external hexagon of a height of 1.0 mm with a M 1.8 thread. The maximum height was 5.3 mm; the maximum width was 8.0 mm (Fig. 1). The rough superficial area was 98 mm^2.

A minimal ridge crest incision was made in the edentulous posterior maxilla in order to limit the damage of the periosteum vascular network. The surgical site was prepared using standard drills with increasing diameters (from 2 mm to 2.8 mm) according to the manufacturer's instructions.

The final core preparation was performed with a 3.3 mm drill reaching 4 mm in height and at the end a mini-sinus lift was conducted (if needed). The lateral lodging for the blades was guided using a piezo-surgery device (Fig. 2A) with slight oblique direction taking into account the buccopalatal slope and the width of the residual alveolar crest; the final position was performed with the Magnetic Mallet (Sweden & Martina s.p.a., Due Carrare, PD, Italy; Fig. 2B) to achieve primary stability. Implants were placed with their platform at the bone crest level, cover screws were applied and flaps sutured to fully submerge the surgical sites (Fig. 2C and D).

Patients were instructed to follow antibiotic and anti-inflammatory therapy. The use of removable prosthesis was generally not allowed until the complete soft tissue healing was completed. Suture was removed 10 days after implants placement.

After 3 months of submerged healing, implants were exposed, and impressions were taken using an individual tray with polyvinyl siloxane material (Flexitime, Heraeus Kulzer). Final metal-ceramic restorations were cemented on customized implant abutments. All the implants were restored with single crown rehabilitation.

Population descriptive factors

The clinician collected important descriptive information of the population: age, gender, smoking habits, systemic diseases, pharmacological therapies, location of the implant.

Variables

All measurements were acquired by a blind investigator immediately after implant placement (baseline), at 3 months and 12 months:

Figure 1 Macroscopic figure depicting the details of the blade implant used in the study (Sweden & Martina s.p.a., Due Carrare, PD, Italy).

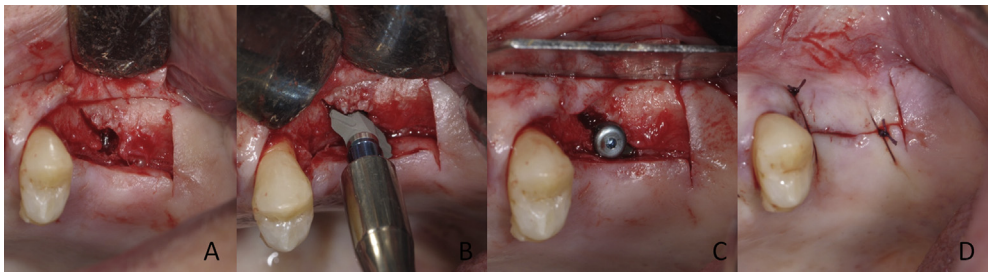

Figure 2 A: Surgical site after initial preparation. B: Placement of the implant. C: The implant is fitted into the osteotomy site with the aid of an electro-magnetic device. D: Suture of the surgical site.

Marginal Bone Level (MBL) with changes respect to baseline value ($\Delta MBL = MBL_{postoperative} - MBL_{baseline}$) at 3- and 12-month survey was evaluated on intraoral radiographs (Fig. 3). Variables represented the mean of mesial and distal aspects. A paralleling device and individualized bite blocks were used for the standardization of the x-ray geometry.

Implant failure and Cumulative Survival Rate (CSRs). Implant failure represented the complete loss of the implant due to any mobility and/or any infection; Cumulative Survival Rate (CSR) was accordingly calculated.

Data analysis

Data were inserted into a software for statistical analysis (Stata 12.0. StataCorp LLC 4905 Lakeway Drive College Station, Texas 77845-4512 USA) computing descriptive statistics and pair wise analysis. The Shapiro—Wilk test was used to confirm normal distribution of the data related to each numerical variable for each follow-up time point. Pair wise comparisons were performed using the Wilcoxon signed-rank test for matched pairs. The level of statistical significance was set at 0.05 for all analyses.

Results

A total of 40 patients (Table 1) were included in the present retrospective. In total, 40 extension implants were placed in the moderate atrophic posterior maxilla (8 implants placed in premolar sites and 32 implants in molar sites). Results describing the marginal bone loss are reported in Table 2.

Difference between the marginal bone level at the 3-month evaluation (5.57 ± 0.67 mm) and that at baseline (5.67 ± 0.55 mm) appeared to be not significant (p-value = 0.63). At the 12-month evaluation, the marginal bone level (4.95 ± 0.45 mm) underwent significant decrease respect to baseline value as proven by significant change at marginal bone level ($\Delta MBL_{baseline \rightarrow 12month} = -0.62 \pm 0.51$ with a p-value of 0.01).

With respect to complications, one implant was lost within the first year because of an infection. Accordingly, the cumulative survival rate at 12 months was 97.5%.

Discussion

When an adequate amount of bone is missing, and it is not always possible to augment the bone volume beneath the sinus due to specific patients' contraindications,[5] the use of tilted implants or extension blade-form implants might be a smart alternative to avoid the sinus augmentation. Unfortunately, tilted implants require the use of angled abutments that have been associated to an increase stress to the surrounding bone.[6] A very recent study reported a survival of 100% and a good esthetic integration for custom-made implants fabricated with selective laser sintering technique and placed in the extremely atrophied posterior (< 4 mm width) mandible.[7] In another report, Strecha and co-workers collected one failure out of 84 blade implants placed in the lateral area of the mandible (survival rate of 98.8%).[8] The present 12-months retrospective case-series has evaluated the clinical and radiological outcomes of 40 blade implants placed in moderately atrophic posterior maxillae. The cumulative survival rate at 12 months was 97.5%. Authors reported a failure due to infection, and it occurred in the only smoker of the population study. The measured marginal bone loss at 12 months was 0.62 ± 0.51 mm and it agreed with previous published literature on standard implants placed in the posterior maxilla.[9]

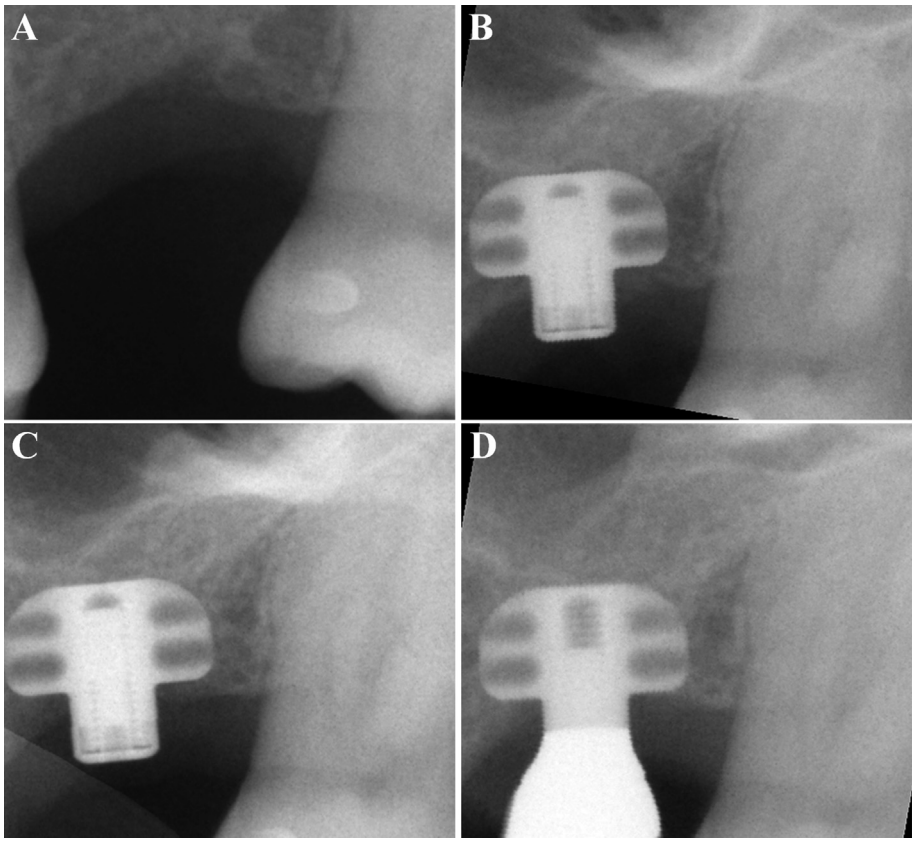

Figure 3 Intraoral radiographs: (A) before implant placement; (B) just after implant placement; (C, D) then at 3 and 12 months after implant placement.

Table 1 Demographic data of study population. Implant success and survival rates.

Descriptive variable	Value
Number of patients	40
Males/Females	4/36
Mean Age (year)	64.3 ± 9.25
Number of implants	40
Survival at 1 year (%)	97.5

Table 2 Mean and standard deviation of Marginal Bone Level (MBL) and its change (ΔMBL) in mm.

Follow-up (time) Variable	Baseline	3 months	12 months
MBL in mm	5.67 ± 0.55	5.57 ± 0.67	4.95 ± 0.45
ΔMBL in mm		-0.08 ± 0.71	-0.62 ± 0.51
Significance		0.63	**0.01**

Significant p-values are reported in bold.

With all the limitations of the present study (study design, the absence of a control group, no possibility to check for internal validity, and short-term), extension implants showed a positive clinical outcome, comparable to that of standard implants. The patients enrolled in the present study consisted mainly of females with a mean age of 64.2 years which may be too forgiving to the outcomes of interest. Reich and colleagues, in their histo-morphometric analysis of the regenerated bone in grafted sinus, highlighted that age (over 60 years) and sex (female) does affect sinus augmentation outcomes.[10] The results of the present study could support further investigations in randomized clinical trials design for the use of extension implants in patients with multiple risk factors (negative prognostic variables). The use of extension implants might preserve patients from several surgeries and adjunctive cost, reducing treatment time and patients' discomfort.

Declaration of Competing Interest

The authors claim to have no financial interest, either directly or indirectly, in the products or information listed in the paper.

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None.

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