



COMPARISON OF THE EFFECTIVENESS OF CORONALLY ADVANCED FLAP ALONE AND IN COMBINATION WITH PLATELET-RICH FIBRIN MEMBRANE FOR TREATMENT OF GINGIVAL RE-CESSIONS

Dimitar Dimitrov, Denislav Emilov, Ivan Ivanov, Antoaneta Mlachkova
Department of Periodontology, Faculty of Dental Medicine, Medical University – Sofia, Bulgaria.

ABSTRACT

Purpose: To compare the effectiveness between the coronally advanced flap alone and in combination with a platelet-rich fibrin membrane for the treatment of gingival recessions Miller class I and II.

Materials and methods: 30 gingival recessions Miller Class I /II were surgically treated randomly divided into 2 groups: 15 recessions in the test group (CAF + PRF) and 15 recessions in the control group (CAF). Before the surgical intervention and on the 6th month postoperatively, the following clinical parameters were evaluated: depth (RD) and width (RW) of gingival recession, probing pocket depth (PPD), clinical attachment level (CAL), amount of keratinized gingiva (KTH) and gingival thickness (GT). In the 6th month, the achieved mean root coverage in percentage (MRC, %) was evaluated.

Results: A similar success of both techniques was demonstrated in terms of achieved MRC % - $88.44\% \pm 16.99\%$ in the CAF + PRF group vs. $84.44\% \pm 20.38\%$ in the CAF group ($p = 0.56$), as well as in the improvement of the following parameters: RD, RW, PPD, CAL and KTH. The additional use of PRF membrane to CAF resulted in a statistically significant increase in gingival thickness when the results were assessed 6 months after the surgical treatment of the recessions in the CAF + PRF group compared to CAF - a mean increase of 0.32 mm vs. 0.06 mm ($p < 0.01$).

Conclusions: Combining CAF with PRF membrane is a more effective approach to increase soft tissue thickness and achieve stable root coverage to maintain periodontal health in patients with sufficient keratinized gingiva in gingival recessions Miller class I and II.

Keywords: gingival recessions, PRF membrane, coronally advanced flap, gingival thickness, complete root coverage, mean root coverage,

INTRODUCTION

Gingival recessions are often associated with dentin hypersensitivity, development of root caries, and aesthetic concerns. Successful treatment of gingival recessions relies on the selection and applying of clinically predictable procedures for root surface coverage. The goal of surgical treatment for gingival recessions is to achieve complete root coverage with satisfactory aesthetics for the patient while also reducing or eliminating dentin hypersensitivity [1, 2].

The coronally advanced flap (CAF) is the most studied and commonly used surgical approach in clinical practice for treating gingival recessions. Its success depends on various parameters such as approximal loss of clinical attachment, the amount of keratinized tissue, recession depth, papilla height, presence of high frenum attachments, vestibular depth, and others [3, 4, 5]. Gingival recessions of Miller Class I and II are the most predictable in terms of achieving complete root coverage, as they do not involve interdental bone or soft tissue loss. The coronally advanced flap has been used with varying degrees of success to cover defects caused by recessions. However, the connective tissue attachment achieved with CAF is not stable over the long term, which has led to the use of additional agents to stimulate healing and improve clinical outcomes [6].

Over the years, researchers have focused on biological substances (growth factors) and specifically their effects in regenerative therapy in dentistry – not only in periodontal surgical treatment but also in regenerative endodontic therapy for direct pulp capping, faster tooth recovery in chronic apical periodontitis or even treatment of an apical cyst [7, 8, 9]. It is known that the use of platelet-rich fibrin (PRF) concentrates, which release sufficient growth factors and stimulate tissue regeneration, can be added to the coronally advanced flap in the surgical treatment of gingival recessions. As a result, in recent years, platelet-rich fibrin (PRF) has gained status as a biomate-

rial whose use in mucogingival surgery leads to predictable root coverage and periodontal regeneration. PRF, obtained through Chaoukroun's protocol, is a second-generation platelet concentrate. Platelet-rich fibrin is an autologous biomaterial composed of cytokines, structural glycoproteins, and glycan chains embedded in a slowly polymerizing fibrin network. When combined with the coronally advanced flap (CAF), PRF enhances root coverage in the treatment of gingival recessions and has been shown to yield good clinical results [10].

The aim of our study was to compare the effectiveness of the coronally advanced flap alone and in combination with a platelet-rich fibrin membrane in the treatment of Miller Class I and II gingival recessions.

MATERIALS AND METHODS

The study was conducted at the Department of Periodontology, Faculty of Dental Medicine – Sofia, and was approved by the Ethics Committee of MU – Sofia with a decision made in Protocol No. 08/20.05.2022 by KENIMUS.

Members of the research team operated on a total of 30 gingival recessions, Class I and II, according to Miller, in patients aged between 21 and 53, meeting the following inclusion and exclusion criteria for the study:

- **Inclusion criteria:** Systemically healthy individuals with no history of allergies and presenting with Miller Class I and/or Miller Class II gingival recessions

- **Exclusion criteria:** Generalized periodontitis; Restorations (fillings or crowns) and root surface defects below the cemento-enamel junction (CEJ); Patients with systemic diseases or systemic medications where surgical therapy is contraindicated

The selected patients were randomly assigned to 2 groups:

- **Test group:** 15 sites with Miller Class I or Miller Class II gingival recessions, where mucogingival surgery with coronally advanced flap (CAF) was performed in combination with a platelet-rich fibrin (PRF) membrane

- **Control group:** 15 sites with Miller Class I or Miller Class II gingival recessions, where mucogingival surgery with coronally advanced flap (CAF) alone was performed

All patients provided written informed consent to participate in the study.

Clinical Examination Methods

Before the surgical procedure and 6 months postoperatively, the following parameters were measured using a UNC15 periodontal probe by a research member who did not participate in the surgeries:

- **Recession Depth (RD)** – the distance in mm from the cemento-enamel junction (CEJ) to the gingival margin

- **Recession Width (RW)** – the distance in mm between the lateral gingival margins of the recession at the level of the CEJ, measured horizontally

- **Probing Pocket Depth (PPD)** – the distance in mm from the gingival margin to the bottom of the pocket

- **Clinical Attachment Level (CAL)** – the distance in mm from the CEJ to the bottom of the pocket

- **Keratinized Tissue Height (KTH)** – the distance in mm from the gingival margin to the mucogingival junction

- **Gingival Thickness (GT)** – measured using an endodontic file No. 15 with a silicone stopper, inserted at a point 3 mm apical to the gingival margin in the attached gingiva. The file is inserted at a 90° angle until resistance is felt, and the silicone stopper is adjusted to the gingival surface. After removing the file, the distance from the tip of the file to the stopper is measured in mm with an electronic caliper.

Surgical Method

The surgical procedure was performed under local anesthesia. In the test group (CAF+PRF), the flap was dissected in a partial-full-partial thickness manner (de Sanctis and Zucchelli, 2007) in the area of the recession. A horizontal incision was made in the interdental papillae, splitting them into two parts: coronally from the incision – the anatomical papilla (not dissected), and apically from the incision – the surgical papilla (dissected with the flap). Two vertical incisions extending to the mucogingival junction were then made. The flap was dissected in partial thickness to the base of the surgical papillae and in full thickness only in an area 1-2 mm apical to the crestal bone margin. The flap base was then dissected in partial thickness with two incisions: a deep incision, separating the muscle fibers and mucosa from the periosteum, and a superficial incision, separating the mucosa from the muscle layer, ensuring passive coronal advancement of the flap. The anatomical papillae were de-epithelialized, creating a donor area for the coronal movement of the flap. The root surface was smoothed with a periodontal mini-curette in the exposed area only (recession depth + buccal probing depth). The root surface was conditioned for 2 minutes with 24% EDTA gel. Blood was drawn from the patients in the test group via venipuncture using a closed butterfly system, with 9 ml of blood collected in a 10 ml specialized vacuum tube. The tube was centrifuged at 1300 rpm for 14 minutes in a PRF DUO centrifuge, according to the protocol of Chaoukroun. The fibrin clot was positioned in the middle of the tube, between the acellular plasma fraction at the surface and the red fraction at the bottom, formed by erythrocytes. The clot was condensed to form a membrane, which was used to cover the exposed root surface. The flap was positioned coronally to cover the membrane and sutured with sling

sutures, while the vertical incisions were closed with interrupted resorbable 6-0 sutures.

NSAIDs (Aulin 100 mg every 12 hours for 3 days) were prescribed, along with 0.2% chlorhexidine gluconate mouthwash twice daily for 6 weeks (2 weeks before and 4 weeks after the intervention). Sutures were removed after 2 weeks. Patients were instructed in proper oral hygiene using a soft toothbrush and the Roll method.

In the control group, with only the coronally advanced flap, the surgical procedure was identical except for the step involving the preparation and placement of the PRF membrane.

Statistical Methods

The following statistical methods were used:

- Descriptive analysis to describe the structure of processes

- Student's t-test for comparison between two samples with quantitative variables

- Paired t-test for intra-group comparison

- Chi-square test to determine dependencies between qualitative variables

A significance level of $p < 0.05$ was accepted for the statistical analyses.

RESULTS

A statistically significant improvement has been observed in all examined clinical parameters as a result of the surgical treatment of gingival recessions. Both the CAF and CAF+PRF groups showed favorable outcomes in terms of reducing recession depth (RD) and width (RW), improving probing pocket depth (PPD), clinical attachment level (CAL), keratinized tissue height (KTH) and gingival thickness (Fig. 1).

Fig. 1. Changes in: a) RD at baseline and 6th month; b) CAL at baseline and 6th month; c) KTH at baseline and 6th month; d) GT at baseline and 6th month.

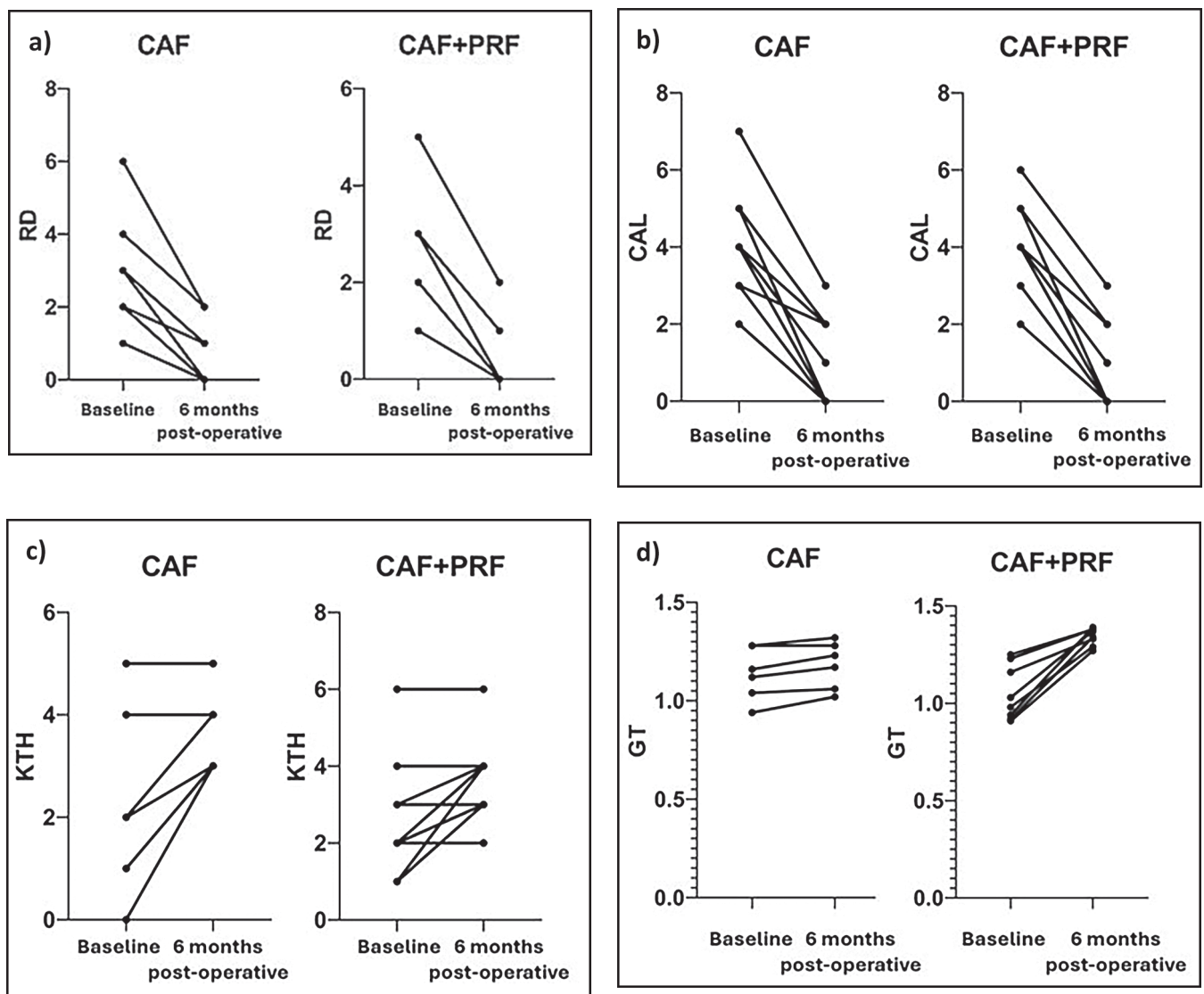
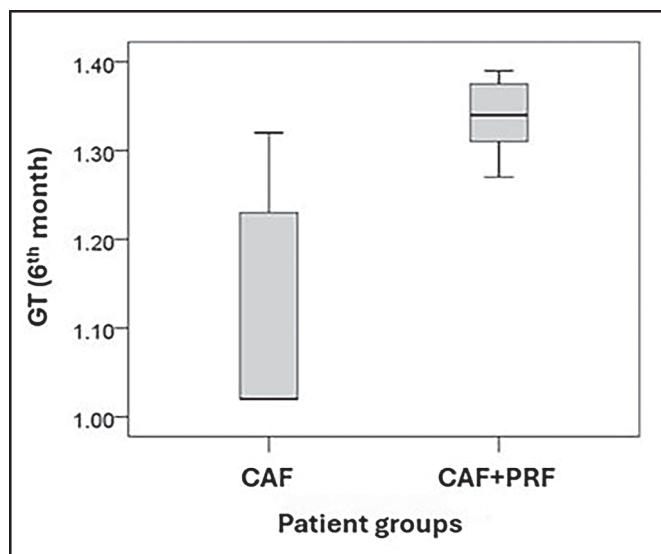


Table 1. Comparison of clinical parameters 6 months post-operative.

Parameter	CAF	CAF + PRF	P coefficient / t-test /
	Mean	Mean	
Recessions number, N	15	15	
RD	0.53	0.4	0.6
RW	0.4	0.33	0.72
PPD	1.07	1	0.33
CAL	0.8	0.67	0.73
KTH	3.67	3.6	0.83
WAG	2.67	2.6	0.83
GT	1.12	1.34	<0.01*

For most clinical parameters – RD, RW, PPD, CAL, KTH, there were no statistically significant differences between CAF and CAF+PRF groups ($p > 0,05$). Statistically significant differences were found only in gingival thickness (GT) when comparing the control group (CAF) with the test group (CAF+PRF) at the 6th month post-operative. GT is higher in patients treated with CAF+PRF compared to the control group (Fig.2).

Fig. 2. Box plot showing differences in gingival thickness



Differences in CRC% and MRC%.

No statistically significant differences were found in complete root coverage - CRC,% (67% in the CAF patient group vs. 60% in the CAF+PRF group, $p = 0.71$) or in mean root coverage - MRC,% ($84.44\% \pm 20.38\%$ vs. $88.44\% \pm 16.99\%$, $p = 0.56$).

No statistically significant differences were observed in RD, RW, PPD, CAL and KTH between CAF and CAF+PRF groups regarding the changes of clinical parameters because of the surgical treatment of gingival reces-

sions. The CAF+PRF group demonstrated a statistically significant increase in gingival thickness ($p < 0.01$), with an average increase of 0.32 mm compared to 0.06 mm in the CAF group (Table 2).

Table 2. Comparison of changes in clinical parameters after surgical treatment

Parameter	CAF	CAF + PRF	P coefficient / t-test /
	Mean	Mean	
Recessions number, N	15	15	
RD	2	2.13	0.65
RW	2.4	2.6	0.58
PPD	0.13	0.27	0.38
CAL	2.87	3.13	0.45
KTH	1.33	1.13	0.61
WAG	1.4	1.6	0.58
GT	0.06	0.32	<0.01*

DISCUSSION

When comparing the results before and 6 months after treatment, both patient groups (CAF and CAF+PRF) demonstrated statistically significant improvements in all evaluated parameters - RD, RW, PPD, CAL, KTH and GT - as a result of the surgical treatment of the recessions, confirming that the coronally advanced flap is a predictable technique for treating Miller Class I and II gingival recessions.

In terms of recession depth (RD) and width (RW), our study showed similar results in both parameters at 6 months post-treatment in both the test and control groups: for RD – an average of 0.40 mm in the CAF+PRF group and 0.53 mm in the CAF group, and for RW – an average of 0.33 mm in the CAF+PRF group and 0.40 mm in the CAF group. The observed reduction in recession depth at 6 months compared to baseline values was an average of 2.13 mm in the CAF+PRF group and 2.00 mm in the CAF group, while the reduction in recession width was an average of 2.60 mm in the CAF+PRF group and 2.40 mm in the CAF group. Our results are consistent with those of Thamaraiselvan et al. and Gupta et al. [11, 12].

The meta-analysis by Miron et al., which includes 9 randomized clinical trials, shows that the use of PRF in addition to the coronally advanced flap leads to a statistically significant improvement in root coverage and clinical attachment gain. The authors report an average of 10-15% better root coverage when a PRF membrane is added compared to the use of a coronally advanced flap alone [13]. Only the study by Aroca et al. demonstrated better root coverage in the control group – CAF [14], while the other 8 studies showed better root coverage results in the CAF+PRF group.

In our study, we found a slight advantage in mean root coverage (MRC%) in the CAF+PRF group compared to CAF, but without statistical significance - $88.44\% \pm 16.99\%$ vs. $84.44\% \pm 20.38\%$, $p = 0.56$. Our results show complete root coverage in 67% of cases with CAF+PRF and 60% with CAF. These percentages of complete root coverage (CRC%) may be explained by the fact that the majority of the treated gingival recessions were in the lower jaw (26 out of 30 recessions), where certain anatomical factors are present, such as high frenula and bulky gingival-buccal attachments, increased muscle pull from the lower lip, and higher tension in the flap, as well as a shallow vestibule, making root coverage of lower jaw recessions less predictable compared to the upper jaw [15].

Both patient groups in our study demonstrated similar results in pocket depth reduction (PPD) and clinical attachment gain (CAL) following the surgical treatment of the gingival recessions. The attachment gain at 6 months postoperatively was an average of 3.13 mm in the CAF+PRF group and 2.87 mm in the CAF group, with no statistically significant difference between them ($p = 0.45$), which is consistent with the findings of other studies [11, 12, 16].

The presence of sufficient keratinized gingiva is important for maintaining periodontal health and preventing the progression of periodontal diseases. In their systematic review, Rodas et al. reported an increase in keratinized gingiva (KTH) in patients treated with CAF+PRF, ranging from 0.38 ± 0.64 mm to 1.18 ± 0.19 mm across various randomized clinical trials [16]. Our team found an average increase of 1.13 ± 0.26 mm in the amount of keratinized gingiva at 6 months postoperatively in the CAF+PRF group, with no statistically significant difference compared to the control group - 1.33 ± 0.29 mm ($p = 0.61$). The results of our clinical study are consistent with the meta-analysis by Miron et al. [13], as well as with other studies [11,12]. Only the study by Padma et al. demonstrated a statistically significant superiority of the CAF+PRF group over the CAF group in terms of KTH at 1 and 3 months postoperatively [17], which may be due to differences in the baseline values of keratinized gingiva between the two study groups. Currently, connective tissue grafting, in addition to the coronally advanced flap, demonstrates the best and most predictable results in improving tissue keratinization, with increases in both the amount of keratinized gingiva and root coverage [18].

Gingival thickness (GT) is important for achieving better root coverage in the treatment of recessions and for maintaining stable levels over time. The meta-analysis by Li et al. shows that the addition of autologous platelet concentrates to the coronally advanced flap leads to a statistically significant increase in gingival thickness. Specifically, with the addition of a PRF membrane, they found an average increase in thickness of 0.31 mm compared to the use of a coronally advanced flap alone [6]. In our study, we found significantly greater changes in gingival thick-

ness (GT) at 6 months postoperatively in the CAF+PRF group compared to the CAF group, with an average increase of 0.32 mm vs. 0.06 mm. At 6 months post-treatment, GT in the CAF+PRF group averaged 1.34 mm compared to 1.12 mm in the CAF group, a statistically significant difference ($p < 0.01$). This increase in soft tissue thickness may be explained by the influence of growth factors from the PRF membrane, which stimulate the proliferation of cells from the periodontal ligament and gingival fibroblasts while inhibiting the action of epithelial cells. The space-maintaining effect of the PRF membrane may also have a beneficial impact [14].

In conclusion, the results of our study demonstrate similar effectiveness of the coronally advanced flap alone and in combination with a platelet-rich fibrin membrane for treating gingival recessions in terms of the following parameters: recession depth (RD) and width (RW), probing pocket depth (PPD), clinical attachment level (CAL), and the amount of keratinized gingiva (KTH). In terms of root coverage, both techniques showed comparable results. The addition of a PRF membrane to the coronally advanced flap led to a statistically significant increase in gingival thickness (GT) when evaluating the results 6 months after the surgical treatment of recessions.

There are some limitations in our study, such as the lack of patient evaluation regarding the post-operative period and the aesthetic outcomes. Future studies evaluating the expression of certain markers during the healing period at a molecular level, in addition to clinical results, would enrich the comprehensive assessment of autologous platelet concentrates in mucogingival surgery.

CONCLUSION

This study compares the effectiveness of the coronally advanced flap (CAF) alone and in combination with a platelet-rich fibrin (PRF) membrane for the treatment of Miller Class I and II gingival recessions. The addition of a PRF membrane to CAF led to a statistically significant increase in gingival thickness (GT) at 6 months postoperatively. Patients with thin periodontal phenotype are at higher risk of clinical attachment loss in cases of inflammation and recession development, which contributes to the progression of periodontal disease. PRF is an easy-to-handle bioactive agent of autologous origin and is cost-effective. Combining CAF with PRF membrane is a more effective approach for increasing the thickness of soft tissues and achieving long-term stable root coverage, thereby maintaining periodontal health in patients with sufficient keratinized gingiva in Miller Class I and II gingival recessions.

Acknowledgements:

The present study was funded by The Council of Medical Science at Medical University – Sofia under contract No. D-148/14.06.2022.

REFERENCES:

1. Emilov D, Deliverska E. Surgical treatment of gingival recession with soft tissue graft procedure. *J of IMAB*. 2018 Jul-Sep;24(3):2149-2159. [[Crossref](#)]
2. Emilov DK, Deliverska-Aleksandrova EG. Treatment of gingival recession with hypersensitivity using free soft-tissue graft procedures. *Folia Medica (Plovdiv)* 2022 Apr 30;64(2):321-326. [[PubMed](#)]
3. Zucchelli G, Tavelli L, Ravidà A, Stefanini M, Suárez-López Del Amo F, Wang HL. Influence of tooth location on coronally advanced flap procedures for root coverage. *J Periodontol*. 2018 Dec;89(12):1428-1441. [[PubMed](#)]
4. Zucchelli G, Tavelli L, Barootchi S, Stefanini M, Wang HL, Cortellini P. Clinical remarks on the significance of tooth malposition and papillae dimension on the prediction of root coverage. *Int J Periodontics Restorative Dent* 2020 Nov-Dec;40(6):795-803. [[PubMed](#)]
5. Stefanini M, Barootchi S, Tavelli L, Marzadori M, Mazzotti C, Mounssif I, et al. Difficulty score for the treatment of isolated gingival recessions with the coronally advanced flap: a preliminary reliability study. *Clin Oral Invest*. 2022 Oct 12;27(2):559-569. [[PubMed](#)]
6. Li R, Liu Y, Xu T, Zhao H, Hou J, Wu Y, et al. The Additional Effect of Autologous Platelet Concentrates to Coronally Advanced Flap in the Treatment of Gingival Recessions: A Systematic Review and Meta-Analysis. *Biomed Res Int*. 2019 Jul 25;2019:2587245. [[PubMed](#)]
7. Kirilova JN, Kosturkov D. Direct Pulp Capping with Advanced Platelet-Rich Fibrin: A Report of Two Cases. *Medicina*. 2023; 59(2):225. [[Crossref](#)]
8. Kirilova J, Kirov D, Yovchev D, Topalova-Pirinska S, Deliverska E. Endodontic and surgical treatment of chronic apical periodontitis: a randomized clinical study. *Biotechnol Biotechnol Equip*. 2022 Sep 8;36(1):737-744. [[Crossref](#)]
9. Kirilova J, Kirov D, Yovchev D, Deliverska E. Treatment of an apical cyst with platelet concentrate – a case report. *Folia Medica (Plovdiv)* 2023 Dec 31;65(6):1005-1010. [[PubMed](#)]
10. Miron RJ, Zucchelli G, Pikos MA, Salama M, Lee S, Guillemette V, et al. Use of platelet-rich fibrin in regenerative dentistry: a systematic review. *Clin Oral Invest*. 2017 Jul; 21(6):1913-1927. [[PubMed](#)]
11. Thamaraiselvan M, Elavarasu S, Thangakumaran S, Gadagi JS, Arthie T. Comparative clinical evaluation of coronally advanced flap with or without platelet rich fibrin membrane in the treatment of isolated gingival recession. *J Indian Soc Periodontol*. 2015 Jan-Feb;19(1):66-71. [[PubMed](#)]
12. Banthia R, Gupta S, Singh P, Banthia P, Raje S, Aggarwal N. Clinical evaluation and comparison of the efficacy of coronally advanced flap alone and in combination with platelet rich fibrin membrane in the treatment of Miller class I and II gingival recessions. *Contemp Clin Dent*. 2015 Apr-Jun;6(2):153-160. [[PubMed](#)]
13. Miron RJ, Moraschini V, Del Fabbro M, Piattelli A, Fujioka-Kobayashi M, Zhang Y, et al. Use of platelet-rich fibrin for the treatment of gingival recessions: a systematic review and meta-analysis. *Clin Oral Invest*. 2020 Aug;24(8):2543-2557. [[PubMed](#)]
14. Aroca S, Keglevich T, Barbieri B, Gera I, Etienne D. Clinical evaluation of a modified coronally advanced flap alone or in combination with a platelet-rich fibrin membrane for the treatment of adjacent multiple gingival recessions: a 6-month study. *J Periodontol*. 2009 Feb;80(2):244-52. [[PubMed](#)]
15. Zucchelli G, Tavelli L, Barootchi S, Stefanini M, Rasperini G, Valles C, et al. The influence of tooth location on the outcomes of multiple adjacent gingival recessions treated with coronally advanced flap: A multicenter re-analysis study. *J Periodontol*. 2019 Nov;90(11):1244-1251. [[PubMed](#)]
16. Rodas MAR, Paula BL, Pazmiño VFC, Lot Vieira FFDS, Junior JFS, Silveira EMV. Platelet-rich fibrin in coverage of gingival recession: a systematic review and meta-analysis. *Eur J Dent*. 2020 Mar;14(2):315-326. [[PubMed](#)]
17. Padma R, Shilpa A, Kumar PA, Nagasri M, Kumar C, Sreedhar A. A split mouth randomized controlled study to evaluate the adjunctive effect of platelet-rich fibrin to coronally advanced flap in Miller's class-I and II recession defects. *J Indian Soc Periodontol*. 2013 Sep;17(5):631-6. [[PubMed](#)]
18. Mufti S, Dadawala SM, Patel P, Shah M, Dave DH. Comparative Evaluation of Platelet-Rich Fibrin with Connective Tissue Grafts in the Treatment of Miller's Class I Gingival Recessions. *Contemp Clin Dent*. 2017 Oct-Dec;8(4):531-537. [[PubMed](#)]

Please cite this article as: Dimitrov D, Emilov D, Ivanov I, Mlachkova A. Comparison of the effectiveness of coronally advanced flap alone and in combination with platelet-rich fibrin membrane for treatment of gingival recessions. *J of IMAB*. 2025 Jan-Mar;31(1):6085-6090. [[Crossref](#) - <https://doi.org/10.5272/jimab.2025311.6085>]

Received: 18/11/2024; Published online: 26/03/2025



Address for correspondence:

Dimitar Dimitrov
Department of Periodontology, Faculty of Dental Medicine, Medical University - Sofia;
1, Georgi Sofiyski Str., 1431 Sofia, Bulgaria.
E-mail: d.dimitrov@fdm.mu-sofia.bg,