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Platelet-Rich Fibrin Combined with Perforated Versus Non-Perforated Collagen Membrane in Treatment of Class II Gingival Recession (A Comparative Clinical Study)

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ABSTRACT

Aim: This study aims to evaluate the efficacy of platelet rich fibrin (PRF) in combination with perforated versus non-perforated collagen membrane in treatment of class II gingival recession.**Subjects and Methods**: fourteen patients having at least one tooth with Miller's Class II buccal/labial gingival recession defect after phase I therapy were classified into two groups, group 1 was treated with coronally advanced flap (CAF) combined with PRF membrane along with perforated collagen membrane and group 2 was treated with CAF combined with PRF membrane along with non-perforated collagen membrane. Clinical parameters were recorded at baseline, 1, 3 and 6 months postoperatively.**Results:** Both treatment groups showed significant root coverage, probing pocket depth (PPD) reduction, clinical attachment (CAL) gain and increase in width of keratinized gingiva (WKG) 6 months after surgery compared with baseline. However, there was a highly significant increase in WKG and CAL gain when collagen membrane was perforated.**Conclusion:** The perforated collagen membrane demonstrated clinical advantages beyond that achieved by the non-perforated one.

KEYWORDS

Platelet-Rich Fibrin, Perforated, Non-Perforated Collagen Membrane, Class II Gingival Recession, Gingivitis.

INTRODUCTION

Gingival recession is defined as "the migration of the gingiva to a point apical to the cemento-enamel junction". The exposure of the root surface as a result of attachment loss has been related to several conditions such as dentine hypersensitivity, root caries, cervical abrasion, difficult maintenance of oral hygiene and compromised aesthetics [(1)].

The coronally advanced flap (CAF) alone is considered easy to perform and effective in obtaining root coverage without the need for a second surgical site [(2)]. On the other hand, the CAF alone has been reported to be associated with an apical relapse of the gingival margin in the long term. This observation has been attributed to the inadequate thickness and amount of keratinized tissue obtained with the CAF alone[(3)].

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Other approaches aimed at enhancing the outcome of the CAF procedure and substituting the CTG include the use of barrier membranes, enamel matrix derivatives, and soft tissue graft substitutes (acellular dermal matrices and xenogeneic collagen matrices) [4].

Platelet-rich fibrin (PRF), a second generation platelet concentrate was defined as an autologous leukocyte and platelet-rich fibrin biomaterial The a-granules present in platelets contain growth factors like platelet derived factor (PDGF), transforming growth factor-b (TGF-b), vascular endothelial growth factor (VEGF) and epidermal growth factor (EGF) [5].

Guided tissue regeneration (GTR) with the use of resorbable and non resorbable barrier membranes was proposed as an alternative approach in the treatment of gingival recession defects. The use of barrier membranes in conjunction with CAF has proven to promote periodontal regeneration with the formation of new cementum and periodontal ligament [6].

Collagen is semipermeable, allowing nutrient passage and gas exchange, and it supports cell proliferation via its lattice-like structure and cell-binding domains. Collagen also is hemostatic, possessing an ability to aggregate platelets, which helps to facilitate early wound stabilization and maturation. Another useful benefit of collagen is that it might augment tissue volume as it is naturally absorbed and replaced by host tissue [7].

Aiming to enable periosteal and gingival stem cells to participate in GTR procedures, perforated collagen membranes were introduced. It was suggested that growth and differentiation factors from cells in the periosteum and gingiva could traverse membrane perforations and therefore enhance regeneration [8].

The present study was designed to evaluate the clinical effect of perforated versus non-perforated collagen membrane with Platelet Rich Fibrin in treatment of class II gingival recession.

SUBJECTS AND METHODS

1. Study setting and population:

The current study included fourteen systemically healthy patients (9 females and 5 males, mean age of 31.5 ± 3 years) undergoing periodontal therapy at the Outpatients Clinic, Department of Oral Medicine, Periodontology, Oral Diagnosis and Dental Radiology, Faculty of Dental Medicine, Al-Azhar University, (Assiut branch). All eligible patients were thoroughly informed of the nature, potential risks and benefits of their participation in the study and signed their informed consent documents.

2. Inclusion and exclusion criteria:

- The presence of at least one tooth with Miller's Class II buccal/labial gingival recession defect following phase I therapy (scaling and root planning).
- All patients had a good compliance, acceptable for oral hygiene instructions, non-smokers and cooperative.
- Female patients were neither pregnant nor taking contraceptive pills.
- No previous history of periodontal surgery in the diseased region in the last 6 months or taking antibiotics or anti-inflammatory drugs in the last 3 months.

3. Patients grouping and randomization:

Patients were divided randomly into two groups using online software (https://www.randomizer.org); numbers were concealed in closed envelopes:

Group (1): were treated with CAF combined with PRF membrane along with perforated collagen membrane.

Group (2): were treated with CAF combined with PRF membrane along with non-perforated collagen membrane.

4. Periodontal intervention:

All patients received phase I therapy including Full-mouth scaling and root planning using manual scalers and curettes or ultrasonic scaler.

5. PRF preparation:

A blood sample of the patient was drawn in 10 mL test tubes without an anticoagulant and centrifuged immediately. Blood was centrifuged for 10 min at 3000 rpm [9]. The resultant product consisted of the following three layers; the upper layer of acellular PPP (platelet-poor plasma), PRF clot in the middle and red blood cells at the bottom. PRF was easily separated from red corpuscles base using sterile tweezers and scissors. The fibrin clot was then placed on the grid in the PRF box with the compressor and lid. This produces an inexpensive fibrin membrane in approximately one minute.

6. Surgical procedures:

- The patients were anaesthetized using infiltration or nerve block technique. Two oblique incisions were made in the interdental papillae at the height of the cementoenamel junction (CEJ) with surgical blade no.15 followed by an intrasulcular/crevicular incision on the buccal aspect then two vertical incisions were made.
- A full thickness mucoperiosteal flap was elevated up to the mucogingival junction followed by a partial thickness flap to enable passive coronal displacement of the flap.
- De-epithelization of the interdental papilla was done sequentially then debridement of all inflammatory granulation tissue from the defect was performed by means of metal curettes until a sound, healthy bone surface was obtained. PRF membrane was positioned on the recession defect at the height of the cementoenamel junction (CEJ).
- Collagen membrane perforations were prepared just before surgery using 25-gauge sterile needle (fig 1). Collagen membranes were trimmed and adapted over the PRF in such a manner that the entire defect and ≥ 2mm of the surrounding alveolar bone was completely covered to avoid membrane collapse.

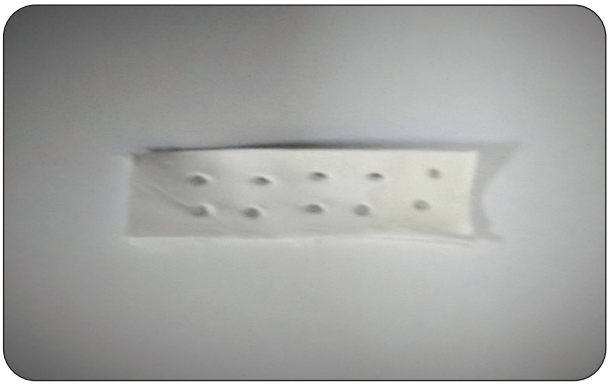

Fig. (1) Collagen membrane perforations.

- The raised mucoperiosteal flap was coronally positioned and sutured using 5/0 resorbable suture. The margin of the gingival flap was repositioned on the enamel and held in position with horizontal slings.

7. Periodontal evaluation:

All patients were evaluated clinically at baseline, 1, 3 and 6 months post surgically using the following parameters: plaque index (PI), gingival index (GI), probing pocket depth (PPD), vertical component of the gingival recession (VGR), clinical attachment level (CAL) and width of keratinized gingiva (WKG).

Statistical analysis:

The data were collected, tabulated and statistically analyzed by IBM® SPSS® Statistics Version 20 for Windows using ANOVA test. Plaque index and Gingival index data showed non-parametric (not-normal) distribution, while PPD, CAL, WKG and VGR data showed parametric (normal) distribution. Pearson test was used to test the correlation between different variables. The significance level was set at $P \leq 0.05$.

Fig. (1) Clinical photographs of a female patient 20 years old with class II gingival recession in lower left central incisor showing preoperative condition, flap reflection, perforated collagen membrane in place, 1, 3 and 6 months postoperatively.

RESULTS

- **Changes in plaque index (PI):** There was no statistically significant difference between (Group 1) and (Group 2) at base line, 1, 3 and 6 months where (*p=0.930*), (*p=0.565*), (*p=0.053*), (*p=0.565*) respectively.
- **Changes in gingival index (GI):** There was no statistically significant difference between (Group 1) and (Group 2) at base line, 1, 3 and 6 months where (*p=1*), (*p=0.260*), (*p=0.094*) and (*p=0.197*) respectively.
- **Changes in probing pocket depth (PPD):** The mean value for group 1 and group 2 was 2.21 and 1.64 mm at baseline and reduced to 2.14 and 1.6 mm at the 6th month with no statistically significant difference between the two groups where (*p=0.087*).
- **Changes in Vertical component of the gingival recession (VGR):** The mean value for group 1 and group 2 was 2.14 and 2.21 mm at baseline and reduced to 1 and 1.36 mm at the 6th month with a statistically significant difference between the two groups where (*p=0.032*).

Parameter	Interval	Group 1	Group 2
PPD	Baseline	2.21 ^{bA}	1.64 ^{bA}
	1m	3.14 ^{aA}	2.57 ^{aAB}
	3m	2.36 ^{bA}	1.71 ^{bAB}
	6m	2.14 ^{bA}	1.64 ^{bAB}
	p-value	0.002*	0.001*
VGR	Baseline	2.14 ^{aA}	2.21 ^{aA}
	1m	0.36 ^{cA}	0.57 ^{cA}
	3m	1.00 ^{bA}	1.14 ^{bA}
	6m	1.00 ^{bA}	1.36 ^{bA}
	p-value	0.001*	<0.001*
CAL	Baseline	4.29 ^{aA}	4.07 ^{aA}
	1m	3.14 ^{bA}	3.00 ^{bA}
	3m	3.21 ^{bA}	2.86 ^{bA}
	6m	2.64 ^{bA}	2.93 ^{bA}
	p-value	0.002*	<0.001*
WKG	Baseline	1.14 ^{cA}	1.07 ^{cA}
	1m	2.07 ^{bA}	2.00 ^{bA}
	3m	2.21 ^{abA}	2.14 ^{abAB}
	6m	2.43 ^{aA}	2.36 ^{aA}
	p-value	<0.001*	<0.001*

- **Changes in Clinical attachment level (CAL):** The mean value for group 1 and group 2 was 4.29 and 4.07 mm at baseline and reduced to 2.64 and 2.93 mm at the 6th month with no statistically significant difference between the two groups where (*p=0.195*).
- **Changes in Width of keratinized gingiva (WKG):** The mean value for group 1 and group 2 was 1.14 and 1.07 mm at baseline and increased to 2.43 and 2.36 mm at the 6th month with no statistically significant difference between the two groups where (*p=0.073*).

DISCUSSION

Gingival recession is a common clinical entity observed in patient populations regardless of their age and ethnicity. Some common consequences of gingival recession, such as tooth hypersensitivity, pain, root caries and esthetic concerns, adversely affect patients' overall well-being [10].

To overcome these adverse consequences, many materials, as well as surgical techniques, have been developed. Conventional soft tissue procedures for root coverage require an additional surgical site, thereby causing additional trauma and donor site morbidity. In addition, the grafted tissues heal by repair, with formation of long junctional epithelium with some connective tissue attachment, so guided tissue regeneration based root coverage was thus developed in an attempt to overcome these limitations while providing comparable clinical results [11].

Coronally advanced flap (CAF) is a predictable procedure to treat Miller's class II mucogingival defects. Initial gingival thickness was the most significant factor associated with complete root coverage[12].

Platelet rich fibrin (PRF) has been claimed to enhance soft tissue healing, promote initial stabilization, revascularization of flaps in root coverage. PRF acts as a storage house for growth factors such as TGF-β and PDGF and they have been demonstrated to induce healing and regeneration of tissues, including those in the periodontal area [13, 14].

The concept of porous guided tissue membrane has been introduced in 2013 as a perforated collagen membrane that could stimulate tissue formation. Membrane perforations could allow for gingival stem cells and fibroblasts to take part in supracrestal regeneration. Also, the perforated section of the membranes would stabilize supracrestal fibrin clot through mechanical interlocking of fibrin strands with the membrane pores providing more membrane and clot stability [15].

Therefore, this randomized controlled study was designed to evaluate the efficacy of perforated versus non-perforated collagen membrane in combination with platelet rich fibrin membrane in treatment of class II gingival recession according to Miller's classification [16].

Regarding clinical attachment level, a significant gain in CAL was obtained in group 1 compared to group 2. This finding is in agreement with previous studies that reported a superior length of new bone and cementum in sites treated by GTR when compared to coronally advanced flap for the treatment of dehiscence-type gingival recession defects [17, 18].

According to a previous study, the collagen membrane not only increased the tissue thickness via membrane integration with the flap, but also protected the initial attachment gain. This could be attributed to the ability of the membrane to create space for the PDL/bone cells to promote tissue regeneration [19].

Regarding root coverage, a significant reduction in the amount of recession was noted in group (1, 2) from baseline to 6 months. Related to the use of PRF membrane, more gradual release of growth factors, up to 10 days and higher growth factor release over time had occurred when compared to the standard PRF clot. Although a mild loss of recession coverage

was reported between 3 and 6 months, the difference was statistically non-significant. These findings are consistent with the previous PRF studies [20, 21].

It can also be speculated that the collagen membrane inhibits the apical migration of the epithelium, stabilizes the wound and augments tissue thickness, which increases the long-term stability of the marginal tissue [22].

Regarding width of keratinized gingiva, an increase was noted at 3rd and 6th month compared to baseline in both groupes. Since the mucogingival line has a tendency to regain its genetically defined position, increase of gingival tissue can be advocated by coronally positioned flaps but supported and stabilized by the use of double layers of PRF and collagen membrane [23].

Regarding probing pocket depth, there was a significant increase in values at 3 months followed by reduction to almost normal values at 6 months as compared to baseline in all groups. It was suggested that the increase in PD during healing resulted from reformation of sulcular epithelium, junctional epithelium, and some part of connective tissue attachment.

These results which exhibited a significant difference to perforated versus non-perforated collagen membrane are inconsistent with the previous studies which claimed that porous guided bone regeneration membranes may be promising for the clinical treatment of delayed and insufficient periodontal healing. Placement of a perforated membrane could allow for more flap stability through membrane pores–gingival CT integration from one side and membrane pore-clot integration from the opposing side. In addition, the authors hypothesized that early gingival CT–root surface adhesion achieved by membrane perforations would eventually provide additional protection against epithelial downgrowth [15, 24].

CONCLUSIONS

Perforated collagen membrane in conjunction with PRF membrane appeared to be superior than non-perforated membrane with PRF membrane in treatment of class II gingival recession. Perforated collagen membrane led to more stable root coverage and adequate width of keratinized gingiva than non-perforated one.

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استخدام الفيبرين الغني بالبلازما وغشاء الكولاجين المثقب والغير مثقب في علاج انحسار اللثة من الصنف الثاني

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الملخص :

الهدف: تهدف هذه الدراسة إلى تقييم فعالية الفيبرين الغني بالصفائح الدموية (PRF) بالاشتراك مع غشاء الكولاجين المثقب مقابل غير المثقوب في علاج تراجع اللثة من الدرجة الثانية.

المواد والاساليب: أربعة عشر مريضًا لديهم سن واحد على الأقل مع عيب ركود اللثة الشدقي / الشفوي من الدرجة الثانية ليلر بعد تصنيف المرحلة الأولى من العلاج إلى مجموعتين. المجموعة 1 عولجت بسديلة إكليلية متقدمة (CAF) مع غشاء PRF جنبًا إلى جنب مع غشاء كولاجين مثقب والمجموعة 2 تمت معالجته باستخدام CAF مع غشاء PRF جنبًا إلى جنب مع غشاء كولاجين غير مثقوب. تم تسجيل المعلمات السريرية في الأساس . 1 و 3 و 6 أشهر بعد الجراحة.

النتائج: أظهرت كلتا المجموعتين العلاجيتين تغطية جذر كبيرة . وانخفاض عمق الجيب (PPD) . واكتساب الارتباط السريري (CAL) وزيادة عرض اللثة المتقرنة (WKG) بعد 6 أشهر من الجراحة مقارنة بخط الأساس. ومع ذلك . كانت هناك زيادة كبيرة في كسب WKG و CAL عندما تم ثقب غشاء الكولاجين.

الخلاصة: أظهر غشاء الكولاجين المثقب مزايا سريرية تتجاوز تلك التي حققها الغشاء غير المثقوب.

الكلمات المفتاحية: الفيبرين الغني بالبلازما, غشاء الكولاجين المثقب,الغير مثقب, انحسار اللثة من الصنف الثاني, التهاب اللثة.