



CORONALLY ADVANCED FLAP ALONG WITH TUNNELING FOR THE TREATMENT OF CLASS II RECESSION DEFECT USING PRF MEMBRANE: A CASE REPORT

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ABSTRACT A multitude of gingival recession management techniques have been introduced but with moderate results. CAF alone and in combination with PRF membrane is a highly predictable procedure for the treatment of Miller Class I and Class II gingival recessions. In the following case, CAF without vertical incisions and use of tunneling was done in combination with placement of PRF membrane in a class II recession defect.

KEYWORDS : PRF, coronally advanced flap, tunneling, gingival recession.

INTRODUCTION:

Periodontitis is a destructive inflammatory disease of the supporting tissues of the teeth and is caused either by specific microorganisms or by a group of specific microorganisms, resulting in progressive destruction of the periodontal ligament and alveolar bone with periodontal pocket formation, gingival recession, or both.[1]

Gingival recession is a matter of concern for both patients and dental professionals, especially when exposure of the root surface is linked to deterioration in esthetic appearance and increase in dental hypersensitivity.[2] Gingival recession is defined as the displacement of the gingival margin apical to the cemento-enamel junction (CEJ) and may involve one or more tooth surfaces.[1] It is one of the major aesthetic concerns seen in the field of periodontology. Root hypersensitivity is a common complaint associated with gingival recession, resulting because of root exposure and subsequent exposure of dentinal tubules in the oral cavity. It also results in attachment loss and root caries. [3] Thus, it is essential to carry out root coverage surgery for the aforementioned conditions. If untreated, gingival recession may progress to the point that it can compromise the prognosis of the tooth in question. [4]

Causes of Gingival Recession:

- **Predisposing factors:**
 - Minimal attached gingiva
 - Aberrant frenal pull
 - Tooth malposition (fenestration and dehiscence).
- **Precipitating factors:**
 - Inflammation related to plaque
 - Improper tooth brushing
 - Iatrogenic factors such as crown preparations extending subgingivally, impression techniques involving gingival retraction, Poor orthodontic treatment where the teeth are moved outside the labial or lingual plate
 - Anatomical factors include abnormal tooth position in the arch, aberrant path of eruption, individual tooth shape, thin gingival biotype
 - Pathological factors such as bone resorption due to periodontal disease.

The amount of recession is assessed clinically by measuring in millimeters the distance from the CEJ and the soft tissue margin. The recession of gingiva, either localized or generalized, may be associated with one or more surfaces, resulting in attachment loss and root exposure. Marginal gingival recession therefore should not be viewed as merely a soft tissue defect, but as the destruction of both the soft and hard tissue.[4] Marginal tissue recession as a clinical entity has been documented since the last century. The earlier concept of a defined width of attached gingiva necessary to maintain oral hygiene does not

hold true now. It is essential to carry out root coverage surgery whenever concerns such as aesthetics, sensitivity, susceptibility to root caries, pulpal symptoms due to exposure of root, food lodgment and plaque deposition exist. [5]

Historically, periodontal therapy has been directed primarily at the elimination of disease and maintenance of a functional, healthy dentition and supporting tissues. More recently, however, it has become increasingly focused on esthetic outcomes, which extend beyond tooth replacement and tooth color to include the soft tissues framing the dentition. [6] Periodontal plastic surgery is defined as the surgical procedures performed to correct or eliminate anatomic, developmental or traumatic deformities of the gingiva or alveolar mucosa. [4] Root coverage procedures aim at providing both tangible (resolution of dentinal hypersensitivity and esthetic dilemma) and intangible benefits (clinical attachment gain, recession coverage, increased keratinized tissue height and gingival thickness [GTH]) to the patients. Various procedures have been tried to obtain root coverage of single rooted teeth. Miller Class I and II gingival recessions hold out the best promise for root coverage as there is no interdental bone and soft tissue loss associated with these recessions. [7] A considerable amount of data demonstrated that various surgical techniques could lead to complete root coverage (RC) in single Miller Class I and II recessions but, multiple adjacent gingival recessions (MAGR) still challenges the clinician as larger avascular surfaces, poorer blood supply, varying recession depth and malposition of teeth jeopardizes wound healing. [8] Various periodontal plastic surgical procedures are offered to treat gingival recession such as free graft which includes free gingival graft and subepithelial connective tissue graft; and pedicle flap which includes lateral pedicle flap and coronally advanced flap (CAF). With the use of free gingival grafts, gingival tissue color matching is always a problem which results in an unsatisfactory aesthetic.[3]

Among a variety of surgical techniques, coronally advanced flap (CAF) is the ideal surgical procedure in the presence of sufficient keratinized gingiva apical to the recession defect. Adequate root coverage, appropriate color match, and healing with the original alignment of the soft-tissue margin can also be achieved with CAF. Therefore, the CAF is very convincing in treating adjacent multiple gingival recession terms of esthetics. [9] Histologically, this technique leads to reformation of junctional epithelium and the connective tissue attachment with minimal bone repair. [7] The quality of healing after RC has been examined in a few histological studies. Although the formation of long junctional epithelium is generally expected after conventional mucogingival surgery, a limited amount of regeneration can be achieved with conventional techniques.[10] CAF when used alone is unstable on long-term, in spite of having many advantages. Such procedure does not always result in the regeneration of lost attachment apparatus such as cementum, periodontal ligament, and

alveolar bone, which may act as a future risk factor in the recurrence of gingival recession. To avoid such further risk of recurrence, CAF is often combined with various regenerative materials like guided tissue regeneration membranes, root biomodification agents, platelet rich plasma, enamel matrix proteins derivatives, aloderm and living tissue-engineered human fibroblast derived dermal substitute, which helps to regenerate functional attachment apparatus as well as enhances root coverage.[3,6]

Periodontal wound healing requires a sequence of interactions between epithelial cells, gingival fibroblasts, periodontal ligament cells, and osteoblasts. The disruption of vasculature during wound healing leads to fibrin formation, platelet aggregation, and release of several growth factors into tissues from platelets through molecular signals which are primarily mediated by cytokines and growth factors.[11] Various new regenerative materials have been tried with CAF. One of such material is autologous platelet concentrates.[3] Platelets have a vital role in periodontal regeneration due to the presence of growth factors and cytokines which are essential for maturation of soft tissue and regeneration of bone. [9] Platelet rich fibrin (PRF) is an autologous biomimetic agent that belongs to second generation platelet concentrate system, with simplified processing.[6] Platelet-rich fibrin was developed in France by Choukroun *et al.* in 2001.[7,10] Its advantages over the platelet rich plasma i.e. better known as PRP include an ease of preparation/application, minimal expense and lack of biochemical modification, as no bovine thrombin or anticoagulant is required for its preparation. PRF is a fibrin matrix in which platelet cytokines (growth factors) and cells are trapped and are released over time.[7] Blood is collected in dry glass tubes or glass coated plastic tubes and centrifuged immediately, and the fibrin clot is formed in the middle of the tube. Unlike the other platelet concentrates, PRF was defined as an autologous leukocyte and PRF biomaterial, because in this method, platelets and leukocytes are collected with high efficiency such that the growth factors will be able to release gradually during at least 1 week. It has been shown in different studies that PRF has a proliferative effect on different types of cells such as dental pulp cells, human osteoblasts, human gingival and periodontal ligament fibroblasts, dermal prekeratinocytes, and preadipocytes. This homogeneous fibrin network is considered as a healing biomaterial and is used to enhance bone regeneration and soft tissue healing in implant and periodontal plastic surgical procedures, healing of extraction sockets, and treatment of intrabony defects and radicular cysts. [10] The alpha granules secreted by the platelets trapped in the membranes will secrete their growth factors for a natural and slow resorption rate of the membranes (15 days). The growth factors released are: platelet-derived growth factor (PDGF), transforming growth factor- β (TGF- β), vascular endothelial growth factor (VEGF), epidermal growth factor (EGF), and insulin-like growth factor-1 (IGF-1).[12] It can also serve as a resorbable interpositional membrane. The PRF layer avoids early invagination of the gingival epithelium, thereby serving as a barrier to epithelium migration. This has been used successfully in combination with CAF for root coverage in isolated and multiple gingival recessions.[7]

Choukroun's PRF (leukocyte- and platelet-rich fibrin, L-PRF) is an autologous, non-thrombinized, dense and stable fibrin matrix rich in platelets and leukocytes. Over an extended period of time, a properly prepared L-PRF membrane releases several cytokines and growth factors related to immune-inflammatory response and complex cascade of wound healing. Considered as a living biomaterial with a simplified preparation and handling protocol, L-PRF is commonly used in dental implant and periodontal plastic surgeries, solely or in combination with some other types of biomaterials, to enhance soft and hard tissue healing. The use of PRF for the treatment of MAGR has also been investigated but not compared with the usage of other biomaterials or autogenous soft tissue grafts.[8]

The tunnel recession coverage method presented by Blanes and Allen, Zabalegui *et al.*, and Santarelli *et al.* is a modification of the envelope method described by Raetzke. Exposed roots are covered using only sulcular incisions, so scars from vertical releasing incisions are avoided in the tunnel technique. In addition to improved wound healing, results of root coverage procedures have been very satisfying.[13] Vertical incisions along with tunnel preparation have been advocated in the literature for the purpose of facile graft placement and flap mobilization.[1] Procedures using connective tissue grafts (CTGs) and the tunnel technique result in good predictability of root coverage, but they require a second surgical site. For patients with multiple recessions, it can be difficult to harvest

sufficient connective tissue from the palate, and multiple surgeries can be necessary to achieve optimal results. Therefore, availability of soft tissue substitutes appears useful for treatment of these conditions.[13]

Indications for pouch and tunnel technique include:[4]

- Miller's Class I and Class II gingival recession
- Lack of adequate donor tissue for lateral sliding flap
- Presence of multiple and wide recessions in maxillary teeth
- Increased recession in areas where esthetic concerns is of great concern
- Exposed root sensitivity.

CASE REPORT:

A 25 year old male patient reported to the department of periodontology, Rama Dental College, Hospital and Research Center, Kanpur with a chief complaint of hypersensitivity in relation to upper anterior teeth.

On oral examination there was Miller's Class II recession in relation to 22 and 23. The distance from CEJ to marginal gingiva was 3 mm and 5 mm respectively[Figure-1]. The width of attached gingiva was found to be inadequate in the region of 22 and 23. A pouch and tunnel technique utilizing palatal connective tissue graft for root coverage was planned. Complete hemogram checkup was done before surgical procedure. Scaling and root planing was carried out and the root convexity was reduced. Oral hygiene instructions were given mainly in terms of proper brushing technique. Three weeks following this initial therapy, the periodontal re-evaluation was done for oral hygiene maintenance and to record gingival tissue response to the initial therapy. After re-evaluation surgical procedure was carried out.



Figure-1 Preoperative view of recession defect

After preoperative oral antiseptics the surgical area was anaesthetized, the exposed root surface was scaled and planed followed by root conditioning with a fresh tetracycline (125 mg tetracycline/ml of saline). A sulcular incision through each recession area was given and the tissues were gently undermined, beyond the mucogingival junction so as to relax the flap sufficiently to allow placement of the connective tissue graft. Each pedicle adjacent to the recession was undermined gently without detaching it completely to prepare a tunnel. The undermining of tissues to prepare the tunnel was done by extending the undermining laterally 3-5 mm. [Figure-2]



Figure-2 Completion of tunnel preparation

But the patient got apprehensive during the treatment after tunnel preparation and was not ready for the harvesting of connective tissue

graft from the palate. So the treatment plan was changed and PRF was placed instead of connective tissue graft and the flap was coronally positioned.

The PRF was prepared following the protocol developed by Choukroun *et al.* amidst the surgery, 10 ml of intravenous blood (by a venipuncture of the antecubital vein) was collected in test tubes without anticoagulant and immediately centrifuged at 3000 revolutions/min for 10 min. At the end of centrifugation, three layers were seen, the top layer containing supernatant serum, the fibrin clot at the middle layer, and the bottom layer containing the red blood corpuscles (RBC) [Figure-3]. The fibrin clot was easily separated from the RBC base (preserving a small RBC layers) using sterile tweezers and scissors, and placed in a sterile dappen dish and was left aside to release their serum slowly into the dappen dish (soft exudates extraction). Care was taken to retain at least 1 mm area of RBC layer as the leucocytes and platelets are found to be concentrated at the junction of PRF clot and RBC layer. PRF membrane was obtained by squeezing out the fluids (serum content) from the fibrin clot by soft compression method in between two glass slabs with the gauze piece.



Figure-3 Retrieving PRF after centrifugation of blood

All surgical procedures as well as PRF preparation were done by a single surgeon. PRF membrane was placed over the recession defect, at the level of the CEJ [Figure-4(a)] and held in position with single independent sling suture. The serum exudate from the fibrin clot was applied over the surgical site. Flaps were then coronally advanced, with its margin located on the enamel, interposed with the PRF membrane and the vestibular soft tissue was positioned 1 mm coronal to CEJ to account for soft tissue shrinkage. The suturing of the flap started with coronal sling suture. Interrupted sutures, given around incision were directed apico-coronal from the flap to adjacent buccal soft tissue [Figure-4(b)]. This was done to facilitate the coronal displacement of the flap and to reduce the tension on the flap. Further the flap stabilization was enhanced by placing an interdental tag suture on each papilla 1 mm apical to the site of sling suture. The periodontal dressing was applied to the surgical site on the buccal and lingual aspects without application of excessive pressure interdentally.



Figure -4(a) PRF placed in the recession defect (b) Interrupted sling sutures placed to CAF

Patient was given antibiotics, analgesics and anti-inflammatory drugs for 5 days and was instructed to rinse their mouth with a 0.12% chlorhexidine solution, 2 times a day for 1 min, for 4 weeks. Periodontal dressing and sutures were removed after 10 days. Patient was reviewed and instructed to refrain from brushing at the site for a period of another 2 weeks. The restitution of mechanical tooth cleaning using an ultrasoft toothbrush and a roll technique was instructed at the

end of the first postoperative month. The patient was followed up to 6 months. [Figure-5] Significant amount of root coverage was achieved. Results of which were stable up till 6 months.

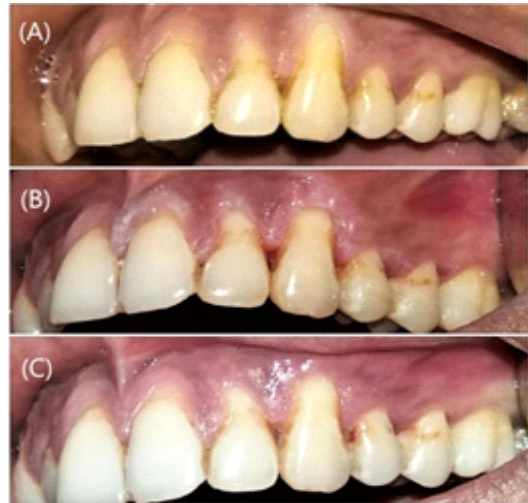


Figure-5 Comparative view (A)-Preoperative view, (B)- 2 week post-operative view, (C)- 6 month post-operative view

DISCUSSION:

The problems of hypersensitivity, root caries and increasing interest in aesthetics, have led to surgical procedures that permit the coverage of exposed roots. The tunnel technique was developed as a modification of the envelope technique to manage multiple adjacent recessions. The results of the tunnel procedure and its modification demonstrated favorable root coverage. [5]

The use of tunnel procedure preserves the intermediate papilla and may accelerate the initial wound healing. The tunnelling also applies less traction and preserves the gingival height. Due to minimal trauma at the recipient site, the procedure may be of advantage in recessions as compared to the coronally repositioned flap. The tunneling technique combines the advantages of sub epithelial grafting along with envelope procedures thus improving the predictability. Thus the pouch and tunnel procedure is ideal for treatment of MAGR in a single surgical procedure demonstrating early healing and highly predictable root coverage results. [5] But in this case the treatment plan was changed to CAF with PRF.

Problems relate particularly to the fact that very often, the patient exposes only the most coronal millimeters of the recession when smiling. Thus, only surgical procedures that provide the clinician with a very high percent of complete root coverage should be included in the mucogingival plastic surgical techniques. Among the pedicle grafts, the CAF is one of the valid surgical options to cover exposed root surfaces. It has many advantages over other surgical procedures used to treat gingival recessions: it does not require a separate surgical site to obtain a graft; the tissue of the pedicle provides a perfect color and contour match with the surrounding tissue; the procedure is simple to perform; and does not require an extended surgical or recovery time. [3]

Most of the studies support the hypothesis that therapy with CAF alone can be successfully applied when the residual gingiva is thick and wide. Accordingly the adjunctive use of a graft could be restricted to sites with thin residual gingiva. Therefore in the present case report, PRF was used along with CAF without vertical releasing incisions. PRF promotes more rapid attachment to the tooth with stable result. In addition, PRF slows down the blood activation process, which could induce an increased leukocyte degranulation and cytokine release from pro-inflammatory mediators, such as interleukin (IL)-1 β , IL-6, and tumor necrosis factor- α , to anti-inflammatory cytokines, such as IL-4, different growth factors like transforming growth factor-1 β , platelet derived growth factor- α β , and vascular endothelial growth factor, and glycoproteins (thrombospondin-1) over more than 7 days. Leukocytes seem to have a strong influence on growth factor release, immune-regulation, anti-infectious activities and matrix remodelling during healing. As a healing material, it stimulates the gingival connective tissue on its entire surface with growth factors and impregnates the root surface with key matrix proteins for cell

migration (fibronectin, vitronectin, and thrombospondin-1). Moreover, the fibrin matrix itself shows mechanical adhesive properties and biologic functions like fibrin glues, it maintains the flap in a high and stable position; enhances neoangiogenesis; reduces necrosis and shrinkage of the flap; and guarantees maximal root coverage.[3]

No untoward reaction such as pain, swelling, hypersensitivity and redness was reported by the patient. Soft tissue showed excellent healing in terms of achievement of color, contour and texture integration as that of clinically healthy gingiva. The tissue merging with the adjacent areas was satisfactory at the sites of vertical incisions.[7]

However, an earlier study by Aroca *et al.* have reported an inferior recession coverage using PRF membrane, when compared with CAF alone in multiple recession defects. This inferior result was attributed to the use of a single PRF membrane for a multiple recession defect. Since PRF membrane is an inhomogeneous matrix with leukocytes and platelet aggregates concentrated within different ends, it is appropriate to use more than one membrane placed in an opposite direction to have a uniform effect over the entire recession defects.[6]

Similarly, Pini-Prato *et al.* have reported a creeping attachment post-surgically at sites where GTH was increased using connective tissue graft. Contradicting to these, Wenstrom and Zucchelli reported that the stability of the gingival margin obtained post-surgically is determined by an altered tooth brushing technique, which reduces tissue trauma rather than to the gingival dimensions. However, the proper evaluation of the effect of GTH on recession coverage stability (i.e. no change, further recession, or creeping attachment) necessitates more investigations with greater follow-up visits.[6]

Thamaraiselvan M *et al* compared CAF with and without PRF in the treatment of isolated Miller's class-I and class-II gingival recession. The CAF group showed a non-significant gingival thickness (GTH) increase of 0.03 ± 0.04 mm which is similar to other studies. Interestingly, the addition of PRF to CAF resulted in a 0.30 ± 0.10 mm GTH increase, which was statistically significant when compared both within and between the groups and concurs well with Aroca *et al* study.[3]

Biju RM *et al* used PRF along with CAF to treat gingival recession of around 2-3 mm with 22 and 23. Superior results were obtained after the treatment with residual recession of only 1mm remaining in 23 after 6 months.[3] Rajaram V *et al* evaluated the effect of PRF, when used along with double lateral sliding bridge flap for the coverage of multiple gingival recessions. No added benefits of PRF was seen in both studies.[3]

Baseline recession depth is important in determining the treatment outcome. Greater baseline gingival recession depth is always associated with decreased results in terms of root coverage. Other factors like root prominence, tooth position, vestibular depth, high frenal pull, gingival thickness as well as tooth brushing technique of the patient have to be considered and should be corrected before carrying out root coverage procedure. This enhances the treatment outcome and helps to maintain long term results.

Thus, in the presented case report, addition of PRF to CAF helped to obtain favorable clinical outcome in terms of root coverage. No histologic evaluation was performed to assess the type of healing. Therefore, the effect of PRF on the establishment of a connective tissue attachment remains to be determined. Further evaluation of PRF to CAF is necessary to find out the type of healing, histologically as well as long term follow up of the clinical case.[3]

CONCLUSION:

CAF alone and in combination with PRF membrane is a highly predictable procedure for the treatment of Miller Class I and Class II gingival recessions. However, PRF provided an additional advantage of earlier healing and quicker attainment of optimal gingival tissue thickness which was maintained throughout the follow-up period. As adequate gingival tissue thickness is a known predictive factor for long-term stability of soft tissue recession coverage; it can be inferred that the use of PRF in conjunction with CAF can prove to be a superior choice for the treatment of such defects.[7]

The ease of applying PRF in the dental clinic and its beneficial outcomes, including reduction of bleeding and rapid healing, holds promise even though the mechanisms involved are still poorly understood. More well-designed and properly controlled studies are needed to provide solid evidence of PRF's capacity for and impact on wound healing, soft tissue reconstruction and augmentation procedures, especially in periodontal therapy.[6]

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