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# Surgical Management of Gingival Recession Using Coronally Advanced Flap With Platelet-Derived and Amniotic Membranes: A Split-Mouth Randomized Controlled Trial

**Dr. Dhanesh Singh Roa[1], *Dr. Akshay Verma[2], Dr. Shreeyam Mohapatra[3], Dr. Abhishek Choudhary[4], Dr. Jagdish Salvi[5], Dr. Shubangi Pareek[6]**
[1]Associate professor, Department of periodontology, Rajasthan dental college and hospital Jaipur.
[2]Professor Department of Oral Pathology and Microbiology, Rajasthan Dental College and Hospital, jaipur
[3]Associate Professor, Department of Oral Medicine and Radiology, SCB Dental College and Hospital, Cuttack
[4]Professor, Department of Oral Surgery, Rajasthan Dental College and Hospital, jaipur
[5]Post graduate trainee, Department of Oral Pathology and Microbiology, Rajasthan Dental College and Hospital, jaipur
[6]Assistant professor, Department of oral pathology and microbiology, SCB Dental College and Hospital, Cuttack
**Address for correspondence**:
**Dr. Akshay Verma**. Professor, Department of Oral Pathology and Microbiology, Rajasthan Dental College and Hospital, Jaipur, Rajasthan

***Abstract***
*The need of Perioplastic surgical therapy for gingival recession coverage has increased due to aesthetic awareness & need for functional comfort. The objective of this study is to compare AM & PRF membrane for surgical correction of Miller class I & II gingival recession.*
*A randomized Controlled clinical trial for bilateral gingival recession in which 10 patients will be selected from the Department of Periodontology & Oral Implantology, Rajasthan Dental College & Hospital, Jaipur. Prior consent and ethical considerations of possible risks and benefits were informed and thoroughly prioritized. The Experimental site Group A was treated with Amniotic membrane and Experimental site Group B with Platelet rich Fibrin.*

## INTRODUCTION

Gingival recession is a prevalent and multifactorial condition in periodontology, characterized by the apical migration of the gingival margin relative to the cemento-enamel junction (Kassab and Badawi, 2010)[1]. While often underestimated, it poses significant clinical and psychosocial challenges—ranging from hypersensitivity, root caries, and cervical abrasions to aesthetic concerns, particularly in the anterior region (Grover and Aggarwal, 2012)[2]. Although commonly observed in aging populations, recession itself is not a diagnosis but rather a clinical manifestation of underlying or multifactorial etiologies (Anarthe et al., 2013)[3].

The pathogenesis of gingival recession encompasses both endogenous and exogenous factors. Improper oral hygiene practices such as aggressive brushing, anatomical factors like thin biotype and bone dehiscence, and iatrogenic causes from orthodontic, prosthetic, and periodontal procedures have all been implicated (Khosya and Devaraj, 2014)[4]. Management thus necessitates not only treatment but also precise identification and mitigation of causative influences.

Historically, a variety of mucogingival surgical techniques—such as the laterally positioned flap, free gingival autograft, and subepithelial connective tissue graft—have been utilized for root coverage. Among them, the Coronally Advanced Flap (CAF)**,** first described by Norberg in 1926 and later refined by Pini Prato in 1993[5], has emerged as a widely accepted approach due to its superior aesthetic blending and donor-site sparing nature (Pini Prato et al., 1993[4]; Agarwal et al., 2016). However, its effectiveness is

constrained by the availability of keratinized tissue apical to the defect and its relatively unstable long-term outcomes (Lee et al., 2002[6];Tanyaand Thomas, 2012[7]).

To address these limitations, Guided Tissue Regeneration (GTR) was introduced as a biologically driven alternative. GTR employs a physical barrier to exclude epithelial down-growth, facilitating the regeneration of lost periodontal structures such as cementum, periodontal ligament, and alveolar bone (Malathi et al., 2013)[8]. While non-resorbable membranes have shown favorable outcomes, their necessity for surgical removal imposes risks to healing (Velez et al., 2010)[9]. Hence, bioresorbable materials—such as collagen, polylactide-co-glycolide membranes, platelet-rich fibrin (PRF), and amnion—are now preferred for their capacity to support regeneration while eliminating the need for re-entry procedures (Trabulsi et al., 2004)[10].

Platelet-Rich Fibrin (PRF**)**, pioneered by Choukroun et al. (2001)[11], is an autologous, second-generation platelet concentrate that forms a fibrin matrix rich in growth factors, cytokines, and stem cells. Its inherent potential to accelerate wound healing and promote periodontal regeneration has led to its widespread adoption in procedures ranging from ridge augmentation to soft tissue root coverage (Choukroun et al., 2001[11]; Kanakamedala et al., 2009[12]). Moreover, its resorbability and scaffold-like structure qualify it as a suitable biologic membrane in GTR protocols (Tanya and Thomas, 2012)[7].

Recently, amnion membranes, derived from human placental tissue, have been introduced as third-generation GTR barriers. Rich in type III, IV, and V collagen, fibronectin, and laminins—particularly laminin-5—amnion supports epithelial adhesion, proliferation, and matrix remodeling (Sharma and Yadav, 2015[13]; Niknejad et al., 2008[14]). Unlike synthetic membranes, amnion possesses intrinsic anti-inflammatory, anti-fibrotic, and immunomodulatory properties. It promotes neovascularization, minimizes scarring, and accelerates epithelialization, fulfilling both the mechanical and biological tenets of regenerative therapy (Singh and Singh, 2013[15]; Gautam, 2017[16]). Its self-adhering property also simplifies surgical handling, reducing operative time and eliminating the need for sutures (Sheikh et al., 2014)[15].

Despite their respective advantages, literature comparing PRF and amnion membranesdirectly in the treatment of gingival recession is scarce. Given the unique biological benefits offered by each, a direct clinical comparison is essential to determine their relative efficacy in promoting root coverage and soft tissue healing.

Therefore, the present study was undertaken to compare the clinical effectiveness of amnion membrane and platelet-rich fibrin in the treatment of Miller's Class I and II gingival recession defects.

**AIM OF THE STUDY**

The aim of the present study is to clinically assess and compare the efficacy of Amnion membrane and Platelet-Rich Fibrin (PRF) in the treatment of gingival recession.

**OBJECTIVE OF THE STUDY**

To evaluate and compare the clinical outcomes of bilateral gingival recession coverage using Platelet-Rich Fibrin and Amnion membrane, based on the following clinical parameters:

1. **Plaque Index (PI)** – to assess the level of oral hygiene.
2. **Gingival Index (GI)** – to evaluate gingival inflammation.
3. **Recession Depth (RD)** – to measure the extent of gingival margin apical shift.
4. **Probing Depth (PD)** – to determine the depth of periodontal pockets.

5. **Relative Attachment Level (RAL)** – to assess periodontal attachment gain or loss.
6. **Width of Attached Gingiva (AG)** – to evaluate the zone of keratinized gingiva post-treatment.

## MATERIALS & METHOD

### Study Design and Subject Selection

This randomized controlled clinical trial involved 10 systemically healthy patients aged 20–35 years, presenting with bilateral Miller's Class I or II gingival recession defects. Patients were recruited from the Department of Periodontology & Oral Implantology, Rajasthan Dental College & Hospital, Jaipur. Ethical approval and informed consent were obtained. Routine medical screening and intraoral periapical radiographs were performed to confirm eligibility. Patients with poor oral hygiene, systemic diseases, contraindicated medications, tobacco use, or previous root coverage procedures were excluded.

➢ **Study Groups**

Bilateral recession sites in each patient were randomly assigned as:

- **Group I**: Treated with Amniotic membrane
- **Group II**: Treated with Platelet-Rich Fibrin (PRF)

➢ **Materials Used**

- **Amniotic membrane**: Freeze-dried, bioabsorbable, and sourced from Tata Memorial Hospital Tissue Bank, Mumbai.
- **PRF preparation**: Followed Choukroun's protocol (2001). 10 mL of intravenous blood was centrifuged at 3000 rpm for 10 minutes without anticoagulant to obtain PRF clots.

➢ **Presurgical Procedures**

Patients underwent full-mouth scaling, root planing, and oral hygiene instruction. Custom acrylic stents were fabricated for standardization of clinical measurements.

➢ **Clinical Parameters Assessed**

Measurements were recorded at baseline, 3 months, and 6 months:

1. **Plaque Index (PI)** – Silness and Löe, 1964
2. **Gingival Index (GI)** – Löe and Silness, 1963
3. **Recession Depth (RD)**
4. **Probing Depth (PD)**
5. **Relative Attachment Level (RAL)**
6. **Width of Attached Gingiva (AG)**

➢ Surgical Procedure

A coronally advanced flap (CAF) technique was used in both groups. After local anesthesia, two vertical incisions and an intrasulcular incision were made, and a full-thickness flap was reflected.

- In **Group I**, the amniotic membrane was placed over the exposed root, followed by flap repositioning and suturing.
- In **Group II**, PRF membrane was similarly placed and secured.

Both groups received periodontal dressing and identical post-operative instructions.

- **Postoperative Care and Follow-Up**

Patients were prescribed antibiotics and analgesics for five days, and instructed to use 0.2% chlorhexidine mouthwash for two weeks. Sutures and dressings were removed after 14 days. Clinical parameters were re-evaluated at 3 and 6 months postoperatively.


## RESULTS

Key clinical parameters assessed at baseline, 3 months, and 6 months included: **Plaque Index (PI)** (Silness& Loe, 1964), **Gingival Index (GI)** (Loe &Silness, 1963), **Recession Depth (RD)**, **Probing Depth (PD)**, **Relative Attachment Level (RAL)**, and **Width of Attached Gingiva (AG)**. Both **inter-group** and **intra-group** comparisons were performed using appropriate statistical tests (Independent t-test and Paired t-test, respectively).

➢ **Inter-Group Analysis**

- **Plaque Index (PI)**: No statistically significant differences between groups at any time point ($p>0.05$) (Table-2, Graph-1).
- **Gingival Index (GI)**: Comparable scores at baseline and 3 months ($p>0.05$), but a **statistically significant improvement in Group I** at 6 months ($p<0.05$) (Table-2, Graph-2).
- **Recession Depth (RD)**: No significant inter-group difference at any interval (Table-2, Graph-3).
- **Probing Depth (PD)**: Significant improvement in Group I at 6 months compared to Group II ($p<0.05$); other time points were non-significant (Table-2, Graph-5).
- **Relative Attachment Level (RAL)**: No statistically significant differences between the groups at any interval (Table-2, Graph-4).
- **Width of Attached Gingiva (AG)**: No significant inter-group differences throughout the study duration (Table-2, Graph-6).

➢ **Intra-Group Analysis**

*Group I (Amnion Membrane)* – Table-3

- **PI, GI, RD, PD, RAL, and AG**: All parameters showed **statistically significant improvements** across baseline to 3 and 6 months.
- Improvements between 3 and 6 months were significant in most parameters, except PI and RAL, which were not statistically significant between these two time points.

*Group II (Platelet-Rich Fibrin)* – Table-4

- **PI, GI, RD, AG, and RAL**: Significant improvements were seen at all intervals.
- **PD** showed **non-significant changes** between baseline & 3 months and baseline & 6 months but was **significant** between 3 & 6 months.

➢ **Conclusion of Results**

Both **Amnion Membrane and PRF** demonstrated **favorable clinical outcomes** in the treatment of gingival recession. However, **Amnion Membrane showed superior results** in certain parameters like **gingival index and probing depth at 6 months**, indicating its potential advantage in promoting soft tissue healing and inflammation reduction.

The findings were supported by statistically sound comparisons and are well-documented in **Tables 1 through 4 and Graphs.**

**Table 1: Descriptive statistics of AM & PRF at different time period**

| Variable | Group | N | Mean | Std. Deviation | Std. Error Mean | |
|---|---|---|---|---|---|---|
| **Plaque Index** | **Baseline** | **AM** | 10 | 1.673 | 0.09 | 0.03 |
| | | **PRF** | 10 | 1.623 | 0.07 | 0.02 |
| | **After 3 months** | **AM** | 10 | 1.289 | 0.38 | 0.12 |
| | | **PRF** | 10 | 1.226 | 0.26 | 0.08 |
| | | **AM** | 10 | 1.074 | 0.33 | 0.10 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **After 6 months** | **PRF** | 10 | 1.141 | 0.28 | 0.09 |
| **Gingival Index** | **Baseline** | **AM** | 10 | 0.849 | 0.12 | 0.04 |
| | | **PRF** | 10 | 0.848 | 0.11 | 0.04 |
| | **After 3 months** | **AM** | 10 | 0.669 | 0.13 | 0.04 |
| | | **PRF** | 10 | 0.739 | 0.09 | 0.03 |
| | **After 6 months** | **AM** | 10 | 0.471 | 0.14 | 0.04 |
| | | **PRF** | 10 | 0.608 | 0.07 | 0.02 |
| **Recession depth** | **Baseline** | **AM** | 10 | 3.451 | 0.21 | 0.07 |
| | | **PRF** | 10 | 3.414 | 0.28 | 0.09 |
| | **After 3 months** | **AM** | 10 | 0.607 | 0.28 | 0.09 |
| | | **PRF** | 10 | 0.699 | 0.25 | 0.08 |
| | **After 6 months** | **AM** | 10 | 0.543 | 0.24 | 0.07 |
| | | **PRF** | 10 | 0.695 | 0.23 | 0.07 |
| **Relative attachment level** | **Baseline** | **AM** | 10 | 9.49 | 0.19 | 0.06 |
| | | **PRF** | 10 | 9.32 | 0.27 | 0.09 |
| | **After 3 months** | **AM** | 10 | 7.302 | 0.36 | 0.11 |
| | | **PRF** | 10 | 7.331 | 0.26 | 0.08 |
| | **After 6 months** | **AM** | 10 | 7.228 | 0.31 | 0.10 |
| | | **PRF** | 10 | 7.274 | 0.27 | 0.08 |
| **Probing depth** | **Baseline** | **AM** | 10 | 1.372 | 0.09 | 0.03 |
| | | **PRF** | 10 | 1.326 | 0.10 | 0.03 |
| | **After 3 months** | **AM** | 10 | 1.232 | 0.07 | 0.02 |
| | | **PRF** | 10 | 1.294 | 0.14 | 0.04 |
| | **After 6 months** | **AM** | 10 | 1.48 | 0.09 | 0.03 |
| | | **PRF** | 10 | 1.371 | 0.08 | 0.03 |
| **Width of Attached gingival** | **Baseline** | **AM** | 10 | 2.312 | 0.13 | 0.04 |
| | | **PRF** | 10 | 2.305 | 0.25 | 0.08 |
| | **After 3 months** | **AM** | 10 | 3.457 | 0.17 | 0.05 |
| | | **PRF** | 10 | 3.384 | 0.17 | 0.05 |
| | **After 6 months** | **AM** | 10 | 3.497 | 0.17 | 0.06 |
| | | **PRF** | 10 | 3.494 | 0.15 | 0.05 |

**Table 2: Inter-group comparison at different time period (Unpaired t-test*)**

| **Variable** | **Duration** | **t*** | **df** | **Sig. (2-tailed)** |
|---|---|---|---|---|
| **Plaque Index** | **Baseline** | 1.314 | 18 | .205 |
| | **After 3 months** | .432 | 18 | .671 |
| | **After 6 months** | -.489 | 18 | .631 |
| **Gingival Index** | **Baseline** | 0.019 | 18 | .985 |
| | **After 3 months** | -1.383 | 18 | .184 |
| | **After 6 months** | -2.743 | 18 | **.013** |
| **Recession depth** | **Baseline** | .333 | 18 | .743 |
| | **After 3 months** | -.762 | 18 | .456 |

| | | | | |
|---|---|---|---|---|
| | **After 6 months** | -1.466 | 18 | .160 |
| **Relative attachment level** | **Baseline** | 1.625 | 18 | .122 |
| | **After 3 months** | -.208 | 18 | .838 |
| | **After 6 months** | -.357 | 18 | .725 |
| **Probing depth** | **Baseline** | 1.062 | 18 | .302 |
| | **After 3 months** | -1.269 | 18 | .221 |
| | **After 6 months** | 2.820 | 18 | **.011** |
| **Width of Attached gingival** | **Baseline** | .078 | 18 | .939 |
| | **After 3 months** | .954 | 18 | .353 |
| | **After 6 months** | .042 | 18 | .967 |

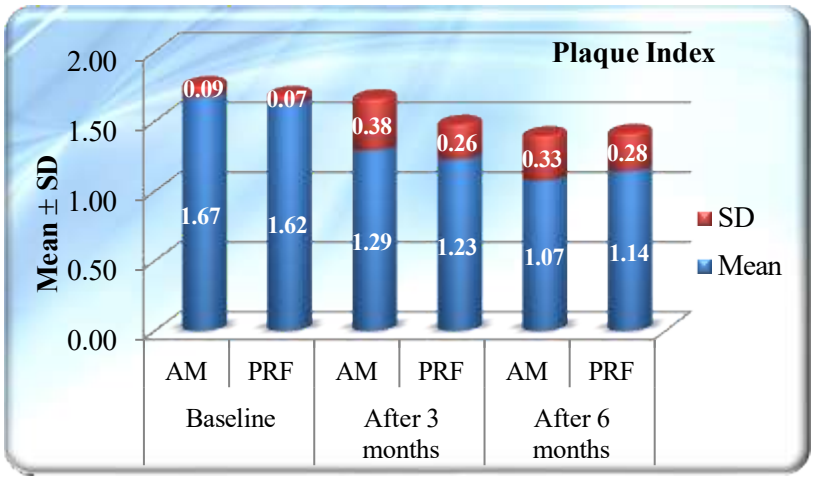
P≤0.05 (Significant)

**Table 3: Intra-group comparisons (AM) at different time period (Paired t-test*)**

| **Variables** | **Duration** | **t*** | **df** | **Sig. (2-tailed)** |
|---|---|---|---|---|
| **Plaque Index** | **Baseline & After 3 months** | 3.065 | 9 | **.013** |
| | **After 3 months & After 6 months** | 1.666 | 9 | .130 |
| | **After 6 months & Baseline** | -5.509 | 9 | **.000** |
| **Gingival Index** | **Baseline & After 3 months** | -4.732 | 9 | **.001** |
| | **After 3 months & After 6 months** | -3.960 | 9 | **.003** |
| | **After 6 months & Baseline** | 6.634 | 9 | **.000** |
| **Recession depth** | **Baseline & After 3 months** | 35.280 | 9 | **.000** |
| | **After 3 months & After 6 months** | 2.478 | 9 | **.035** |
| | **After 6 months & Baseline** | -37.120 | 9 | **.000** |

| | | | | |
|---|---|---|---|---|
| **Relative attachment level** | **Baseline & After 3 months** | 15.512 | 9 | **.000** |
| | **After 3 months & After 6 months** | 1.254 | 9 | .242 |
| | **After 6 months & Baseline** | -18.513 | 9 | **.000** |
| **Probing depth** | **Baseline & After 3 months** | 6.778 | 9 | **.000** |
| | **After 3 months & After 6 months** | -8.807 | 9 | **.000** |
| | **After 6 months & Baseline** | 3.017 | 9 | **.015** |
| **Width of Attached gingival** | **Baseline & After 3 months** | -15.908 | 9 | **.000** |
| | **After 3 months & After 6 months** | -3.464 | 9 | **.007** |
| | **After 6 months & Baseline** | 16.867 | 9 | **.000** |

P≤0.05 (Significant)



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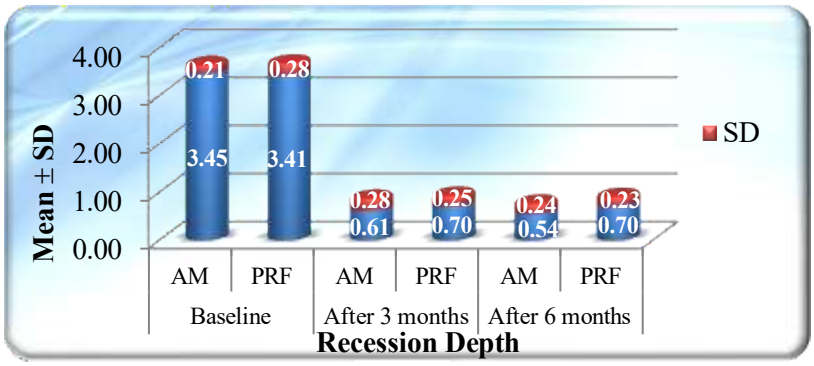


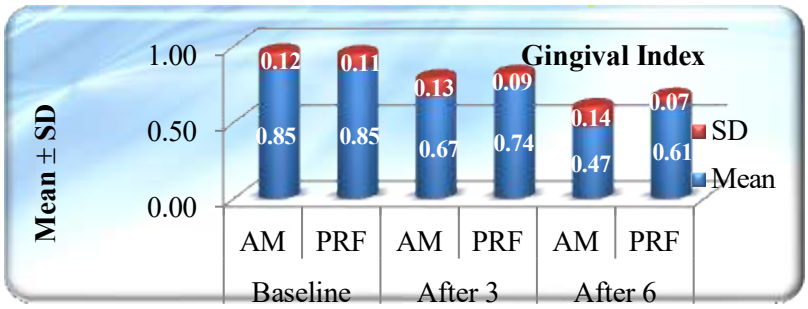


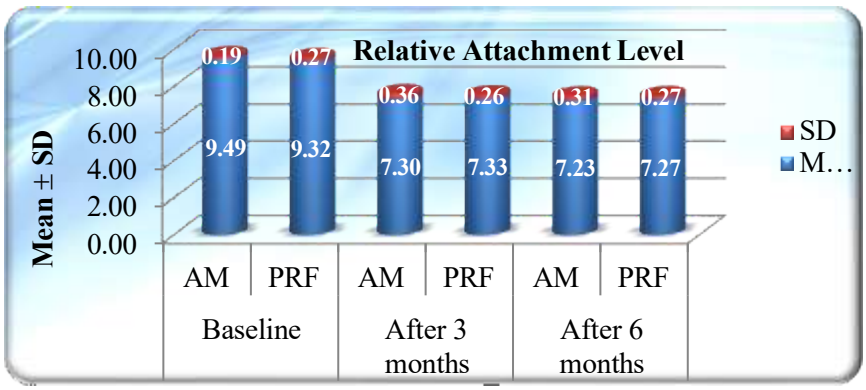


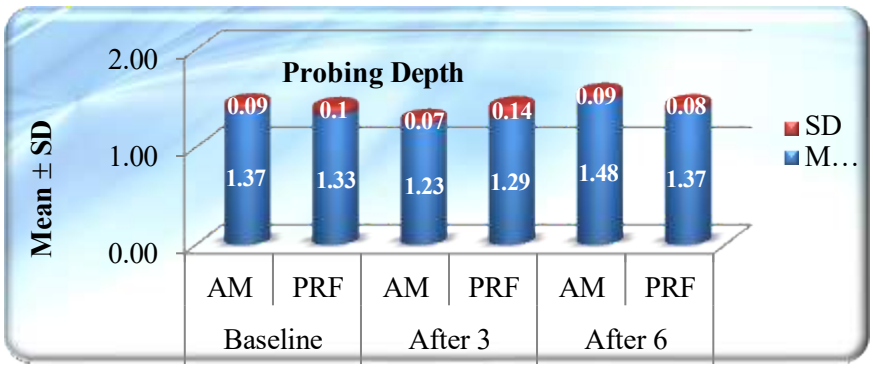


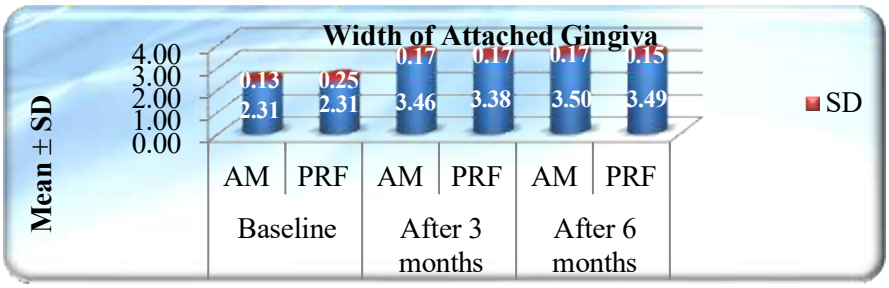

## DISCUSSION

The management of gingival recession has advanced considerably over recent decades, with a paradigm shift toward regenerative approaches aimed at achieving not just aesthetic root coverage, but true periodontal regeneration. Traditional techniques such as free gingival grafts and subepithelial connective tissue grafts have demonstrated success but are limited by donor site morbidity, limited tissue availability, and patient discomfort. To address these limitations, **Tinti et al. (1992)**[17] and **Harris (1997)**[18] introduced the concept of guided tissue regeneration (GTR), which was refined further through the use of resorbable barrier membranes, as advocated by **Müller et al. (1999)**[19] and **Wang & Al-Shammari (2002)**[20]. These techniques aim to facilitate selective cell repopulation, critical for the formation of new periodontal attachment.

Among modern biomaterials, **Platelet-Rich Fibrin (PRF)** and **Amnion membrane** have gained prominence due to their intrinsic regenerative capacities. PRF, as developed by **Choukroun et al. (2001)**[11], is a second-generation platelet concentrate that releases essential growth factors like PDGF, TGF-β, VEGF, and IGF-1 in a sustained manner. It also offers a fibrin matrix for cell migration, aiding in wound healing and soft tissue augmentation without requiring additives or anticoagulants. On the other hand, the **Amnion membrane**, introduced in medicine by **Davis (1910)** and popularized in dentistry by **Shah et al. (2014)**[21] and **Agarwal et al. (2016)**[22], is a third-generation allograft rich in collagen types IV and VII, fibronectin, laminin, and several growth factors. Its anti-inflammatory, anti-scarring, antimicrobial, and non-immunogenic properties make it highly suitable for oral regenerative applications.

In the present study, both PRF and Amnion demonstrated significant clinical improvements in all measured parameters. In terms of **Plaque Index (PI)** and **Gingival Index (GI)**, both groups exhibited a consistent reduction, with Group I (Amnion) showing a statistically superior outcome at 6 months. These findings are in line with studies by **Agarwal et al. (2016)** and **Sharma et al. (2015)**[13] for Amnion, and **Thamaraiselvan et al. (2015)**[23] and **Shetty et al. (2014)**[24] for PRF. The enhanced GI performance in the Amnion group may be attributed to its anti-inflammatory cytokines and growth factors that facilitate early epithelial healing. Improvements in **Recession Depth (RD)** and **Relative Attachment Level (RAL)** were significant in both groups, matching the trends observed by **Gautam (2017)** and **Thamaraiselvan et al. (2015)**[23] The Amnion membrane's additional role as a physical scaffold likely contributed to the more stable tissue integration observed in Group I.

**Probing Depth (PD)** reduction was another critical outcome, where Group I again outperformed Group II at the 6-month mark. This finding corroborates the conclusions of **Sharma et al. (2015)**[13] and suggests a possible anti-inflammatory modulation unique to the amniotic tissue. Both groups also exhibited a measurable gain in the **Width of Attached Gingiva (AG)**, consistent with the literature by **Agarwal et al. (2016)** and others. Notably, although PRF provided substantial regenerative potential, the Amnion membrane appeared to offer superior tissue biocompatibility, better handling properties, and enhanced aesthetic outcomes. These clinical advantages, combined with its resorbable nature and off-the-shelf availability, support its potential as a viable, patient-friendly alternative to autogenous grafts in the management of mild to moderate gingival recession defects.

Conclusion

Root coverage procedures have evolved into successful and predictable therapeutic approaches in periodontics, with a shift toward minimally invasive and tissue-engineering-based techniques. While subepithelial connective tissue grafts remain the gold standard, their limitations—particularly the need for a second surgical site—have led to the exploration of alternative biomaterials. This study demonstrates that both Coronally Advanced Flap (CAF) combined with Platelet-Rich Fibrin (PRF) and CAF combined

with Amniotic Membrane (AM) are effective in treating Miller's Class I and II gingival recession defects. However, within the limitations of this study, the use of the Amniotic Membrane as an alternative to autogenous grafts and PRF shows promising advantages. AM not only eliminates the need for palatal harvesting and complex preparation but also provides superior handling, faster healing, and better patient acceptance. The results indicate that while both modalities are clinically viable, **CAF with Amniotic Membrane yields comparatively better outcomes in terms of gingival healing and overall clinical performance**, thus supporting its application as a reliable, bioactive, and patient-friendly material in periodontal regenerative procedures.

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