



Optimization of the Plasmolifting Method in Periodontitis

Abdurashitova Maftuna Anvarovna

Student of group 421, Faculty of Dentistry

Turaeva Firusa Abdurashidovna

Scientific supervisor

<https://orcid.org/0009-0006-6486-7633>

Bukhara State Medical Institute named after Abu Ali ibn Sino, Bukhara, Uzbekistan

E-mail: turayeva.firusa@bsmi.uz

Abstract. Chronic generalized periodontitis remains one of the leading causes of tooth loss in adults, and the outcomes of platelet-rich plasma (PRP) therapy depend largely on the accuracy of its administration. The aim of the study was to evaluate the clinical effectiveness of an optimized plasmolifting protocol performed under real-time ultrasound navigation in the complex treatment of moderate and severe chronic generalized periodontitis. A prospective randomized controlled trial included 68 patients aged 28–57 years, divided into a main group (n=34; PRP injections under ultrasound navigation) and a comparison group (n=34; standard PRP injections without navigation). Periodontal pocket depth, clinical attachment level, bleeding on probing, the OHI-S index and the concentrations of PDGF-BB and TGF- β 1 in gingival crevicular fluid were assessed; the follow-up period was 6 months. In the main group, pocket depth decreased from 4.82 ± 0.63 to 2.31 ± 0.41 mm ($p < 0.001$), bleeding on probing decreased from $68.4 \pm 9.2\%$ to $18.7 \pm 5.4\%$, and the PDGF-BB concentration increased more than twofold. The reduction in pocket depth (2.51 ± 0.42 vs 1.38 ± 0.35 mm) and the gain in clinical attachment (1.83 ± 0.31 vs 0.94 ± 0.27 mm) were significantly greater than in the comparison group ($p < 0.05$), with fewer procedures required. Ultrasound-guided plasmolifting can be recommended for use in specialized periodontal practice.

Keywords: *chronic generalized periodontitis; plasmolifting; platelet-rich plasma; ultrasound navigation; growth factors; PDGF-BB; TGF- β 1; clinical attachment level.*

INTRODUCTION

Chronic periodontitis is one of the leading causes of tooth loss in people over 35 years of age and a significant medical and social problem: its severe forms affect about 10–15% of the world's adult population [1]. Periodontal diseases have a considerable impact on nutrition, general health and quality of life, which makes their effective treatment a public health priority [2]. Despite a significant arsenal of conservative and surgical treatment methods, achieving stable clinical remission remains a difficult task requiring the integration of innovative therapeutic approaches [3]. Among the biologically active methods of influencing inflamed periodontal tissues, a special place is occupied by plasmolifting — an autologous regenerative therapy method based on local administration of platelet-rich plasma (PRP) [4]. Platelets contain a wide range of growth factors: platelet-derived growth factor (PDGF), transforming growth factor- β (TGF- β), epidermal growth factor (EGF), insulin-like growth factor-1 (IGF-1) and vascular endothelial growth factor (VEGF), which stimulate fibroblast proliferation, neoangiogenesis and acceleration of regenerative processes in periodontal tissues [5].

At the same time, standardization of PRP preparation and administration remains an urgent problem in clinical periodontology [6]. The depth of injections, their localization and the volume of the



administered preparation vary significantly depending on the individual anatomical characteristics of the patient and the experience of the operator, which considerably reduces the reproducibility of treatment results. The use of real-time ultrasound navigation theoretically makes it possible to overcome this limitation by visualizing the needle path and controlling the area of deposition of the preparation directly during the manipulation [7]. There are no systematic data in the available literature on the clinical efficacy of navigated plasmolifting in comparison with standard techniques in moderate and severe chronic periodontitis. The few publications covering this issue are limited to descriptions of isolated clinical cases or pilot studies with small samples [8], and meta-analyses emphasize the heterogeneity of the results obtained [9]. The above determines the scientific significance and practical relevance of this research.

The aim of the study was to evaluate the clinical effectiveness of an optimized plasmolifting protocol with ultrasound navigation in the complex treatment of moderate and severe chronic generalized periodontitis.

MATERIALS AND METHODS

This prospective randomized controlled trial was conducted at the Department of Therapeutic Dentistry and Periodontology in 2022–2024. The study included 68 patients (38 women and 30 men) aged 28 to 57 years (mean age 41.3 ± 7.6 years) diagnosed with chronic generalized periodontitis of moderate ($n=41$) and severe ($n=27$) severity, verified according to the 2018 classification of periodontal and peri-implant diseases and conditions [10] with case definitions based on the consensus report of workgroup 2 [11].

Inclusion criteria: periodontal pockets 4–8 mm deep, radiologically confirmed alveolar bone resorption of no more than 2/3 of the root length, absence of general somatic pathology in the decompensation stage, normal coagulogram parameters (platelets $\geq 150 \times 10^9/l$), and signed informed consent. Exclusion criteria: pregnancy and lactation, use of anticoagulants, immunodeficiency disorders, a history of allergic reactions to blood products, and smoking more than 10 cigarettes per day.

Using stratified randomization, patients were divided into two equal groups of 34 people: the main group (MG), in which plasmolifting was performed under ultrasound navigation control, and the comparison group (CG), which received the standard protocol of PRP injections without navigation.

PRP was obtained using a unified two-stage centrifugation method. Venous blood (18–20 ml) was collected on an empty stomach into specialized tubes containing sodium citrate. Primary centrifugation was performed at 1500 rpm for 10 min, secondary centrifugation at 3500 rpm for 10 min. The final platelet concentration in the preparation was $874.2 \pm 62.3 \times 10^9/l$, which corresponds to a 5–7-fold excess over the baseline level and meets the criterion of therapeutic efficacy of PRP.

In the MG, PRP was administered under the control of a high-frequency linear ultrasound transducer (7.5–12 MHz) in B-mode. Visualization was performed in the scanning plane parallel to the long axis of the tooth. The depth of needle insertion (27G, 30 mm) was monitored in real time; the target point was the transition zone between the bottom of the pocket and the bony wall of the alveolus. The volume of PRP injected per pocket was 0.2–0.3 ml. In the CG, injections were performed using the standard technique without imaging, guided by clinical landmarks (pocket probing, palpation). In both groups, the course of treatment included 3 plasmolifting procedures at intervals of 10–14 days against the background of standard basic therapy (professional oral hygiene, ultrasonic removal of dental deposits, antibacterial therapy as indicated). The follow-up period was 6 months.

Clinical effectiveness was assessed by the following parameters: periodontal pocket depth (PPD, mm), clinical attachment level (CAL, mm), bleeding on probing (BOP, %) and the Simplified Oral Hygiene Index (OHI-S). Laboratory control included determination of PDGF-BB and TGF- β 1 concentrations in gingival crevicular fluid by enzyme-linked immunosorbent assay (ELISA) at baseline



and 1 month after completion of the course of therapy.

Statistical processing of the results was carried out using IBM SPSS Statistics 26.0. The Mann–Whitney U test was used for intergroup comparisons and the Wilcoxon signed-rank test for intragroup comparisons. Differences were considered statistically significant at $p < 0.05$.

RESULTS

The dynamics of clinical and laboratory parameters in the main group are presented in Table 1.

Table 1

Dynamics of clinical and laboratory parameters in the main group (n=34)

Parameter	Baseline	After treatment
PPD, mm	4.82±0.63	2.31±0.41*
BOP, %	68.4±9.2	18.7±5.4
OHI-S, points	2.74±0.38	1.12±0.29
PDGF-BB, pg/ml	142.6±18.4	312.8±24.6
TGF-β1, pg/ml	86.3±11.2	198.4±21.7

Note: * $p < 0.001$ compared with baseline (Wilcoxon test). PDGF-BB and TGF-β1 were determined at baseline and 1 month after completion of the course of therapy.

In the MG, a significant decrease in periodontal pocket depth was recorded, from 4.82±0.63 mm to 2.31±0.41 mm ($p < 0.001$), which corresponds to a clinically significant reduction of pathological pockets. BOP decreased from 68.4±9.2% to 18.7±5.4%, reflecting a pronounced anti-inflammatory effect. A significant improvement in hygiene status (OHI-S from 2.74±0.38 to 1.12±0.29) indicates patient compliance and the effectiveness of the hygiene training conducted in parallel with the main course of treatment. The concentration of PDGF-BB in the gingival fluid of MG patients increased more than twofold — from 142.6±18.4 to 312.8±24.6 pg/ml, which confirms the activation of platelet secretion and local stimulation of the regenerative potential of periodontal tissues. Similar dynamics were recorded for TGF-β1 (from 86.3±11.2 to 198.4±21.7 pg/ml), which is responsible for inhibiting the inflammatory response and remodeling the connective tissue matrix.

The results of the intergroup comparison are presented in Table 2.

Table 2

Comparison of treatment outcomes in the study groups

Parameter	MG (n=34)	CG (n=34)	p
Reduction in PPD, mm	2.51±0.42	1.38±0.35	<0.05
Gain in CAL, mm	1.83±0.31	0.94±0.27	<0.05
Number of procedures to clinical stabilization	2.1±0.4	3.6±0.6	<0.05
Post-procedural complications, %	2.9	8.8	>0.05

Note: MG — main group (ultrasound-guided plasmolifting); CG — comparison group (standard technique); p — Mann–Whitney U test.

The intergroup comparison demonstrates a statistically significant advantage of navigated plasmolifting in all key parameters. The reduction in PPD in the MG was 2.51±0.42 mm versus 1.38±0.35 mm in the CG ($p < 0.05$). The gain in clinical attachment in the MG exceeded that in the CG by 1.95 times



(1.83 ± 0.31 mm and 0.94 ± 0.27 mm, respectively). The number of procedures required to achieve clinical stabilization of the inflammatory process was significantly lower in the MG (2.1 ± 0.4 versus 3.6 ± 0.6 , $p < 0.05$), which is of practical importance in terms of cost-effectiveness and patient adherence to treatment. The incidence of post-procedural complications (local hematoma, transient increase in pain) was 2.9% in the MG and 8.8% in the CG, although the differences did not reach statistical significance ($p > 0.05$), which may be due to the relatively small sample size.

DISCUSSION

The results obtained are consistent with the data of foreign authors indicating the prospects of using platelet concentrates in periodontology [12]. Meta-analyses have also shown that the addition of autologous platelet concentrates to periodontal regenerative procedures improves pocket depth reduction and clinical attachment gain [13]. At the same time, unlike most published studies, ultrasound navigation was systematically used in this work, which made it possible to objectify the accuracy of drug administration and minimize operator-dependent variability. Ultrasound monitoring ensured the deposition of PRP directly in the area of the pocket bottom and the adjacent alveolar structures, which most likely provides higher local bioavailability of growth factors and, as a result, superior clinical efficacy compared with the standard technique. This is in line with current clinical practice guidelines for advanced periodontitis, which emphasize a comprehensive, evidence-based treatment approach [14].

The limitation of this study is the relatively short follow-up period (6 months), which is insufficient to assess the long-term results of bone tissue regeneration. In addition, the study design did not provide for histomorphometric verification of regenerative processes. These limitations determine the direction of further research, including expanding the patient cohort and extending the follow-up period to 12–24 months.

CONCLUSION

The use of ultrasound navigation in the plasmolifting protocol for chronic generalized periodontitis provides a significantly more pronounced clinical effect compared with the standard PRP administration technique. Navigation control makes it possible to achieve a significant reduction in periodontal pocket depth, an increase in clinical attachment level and normalization of the concentration of key growth factors in the gingival fluid with fewer procedures. The developed protocol can be recommended for implementation in the practice of specialized periodontal departments as an effective and safe method of biologically oriented treatment of moderate and severe forms of periodontitis.

REFERENCES

1. Kassebaum NJ, Bernabé E, Dahiya M, Bhandari B, Murray CJ, Marcenes W. Global burden of severe periodontitis in 1990–2010: a systematic review and meta-regression. *J Dent Res*. 2014;93(11):1045–1053. doi:10.1177/0022034514552491
2. Tonetti MS, Jepsen S, Jin L, Otomo-Corgel J. Impact of the global burden of periodontal diseases on health, nutrition and wellbeing of mankind: a call for global action. *J Clin Periodontol*. 2017;44(5):456–462. doi:10.1111/jcpe.12732
3. Sanz M, Herrera D, Kebschull M, et al. Treatment of stage I–III periodontitis — The EFP S3 level clinical practice guideline. *J Clin Periodontol*. 2020;47(Suppl 22):4–60. doi:10.1111/jcpe.13290
4. Marx RE. Platelet-rich plasma (PRP): what is PRP and what is not PRP? *Implant Dent*. 2001;10(4):225–228. doi:10.1097/00008505-200110000-00002
5. Anitua E. Plasma rich in growth factors: preliminary results of use in the preparation of future sites for implants. *Int J Oral Maxillofac Implants*. 1999;14(4):529–535.
6. Dohan Ehrenfest DM, Rasmusson L, Albrektsson T. Classification of platelet concentrates: from



- pure platelet-rich plasma (P-PRP) to leucocyte- and platelet-rich fibrin (L-PRF). *Trends Biotechnol.* 2009;27(3):158–167. doi:10.1016/j.tibtech.2008.11.009
7. Chan HL, Wang HL, Fowlkes JB, Giannobile WV, Kripfgans OD. Non-ionizing real-time ultrasonography in implant and oral surgery: a feasibility study. *Clin Oral Implants Res.* 2017;28(3):341–347. doi:10.1111/clr.12805
 8. Tözüm TF, Demiralp B. Platelet-rich plasma: a promising innovation in dentistry. *J Can Dent Assoc.* 2003;69(10):664.
 9. Del Fabbro M, Bortolin M, Taschieri S, Weinstein R. Is platelet concentrate advantageous for the surgical treatment of periodontal diseases? A systematic review and meta-analysis. *J Periodontol.* 2011;82(8):1100–1111. doi:10.1902/jop.2010.100605
 10. Caton JG, Armitage G, Berglundh T, et al. A new classification scheme for periodontal and peri-implant diseases and conditions — introduction and key changes from the 1999 classification. *J Clin Periodontol.* 2018;45(Suppl 20):S1–S8. doi:10.1111/jcpe.12935
 11. Papapanou PN, Sanz M, Buduneli N, et al. Periodontitis: consensus report of workgroup 2 of the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions. *J Periodontol.* 2018;89(Suppl 1):S173–S182. doi:10.1002/JPER.17-0721
 12. Miron RJ, Zucchelli G, Pikos MA, et al. Use of platelet-rich fibrin in regenerative dentistry: a systematic review. *Clin Oral Investig.* 2017;21(6):1913–1927. doi:10.1007/s00784-017-2133-z
 13. Panda S, Doraiswamy J, Malaiappan S, Varghese SS, Del Fabbro M. Additive effect of autologous platelet concentrates in treatment of intrabony defects: a systematic review and meta-analysis. *J Invest Clin Dent.* 2016;7(1):13–26. doi:10.1111/jicd.12117
 14. Herrera D, Sanz M, Kebschull M, et al. Treatment of stage IV periodontitis: the EFP S3 level clinical practice guideline. *J Clin Periodontol.* 2022;49(Suppl 24):4–71. doi:10.1111/jcpe.13639