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Multidisciplinary Rehabilitation of The Anterior Esthetic Zone with Immediate Implant, Gbr, L-Prf, and Connective Tissue Grafting: Case Report

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Abstract

Introduction

Rehabilitation of the anterior aesthetic zone remains one of the most challenging scenarios in implantology, as it requires the integration of biological tissue stability, functional performance and optimal aesthetic results; however, post-extraction remodeling and soft tissue deficiencies can compromise the final results.

Objective

To present a multidisciplinary protocol for anterior esthetic zone rehabilitation using immediate implant placement (II) combined with guided bone regeneration (GBR), guided tissue regeneration (GTR), leukocyte- and platelet-rich fibrin (L-PRF), connective tissue grafting (CTG), and gingivoplasty.

Materials and Methods
A 28-year-old male patient presented with an avulsed and coronally fractured tooth #11 due to trauma. Following comprehensive diagnosis, an II was placed post-extraction. The residual gap was grafted with a xenograft combined with L-PRF membranes. Soft-tissue augmentation was performed using a CTG and gingivoplasty to optimize peri-implant tissue contours.

Results
The patient was successfully rehabilitated with a definitive screw-retained ceramic prosthesis, achieving a harmonious emergence profile and satisfactory aesthetic integration. Peri-implant bone and gingival architecture were favorably restored, meeting biological, functional, and aesthetic demands.

Conclusions
The integration of immediate implant placement with combined hard- and soft-tissue regenerative techniques resulted in predictable clinical outcomes in the anterior esthetic zone. This multidisciplinary approach may serve as a viable treatment option when clinical conditions are favorable.

Keywords
Immediate implant; Guided bone regeneration; Guided tissue regeneration; Fibrin-rich plasma; Case report.

Introduction
Traumatic dental avulsion and fractures cause alterations in both hard and soft peri-dental tissues, particularly in the anterior region, leading to significant aesthetic, functional, social, and psychological consequences for the patient. Among the therapeutic options to preserve alveolar architecture in the esthetic zone and restore harmony with the adjacent dentition, immediate implant (II) rehabilitation has become essential.

II placement requires an extraction socket with intact bony walls, as the implant is inserted during the same surgical procedure in which the tooth is removed. This approach offers several advantages, including fewer surgical interventions, shorter healing time, and better preservation of the alveolar bone architecture [1]. An important factor to consider is the space between the implant surface and the alveolar wall (GAP), to overcome this problem and induce bone neoformation in these spaces we use Guided Bone Regeneration (GBR), which uses various bone grafts and substitutes to facilitate osseointegration [2].

Combining GBR with guided tissue regeneration (GTR) for soft-tissue defects provides considerable aesthetic benefits. Without filling the post-extraction gap, physiological resorption of the alveolar ridge in both height and width occurs, inevitably leading to gingival collapse. GTR involves the use of gingival grafts or xenografts to naturally restore tissue volume during healing. One of the most promising strategies within tissue engineering for accelerating peri-implant tissue regeneration is the combination of GBR/GTR with leukocyte- and platelet-rich fibrin ((L-PRF) [3].

L-PRF, as a second generation platelet concentrate, provides a dense fibrin matrix containing growth factors, adhesive proteins, leukocytes, and fibrinogen obtained from centrifuged autologous blood. This scaffold promotes the migration of mesenchymal cells, fibroblasts, and epithelial cells, thereby

enhancing wound healing, accelerating tissue regeneration, and reducing postoperative inflammation and pain [4].

Furthermore, to refine peri-implant soft-tissue contours and achieve an optimal emergence profile, adjunctive procedures such as connective tissue grafting (CTG) and gingivoplasty are often necessary. CTG enhances vestibular volume and keratinized tissue width, while gingivoplasty sculpts the gingival architecture for harmonious integration with adjacent teeth [5].

In light of these considerations, this case report describes a multidisciplinary approach for rehabilitating the anterior esthetic zone using II combined with GBR, GTR, L-PRF, connective tissue grafting (CTG), and gingivoplasty.

Case Report

A 28-year-old male patient with melanoderma presented for dental care, reporting pain and aesthetic dissatisfaction in the anterior region. His quality of life was notably affected due to embarrassment when smiling, resulting in aesthetic, social, and psychological discomfort (Figure 1).

Figure 1: Clinical presentation, with adequate buccal bone volume and thick periodontal biotype.

A comprehensive anamnesis, extra- and intraoral clinical examination, and radiographic evaluation were performed. Tooth #11 exhibited avulsion, a coronal fracture, and root resorption as a consequence of childhood trauma. Periapical radiography revealed previous endodontic treatment and significant vertical bone loss, which contraindicated preservation of the tooth. The patient reported no systemic diseases or relevant medical history. Based on the diagnostic findings, II placement at the time of extraction was recommended to preserve the existing bone and gingival architecture in this aesthetic zone, along with periodontal plastic surgery to maintain an appropriate gingival zenith (Figure 2).

Figure 2: Atraumatic extraction of tooth #11.

Periodontal probing revealed pocket depths of less than 4mm. Surgical planning confirmed several favorable prognostic factors, including intact proximal bone crests, sufficient buccal bone volume, and a thick periodontal biotype, all deemed satisfactory for immediate implant placement. Prosthetically, a screw retained restoration with screw access at the cingulum level was selected to optimize implant anchorage and stability, given the greater bone volume in this area and the potential for preserving the buccal bone plate. Following informed consent, the surgical procedure was initiated.

Infraorbital, terminal infiltrative, and palatal anesthesia were administered. A syndesmotomy was then performed to release gingival fibers and access the periodontal ligament, which was carefully dissected using a 15c scalpel blade (Swann-Morton®, Sheffield, England). This technique allowed disruption of the gingival contour while preserving papillary position, minimizing bone loss and maintaining the existing concave architecture. An atraumatic extraction of tooth #11 was achieved, followed by socket curettage (Figure 3). The ideal implant position was then assessed in relation to the three-dimensional prosthodontic plan.

Figure 3: Occlusal view of the post-extraction dental socket.

Drilling followed a standard sequential protocol with progressive diameters. Implant positioning was carefully guided mesiodistally and buccolingually, placing it approximately 1–2 mm palatal to the vestibular surfaces of adjacent teeth. Osteotomy commenced with a lance drill in the planned position, followed by perforation of the palatal socket wall to accommodate a screw-retained prosthesis. A 2.0 mm pilot drill with a direction indicator verified orientation, after which a 3.5 mm drill was used to a depth of 13 mm. A Unitite® implant (SIN, São Paulo, Brazil), measuring 3.5 × 13 mm, was selected. The II was placed at 20 RPM, positioned 3 mm apical to the future gingival margin along the cementoenamel junction plane, with an insertion torque of 25 Nw, confirming adequate primary stability.

In this case, we chose not to perform immediate loading and filled the gap with Lumina-Bone. The GAP was filled with 0.5 g of Lumina-Bone Porous Lare particulate bone graft (Criteria® Biomateriais, Brazil). This was combined with L-PRF membranes prepared from 40 mL of venous blood, which was aliquoted into four 10 mL tubes (BD Vacutainer Serum, NJ, USA) and centrifuged at 2,700 rpm for 12 minutes using a Benchtop Low-Speed Centrifuge (DT5-6A, Hunan, China) to obtain an L-PRF clot. Simple interrupted sutures were placed with 4-0 nylon suture (Shalon, Curitiba, Brazil). Subsequently, an immediate provisional restoration (IPR) was fabricated, seated, and bonded to the adjacent teeth using light cured composite resin (3M Filtek™ Universal, USA) (Figure 4).

Figure 4: Immediate provisional restoration in place of tooth #11

Five months postoperatively, during the reopening phase, the gingival zenith, periodontal status, adjacent papillae, and mucosa were evaluated (Figure 5). A connective tissue graft (CTG) harvested from the palate was deemed necessary to augment the gingival tissue. The CTG was positioned and secured with suspensory sutures on the vestibular surface of the anterior aesthetic zone in close contact with the periosteum, aiming to enhance the concave ridge contour and restore adequate tissue thickness in the region of tooth #11 (Figure 6). A second provisional restoration, fabricated from acrylic resin, was then screw-retained to establish an appropriate emergence profile (EP) in alignment with the desired mucogingival line.

Figure 5: Tissue healing at 5 months (vestibular view).

Figure 6: Connective tissue graft placed on the buccal aspect of site #11.

Sixty days following the second periodontal surgery, a renewed aesthetic assessment of the peri-implant tissues were conducted. Gingivoplasty was indicated to harmonize the gingival zenith and reestablish the correct height relative to adjacent teeth. The procedure was performed under local infiltrative anesthesia using a 15c scalpel blade (Swann-Morton®, Sheffield, England) (Figure 7).

Figure 7: Periodontal plastic surgery on adjacent teeth.

Twenty-one days after the final periodontal intervention, pink esthetic scores and the emergence profile were evaluated clinically (Figure 8) and radiographically. The definitive screw-retained ceramic prosthesis was delivered, achieving harmonious integration with the surrounding peri-implant soft tissues and a natural emergence profile (Figure 9). Radiographic assessment confirmed stable bone levels around the implant. The patient expressed high satisfaction with the aesthetic and functional outcome, and no complications were reported during the follow-up period (Figure 10).

Figure 8: Peri-implant pink esthetics.

Figure 9: Emergence profile.

Figure 10: Definitive screw-retained ceramic prosthesis on implant #11.

Discussion

This case report presents an implant-supported rehabilitation involving II placement after tooth extraction, combined with guided bone regeneration (GBR), guided tissue regeneration (GTR), leukocyte- and platelet-rich fibrin (L-PRF), and gingivoplasty in the anterior esthetic zone. The treatment aimed to replace the upper right central incisor (#11), which was affected by avulsion and coronal fracture, resulting in notable aesthetic and social concerns for the patient.

Clinical evaluation revealed that tooth #11 had undergone approximately 5 mm of vertical avulsion, accompanied by discoloration, partial enamel loss, a coronal fracture, and considerable exposure of radicular cementum all sequelae of dental trauma. Trauma-induced damage to the alveolar process can lead to morphological changes in periodontal ligament fibers. When exposed to the oral environment, these tissues may undergo pathological dehydration and subsequent degeneration, ultimately triggering alveolar and radicular resorption. In such cases, tooth extraction followed by implant-based rehabilitation is often indicated [6].

The decision to proceed with II placement in this case was supported by a comprehensive clinical assessment, which revealed favorable dentoalveolar conditions for preserving both bone and soft tissue architecture in the anterior region. Specifically, there was no gingival recession, the zone of attached gingiva was adequate, and the buccal bone wall remained intact. According to the literature, II placement is indicated when alveolar bone quality and quantity are sufficient. This approach helps mitigate the physiological bone resorption that follows tooth extraction, reduces the need for additional surgeries, and shortens overall treatment time while minimizing surgical trauma [7].

Combining II placement with guided bone regeneration (GBR) to fill the residual gap contributed to the volumetric stability of the socket and promoted consolidation of the xenograft. Adequate compaction of the biomaterial actively induces osteogenesis, while the subsequent remodeling process driven by the differentiation of osteoprogenitor cells into osteoblasts plays a key role in maintaining bone homeostasis around the implant and ensuring stable postoperative outcomes [8].

For GBR to be effective, membranes are essential to prevent the invasion of non-osteogenic tissue that could interfere with bone augmentation. In this case, L-PRF membranes an autogenous biomaterial served as an ideal physical barrier, preventing the migration of gingival and connective tissue epithelial cells into the regenerated site. This approach effectively utilized the vestibular gingiva to maintain and regenerate peri-implant keratinized mucosa, representing a cost-effective, versatile, and efficient alternative in regenerative procedures [9].

Similarly, the fabrication and placement of the provisional prosthesis helped shape the peri-implant soft tissue contours. This provided immediate aesthetic comfort to the patient, reduced the risk of gingival margin exposure, and improved masticatory function. The provisional restoration also played a key role in supporting soft-tissue healing and preventing disturbances in osseointegration due to premature loading [10].

During the healing phase, peri-implant tissues may undergo physiological resorption of the buccal bone wall, potentially compromising the EP and leading to aesthetic deficiencies. To address this, various surgical techniques and biomaterials are employed for GTR. In the present case, a reduction in vestibular peri-implant gingival volume was observed, which was corrected using a CTG. Due to its autologous nature and favorable biomimetic properties, the CTG enhanced keratinized mucosal thickness, improved connective tissue adhesion, expanded the vestibule, and yielded satisfactory aesthetic outcomes [11].

Finally, gingivoplasty was performed to stabilize the gingival zenith and refine the aesthetic result. This procedure reshaped the peri-implant gingival tissue, reestablishing appropriate anatomical contours, reducing inflammation, and helping prevent future periodontal pocket formation. As a periodontal plastic surgery intervention, gingivoplasty contributed to restoring gingival health, texture, and peri-implant pink esthetics, while also optimizing the definitive EP.

In summary, the combined application of multiple regenerative and reconstructive periodontal surgical techniques contributed to improved aesthetic and functional outcomes in the anterior aesthetic zone. When clinical conditions are favorable, a comprehensive approach that integrates evidence-based knowledge, appropriate biomaterials, and refined periodontal plastic surgery principles is essential to achieve predictable and successful treatment results.

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Institutional review board statement

Ethical approval was not required for this case report.

Data availability statement

No new data were created or analyzed in this study. Data sharing is not applicable to this article.

Informed consent statement

Written informed consent was obtained from the patient for publication of his clinical information and images, ensuring confidentiality and anonymity in accordance with the Declaration of Helsinki.

Conflict of interest

The authors declare no conflicts of interest.

Author contributions

V.F.C.P. performed the original writing of the manuscript. V.S.M.R., R.O.A.J. and M.A.M. contributed to the clinical management of the patient. V.F.C.P., V.S.M.R., R.O.A.J. and M.A.M. contributed to data collection and literature review.

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