

Bone regeneration using an ultra-short implant in a periodontal patient: 15 years of follow-up

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Abstract

Introduction: Managing implants in patients with chronic periodontitis and severe post-extraction bone atrophy presents a significant clinical challenge. Using ultra-short (≤ 6 mm) implants combined with bone regeneration techniques provides a minimally invasive alternative to sinus lift procedures, but requires strict protocols to ensure long-term stability.

Case report: We present the case of a 45-year-old patient with chronic generalized periodontitis, 2.7 element loss, and advanced periodontal deterioration. After causal and surgical periodontal treatment, an extraction was performed, followed by socket preservation with heterologous biomaterial and resorbable membrane. After 6 months, an ultra-short endosseous implant (3.8 x 6 mm, MRS surface) was placed in site 2.7. Prosthetic rehabilitation was conducted in two stages: a temporary resin crown and a subsequent zirconia definitive crown. The patient was enrolled in a structured periodontal maintenance protocol.

Discussion and conclusions: After 15 years of follow-up, the implant appears to be fully osseointegrated, with stable peri-implant probing (1.5 mm), no radiographic bone loss, and no clinical signs of peri-implantitis. Biomechanical management, occlusal control, and periodontal monitoring were crucial for the favorable prognosis. This case report demonstrates that even in patients with previous periodontal disease and severe posterior maxillary atrophy, using ultra-short implants combined with pre-implant bone regeneration can lead to predictable and stable long-term results. This is especially true when strict periodontal management and prosthetic customization are maintained. Therefore, ultra-short implants provide a viable treatment option in cases where more invasive surgical procedures are contraindicated.

Keywords: ultra-short implants, bone regeneration, periodontitis, MRS, 15-year follow-up, socket preservation, posterior implantology, maxillary atrophy.

Introduction

The loss of one or more dental elements leads to progressive alveolar ridge resorption, a multifactorial phenomenon influenced by factors such as age, sex, presence of systemic diseases (e.g., diabetes mellitus and osteoporosis), genetic predisposition, and the patient's periodontal health. Additionally, the time between tooth extraction and subsequent implant treatment is a critical factor: the longer the elapsed time, the less residual bone is available for placing standard-length implants¹. One of the most effective strategies to combat post-extraction bone loss is socket preservation. This technique



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helps maintain the integrity of the marginal bone peaks around the extraction site, which undergo minimal remodeling compared to the significant resorption seen without regenerative intervention. In the literature, an average bone loss of 43% is estimated within one year of tooth loss without regenerative techniques².

However, even when preservation techniques partially maintain alveolar bone, it is important to consider the specific anatomical relationships of the implant site. The present clinical case features two additional critical issues: a residual distance between the alveolar ridge and sinus floor of ≤ 5 mm and generalized periodontal disease stage³⁻⁴. In this work, we describe the implant rehabilitation of a single edentulous site located in the left posterior sector of the upper jaw using bone regeneration combined with the placement of an ultra-short implant⁵. The clinical results highlight how, in cases of severe posterior bone atrophy and patients with a history of periodontal disease, adopting strict surgical, prosthetic, and maintenance protocols allows for successful rehabilitation with short-length implants. Such devices are therefore a viable treatment option when the patient's anatomical and systemic conditions limit the use of long implants⁶.

Case Report

A 43-year-old female patient visited our clinic in 2010 for an assessment of severe furcation exposure and significant mobility of tooth 2.7, as part of diagnosing generalized chronic periodontitis.

The patient received nonsurgical periodontal therapy to eliminate residual periodontal pockets and achieve a Bleeding on Probing (BOP) index of less than 25% throughout the oral cavity. The medical history was free of relevant systemic diseases.

First-level radiographic investigations included an orthopantomogram (OPT) and a comprehensive periodontal radiographic assessment (Figure 1). The radiographic evaluation, supplemented by

the periodontal survey (Figures 2-3), enabled the development of a treatment plan that began with an initial phase of nonsurgical etiologic therapy, followed by a clinical reassessment at two months. This reassessment focused on monitoring gingival bleeding and assessing furcations.

In areas where pockets deeper than 5-6 mm and grade I or II furcation involvements remained, periodontal surgery with access flaps was performed. The flap was conducted in the left upper sextant at the end of the conservative surgical phase, which extended to both arches.

During the intraoperative phase, a grade III pass-through furcation was associated with significant mobility (grade III) of the 2.7 element. Due to the severely compromised clinical situation, removal of the dental component was performed during the same surgical procedure. Post-extraction socket exploration revealed a bony defect distal to element 2.6, which showed no clinical signs of periodontal involvement.

After the site was revised, guided tissue regeneration (GTR) was performed by filling the socket with deproteinized heterologous bone (Bio-Oss® spongiosa) and covering the defect with a resorbable collagen membrane (Figure 4). Surgical closure was achieved using staccato and cross-stitch sutures, with partial membrane exposure to preserve the approximately 2 mm wide vestibular keratinized gingiva line.

After a six-month healing period (Figure 5), a WinSix® endosseous implant (Biosafin), with a 3.8 mm diameter and 6 mm length, TTX connection, was placed (Figure 6). After four months, the implant was activated and restored with an angled titanium abutment and a temporary resin crown (Figure 7).

Single or multiple implant prosthetic rehabilitation in patients with periodontitis is only recommended if the bacterial load in the residual periodontal pockets is adequately controlled. However, the implant prosthesis must not cause functional overload during mastication.



Figure 1. Initial orthopantomography (year 2010).

RODONTOLOGIA

Data: 22/4/2010

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mpianto																		
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stibolare		8	9	2	3	2	2	2	3	2	2	2	2	2	2	2	2	2
latale		8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	
genitiva:	1	212	212	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

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Superiore

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genitiva:	1	1	X	221	121	1	1	121	121	121	131	141	1	X	1	1		
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stibolare	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
latale	8	7	X	5	4	3	2	1	1	2	3	4	5	X	7	8		
uq.	3	2	2	2	5	2	2	2	2	2	2	2	2	2	2	2	2	2
genitiva:	1	1	X	211	121	1	1	121	121	131	121	121	1	1	X	1	1	1

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Inferiore

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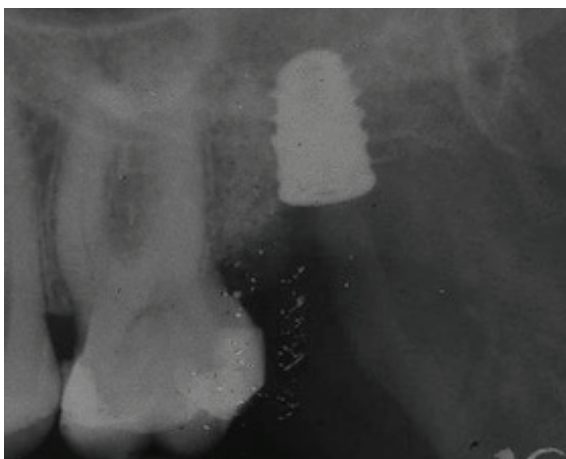


Figure 6. Endoral X-ray after implant placement (year 2012).

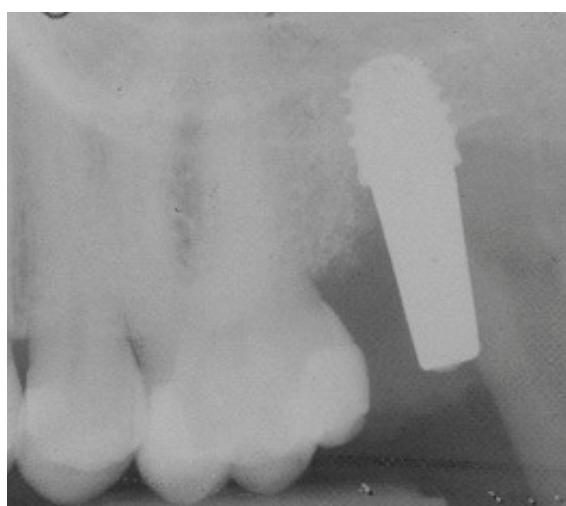


Figure 7. Endoral X-ray of prosthetic implant (year 2013).

From a biomechanical perspective, it is essential to understand that a natural tooth with attachment loss exhibits an intrusive mobility of about 40 microns through the periodontal ligament. In comparison, the excursion of an osseointegrated implant is limited to approximately 2-4 microns. The implant must perform a controlled occlusal function, avoiding any overload. The initial use of a resin crown with an elastic modulus of around 60 MPa helps cushion occlusal loads during the early stages of osseointegration while waiting for lamellar bone maturation, which, according to literature, is completed no earlier than 6-8 months. In the second phase, a replacement with a definitive metal-ceramic crown is planned (7-8). After six months, the definitive prosthesis was placed (Figure 8), with a peri-implant periodontal probing of 1.5 mm, indicating tissue stability.

A control intraoral X-ray was taken every three years, showing no evidence of bone loss, and peri-implant probing remained unchanged (Figures 9-10-11-12).

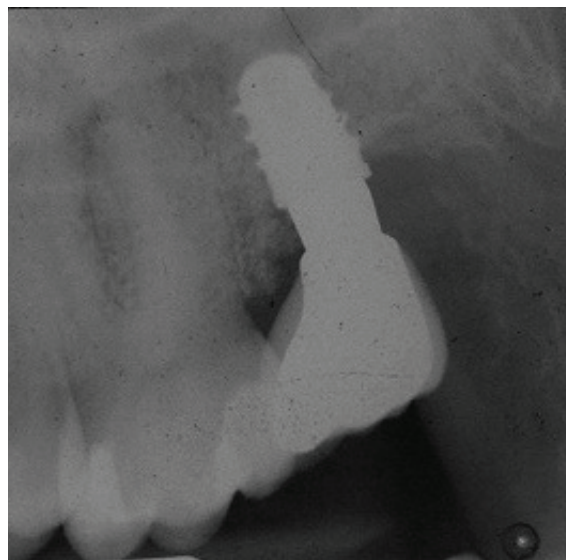


Figure 8. Final prostheses (2013).

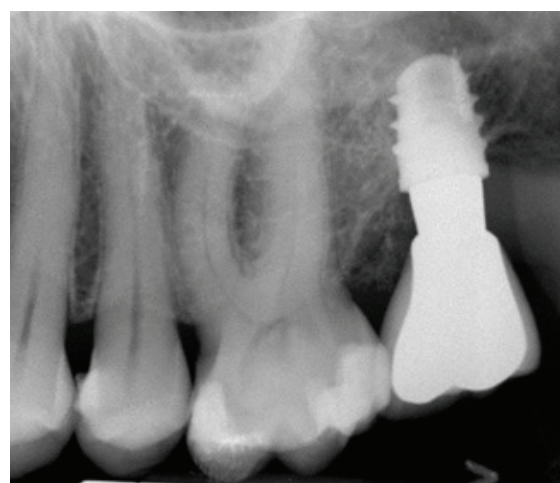


Figure 9. Control X-ray 3 years after surgery (2016).

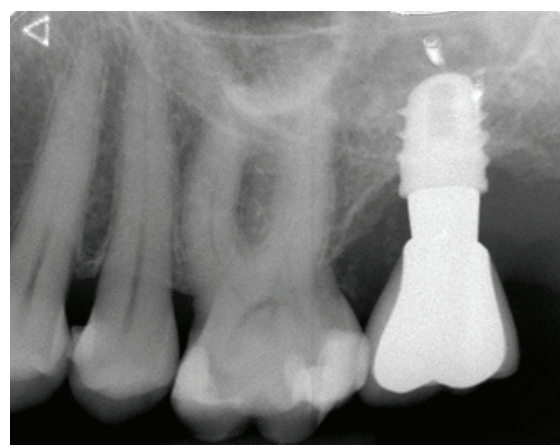


Figure 10. C Control endoral X-ray 6 years after surgery (2019).

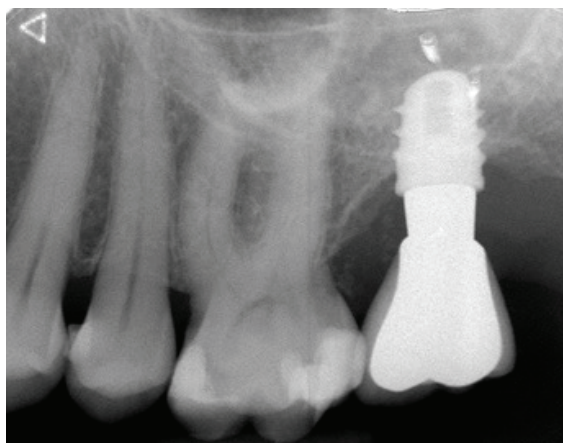


Figure 11. Control endoral X-ray 9 years after surgery (2022).

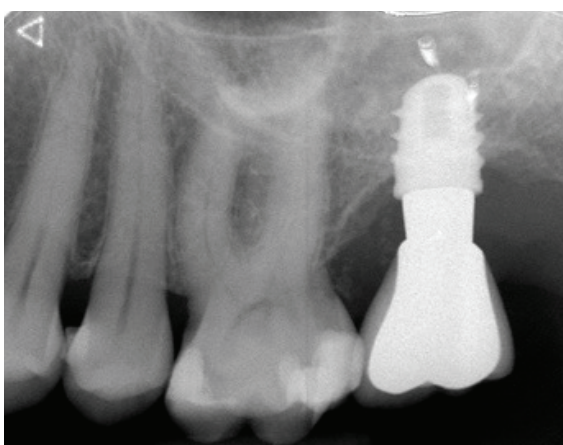


Figure 12. Control endoral X-ray 15 years after surgery (year 2025).

Discussion

The biomechanical principle that justifies using short implants is that the most coronal part of the interface between bone and osseointegrated implant is responsible for absorbing most prosthetic loads ⁹. This also allows short implants to be effectively used in areas with severe alveolar atrophy, ensuring success and survival rates comparable to those achieved with longer implants following bone regeneration procedures ¹⁰⁻¹¹.

The present study emphasizes the effectiveness of using an ultra-short MRS (Micro Rough Surface) implant for rehabilitating a severely atrophic site in periodontal disease. This type of implant surface can enhance the bone-implant contact (BIC), thereby providing a larger area for distributing masticatory forces and reducing stresses at the interface between bone and implant ¹²⁻¹³. However, the main limitation of a rough surface is its increased susceptibility to bacterial biofilm adhesion. This factor predisposes to the development of peri-implantitis when exposed to the oral cavity. The risk is

further heightened in patients with a previous history of periodontal disease ¹⁴.

The case report demonstrates how careful and coordinated surgical, prosthetic, and hygienic management can ensure the long-term success of ultra-short MRS implants, even in difficult clinical conditions. The success of these treatments depends on several key factors.

Firstly, the entire porous surface portion and at least 0.5 mm of the smooth coronal area of the implant must be fully immersed in bone tissue ¹⁵. The peri-implant bone ridge should also be at least 1.5 mm thick to prevent bacterial colonization of the wrinkled area ¹⁶. To preserve the remaining basal bone and avoid sinus lift procedures, a bone regeneration method using the socket preservation technique, performed immediately after extraction, was selected 17-18.

This procedure aims to preserve post-extraction bone and tissue volumes, limit physiological alveolar resorption, and maintain optimal conditions for future implant placement. Bone regeneration fills defects and reinforces the vestibular and palatal bone components, creating a favorable osteogenic environment essential for proper implant positioning from functional and aesthetic viewpoints.

Secondly, the biomechanics of implant-supported prosthetic structures are crucial for long-term prognosis. Viewing the height of the crown as a vertical cantilever, it is essential to keep the crown-to-implant ratio below 3.1 to prevent peri-implant bone loss ²¹ and to avoid screw loosening or fracture caused by functional overload ²². It is also essential to carefully monitor the occlusion in the centric position and during eccentric movements at each periodic check-up, especially in patients with a history of periodontal disease. In these patients, increased tooth mobility combined with impaired periodontal proprioception may, over time, lead to changes in occlusal contacts, resulting in precontacts on implants and excessive loads.

Therefore, implant occlusion should only be adjusted once contacts with natural teeth are stabilized at the maximum intrusion level. It is also essential to establish and maintain proper contacts in centric relation and to ensure incisal guidance through canine guidance or a reciprocally protected occlusion. This helps distribute forces along the implant axis and prevents lateral loads during all mandibular movements ²³.

Finally, it is essential to remember that the MRS surface has the drawback of promoting bacterial biofilm adhesion, which increases the risk of developing and progressing peri-implantitis, especially in individuals with previous periodontal disease ²⁴. Therefore, after causal therapy, it is crucial to ensure that no residual pockets have probing depths greater than 5 mm, that any furcations are clinically stable and easy to clean, and to achieve a bleeding on probing (BOP) rate of less than 25% throughout the entire mouth ⁶. At the same time, strict adherence to a structured periodontal maintenance protocol is vital to ensure these rehabilitations' long-term success and minimize the risk of early failure due to peri-implantitis, particularly with short implants.

Conclusions

In conclusion, the clinical case described shows that even in challenging anatomical and periodontal conditions, predictable and lasting results are possible with ultra-short implants, as long as strict clinical protocols and personalized planning are followed. Pre-implant bone regeneration is a strategy to maintain residual bone volume and facilitate implant placement in severely atrophied areas, avoiding more invasive procedures like sinus lift. Proper biomechanical management—through correct crown-implant relationships and careful occlusion adjustments—is essential to reduce functional stress and prevent long-term prosthetic and biological issues. However, it is important to recognize the higher risk of peri-implantitis linked to the MRS rough surface, especially in patients with previous periodontal disease. Therefore, patient selection must be thorough and based on achieving good periodontal control along with strict maintenance therapy. From these findings, it can be concluded that ultra-short implants are a viable treatment option for rehabilitating posterior regions with severe bone loss and chronic periodontal disease, provided they are placed in a well-managed clinical setting and with rigorous ongoing supervision.

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