ORIGINAL RESEARCH

Less Invasive Vestibule Access Tunneling with Platelet-rich Fibrin Membrane for the Treatment of Gingival Recession

Agung Krismariono

Abstract

Aim: The aim of this study was to introduce the less invasive vestibule access tunneling in combination with platelet-rich fibrin (PRF) membrane for gingival recession treatment.

Materials and methods: Seven subjects with Miller's class I or II buccal gingival recession were selected for this study. All subjects were treated with mucogingival surgery using the less invasive vestibule access tunneling in combination with PRF membrane. Clinical examination performed on each subject and the height of gingival recession was recorded preoperatively (baseline), and at 1 and 3 months postoperatively. The data were statistically analyzed using analysis of variance (ANOVA) with *post hoc* Tukey's LSD test to determine the significant difference between groups. Statistical significance level was set at 0.05.

Results: The results showed that there were significant differences in recession height between baseline and both 1 month and 3 months postoperatively ($p < 0.05$). Nevertheless, there was no significant difference between 1 and 3 months postoperatively ($p > 0.05$). All patients reported satisfactory esthetic results both at 1 and 3 months postoperatively.

Conclusion: Mucogingival surgery using the less invasive vestibule access tunneling in combination with PRF membrane for gingival recession treatment provided optimal root coverage.

Clinical significance: This article introduces a new tunnel technique in combination with PRF membrane for gingival recession treatment. Previous studies tried to make access using the tunnel technique performed through gingival sulcus. In this study, the access is performed through the vestibule region. Access from the vestibule can minimize the damage of gingival margin integrity, especially in patients with thin gingival biotype.

Keywords: Gingival recession, Platelet-rich fibrin, Tunnel technique, Vestibule.

The Journal of Contemporary Dental Practice (2019): 10.5005/jp-journals-10024-2638

Introduction

Gingival recession is defined as the apical migration of the gingival margin away from the cementoenamel junction (CEJ), resulting in exposure of root surface and loss of attachment. Gingival recession is associated with the medical and esthetic problems, especially recession on the maxillary anterior teeth. Treatment of gingival recession is not only for esthetic consideration but also to prevent root caries, cervical abrasion, and root hypersensitivity, which are the result of exposed root surface.[1,2]

Gingival recession is characterized by a decrease in volume and cell population of gingival tissue. These conditions occur due to mechanical compression so that the cell becomes hypoxic and locally reduced vascularization. These circumstances may be restored to a normal level if the causal factors can be eliminated. Nevertheless, the tissue repair process depends on the severity of injuries and the type of periodontal tissue involved.[3]

The gingival recession has multifactorial etiology, including physiological, anatomical, and pathological factors. Natural factor, such as the aging process. Anatomical factors, such as tooth malposition, prominent tooth root, narrow zone of attached gingiva, fenestration, and dehiscence. The most etiologic factor of gingival recession is pathological factors, such as inflammatory caused by calculus deposits, traumatic tooth brushing, and iatrogenic factors.[4,5]

Treatment of gingival recession can be performed using mucogingival surgery. The major goal of the surgical treatment for gingival recession is esthetic and functional improvement. Mucogingival surgery may cover the exposed root surface up to the CEJ; in addition, it increases the zone of attached gingiva, maintains normal soft tissue morphology, and provides adequate gingival thickness with normal color.[6]

Numerous mucogingival surgery techniques have been designed to treat gingival recession. Tunnel or supraperiosteal envelope technique presented by Allen (1994) is one of the common approaches to complete root coverage. Tunnel technique was performed initially by an internal beveled incision from the top of the gingival margin on areas of recession. Afterward, partial-thickness supraperiosteal envelope by sharp dissection is extended 3–5 mm laterally and apically to areas of recession, undermining interdental papilla.[7,8]

The less invasive vestibule access tunneling is the modification of the tunnel technique, which is designed to minimize the risk of laceration of the gingival margin. Laceration of the gingival margin results in unfavorable healing outcomes. In the less invasive vestibule access tunneling, the initial incision was performed from the vestibule area apically to the recession.

Department of Periodontology, Universitas Airlangga, Surabaya, Indonesia

Corresponding Author: Agung Krismariono, Department of Periodontology, Universitas Airlangga, Surabaya, Indonesia, Phone: +62 315020255, e-mail: agung-k@fkg.unair.ac.id

How to cite this article: Krismariono A. Less Invasive Vestibule Access Tunneling with Platelet-rich Fibrin Membrane for the Treatment of Gingival Recession. J Contemp Dent Pract 2019;20(9):1024–1028.

Source of support: Nil

Conflict of interest: None

This study uses PRF as an adjunctive agent. PRF is required to accelerate the recovery after surgery so that it enhances the successful clinical outcomes. PRF is described by Choukroun et al.[9] as a second-generation platelet concentrate which contains many growth factors. PRF stimulates fibroblast proliferation and tissue vascularization. PRF has several advantages, such as economical in cost, simple in preparation, and easy in application. PRF contains various human-derived growth factors, among others, are: platelet-derivate growth factor (PDGF), transforming growth factor-beta (TGF-β), insulin-like growth factor-1 (IGF-1), epidermal growth factor (EGF), and vascular endothelial growth factor (VEGF).[10,11] PRF has been used widely for periodontal regeneration. In this context, this article aims to introduce and evaluate clinical outcomes of the less invasive vestibule access tunneling in combination with PRF membrane for gingival recession treatment.

Materials and Methods

A total of 7 women aged 30–40 years old were included from the patients treated at Periodontics Clinic, Universitas Airlangga Dental and Oral Hospital. They were selected based on the following criteria: presented Miller's class I or II buccal gingival recession defects (3 mm or greater) on the maxillary teeth (Fig. 1), probing depth <2 mm, good oral hygiene, absence of caries or restoration, no medically compromised, and normal alignment of teeth in the arch. Table 1 shows the recession height of sample teeth.

All the patients gave informed consent to participate in this study. The treatment protocol was explained to all patients, including surgery procedure and oral hygiene instructions. After all the patients get routine periodontal therapy, they were called again 4 weeks later to commence the mucogingival surgery using the less invasive vestibule access tunneling.

Fig. 1: Buccal gingival recession on the maxillary left canine, first premolar, and second premolar (baseline)

Table 1: Recession height of sample teeth ($n = 7$)

No.	*Sample teeth*	*Recession height (mm)*
1	Caninus	4
2	Caninus	3
3	First premolar	3
4	First premolar	4
5	First premolar	4
6	Second premolar	3
7	Second premolar	3

Assessment of Gingival Recession Height

The exposed root surfaces were carefully debrided. Gingival recession height, which is the distance from the gingival margin to the CEJ, was recorded using the University of North Carolina 15 probe (Hu-Friedy). This clinical parameter was observed preoperatively (baseline), and at 1 and 3 months postoperatively.

PRF Preparation

Before the surgical procedure, according to the PRF protocol,[12] 10 mL peripheral venous blood was collected from the patients and stored in tubes (BD Vacutainer Serum, NJ, USA) without any anticoagulant. Tubes containing peripheral venous blood were centrifuged (Onemed Centrifuge 0508-1, China) at 3,000 rpm for 12 minutes. Thereafter, a fibrin clot in the middle part of the tube was taken and gently compressed between two pieces of sterile gauze in order to obtain the membrane shape (Fig. 2).

Surgical Technique

Prior to surgical procedure, preoperative preparation of the surgical area was performed using antiseptic solution. The exposed root surface was conditioned for 3 minutes with a solution obtained from tetracycline 500 mg dissolved in 2 mL of saline solution to eliminate the smear layer. Local anesthesia was given by injection in the mucobuccal fold of 1 mL of 2% lidocaine containing 1:80.000 epinephrine. Afterward, a narrow horizontal incision was made in the vestibule region, apically to the area of recession using a # 15c blade (Fig. 3).

A supraperiosteal dissection was performed using tunnel instrument (Osung Co., Ltd, Korea). This instrument was inserted through the vestibule access that was made in the previous step (Fig. 4). The dissection was extended coronally and horizontally without disrupted stability of interdental papilla until the gingival margin could passively reach the CEJ. The fresh PRF membrane was inserted inside the space under the gingival connective tissue through the vestibule access (Fig. 5). Thereafter, both the membrane and the gingiva were coronally positioned without excessive tension, beyond the CEJ of the compromised teeth. The gingiva in this new position was sutured with a simple interrupted suture using 4.0 Nylon for stabilization. The sutures were temporarily fixated using composite resin at the one-third coronal of the facial aspect of the compromised teeth (Fig. 6). This fixation was performed in order to prevent the apical relapse of the gingival margin during the healing phase.

Fig. 2: Prepared PRF membrane

Fig. 3: Narrow horizontal incision in the vestibule region using a #15c blade

Fig. 4: Tunnel instrument was inserted through the vestibule access and extended coronally and horizontally

Fig. 5: Fresh PRF membrane was inserted through the vestibule access

Fig. 6: Sutures were temporarily fixated using composite resin

Postoperative Care

All patients were prescribed amoxicillin 500 mg, three times daily, for 5 days and mefenamic acid 500 mg, three times daily, for 3 days. All patients were instructed to gently brush their tooth using a soft-bristled toothbrush on the surgical site and advised to use 0.12% chlorhexidine gluconate mouth rinse, three times a day for 2 weeks. All patients were followed up after 24 hours, 7 and 14 days of surgery. The sutures were removed 14 days after surgery. After 1 month, all patients were instructed to perform the roll brushing technique using a medium-bristled toothbrush. All patients were followed up postoperatively at 1 and 3 months. During every visit, oral hygiene instructions were reinforced.

Statistical Analysis

Statistical analysis was performed to compare the gingival recession height preoperatively (baseline) and postoperatively (one and three months). The data were statistically analyzed using ANOVA with *post hoc* Tukey's LSD test. Statistical significance level was set at 0.05.

Results

Common minor complications after surgery, such as pain and swelling, were presented in the first week postoperatively. Mild inflammation on the gingival margin was observed two weeks postoperatively. After two weeks, healing was uneventful for all patients. No adverse outcomes were observed in any patient during the healing phase. All patients reported satisfactory esthetic results both at 1 (Fig. 7) and 3 (Fig. 8) months postoperatively.

There was a decrease in mean recession height from the baseline to both 1 month and 3 months follow-up. Furthermore, the results of the *post hoc* test with Tukey's LSD comparing recession height at baseline to both at 1 and 3 months postoperatively exhibited $p = 0.00$ ($p < 0.05$), indicating there were significant differences between baseline to both 1 and 3 months postoperatively (Table 2). However, there was no significant difference in mean recession height between 1 month and 3 months follow-up, statistically exhibited at $p = 0.58$ ($p > 0.05$).

Discussion

Ideal periodontal treatment should improve periodontal health and esthetics. Gingival recession is one of the patient's complaints in esthetics. Thus, the treatment of gingival recession is an important therapeutic for enhancing esthetic outcome. Treatment of gingival recession is based on the etiological factor and the severity of the gingival defect. Eliminating the etiological factor is an initial treatment stage of gingival recession.[13,14] One of the treatment options for gingival recession is surgical using the tunnel technique.

In previous studies, the procedure to make the tunnel access is performed through gingival sulcus.[10,15] Access from gingival sulcus is very sensitive because the gingival sulcus is very narrow, and in addition, many patients have a thin gingival biotype.

Fig. 7: 1 month postoperatively

Fig. 8: 3 months postoperatively

Table 2: Mean ± SD of gingival recession height at baseline, 1 month and 3 months postoperatively

	Baseline	*1 month post-operatively*	*3 months post-operatively*
Recession height (mm)	3.43 ± 0.53^{a}	0.14 ± 0.38^{b}	0.29 ± 0.49^{b}
Tukey's LSD	$p = 0.00$		

[a,b]Significant differences ($p < 0.05$)

This gingival profile made it difficult to separate the junctional epithelium from its attachment on root surface properly, so that controlled mechanical instrumentation during tunneling procedure is hard. When the defect of gingival margin occurs, the success of mucogingival surgery is poor.

The gingival fibers play an important role. They brace and stabilize the gingival margin firmly against the tooth.[16] Tunneling access through gingival sulcus may cause damage to the gingival fibers integrity, especially laceration of circular and semicircular gingival fibers. Trauma to these gingival fibers leads to unfavorable healing outcomes.

This study introduces a new tunnel technique, namely the less invasive vestibule access tunneling. This technique is developed as a modification of the supraperiosteal envelope technique. Tunneling access in supraperiosteal envelope technique was performed through gingival sulcus. The less invasive vestibule access tunneling is performed through a narrow horizontal incision in the vestibule. This new technique has several advantages: it can minimize the damage of gingival fibers complex on the gingival margin due to mechanical instrumentation; it is conducted without releasing interdental papilla, and therefore it is less bleeding and has a better interproximal esthetic outcome; and it ensures optimal vascularity at the surgical site, because there is only a narrow horizontal incision in the vestibule. There is no vertical incision in this technique. Several modified tunnel techniques use vertical incision for the tunneling procedure.[10,17,18] Incision in the vertical direction may reduce gingival vascularization. Whereas the successful mucogingival surgery for gingival recession treatment is dependent on the excellent blood supply to the surgical site. Adequate blood supply is necessary to maintain the stability of the gingival attachment to the root surface.

This study used PRF membrane to support adequate adaptation and better stabilization of the gingiva in the new position. Soft tissue augmentation with PRF membrane is recommended for patients who do not have adequate gingival thickness. Application of PRF membrane in mucogingival surgery for gingival recession can improve the gingival thickness and provide the long-term stability of gingival connective tissue attachment to the root surface. The study conducted by Garg et al.[19] showed that reduction in gingival recession height after manipulation of the gingival margin with surgical alone was 40–50%, but in combination with PRF, its reduction increased up to 80%.

Platelet-rich fibrin contains multiple growth factors that improve cellular functions in tissue healing. Platelet growth factor has several biological activities that promote and modulate cell proliferation and regeneration.[20] Application of PRF membrane in the surgical area will enhance the survival of gingival epithelial cell and fibroblast in the new position. By using PRF, the donor site is not necessary, which means minimal postoperative discomfort.

Platelet-rich fibrin is the latest generation of platelet concentrates. PRF increases proliferation of connective tissue progenitors. PRF contains growth factors such as transforming growth factor-β (TGF-β), platelet-derived growth factor (PDGF), epidermal growth factor (EGF), vascular endothelial growth factor (VEGF), and insulin-like growth factor-1 (IGF-1) which are the important factors for optimal healing.[21,22] TGF-β and PDGF produced by PRF are the major initial growth factors in the wound healing response. TGF-β attracts fibroblast into the wound and directly stimulates collagen production by fibroblast. On the contrary, PDGF is a potent chemoattractant for fibroblast. PDGF also stimulates fibroblast to produce endogenous growth factors, including TGF-β. In turn, this TGF-β induces new collagen synthesis.[22] *In vitro* study showed that slow release of TGF-β from PRF began at the first minute and continued for 7 days.[23]

Several studies represent a histological evaluation of treatment results of mucogingival surgery for gingival recession. Histological examination showed that the gingival attachment to the root surface is characterized by the combination of new connective tissue attachment and junctional epithelium.[24–26] Gingival connective tissue attaches to the root surface depending upon fibrin and collagen interactions. Attachment of collagen fiber to the root surface is preceded by fibrin linkage. Fibrin linkage attaching to the root surface is an essential step for the gingival connective tissue attachment. This attachment is mediated by an adhesive protein, namely fibronectin. PRF facilitates the presence of fibronectin.[27,28] Thus, the stability of the gingival attachment to the root surface is better achieved.

The limitation of this study is that the treatment was performed by only one method, which is the less invasive vestibule access tunneling in combination with PRF membrane. Evaluation for three months after surgery exhibits good clinical outcomes. However, the successful treatment of this technique without PRF membrane is not yet precisely known. Consequently, more studies with some variation methods and long follow-up are still required.

Conclusion

Treatment for gingival recession using the less invasive vestibule access tunneling demonstrates favorable root coverage. This technique results in a decreasing degree of gingival recession with the optimal healing outcomes without any adverse effect. Application of PRF membrane in this surgical technique improves the successful treatment of gingival recession. The gingival margin shows stable conditions and an increase in gingival thickness. The less invasive vestibule access tunneling was suitably performed for Miller's class I and II gingival recession, narrow gingival sulcus, and thin gingival biotype.

Clinical Significance

This article introduces a new tunnelling technique in combination with PRF membrane for gingival recession treatment. The previous procedure to make tunnel access was performed through gingival sulcus. Access from gingival sulcus may cause disintegration of circular and semicircular gingival fibers. Tunnel access in the less invasive vestibule access tunneling is performed through a narrow horizontal incision in the vestibule region. Access from the vestibule can minimize the damage of gingival margin integrity, especially in patients with thin gingival biotype.

References

1. Gulati M, Saini A, et al. Esthetic dentistry for multiple gingival recession cases: Coronally advanced flap with bracket application. J Indian Soc Periodontol 2016 Mar–Apr;20(2):207–210. DOI: 10.4103/0972-124X.175178.
2. Masud M, Al-Bayaty FH, et al. Gingival recession and dentine hypersensitivity in periodontal patients: Is it affecting their oral health related quality of life? J Int Dent Med Res 2017;10(3):909–914.
3. Jati AS, Furquim LZ, et al. Gingival recession: its causes and types, and the importance of orthodontic treatment. Dental Press J Orthod 2016 Jun;21(3):18–29. DOI: 10.1590/2177-6709.21.3.018-029.oin.
4. Balasubramanian K, Arshad LM, et al. Reconstruction of pink esthetics: The periodontal way. Contemp Clin Dent 2015 Jan–Mar;6(1):84–87. DOI: 10.4103/0976-237X.149298.
5. Heasman PA, Ritchie M, et al. Gingival recession and root caries in the ageing population: A critical evaluation of treatments. J Clin Periodontol 2017;44(Suppl 18):S178–S193. DOI: 10.1111/jcpe.12676.
6. Ronco V, Dard M. Esthetic and functional treatment of gingival recessions in the mandible: A micro-surgical and mini-invasive concept based on tunneling procedure and controlled connective tissue graft exposure: case reports. J Clin Med Case Rep 2017 Mar;4(1):01–07.
7. Allen AL. Use of the supraperiosteal envelope in soft tissue grafting for root coverage. I. Rationale and technique. Int J Periodontics Restorative Dent 1994 Jun;14(3):216–227.
8. Saadoun AP. Current trends in gingival recession coverage. Part I: The tunnel connective tissue graft. Pract Proced Aesthet Dent 2006;18(7):433–438.
9. Choukroun J, Diss A, et al. Platelet-rich fibrin (PRF): A second-generation platelet concentrate. Part IV: Clinical effects on tissue healing. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2006 Mar;101(3):e56–e60. DOI: 10.1016/j.tripleo.2005.07.011.
10. Reddy S, Prasad MGS, et al. Vestibular incision subperiosteal tunnel access (VISTA) with platelet-rich fibrin (PRF) and connective tissue graft (CTG) in the management of multiple gingival recession- A case series. Int J Appl Dent Sci 2016;2(4):34–37.
11. Oncu E. The use of platelet-rich fibrin vs subepithelial connective tissue graft in treatment of multiple gingival recessions: A randomized clinical trial. Int J Periodontics Restorative Dent 2017 Mar/Apr;37(2):265–271. DOI: 10.11607/prd.2741.
12. Chang YC, Zhao JH. Effects of platelet-rich fibrin on human periodontal ligament fibroblasts and application for periodontal infrabony defects. Aust Dent J 2011 Dec;56(4):365–371. DOI: 10.1111/j.1834-7819.2011.01362.x.
13. Krismariono A. Basic principal in the treatment of gingival recession. Dentika Dent J 2014;18(1):96–100.
14. Pradeep K, Rajababu P, et al. Gingival recession: Review and strategies in treatment of recession. Case Rep Dent 2012;1–6. DOI: 10.1155/2012/563421.
15. Moussa EW, Bissada NF. Comparative outcomes of Miller class III gingival recession treatment using the tunnel or coronally advanced flap approach: a case report. Clin Adv Periodontics 2017 Feb;7(1): 35–41. DOI: 10.1902/cap.2016.160023.
16. Newman MG, Takei HH, et al. Carranza's clinical periodontology, 12th ed., Philadelphia: WB Saunders; 2015. pp. 21–22.
17. Santarelli GA, Ciancaglini R, et al. Connective tissue grafting employing the tunnel technique. A case report of complete root coverage in anterior maxilla. Int J Periodontics Restorative Dent 2001 Feb;21(1):77–83.
18. Pawar B, Bhuse K, et al. A fantastic approach for multiple recession coverage: Vestibular incision subperiosteal tunnel access technique (vista) - A case report. IOSR J Dent Med Sci 2016 Feb;15(2): 52–56.
19. Garg S, Arora SA, et al. Multiple gingival recession coverage treated with vestibular incision subperiosteal tunnel access approach with or without platelet-rich fibrin - A case series. Contemp Clin Dent 2017 Jul–Sep;8(3):464–468. DOI: 10.4103/ccd.ccd_142_17.
20. Arunachalam M, Pulikkotil SJ, et al. Platelet-rich fibrin in periodontal regeneration. Open Dent J 2016;10:174–181. DOI: 10.2174/1874210601610010174.
21. Dohan DM, Choukroun J, et al. Platelet-rich fibrin (PRF): A second-generation platelet concentrate. Part II: Platelet-related biologic features. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2006 Mar;101(3):e45–e50. DOI: 10.1016/j.tripleo.2005.07.009.
22. Choukroun J, Diss A, et al. Platelet-rich fibrin (PRF): A second-generation platelet concentrate. Part IV: Clinical effects on tissue healing. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2006 Mar;101(3):e56–e60. DOI: 10.1016/j.tripleo.2005.07.011.
23. Pierce GE, Mustoe TA, et al. Platelet-derived growth factor and transforming growth factor enhance tissue repair activities by unique mechanisms. J Cell Biol 1989 Jul;109:429–440. DOI: 10.1083/jcb.109.1.429.
24. Tomar N, Dureja D, et al. Inclusion of guided tissue regeneration membrane for the management of multiple gingival recession. Int J Health Allied Sci 2017 Jan–Mar;6(1):50–52.
25. Patel J, Rai J, et al. Panoramic view of junctional epithelium and biologic width around teeth and implant. IOSR J Dent Med Sci 2017 Sep;16(9):61–70.
26. Emilov D, Deliverska E. Surgical treatment of gingival recession with soft tissue graft procedure. J IMAB 2018 Jul–Sep;24(3):2149–2159. DOI: 10.5272/jimab.2018243.2149.
27. Dohan DM, De Peppo GM, et al. Slow release of growth factors and thrombospondin-1 in Choukroun's platelet-rich fibrin (PRF): A gold standard to achieve for all surgical platelet concentrates technologies. Growth Factors 2009 Feb;27(1):63–69. DOI: 10.1080/08977190802636713.
28. Preeja C, Arun S. Platelet-rich fibrin: Its role in periodontal regeneration. Saudi J Dent Res 2014;5:117–122. DOI: 10.1016/j.ksujds.2013.09.001.