Rehabilitation of a traumatic single-tooth defect in the anterior maxilla using guided bone regeneration and a bone level implant

Piero Papi[1]

Introduction

Single-tooth replacement in the anterior maxilla is described as one of the most challenging indications in implant dentistry, particularly when associated with traumatic tooth loss and advanced alveolar ridge deficiencies. From an ITI treatment perspective, the anterior maxilla represents a high-risk esthetic site, where implant positioning, peri-implant hard- and soft-tissue stability, and prosthetically driven planning are critical determinants of long-term clinical success.

Traumatic avulsion of anterior teeth is frequently followed by rapid resorption of the alveolar ridge and collapse of the buccal bone plate, resulting in combined vertical and horizontal defects. In such situations, implant placement in a prosthetically ideal position is often not possible without prior ridge augmentation. Guided bone regeneration (GBR) is a well-documented approach for the reconstruction of localized alveolar defects; however, its predictability is closely linked to appropriate case selection, surgical technique, and the use of biomaterials that ensure space maintenance, volume stability, and favorable biological integration.

Xenogeneic bone substitute materials with low resorption rates, such as Cerabone® Plus, are commonly used to support volume preservation during GBR procedures. When combined with resorbable barrier membranes, including magnesium-based membranes such as NOVAMag®, the regenerative environment can be stabilized while allowing gradual membrane degradation in accordance with physiological bone



Figure. 1



Figure 2

[1] Dr. Piero Papi, DDS, PhD, MSc
Dentist, Oral Surgery Specialist.
Researcher, Dept of Oral and Maxillo-facial Sciences
Sapienza University of Rome, Italy



Figure 3



Figure 4



Figure 5

healing processes. This combination supports predictable hard-tissue regeneration in esthetically demanding regions.

Implant placement in regenerated bone presents additional biological and mechanical considerations, particularly with respect to achieving sufficient primary stability. High primary stability is a prerequisite for immediate or early provisionalization, which is often indicated in the anterior maxilla to support peri-implant soft-tissue conditioning and esthetic outcomes. The Straumann BLX™ implant, Roxolid®, and featuring a self-cutting macro-design with an SLActive® surface, is designed to facilitate high insertion torque and predictable primary stability, including in regenerated or compromised bone conditions, in accordance with the manufacturer's instructions for use.

When applied within the Straumann iEXCEL™ Implant System, the BLX implant allows integration of digital planning, static computer-assisted surgery, and prosthetically driven implant placement. This workflow supports accurate three-dimensional positioning of the implant in relation to the planned restoration and contributes to optimized restorative and biological outcomes.

The following case report describes the staged rehabilitation of a single-tooth defect in the anterior maxilla following traumatic avulsion, combining guided bone regeneration using Cerabone® Plus and NOVAMag®, followed by computer-assisted placement of a Straumann BLX™ implant using the iEXCEL workflow. The clinical outcome demonstrates stable hard- and soft-tissue conditions, successful immediate provisionalization, and satisfactory esthetic integration. This case provides clinically relevant insights for clinicians managing complex anterior implant cases with high esthetic risk profiles.

Initial situation

The patient was a 35-year-old male who presented to our clinic as an emergency case after an accident that resulted in the complete avulsion of tooth 11. The patient sought esthetic and functional rehabilitation of the maxillary anterior region following the traumatic tooth loss. Associated soft tissue injury was noted, including trauma to the upper and lower lips (Figs. 1,2).

His primary expectation was to achieve an optimal esthetic outcome, while maintaining proper function and a restoration that could be easily cleaned and remain healthy over time.

From a systemic health perspective, the patient was classified as ASA I, with no history of systemic disease. He reported no relevant risk factors, including smoking, and was not taking any medication.

On clinical evaluation, the patient demonstrated good oral hygiene, with minimal plaque and no signs of active inflammation. No other periodontal problems were noted, and there was no history of periodontitis. The absence of tooth 11 was observed, with clinical evidence of alveolar bone loss on the buccal wall (Figs. 3-5).

Radiographic analysis revealed the absence of tooth 11, accompanied by alveolar bone loss (Figs. 6a,b).

The remaining teeth appeared healthy, with a favorable prognosis. Clinical and radiographic evaluation revealed no signs of other pathology.



Figure 6a

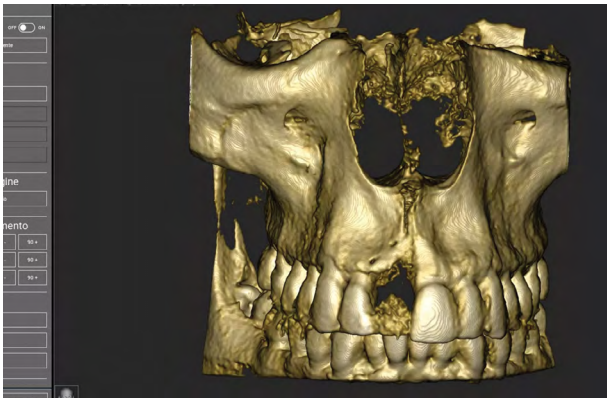
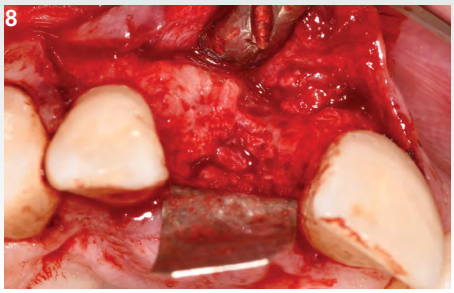
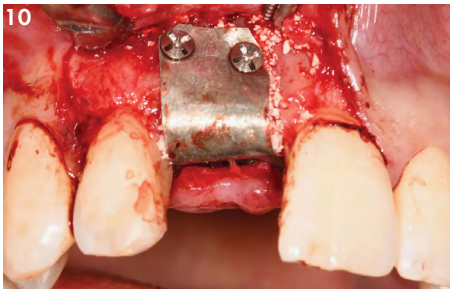
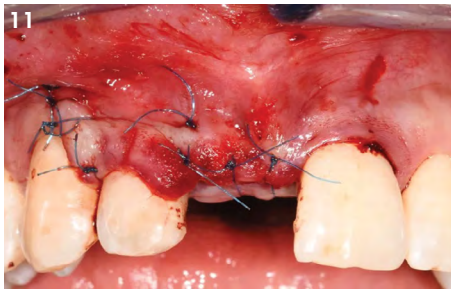


Figure 6b

Figures 7 - 11

Treatment planning

- Guided bone regeneration of the defect using NOVAMag® membrane and Cerabone® Plus.
- Healing period of 6 months.
- CBCT to virtually plan implant position.
- Selection of a BLX Implant, Ø 3.75 mm, SLActive® 12 mm, Roxolid® dental implant.
- Static computer-assisted implant placement, digital impression using a Straumann® RB Scanbody after implant placement.
- Delivery of a screw-retained temporary restoration in PMMA after a few hours.
- Osseointegration period of 3 months and healing of soft tissues.
- Delivery of final screw-retained restoration in zirconia with a minimal vestibular cut-back design and a small layer of ceramics.

Surgical procedure

Before surgery, the patient underwent standard preoperative preparation. Local anesthesia was achieved through infiltration in the anterior maxilla.

A full-thickness mucoperiosteal flap was raised using a mid-crestal incision with releasing incisions, allowing adequate access and tension-free closure. This approach provided clear visualization of the defect and facilitated precise management of both hard and soft tissues. Upon flap elevation, a combined vertical and horizontal bone defect was observed at the site of tooth 11, classified as a class III Seibert defect, affecting both ridge height and width. Bone quality in the maxilla was evaluated as D2, with dense cortical bone and a coarse trabecular structure, suitable for implant placement.

Then the NOVAMag® membrane was carefully positioned to stabilize the grafted area and maintain space for optimal regenerative outcomes (Figs. 7,8).

The combined vertical and horizontal bone defect was then filled with Cerabone® Plus, ensuring complete adaptation of the biomaterial to the defect morphology (Fig. 9). The membrane was subsequently fixed using titanium screws to prevent micromovement and to ensure stability during the healing phase (Fig. 10).

Proper fixation allowed predictable guided bone regeneration and supported optimal regeneration conditions. Following membrane stabilization, the flap was repositioned and sutured using tension-free primary closure to promote uneventful healing (Fig. 11).

Postoperative care included standard analgesic and anti-inflammatory medication, as well as appropriate oral hygiene instructions. The patient was scheduled for regular follow-up visits to monitor wound healing, which progressed without complications.

Following the surgical procedure, the site underwent a six-month healing period. After this period, a CBCT scan was obtained and analyzed using coDiagnostiX®, which revealed sufficient bone volume and quality to accurately plan the implant placement. A BLX implant Ø 3.75 mm,

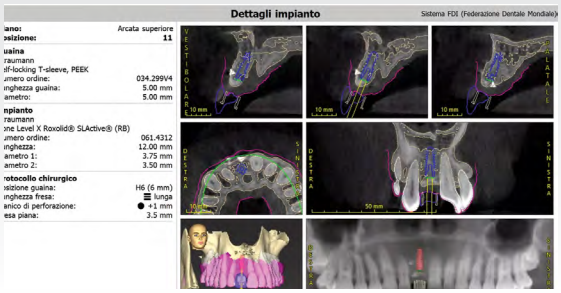


Figure 12



Figure 13

SLActive® 12 mm, Roxolid® was then selected (Fig. 12).

Prior to implant placement, a try-in of the surgical template was performed to verify its proper fit and to confirm the accuracy of the planned implant position (Fig. 13).

Local anesthesia was administered in the anterior maxilla, and a full-thickness mucoperiosteal flap was then elevated to provide optimal access and visualization for implant placement (Figs. 14,15).

The BLX implant Ø 3.75 mm, SLActive® 12 mm, Roxolid® was placed using static computer-assisted implant placement with the Straumann iEXCEL™ Implant System, following the manufacturer's instructions. After placement, the implant position was clinically verified to ensure accurate three-dimensional alignment. An occlusal view confirmed that the implant was properly seated within the regenerated bone, demonstrating sufficient bone volume and support achieved through the prior regenerative procedure (Figs. 16,17).

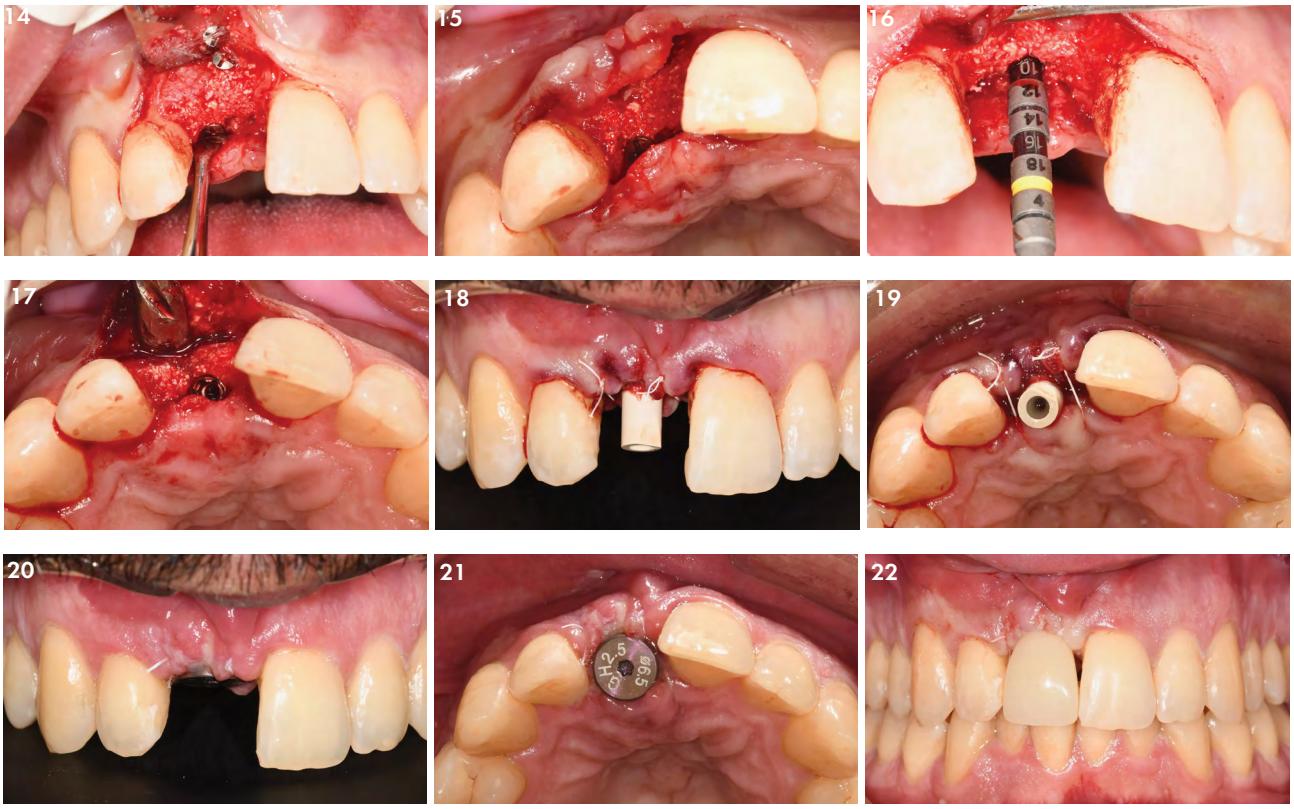
After implant placement, a Straumann® RB Scanbody was positioned to take a digital impression, allowing for immediate loading (Figs. 18,19).

Subsequently, a healing abutment was placed to support the peri-implant soft tissue before delivering the provisional restoration (Figs. 20,21).

Prosthetic procedure

A screw-retained temporary restoration in PMMA was delivered a few hours after placement of the healing abutment. The provisional was left out of occlusion and the patient was closely monitored during the healing phase (Fig. 22).

Following a three-month osseointegration period and adequate healing of the peri-implant soft tissues, the final screw-retained restoration in zirconia was delivered. The prosthesis featured a minimal vestibular cut-back design with a thin ceramic layer, allowing optimal esthetic integration with the surrounding dentition. The final restoration demonstrated



Figures 14 - 22



Figure 23



Figure 24

excellent marginal adaptation, stable peri-implant soft tissue contours, and harmonious functional occlusion, successfully meeting the high esthetic demands of the anterior maxillary region (Figs. 23,24).

Radiographic evaluation confirmed the final position of the restoration, showing accurate implant placement, stable crestal bone levels, and proper adaptation of the prosthesis (Fig. 25). The patient's smile looked very natural, and he was extremely satisfied with the result (Fig. 26).

Treatment outcomes

The final outcome showed excellent functional and esthetic integration in the anterior maxilla. Hard and soft tissues were stable, with harmonious gingival contours and a natural restoration. The treatment met the patient's esthetic expectations and clinical goals, resulting in a predictable and satisfying rehabilitative result.

The patient expressed high satisfaction with the outcome, stating, "I am extremely satisfied with the treatment. My smile looks natural again, and I feel much more confident after the rehabilitation of my front tooth.

Key take-aways

- Using a Straumann BLX™ implant with the iEXCEL Implant System allowed predictable rehabilitation of a complex anterior maxillary case with combined vertical and horizontal bone defects in the esthetic zone.
- The BLX implant design offered high primary stability in regenerated bone, enabling a prosthetically driven approach and immediate provisionalization in a demanding esthetic area.
- Careful surgical and digital planning with the Straumann iEXCEL™ workflow contributed to stable hard- and soft tissue outcomes, resulting in functional success and high patient satisfaction.

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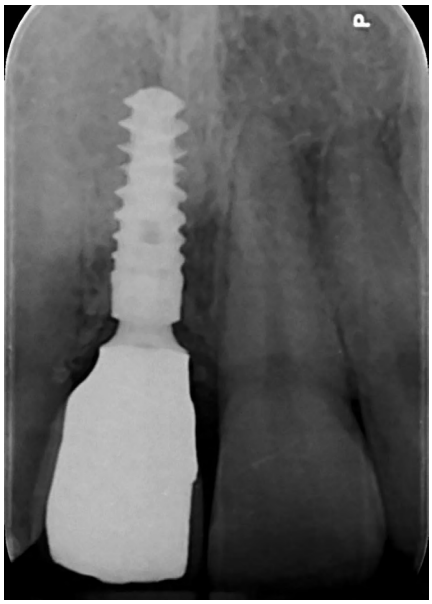


Figure 25



Figure 26