CASE REPORT

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Guided Bone Regeneration Using PRF as a Membrane- A Novel Approach

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Abstract

Guided bone regeneration (GBR) is a widely used technique for bone regeneration. Platelet rich fibrin (PRF) is a second-generation platelet concentrate consisting of fibrin membrane enriched with platelets, leukocytes, growth factors, and cytokines with potential for bone and soft tissue regeneration. A 33 years old male patient reported with missing teeth in the lower right back region of the jaw since 2 years. Clinical examination showed Siebert's class II deficiency in the alveolar ridge. GBR was performed using bone graft (Bio Oss) and PRF as a membrane. Pre and Post-operative IOPAs were compared and it showed bone fill in the area where the procedure was carried. Clinically good soft tissue healing with increased tissue bulk was seen. The use of PRF as membrane permitted a rapid epithelization and represented an effective barrier membrane. Thus, this case report shows the usage and advantages of using PRF as a membrane in GBR.

***Keywords**: Guided bone regeneration, Platelet rich fibrin, bone graft*

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Introduction

The best modality available today for the replacement of a missing tooth is the implant. After the tooth is lost, the alveolar bone starts resorbing and around 25% bone is lost in the first year and around 30-40% in the subsequent three years. Thus, for the placement of the implant the presence of adequate amount of alveolar bone is essential. Guided bone regeneration (GBR) is a widely used technique for bone regeneration on alveolar bone defects.[1, 2] It is a surgical procedure involving the placement of a cell exclusive physical barrier between the connective tissue and the alveolar bone defect.[3-6] Dahlin et al; were the first to show that bony defects created in rat mandibles could be successfully closed using guided tissue regeneration procedures.[7]

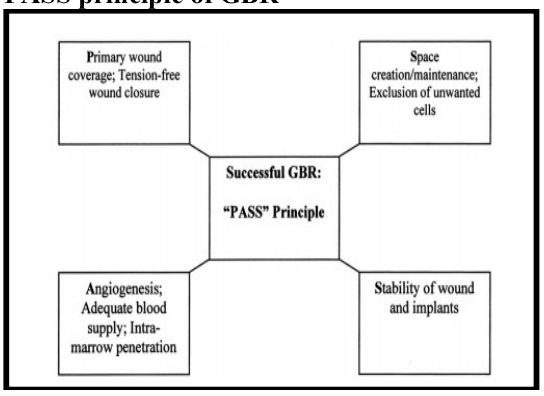
The principles of GBR are [8]

1. **Cell exclusion**-The cell population that hinders the regenerative process such as gingival fibroblast or epithelial cells should be prevented from reaching the area of healing. This is done using a barrier membrane.
2. **Tenting**- The membrane is carefully fitted and applied in such a manner that a space is created beneath the membrane, completely isolating the defect to be regenerated from the overlying soft tissue. It is important that the membrane be trimmed so that it extends 2 to 3 mm beyond the margins of the defect in all directions. The corners of the

membrane should be also rounded to prevent inadvertent flap perforation.

3. **Scaffolding-** The tented space initially becomes occupied by a fibrin clot, which serves as a scaffold for the in-growth of progenitor cells. It acts as a framework for cell migration and cell proliferation. The progenitor cells migrate from adjacent bone or bone marrow.
4. **Stabilization-** The membrane must also protect the clot from being disturbed by movement of the overlying flap during healing. It is therefore often, but not always, fixed into position with sutures, titanium screws, mini bone screws, or bone tacks. Sometimes, the edges of the membrane are simply tucked beneath the margins of the flaps at the time of closure, providing stabilization.
5. **Framework-** In areas such as, dehiscence or fenestrations, the membrane collapses and cannot maintain the space. In such areas, the membrane should be supported by framework to prevent it from collapsing. Bone grafts such as autografts, allografts or xenografts may be placed which acts as framework, preventing membrane collapse. Stiffer membranes such as titanium reinforced membranes can also be used.

PASS principle of GBR[9]



Case Report

A 33 years old male patient reported to the outpatient department of Department of Periodonics, AB Shetty Memorial Institute of Dental Sciences, Mangalore with the chief complaint of missing teeth in the right lower back region of the jaw since 2 years. Patient was moderately built and well nourished. No relevant family or medical history was associated. On intra oral examination, tooth 46 was missing with Siebert's Class II defect of the ridge (Fig 1). An intra oral periapical (IOPA) radiograph was advised with the same (Fig 2). Hence, a staged surgical technique, i.e., GBR was planned with the same followed by implant placement with 46.

Phase 1 therapy was done and patient was advised to maintain oral hygiene. Patient was recalled after 10 days for the GBR procedure. After anaesthetizing the area with local infiltration, a supracrestal incision was placed slightly lingually with 46. A full thickness mucoperiosteal flap was reflected beyond he mucogingival junction (Fig 3). The area was decorticated using no 5 round bur to induce bleeding points for angiogenesis (Fig 4). Bio Oss as a bone graft was used which was mixed with the normal saline and was paced in that area (Fig 5).

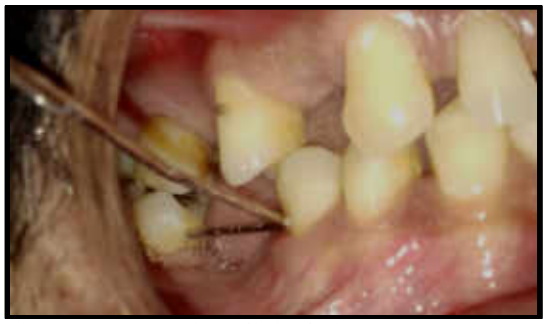


Fig 1- Pre-operative clinical picture

Fig 2- Pre-operative IOPA

5ml of blood was collected via venipuncture from the anticubital vein in the anticubital fossa and was centrifuged for 10 mins in 3000 rpm. PRF clot was obtained which was squeezed between two surgical gauzes to form a membrane [10, 11]. This PRF membrane was placed on top of the bone graft (Fig 6). Sutures were

paced (Fig 7) and was covered with a periodontal pack. Post operative antibiotic and analgesics were prescribed. Patient was given post operative instructions and was advised to report back after 10 days for suture removal. After 10 days, sutures were removed (Fig 8). Healing was satisfactory. Patient was put on maintenance therapy and was recalled after 4 months. 4 months post operatively, good soft tissue healing with an increased bulk was seen with 46 (Fig 9). IOPA was taken with the same and bone fill was noticed (Fig 10).

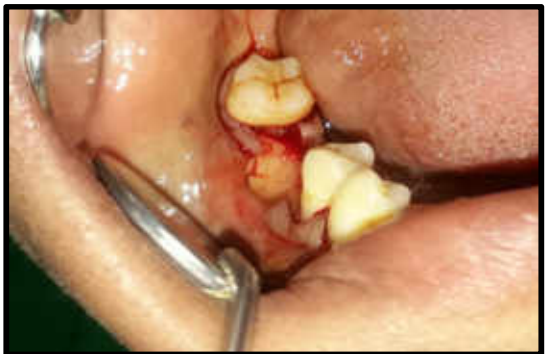


Fig 3- Flap reflection

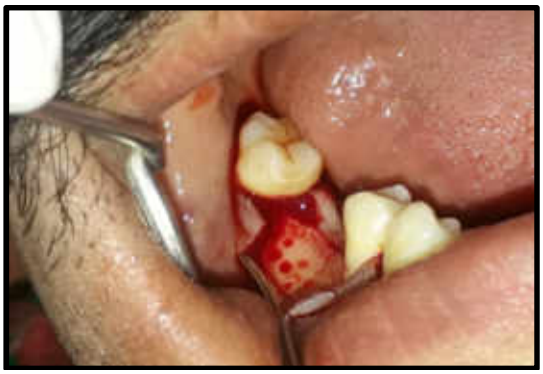


Fig 4- Decortication

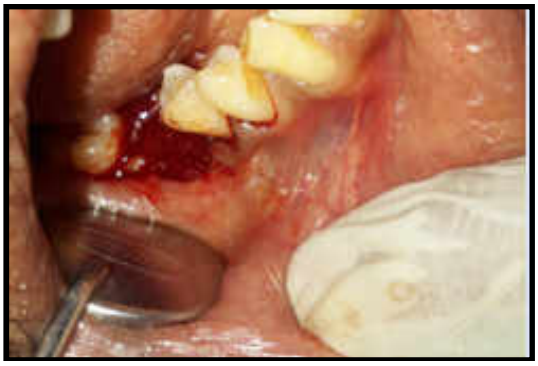


Fig 5- BioOss placed

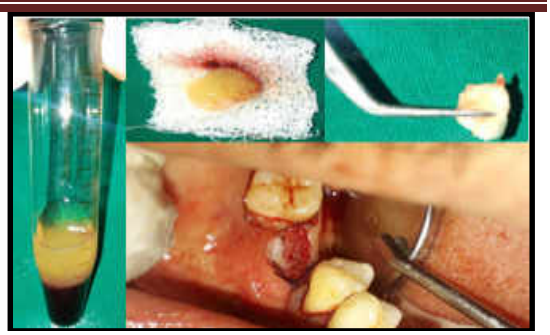


Fig 6- PRF as a membrane

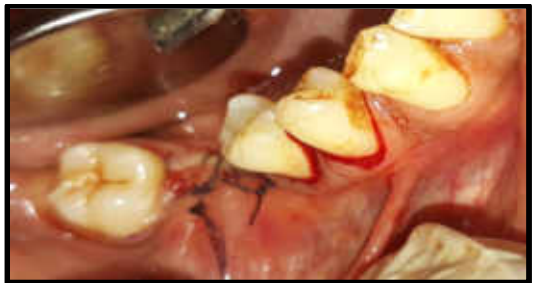


Fig 7- Sutures placed

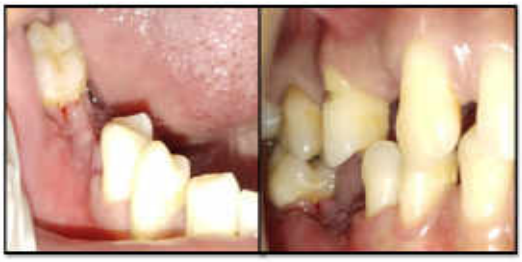


Fig 8- 10 days post operative

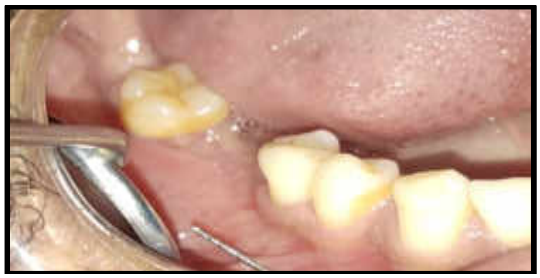


Fig 9- 4 months post-operative

Fig 10- Comparison of pre and 4 months post operative IOPA showing bone fill

Discussion

Platelet rich fibrin (PRF) is a second-generation platelet concentrate consisting of fibrin membrane enriched with platelets, leukocytes, growth factors, and cytokines. [10, 12] It is autologous in nature, gradually resorbed over time, and healing biomaterial with potential for bone and soft tissue regeneration. [12] PRF is simpler and faster to prepare compared to platelet rich plasma (PRP), because it is only centrifuged blood without any additives such as anticoagulant, bovine thrombin, and any other gelling agent. [13, 14] It is also more suitable for manipulation or suturing. [13] In addition, it is cost effective and carries no risk of allergic reaction. [11, 14]

PRF as a membrane- *[15, 16]*

1. Increases local cytokines and growth factors
2. Reduces local inflammation
3. Promotes the formation of new bone

During GBR procedures, it is crucial to create a space that is properly isolated from the surrounding soft tissues and can be maintained for an appropriate period of time to ensure osteogenesis. [17, 18] In addition to space maintenance, the membrane plays a role in clot stabilization while simultaneously preventing migration of non-osteogenic tissues into the area. [19, 20] PRF has to be considered as a fibrin biomaterial. Its molecular structure with low thrombin concentration is an optimal matrix for migration of endothelial cells and fibroblasts. [21, 22] It permits a rapid angiogenesis and an easier remodeling of fibrin in a more resistant connective tissue. [23] The matrix carries all the favorable constituents present in a blood sample. Because the PRF fibrin matrix is better organized, it was able to more efficiently direct stem cell harnessing and the healing program. [24] Direct interactions between fibrin and osseous cells during healing are insufficiently documented. Thus, regeneration using PRF as grafting material and membrane enriched with growth factors can induce and improve bone formation.

However, PRF as a membrane lacks rigidity and needs to be carefully handled to prevent tearing. [10, 11] As PRF membrane is resorbed within two weeks or less at the implantation site, it can barely maintain sufficient space for bone regeneration. [25]

Several studies have been conducted to overcome these drawbacks. Heat-compression of the PRF membrane results in delayed degradation up to 4 weeks without sacrificing its biocompatibility by reducing the porosity and surface area, and it could easily be prepared at chair-side and applied as a barrier membrane. [25] In addition, Ankaferd Blood Stopper, a standardized herbal extract approved for external bleeding hemostasis, loaded PRF improved mechanical properties by reducing porosity similar to heat compressed PRF membrane. [26] However, advanced research is required on its biological properties.

As an improved formulation of PRF, concentration growth factor (CGF) was introduced by Sacco in 2006. [27, 28] It is considered as a new fibrin matrix block made by separating it from a centrifuged blood sample using a special device in a manner similar to PRF. CGF is a bigger fibrin matrix with a higher concentration of growth factors because of the different centrifugation speed. [28] Clinically, CGF has showed good bone regeneration ability in maxillary sinus and alveolar bone augmentation, and it was reported that the use of CGF membrane showed bone regeneration similar to collagen membrane in GBR. [29, 30]

Conclusion

GBR using bone graft and PRF as membrane enriched with growth factors can induce and improve bone formation. However more research is needed is this field to know the success rate of PRF as a membrane.

Conflict of Interest: *None declared*
Source of Support: *Nil*
Ethical Permission: *Obtained*

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