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An impact of CGF on both soft and hard tissues in intrabony defects: A case report

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Abstract

Background: Despite a deep intrabony Ay defect, there is an increased chance of further periodontal deterioration. Surgical intervention is mostly needed to address the abnormality, and non-surgical periodontal care may present difficulties. Because they are enriched with growth factors, autologous platelet concentrates like concentrated growth factor (CGF) and inject able platelet rich fibrin (i-PRF) may enhance surgical outcomes.

Materials and methods: There is just one patient in this research. CGF is inserted into the appropriate intrabony defect following traditional flap debridement. Volumetric analysis was performed before and six months after surgery.

Results: When compared to i-PRF, it has been seen that bone volume is greatly increased and that it also contains high levels of regenerative and reconstructive growth factors, which help facilitate early and high bone fill.

Conclusion: In reconstructive and regenerative medicine, concentrated growth factor is a straightforward and superior autologous platelet concentrate biomaterial. Expanding the field of customized medicine, encouraging osseous regeneration, and raising the volume of bone intra bony defect.

Keywords: Concentrated growth factor (CGF), Regeneration, Bone volume.

Introduction

Human tooth loss is the main outcome, and the periodontal region's normal clinical feature is the deterioration of bone and connective tissue.[1] Imperfect

teeth lead to poor mastication, which worsens periodontitis patients' quality of life and makes it more difficult for them to talk and appear well—all socially functioning skills.[2]The main method for removing localized periodontal irritation and halting the progression of inflammation is subgingival cleaning and root planing (SRP).[3] The desired result of restoring the periodontal tissues to their pre-existing state is essentially unachievable with SRP.[4]Guided tissue regeneration (GTR) was developed in the 1980s to prohibit fibroblasts and epithelial cells from interlacing growth by covering intrabony defects with a barrier membrane. This created the optimum environment for periodontal tissue regeneration. [5]However, it is challenging to fully restore periodontal tissue due to inherent defects underneath the barrier membrane.[6]

Since the discovery of biomaterials, periodontal flap surgery combined with autologous, allograft, and xenograft bone has become a standard clinical treatment. Within these tissues, blood clots have the potential to form and grow. The efficiency of bone induction is still unknown, though.[7] The goal of providing the best feasible treatment for periodontal intrabony abnormalities requires the development of a practical plan. Endogenous regeneration technology has gained more interest recently due to investigations focused on the functional regeneration of non-renewable tissues using autologous "regeneration agents".[8] Because of their superior qualities and ease of production, autologous platelet concentrates (APCs) are widely used in all fields of oral therapy through the generation transition from platelet rich plasma (PRP) to platelet rich fibrin (PRF). This is because using APCs in endogenous regeneration technologies is highly recommended.[9]

To produce CGFs, blood samples are centrifuged at different, controlled rates using a specialized centrifuge. It is feasible to isolate a substantially larger and denser fibrin matrix that is richer in growth factors than is generally found in PRF or PRP by utilizing different centrifugation speeds. A fibrin network made of thick and thin fibrillar components was recently identified, and multiple platelet cell elements were seen generating a cell aggregation that was captured within the fibrin network.[10]This study aimed to assess the effectiveness of CGF in the treatment of periodontal intrabony defects.

Materials and methods

The current investigation involved four intrabony defects in only one patient who met the inclusion and exclusion criteria listed below in order to be recruited for the study. Inclusion criteria: Patient must be between the ages of 18 and 50. When probed, each individual's periodontal pocket is at least 5 mm deep. People with intrabony flaws visible on radiography that are at least 3 mm deep (the depth of the defect measured from the base to the alveolar crest). those without any underlying medical issues that might prevent them from receiving surgery. Patients who did not get any form of regenerative periodontal therapy in the afflicted area six months prior to the initial assessment.

Exclusion criteria: Those with uncontrolled diabetes, anticoagulant drugs, immunosuppressive drugs, or other systemic illnesses were not permitted to participate in the study. Breastfeeding or expecting mothers. Patients who did not practice good oral hygiene before to surgery. Smokers (more than ten per day) All patients were informed about the trial before to its initiation, and they were required to submit written, informed permission.

Periodontal assessment

The pocket depth was calculated with a fixed stent reference point. For the length of the trial, all of the customized acrylic stents were maintained on the

prefabricated study casts to minimize distortion. Clinical indices: The following clinical measurements were made with a UNC-15 probe on a synthetic occlusal stent, and the results were recorded to the nearest millimetre. FRP - BOP stands for fixed reference point to base of pocket (BOP). The Fixed Reference Point (FRP-GM) is the gingival margin (GM). The stent's apical limit is known as the Fixed Reference Point (FRP).

Parameters related to clinical practice

Probing Depth: The distance between the bases of the pocket to the free gingival margin. It was computed by subtracting (FRP-GM) from (FRP-BOP).

Indices: Plaque index was recorded according to the criteria of Silness & Loe (Table 1).The PI was calculated by adding the total number of scores and dividing by the total number of surfaces present. Plaque index of 0.1 – 0.9 indicated good oral hygiene, 1.0 -1.9 indicated fair oral hygiene and 2.0 – 3.0 indicated poor oral hygiene.Gingival Index (Loe H & Silness J)(Table 2) The tissue surrounding each tooth is divided into four scoring units, mesiobuccally, mid buccal, distobuccally and lingual. Each area was clinically examined, probed and scored based on Degree of gingivitis0.1-1.0: Mild gingivitis, 1.1-2.0: Moderategingivitis, 2.1-3.0: Severe gingivitis

Radiographic Parameters

CEJ to BOD: Measured from cement enamel junction to base of the defect. Calculating linear bone growth and volumetric bone fill. The linear measurements CEJ to BOD were used to determine the linear bone growth Linear bone growth was calculated by subtracting CEJ to BOD at baseline from CEJ to BOD at 6months. Volumetric bone fill was calculated three dimensionally by using CBCT In vivo software through volume rendering tool.

Imaging Techniques

Cone beam computed tomography imaging was obtained prior to the regenerative process in order to assess the measures made preoperatively at baseline and postoperatively after nine months, as well as to analyze the 3D architecture of the intrabony defect for optimal treatment planning. CBCT Imaging Technique: At baseline and nine months later, a single, qualified technician performed all of the CBCT (NEW CS 9000 System®) images. The exposure duration (10.8 seconds), voltage (90.00KV), and current (10.00mA). The bi-spinal line, which corresponds with the vertical and horizontal planes, was used as the reference to standardize the axial and sagittal planes. The line connecting infra-orbital points—referred to as the infra-orbital line—were used as a reference to standardize the coronal plane, completing the placement of images over the three spatial planes. After six months, the sagittal and coronal sections were rebuilt using the baseline's axial slicing.

Treatment Protocol

Preoperative protocol: Following the initial evaluation, participants' eligibility for the study was assessed. The eligible patients were fully informed about the study protocol, and those who consented to participate were enrolled after giving their informed consent. Impressions were collected and the clinical history recorded in order to build occlusal stents for the treated teeth and to create study casts. Scaling and root planing were performed using hand curettes and ultrasonic equipment while under local anaesthesia. Occlusal correction was performed if damage linked to occlusion were found. The suitability of the locations for this periodontal surgery study was confirmed four weeks later by a periodontal re-evaluation. Patients who are a good fit for

the procedure are advised to have a baseline CBCT before surgery.

Procedure: First Visit (0 weeks, baseline): RAL, PD, PI, and GI were noted to evaluate periodontal health. Following an evaluation of their oral hygiene maintenance, surgery was only permitted for individuals who maintained exceptional oral hygiene (PI < 1). The patient was told to cleanse the oral cavity with 10ml of 0.2% chlorhexidine digluconate solution and swab the peri-oral tissues with a 5% w/v Povidone iodine solution. The surgical site was made unconscious using a local anesthetic technique that included 2% lignocaine and 1:1,000,000 dilutions of adrenaline. The procedure was carried out with the proper aseptic precautions and continual aspiration to preserve a clean surgical site. Incisions were made in the buccal and lingual sulcular areas, and mucoperiosteal flaps were elevated. With considerable caution, the largest amount of interproximal soft tissue was retained. The defects were fully removed using ultrasonic technology and manual curettes, and root planing and scaling were used to guarantee smooth roots. Open flap debridement is done and CGF is placed at the site (figure 1). Bone volume have been evaluated in the mentioned times (Figure 2) On the first day following surgery, patients were provided 500 mg of Amoxicillin eight hours a day for five days and 50 mg of Diclofenac sodium, an analgesic, eight hours a day. The subjects were instructed to take an analgesic in case they felt pain later. Appropriate post-operative instructions were given to the patient's which included avoidance of brushing, flossing and chewing in the surgical site for 2 weeks. Entire treatment flowchart is given (Table 3).

Results

Results show excellent difference and improvement at 6 months when compare to baseline in PI, GI, PPD.CGF shows higher reduction in PI, GI, PPD from base line to 6 months (Table 4).

There is an increase in bone volume from base line to 6 months. CGF show more bone volume from baseline to 6 months (Table 5).

Discussion

In this study, soft tissue was examined using PI, GI, and PPD. Parameters were assessed six months after baseline. In this aspect, from baseline to six-month PPD, GI, and PI levels reductions show improvement. Many growth factors, including transforming growth factor-β (TGF-β), platelet-derived growth factor (PDGF), and vascular endothelial growth factor (VEGF), may contribute to the development of new tissue.[11]The growth factors are attached to a thick network of fibrinous scaffolds, delaying their release and preventing early proteolysis. By doing this, the greatest outcomes for both immediate and long-term wound healing are guaranteed.

In the current study, CBCT was utilized to do bone volumetric analysis using software. The results showed that both groups' bone volume increased from baseline to six months. After six months from the baseline, there is a discernible rise in bone volume. This may be the case because CGF promotes osteoblast proliferation and bone repair, which speeds up Osseo integration.

Angiogenesis and tissue remodelling are aided by CGF, which consists of fibrinogen, growth factors, leukocytes, coagulation factors, endothelial growth factors, and platelets. Scarring is reduced by CGF because of its various advantages, which include increasing osteogenesis and wound healing, speeding up epithelial, endothelial, and epidermal regeneration, and possessing properties that aid in homeostasis and tissue healing. Strong antibacterial properties are conferred by its high leukocyte concentration, which also serves as a scaffold

to encourage cytokines and cellular movement. Its moldable quality and strong interwoven fibrin network make it potentially useful for treating a variety of shaped bony abnormalities.[12]

By ensnaring platelets and leukocytes in the fibrin network and releasing the growth factor, it expedites bone regeneration and does away with the need for titanium mesh or bone tack. It doesn't require any biochemical additives to produce, and its strong fibrin interaction minimizes the creation of soft tissue. The mineral scaffold contains growth factors and bone cells, both of which are necessary for the production of new bone. These elements elicit cell stimulation. The results listed above are consistent with the findings of Yousef[13], Mohd noh[14], and Yao M[15].

Conclusion

Regenerative therapy is one line of treatment that can be suggested to patients for the management of intrabony defect. Platelet concentrations like as CGF can be used as an adjuvant to replace collagen membrane in periodontal regeneration without compromising clinical outcomes, even if resorbable GTR is still the preferred method for regeneration.

These results would suggest that, under some circumstances, a single CGF application might be just as beneficial therapeutically as a mixture of grafting materials. In the future, this would encourage the use of CGF alone rather than grafting materials. Effective in reducing PPD and radiographic findings such defect depth as compared to CGF alone. As a result, when treating intrabony osseous defects, it is preferred over CGF. Furthermore, it was discovered that CBCT was a better option than invasive histologic evaluation.

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Legends Figures and Tables

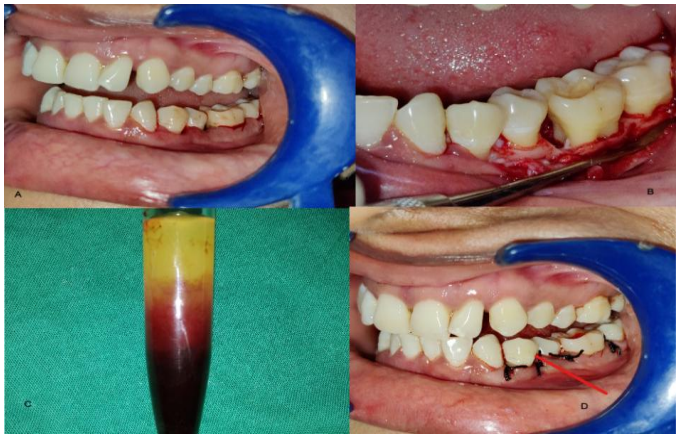

Figure 1: A-Incision, B-Reflection at defect site, C-CGF prepared and placed at the defect site, D- Sutures placed.

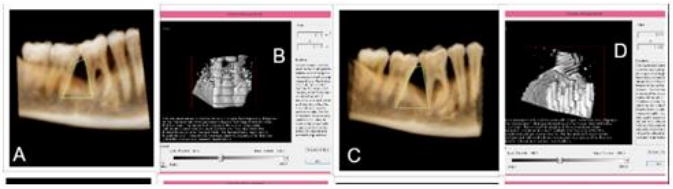

Figure 2: A-Pre-Operative Bone volume rendering at CGF site, B-Pre-Operative Bone volume extracted after rendering, C-Post-Operative Bone volume rendering at CGF site, D-Post-Operative Bone volume extracted after rendering.

Score 0	No plaque in the gingival area.
Score 1	A film of plaque adhering to free gingival margin and adjacent area of the tooth. The plaque may be recognized only by running a probe across the tooth surface.
Score 2	Moderate accumulations of soft deposits within the gingival pocket and on the gingival margin and / or the adjacent tooth surface that can be seen by the naked eye
Score 3	Abundance of soft matter within the gingival pocket and/or on the gingival margin and adjacent tooth surface.

Table 1: Plaque index

Mild gingival inflammation, slight changes in color, slight edema, no bleeding on probing.	Mild gingivitis
Moderate inflammation, redness, edema, glazing; bleeding on probing.	Moderate gingivitis
Sever inflammation, marked redness and edema, ulceration, tendency to spontaneous bleeding.	Severe gingivitis

Table 2: Gingival Index

Visits	Time Period	Treatment Done
I	Baseline	GI,PI, surgical procedure, volumetric analysis ,procedure, oral hygiene instructions
II	2 Weeks	Suture removal, recording of any adverse events, oral hygiene instructions
II	6 Months	GI,PI, surgical procedure, volumetric analysis ,procedure, oral hygiene instructions

Table 3: Entire treatment flow chart

Parameter	Group	Time	No of patients	Mean
Plaque index(PI)	i-PRF group	Baseline	2	1.9
		6 months	2	0.9
	CGF group	Baseline	2	1.9
		6 months	2	0.9
Gingival index(GI)	i-PRF group	Baseline	2	2.0
		6 months	2	1.0
	CGF group	Baseline	2	2.0
		6 months	2	1.0
Periodontal pocket depth (PPD)	i-PRF group	Baseline	2	8.0mm
		6 months	2	6.0mm
	CGF group	Baseline	2	8.0mm
		6 months	2	4.0mm

Table 4: plaque index, gingival index and periodontal pocket depth values from baseline to 6 months

Parameter	Group	Time	Mean
Bone volume in cubic centimeters(cc)	i-PRF group	Baseline	1326.93
		6 Months	1399.32
	CGF group	Baseline	1618.73
		6 Months	1807.61

Table 5: bone volume from base line to 6 months.