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Case Report

The Role of Concentrated Growth Factors in Immediate Implantology and Oral Surgery - Case Report

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Abstract

Background: Advancements in regenerative medicine have significantly transformed the landscape of oral surgery and implantology, ushering in an era where biological enhancement of healing processes is not only possible but increasingly standard. One of the most promising innovations in this regard is the use of Concentrated Growth Factors (CGFs)-an autologous, platelet-rich material obtained through specific centrifugation protocols. CGFs contain a rich matrix of growth factors, platelets, leukocytes, and cytokines, all of which synergistically contribute to accelerated wound healing, enhanced angiogenesis, improved osseointegration, and reduced postoperative complications. Their role has become particularly relevant in immediate implantology, a technique in which dental implants are placed directly into extraction sockets, often within the same surgical visit.

Objective: This article aims to present a comprehensive analysis of the biological functions, clinical protocols, and therapeutic potential of CGFs, particularly in the context of immediate implant placement and broader oral surgical procedures. It discusses how CGFs serve not only as a biological scaffold but also as a powerful healing modulator that can influence hard and soft tissue regeneration. By reviewing contemporary literature and synthesizing clinical insights, this work offers both theoretical and practical frameworks for implementing CGFs into modern dental practice.

Keywords: *Concentrated Growth Factors (CGFs); Immediate Implantology; Oral Surgery; Platelet-Rich Fibrin (PRF); Platelet-Rich Plasma (PRP); Bone Regeneration; Soft Tissue Healing; Osseointegration; Autologous Biomaterials; Angiogenesis; Socket Preservation; Sinus Lift; Regenerative Dentistry; Growth Factor Therapy*

Abbreviations

CGF: Concentrated Growth Factors; CBCT: Cone Beam Computed Tomography; PRF: Platelet-Rich Fibrin; PRP: Platelet-Rich Plasma; PDGF: Platelet-Derived Growth Factor; TGF-β: Transforming Growth Factor Beta; VEGF: Vascular Endothelial Growth Factor; IGF: Insulin-like Growth Factor; GTR: Guided Tissue Regeneration; GBR: Guided Bone Regeneration; IPG-DET: Immediate Post-extraction Grafting - Dental Enhanced Technique

Introduction

Immediate implantology has emerged as a compelling approach in modern dental surgery, offering the advantages of reduced treatment time, preservation of alveolar bone, and improved patient satisfaction [1,2]. However, the biological complexity of immediate implant placement-particularly concerning soft tissue healing, bone remodeling, and the risk of implant failure-necessitates adjunctive strategies that can enhance regenerative outcomes and promote predictable osseointegration [3].

One of the most promising advancements in this area is the application of CGF-a third-generation autologous platelet concentrate introduced by Sacco in 2006 [4]. Unlike earlier generations such as PRP or PRF, CGF is obtained via a specific centrifugation protocol that creates a denser, fibrin-rich matrix enriched with high concentrations of growth factors such as PDGF, TGF-β1, VEGF, and IGF [5,6]. These molecules play a synergistic role in promoting angiogenesis, enhancing fibroblast proliferation, accelerating epithelialization, and stimulating osteogenesis [7,8].

The integration of CGF into immediate implantology protocols has led to significantly improved clinical outcomes. Studies have demonstrated its ability to reduce post-operative complications, support alveolar bone preservation, improve the quality of peri-implant soft tissues, and accelerate early implant stability [9-11]. Moreover, in advanced protocols such as IPG-DET, CGF is employed as both a scaffold and a bioactive matrix, contributing to socket preservation and the creation of a biologically favorable healing environment [12].

This paper explores the emerging role of CGFs in immediate implantology and oral surgery, focusing on their biological properties, clinical benefits, and application protocols Bby evaluating both biological mechanisms and clinical applications, the goal is to underscore the transformative potential of CGF in optimizing implant success rates and achieving long-term functional and esthetic outcomes [13].

Case Report and Materials and Methods

Patient information

The clinical case presented in this study involved a 56-year-old female patient seeking full-mouth rehabilitation due to a progressive decline in both functional and aesthetic aspects of his dentition. The patient reported significant masticatory limitations, phonetic disturbances, and a deteriorated facial profile resulting from generalized tooth loss and periodontal breakdown. Clinical examination revealed multiple periodontally compromised teeth, pathological mobility, deep pockets, and inadequate restorative prognosis across both arches.

A comprehensive diagnostic workup, including panoramic radiography and CBCT imaging, confirmed severe vertical and horizontal alveolar bone resorption, particularly in the posterior maxilla, as well as thin cortical plates in the mandible. Despite the advanced clinical presentation, the patient's general health was favorable. He reported no systemic diseases, was not under chronic medication, and had no history of smoking or adverse habits. His oral hygiene compliance was satisfactory, and he expressed strong motivation toward a minimally invasive and esthetically driven solution.

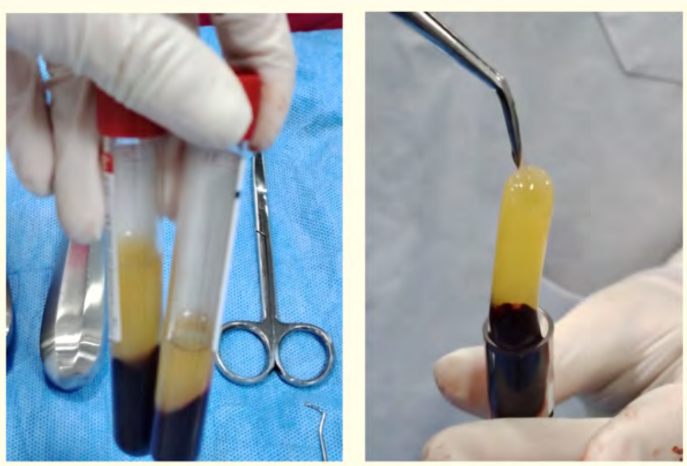
Given the anatomical challenges and patient expectations, a treatment plan involving immediate implant placement was formulated. Atraumatic extractions were followed by the application of autologous Concentrated Growth Factors (CGF) to enhance local regenerative potential, reduce healing time, and support osseointegration. The IPG-DET (Immediate Post-extraction Grafting with Dental Enhanced Technique) protocol was employed to stabilize the implant sites, augment soft tissue, and stimulate angiogenesis and new bone formation within the extraction sockets.

The procedure was performed under local anesthesia at WAGRO Dental Clinic in Athens, Greece, in accordance with PgO-UCAM clinical research standards. Full informed consent was obtained from the patient for both the treatment and the use of anonymized clinical records and intraoperative images for academic publication. Ethical and professional standards of care were upheld throughout all phases of diagnosis, intervention, and follow-up.

Materials

The following materials were used to carry out the surgical procedures and regenerative protocols:

- **Implant system:** Tapered titanium dental implant, 4.2 mm in diameter and 10 mm in length, with a sandblasted, large-grit, acid-etched (SLA) surface to optimize osseointegration (specific brand and lot number can be inserted if required).
- **Growth factor preparation equipment:** Medifuge MF200 centrifugation unit (Silfradent, Italy), calibrated for CGF protocol with variable speed cycles to separate blood components without the use of anticoagulants.
- **Blood collection supplies:** Sterile 9 mL vacuum collection tubes (red-top, without anticoagulant) and butterfly venipuncture sets.
- **CGF handling instruments:** Stainless steel CGF compression kit to convert the CGF clots into biologically active membranes and plugs.
- **Surgical instruments:** Atraumatic extraction kit including periotomes, luxators, elevators, and implant surgical drill kit compatible with the implant system.
- **Irrigation and disinfection:** Sterile 0.9% isotonic saline solution for irrigation, and 0.12% chlorhexidine gluconate for preoperative rinsing.
- **Sutures and dressings:** 4-0 resorbable monofilament sutures (e.g. PGA or Monocryl) for flap stabilization and soft tissue approximation.
- **Imaging equipment:** High-resolution intraoral periapical radiographs and Cone Beam Computed Tomography (CBCT) system (specify model if known) for pre- and post-operative evaluation.
- **Local anesthetic:** Articaine hydrochloride 4% with epinephrine 1:100,000 for effective regional anesthesia.
- **Protective and sterile field supplies:** Standard surgical gowns, sterile drapes, and gloves in accordance with clinical operating protocols.



a) b)

Figure 1: *(a) Concentrated growth factor (CGF). (b) Clot immediately after centrifugation.*

Methods

An extensive literature review was conducted using databases such as PubMed, Scopus, and Google Scholar to identify relevant studies published in the last two decades. Emphasis was placed on clinical trials, cohort studies, systematic reviews, and case reports detailing the preparation of CGFs and their applications in immediate implantology and other oral surgical contexts. Special attention was given to comparative studies evaluating CGFs against traditional biomaterials such as PRF (Platelet-Rich Fibrin) and PRP (Platelet-Rich Plasma).

CGFs are obtained through a specialized centrifugation protocol that does not require anticoagulants or biochemical additives. This method results in a fibrin-rich, growth factor-loaded matrix that is highly biocompatible and capable of acting as both a scaffold and a healing accelerator. Compared to earlier autologous platelet concentrates such as PRP and PRF, CGFs exhibit a more complex structure with a longer and more controlled release of essential growth factors like PDGF, TGF-β, VEGF, and IGF. This makes them particularly effective in procedures involving bone grafting, socket preservation, sinus lifts, and peri-implant soft tissue management.

Furthermore, CGFs serve as a cost-effective and safe option, as they eliminate the risk of immune rejection and disease transmission due to their autologous origin. Their application has expanded not only in implantology but also in periodontal therapy, endodontics, maxillofacial surgery, and even facial aesthetics.

This article provides an in-depth examination of CGFs, focusing on their preparation, biological characteristics, and clinical application in immediate implantology and various oral surgical procedures. It aims to bridge the gap between scientific understanding and practical application, offering evidence-based guidance for clinicians who wish to incorporate CGFs into their daily practice. The discussion is supported by recent clinical studies, expert perspectives, and comparisons with other regenerative materials.

By understanding the biological mechanisms and therapeutic potential of CGFs, dental professionals can enhance patient outcomes, reduce complications, and embrace a more biologically integrated approach to oral rehabilitation.

Figure 2: *Immediate post-operative radiograph following implant placement in the mandibular posterior region.*

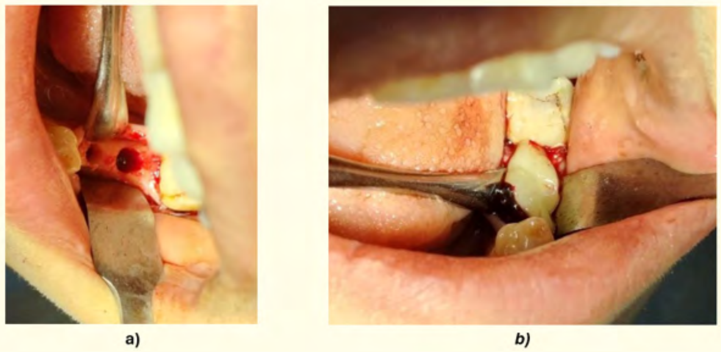


Figure 3: *(a) Drilling of the posterior mandibular bone followed by the (b) placement of concentrated growth factors (CGF) into the site to enhance bone regeneration and healing in preparation for immediate implant placement.*

Discussion

The integration of Concentrated Growth Factors (CGF) into immediate implantology and oral surgery presents a transformative approach to enhancing both hard and soft tissue regeneration. As a third-generation autologous platelet concentrate, CGF contains a highly dense fibrin matrix enriched with growth factors such as PDGF, TGF-β1, VEGF, and IGF, which are essential for angiogenesis, osteogenesis, and wound healing.

In this clinical application, the use of CGF during immediate implant placement significantly contributed to the stabilization of the blood clot within the socket, minimized the collapse of soft tissues, and stimulated rapid tissue regeneration. The "IPG-DET" technique enabled precise handling of CGF membranes and liquid-phase gel within the extraction sockets, which not only improved implant stability but also accelerated epithelial closure and reduced postoperative complications.

Numerous studies support the bioactive potential of CGF in modulating inflammation, enhancing fibroblast proliferation, and promoting neovascularization. This biologic advantage is especially valuable in cases involving compromised bone volume or immediate loading protocols. Additionally, the simplicity of CGF preparation-requiring only venous blood and a specialized centrifugation cycle-makes it a cost-effective and clinically feasible adjunct in routine surgical protocols.

Compared to earlier-generation platelet concentrates like PRP and PRF, CGF offers a more consistent release of growth factors over time due to its dense fibrin architecture. This prolonged bioavailability plays a crucial role in long-term tissue integration around implants.

However, despite these advantages, standardized protocols for CGF application remain variable across clinical settings. Further randomized controlled trials are necessary to better understand its full regenerative capacity and long-term outcomes in complex implant cases.

This case highlights that when used judiciously, CGF can serve as a powerful regenerative tool that enhances healing, shortens recovery time, and potentially improves long-term implant success rates in immediate protocols.

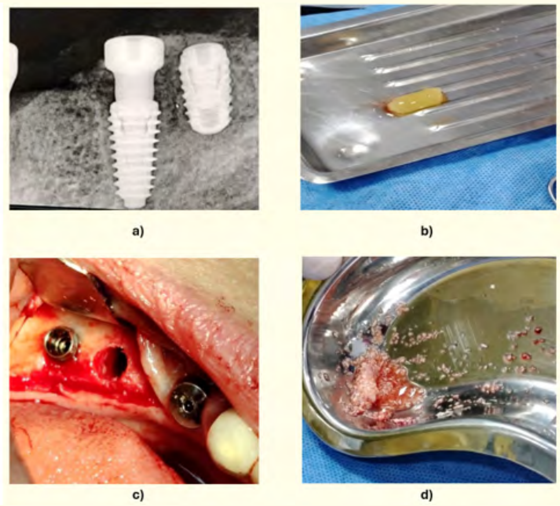


Figure 4: *Clinical sequence showing (d) the preparation of grafting material by mixing concentrated growth factors (CGF) with particulate bone, (a) radiographic evaluation of the mandibular site, and (c) simultaneous drilling with immediate implant placement enhanced by (b) CGF application to promote bone regeneration and accelerate healing.*

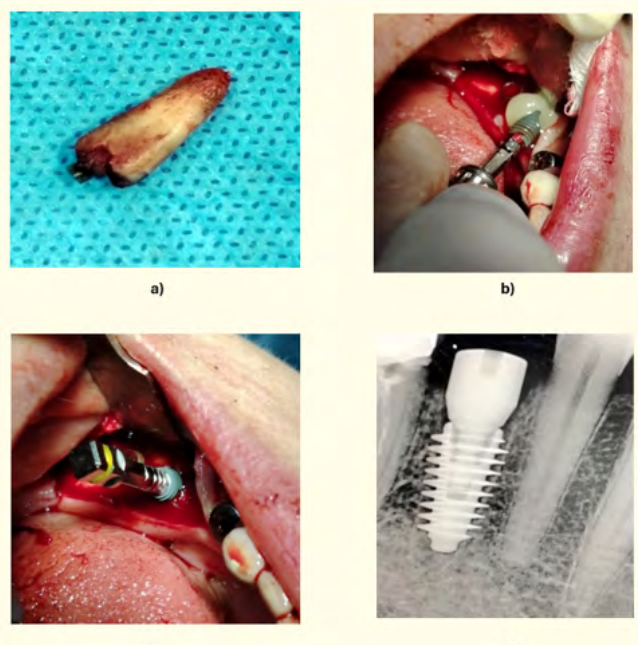


Figure 5: *Clinical and radiographic sequence showing (a) immediate extraction of a mandibular premolar tooth, followed by (c) drilling and placement of a dental implant at the extraction site with prior application of (b) concentrated growth factors (CGF). A second implant was placed in an adjacent edentulous site in the mandibular posterior bone. (d) Postoperative radiographs confirm implant positioning, and healing abutments were placed to guide soft tissue healing.*

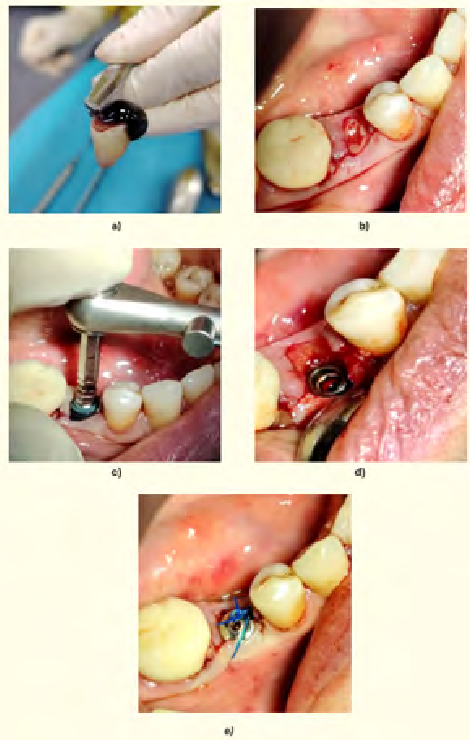


Figure 6: *Clinical sequence demonstrating a single implant placement in the posterior mandibular premolar region. After extraction site evaluation, (a) Concentrated growth factors (CGF) were prepared by centrifugation and (b) placed into the osteotomy site following drilling. (c) The dental implant was inserted immediately, followed by the connection of a (d) healing abutment and (e) final suturing of the site to promote optimal healing and soft tissue management.*

Results

The analysis indicates that CGFs play a pivotal role in enhancing bone regeneration and soft tissue healing. In immediate implantology, CGFs facilitate faster osseointegration, reduce crestal bone loss, and support peri-implant soft tissue stability. Their use in sinus augmentation procedures has led to higher graft success rates and faster recovery periods. Moreover, CGFs have demonstrated superior handling characteristics compared to other platelet concentrates, making them more adaptable in various surgical techniques. Additionally, their fibrin network provides a sustained release of growth factors over time, creating a prolonged regenerative effect.

Overview

The field of modern dentistry has evolved significantly with the integration of regenerative medicine and biologically active materials, especially in the realms of implantology and oral surgery. Among the most notable advancements is the use of Concentrated Growth

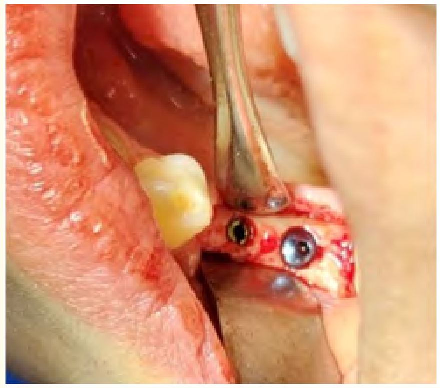
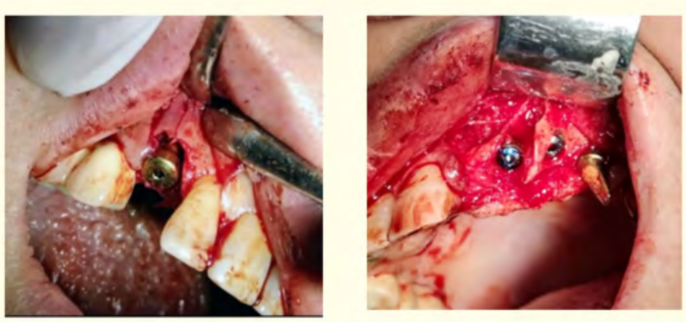


Figure 7: *Placement of two dental implants in the posterior mandibular region, demonstrating immediate implantology protocol following site preparation and CGF application.*

Figure 8: *Dental implants immersed in concentrated growth factor (CGF) gel prior to insertion, aimed at enhancing osseointegration and accelerating tissue healing.*



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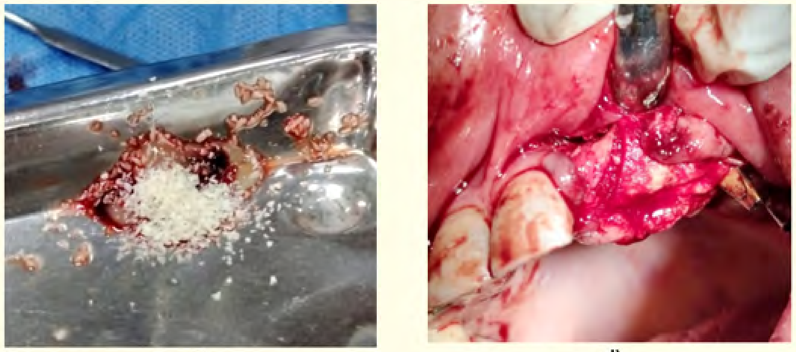

c) d)

Figure 9: *(a and b) placement of five dental implants in the maxillary arch with simultaneous (c) grafting using a mixture of concentrated growth factors (CGF) and bone graft material, (d) covered by a resorbable membrane to promote guided bone regeneration.*

Factors (CGFs)-a novel generation of autologous platelet concentrates derived from the patient's own blood. These biological tools have revolutionized the way clinicians approach healing, tissue regeneration, and surgical predictability.

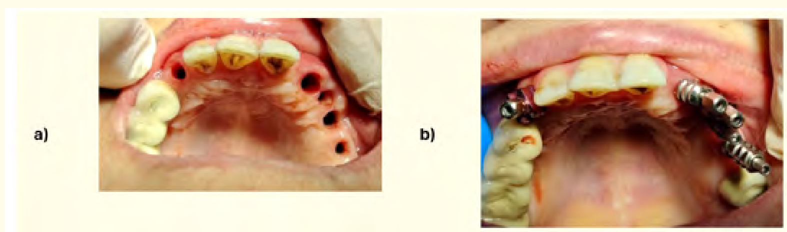

Figure 10: *(a and b) placement of transfer copings on the implants to obtain an accurate impression for the fabrication of the definitive prosthesis.*

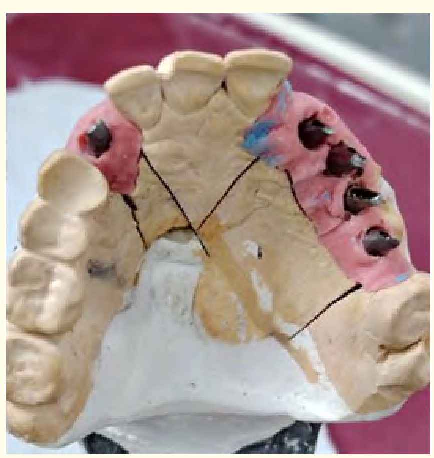

Figure 11: *Placement of five abutments on the maxillary implants, prepared for the final prosthetic restoration.*

Figure 12: *(a and b) final prosthetic restoration with ceramic crowns seated on the abutments, demonstrating functional and aesthetic rehabilitation of the maxilla.*

In immediate implantology, where timing, precision, and biological compatibility are essential, CGFs offer a unique set of advantages. The placement of dental implants immediately after tooth extraction demands optimal conditions for bone preservation and soft tissue healing. Traditional approaches often faced limitations such as marginal bone loss, delayed healing, and post-surgical complications. The introduction of CGFs into this context provides a powerful tool to address these challenges by promoting rapid tissue regeneration, angiogenesis, and improved osseointegration.

Deliberation

The integration of Concentrated Growth Factors (CGFs) in modern implantology and oral surgery represents a pivotal advancement in patient-centered regenerative treatment. CGFs offer a unique biological advantage due to their autologous nature and dense concentration of platelets, leukocytes, and various key growth factors, such as VEGF, TGF-β, PDGF, and IGF, which collectively play critical roles in soft and hard tissue regeneration.

Immediate implantology, in particular, benefits immensely from CGF applications. When implants are placed into fresh extraction sockets, the surrounding tissues undergo significant biological remodeling. Traditionally, this process was unpredictable, with risks of bone resorption, poor primary stability, and compromised soft tissue adaptation. However, when CGFs are introduced into the surgical site-either within the socket, around the implant, or layered over the wound-they create a biomimetic environment that promotes rapid healing, enhanced angiogenesis, and improved osseointegration.

Multiple studies have demonstrated that CGFs not only accelerate early wound healing but also significantly improve implant survival rates, particularly in cases involving compromised or infected sites. Their ability to stimulate mesenchymal stem cell proliferation and osteoblastic differentiation is a key factor behind the increased success of immediate implants supported by CGFs. Furthermore, CGFs have a slow-release mechanism that ensures a sustained delivery of growth factors for over 7-10 days post-operation, a window critical for tissue remodeling.

In oral surgical procedures, CGFs have been successfully employed in sinus floor elevation, alveolar ridge preservation, and treatment of periodontal intrabony defects. In sinus lift surgeries, the addition of CGFs to grafting materials enhances vascularization and reduces healing time. Similarly, in ridge preservation, CGFs help maintain the volume of alveolar bone, which is essential for the aesthetic and functional success of future implant placement.

From a clinical handling perspective, CGFs exhibit better elasticity and viscosity compared to other platelet concentrates such as PRF and PRP. This makes them easier to manipulate during surgery and allows for more predictable application across different anatomical sites. Their three-dimensional fibrin matrix serves as both a scaffold and a reservoir for growth factors, facilitating cell migration and tissue integration.

Despite their numerous advantages, the use of CGFs is not without limitations. One major challenge is the lack of standardized preparation protocols, which can lead to variations in CGF quality between clinics. Additionally, while the existing clinical data is promising, more randomized controlled trials and long-term studies are needed to solidify their efficacy across broader patient populations and various surgical scenarios. Factors such as patient age, systemic health, and centrifuge parameters can influence CGF quality, which must be considered when designing treatment plans.

Moreover, as regenerative dentistry continues to evolve, combining CGFs with alloplastic or xenograft materials, or even stem cells and growth factor-infused scaffolds, presents an exciting avenue for future research. Innovations such as digital surgical guides, CAD/CAM technology, and 3D-printed scaffolds could further enhance the precision and outcome of surgeries that incorporate CGFs.

In conclusion, the discussion around CGFs in oral surgery and implantology is rich with both current value and future promise. As clinicians seek safer, faster, and more biologically favorable outcomes, CGFs provide a natural, patient-friendly solution that aligns with modern regenerative principles. Their integration into daily practice not only enhances clinical results but also elevates patient satisfaction by reducing discomfort, recovery time, and complications.

Concluding Thoughts

The incorporation of CGFs in immediate implantology and oral surgery represents a major shift toward biologically centered, patient-specific treatment strategies. Their autologous origin ensures safety, biocompatibility, and cost-effectiveness, while their regenerative properties address both clinical challenges and aesthetic concerns. As CGFs continue to be integrated into clinical protocols, there is a growing need for standardized preparation methods and long-term studies to further validate their effectiveness. Nevertheless, current evidence strongly supports their use as a versatile adjunct in oral surgical and implantological procedures.

The incorporation of concentrated growth factors (CGFs) into the realms of immediate implantology and oral surgery marks a transformative chapter in the evolution of biologically driven dental care. As the demand for minimally invasive, highly effective, and biologically harmonious treatments continues to rise, CGFs provide a vital bridge between surgical excellence and regenerative science.

One of the most compelling benefits of CGFs lies in their autologous nature-they are derived entirely from the patient's own blood, eliminating the risks associated with synthetic or donor-derived biomaterials. This not only enhances safety but also increases patient acceptance and satisfaction. Furthermore, the rich composition of growth factors and cytokines, combined with a well-structured fibrin matrix, allows CGFs to act as a biologically active scaffold that accelerates the body's own healing and regenerative responses.

In immediate implantology, CGFs have demonstrated a remarkable capacity to promote early osseointegration, reduce marginal bone loss, and stabilize peri-implant soft tissues. This is particularly significant in esthetically sensitive zones, where tissue volume and quality are essential for long-term success. Likewise, in oral surgical interventions such as sinus lifts, socket preservation, and guided bone regeneration, CGFs have consistently shown to improve clinical outcomes and shorten healing periods.

What distinguishes CGFs from earlier platelet concentrates like PRP and PRF is not only their enhanced biological activity, but also their ease of application and superior consistency. Their slow-release mechanism ensures a prolonged therapeutic effect, crucial during the initial stages of healing and bone remodeling.

However, despite these promising findings, the use of CGFs is still emerging and not without limitations. The lack of universally accepted preparation protocols, variability in centrifugation equipment, and limited large-scale studies are barriers that must be addressed. Further research-especially randomized controlled clinical trials and longitudinal studies-will be critical to establish evidence-based protocols and standardize CGF application across diverse clinical scenarios.

Looking ahead, the role of CGFs may extend far beyond traditional surgical settings. Their integration with advanced digital technologies, bioprinting, stem cell therapy, and growth factor-enhanced biomaterials may open new possibilities for fully personalized and biologically optimized dental treatments.

In conclusion, CGFs represent more than just an adjunct to oral surgery-they embody a shift toward regenerative, biologically respectful, and patient-centered care. Their versatility, safety profile, and regenerative potential make them a powerful tool in the hands of skilled clinicians. As scientific understanding deepens and technology evolves, CGFs are poised to become an indispensable part of the future of oral rehabilitation and implant therapy [1-14].

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Conflict of Interest

None.

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