**Edelweiss Applied Science and Technology**
*ISSN: 2576-8484*
*Vol. 9, No. 7, 1737-1747*
*2025*
*Publisher: Learning Gate*
*DOI: 10.55214/2576-8484.v9i7.9007*


# Scientific and practical justification of alternative methods for using the phytopreparations Hemostat and Clove Essential Oil in the treatment of severe chronic generalized periodontitis

Sobirov Alijon Axmadovich[1*], Gafforov Sunatullo Amrulloyevich[1], Abdukholiqov Sirojiddin Fakhriddin o`g`li[2], Xamrayev Mirali Sherali o`g`li[1], Djambilov Ravshanbek Sotvoldiyevich[3], Nurmatova Nodira Tuhtakhodjaevna[1], Odiljonov Javokhir Dilmurodjon o`g`li[3]
[1]Department of dentistry, children's dentistry and orthodontics, Tashkent Institute of Postgraduate Medical Education, Tashkent, Uzbekistan; alijonsobirov204@gmail.com (S.A.A.) gafforovsunnatullo8@gmail.com (G.S.A.) miralim0211@gmail.com (X.M.S.) nurmatovanodira@gmail.com (N.N.T.).
[2]Department of therapeutic dentistry, Tashkent State Dental Institute, Tashkent, Uzbekistan. abduxalikovs@mail.com (A.S.F.)
[3]Department of therapeutic dentistry, Andijan State Medical Institute, Andijan, Uzbekistan. jambilovr@gmail.com (D.R.S.). black_prince1112@mail.ru (O.J.D.).

**Abstract:** The widespread prevalence of periodontal tissue diseases, including severe chronic generalized periodontitis, has increased interest in the use of plant-based herbal remedies for treatment due to their safety and positive outcomes. The aim of this study was to treat severe chronic generalized periodontitis using the liquid extract of the herbal remedy "Hemostat" as an alternative. A total of 326 patients aged 41-60 years with a diagnosis of chronic generalized periodontitis (K05.5) were evaluated for periodontal tissue condition using a special chronological chart. Measurements were taken before treatment, as well as 10 and 20 days after treatment, based on eight clinical indicators: oral hygiene, quantitative and qualitative characteristics of the microflora of periodontal pockets, neutrophil infiltration, local allergic reactions, bleeding of periodontal pockets and gingival sulci, tissue repair, and atrophy of interproximal alveolar bone ridges. Observations based on these eight indicators during the treatment of severe chronic generalized periodontitis led to the conclusion that, for eliminating pathology, the clinical effectiveness of the integral indicators demonstrates the possibility of using alternative methods when selecting oral antiseptics: liquid extract of the herbal remedy "Hemostat" followed by "Clove Essential Oil" and, with satisfactory results, the synthetic drug "Chlorhexidine Bigluconate."

***Keywords:*** *"Chlorhexidine bigluconate", "Hemostat", "Clove essential oil", Dental pathologies, Hygiene indicators, Oral tissue physiology, Herbal remedies, Periodontal tissue inflammation.*

## 1. Introduction

Relevance. Periodontal tissue (PT) diseases, including periodontitis, are reported in 80% of the population worldwide. Periodontitis ranks second in prevalence among dental diseases [1-3]. According to the World Health Organization (WHO), inflammatory pathologies of periodontal tissue (IPPT) affect 80–100% of the adult population, with a significant increase observed particularly among individuals aged 20–35 years [4-6].

Currently, great attention is being paid to phytotherapy for the treatment of chronic pathologies of periodontal tissues (PT), including severe chronic generalized periodontitis (SCGP). In practice, there is growing interest in the harmless effects and positive outcomes of plant-based phytopreparations [7-10].

Notably, the WHO and several other authors have highlighted that approximately 75–80% of the world's population utilizes plant-based preparations, with over 23,000 plant species being used for this


**History:** Received: 19 May 2025; Revised: 26 June 2025; Accepted: 3 July 2025; Published: 22 July 2025
* Correspondence: alijonsobirov204@gmail.com

purpose [11-13]. However, it is worth emphasizing that despite the long-term use and demonstrated advantages of various phytopreparations [14-17] no unified consensus has been reached regarding the algorithms substantiating their specific effectiveness in SCGP.

The aim of the study: To optimize the treatment of severe chronic generalized periodontitis by introducing alternative approaches using the liquid extract phytopreparation "Hemostat."

Materials and Methods: A specialized chronological card was developed for 326 patients aged 41–60 years who were diagnosed with severe chronic generalized periodontitis (SCGP, K05.5) based on the WHO standards. The condition of the periodontal tissues (PT) was assessed at three time points: before treatment, 10 days after treatment, and 20 days after treatment. Assessments included eight clinical criteria: oral hygiene status (CPITN, PMA index by Parma C., 1960; PI index by Russell, 1956), quantitative and qualitative indicators of microbial content in periodontal pockets, neutrophil infiltration, local allergic reactions, bleeding of periodontal pockets and sulci, tissue repair, and resorption of the interproximal alveolar bone ridges. These parameters were periodically analyzed and compared across groups [18-21]. Oral cavity sanitation was performed in 146 patients aged 41–50 years (44.8%) and in 180 patients aged 51–60 years (55.2%). This included the extraction of teeth indicated for the removal and cleaning of dental deposits. The patients were then divided into the following treatment groups for therapeutic and preventive interventions: Group 1: 112 patients (34.35%) received local treatment with "Hemostat" liquid extract (KFM 42 Uz-22477731-3757-2019, State Project AL-422105573) combined with a 0.05% solution of "Chlorhexidine Bigluconate." The study group included 65 men and 47 women. Group 2: 104 patients (46%) were treated with "Clove Essential Oil" combined with a 0.05% solution of "Chlorhexidine Bigluconate." The study group included 46 men and 58 women. Group 3:110 patients (33.7%) were treated with 0.05% Chlorhexidine Bigluconate" alone. The study group included 50 men and 60 women. This study was conducted across all groups (Table 1).

**Table 1.**
Distribution of the study group by age, gender, and treatment type (M±n %)

| No | Groups | n=patient | Distribution by age and gender. | | | |
|---|---|---|---|---|---|---|
| | | | 41-50 age | | 51-60 age | |
| | | | men | women | men | women |
| 1 | 1-group | 112/34. 35% | 24/21.4%<br>24/16.4% | 20/17.8%<br>20/13.7% | 41/36.6%<br>41/22.3% | 27/24.1%<br>27/15% |
| 2 | 2-group | 104/46% | 19/18.3%<br>19/13% | 30/28.8%<br>30/20.5% | 27/25.9%<br>27/15% | 28/26.9%<br>28/15.5% |
| 3 | 3-group | 110/33.7% | 22/20%<br>22/15% | 28/25.4%<br>28/19.2% | 28/25.4%<br>28/15.5% | 32/29%<br>32/17.8% |
| 4 | Total | 326/100% | 65/19.9%<br>65/44.5% | 78/23.9%<br>78/53.4% | 96/29.4%<br>96/53.3% | 87/26.7%<br>87/48.3% |
| Total | | 326/100% | 146/44,8% / 146/100% | | 180/55.2% / 180/100% | |

**Note:** Group 1: "Hemostat" + "Chlorhexidine Bigluconate"; Group 2: "Clove Essential Oil" + "Chlorhexidine Bigluconate"; Group 3: "Chlorhexidine" only. The numbers in row 1 represent the treatment group percentages, while the numbers in row 2 correspond to the percentage distribution across age groups.

The "Hemostat" liquid extract, first used, is derived from Polygonum hydropiper L. (smartweed) and Urtica dioica (stinging nettle), as shown in Figures 1 and 2, respectively. This extract was developed under the practical project AL-422105573, titled "Creating new-generation antimicrobial and hemostatic drug preparations from local medicinal plants" within the framework of the Tashkent Pharmaceutical Institute, Uzbekistan. The extract is composed of bioactive compounds and an extractant (70% ethanol), prepared from plant extracts [11, 15].

*Edelweiss Applied Science and Technology*
*ISSN: 2576-8484*
*Vol. 9, No. 7: 1737-1747, 2025*
*DOI: 10.55214/2576-8484.v9i7.9007*

**Figure 1.**
Stinging Nettle. (Urtica dioica).

*Edelweiss Applied Science and Technology*
*ISSN: 2576-8484*
*Vol. 9, No. 7: 1737-1747, 2025*
*DOI: 10.55214/2576-8484.v9i7.9007*

**Figure 2.**
Urtica dioica (Stinging Nettle).

Statistical Analysis of Results: Two principles were used in the selection and calculation of the sample size: Proving the case: Increasing the sample size to enhance representativeness and improve statistical reliability. Mathematical express method: This method was applied for optimal sample size selection. In the variation statistics method, for indicators that did not have "statistical dispersion," relative percentages for each group were calculated and compared in future rankings. The statistical solution for multiple comparisons was performed using one-way parametric analysis of variance (ANOVA), and comparisons were made using the Scheffe method. The data obtained were processed and statistically analyzed using software on a Windows XP computer.

Results and Discussion. In this study, the prevalence of severe chronic generalized periodontitis (SCGP, K05.5) was higher in individuals over 40 years of age, particularly in men. This increased incidence could be linked to personal hygiene habits and tobacco consumption. Periodontal tissue inflammatory conditions (PTIC), including damage to periodontal pockets, ligaments, and alveolar bones, as well as serious injuries to ligaments, bleeding gums, tooth neck sensitivity, and the presence of tartar, were observed. These symptoms, along with complaints of temporary efficacy from local

*Edelweiss Applied Science and Technology*
*ISSN: 2576-8484*
*Vol. 9, No. 7: 1737-1747, 2025*
*DOI: 10.55214/2576-8484.v9i7.9007*

treatments, were noted during initial dental examinations and medical history reviews. Furthermore, rapid progression of periodontal tissue inflammatory conditions was observed among the participants, affecting multiple teeth within a relatively short period. Symptoms included sensation of tooth movement, displacement, and opening of spaces between teeth, particularly in the central incisors, where diastema was noted. Additionally, the presence of serous discharge and pus from periodontal pockets, along with the increasing accumulation of dental calculus, has been described (Figures 3–4).

**Figure 3.**
Patient S.J., 47 years of age.

**Figure 4.**
Patient J.L., 54 years old.

*Edelweiss Applied Science and Technology*
*ISSN: 2576-8484*
*Vol. 9, No. 7: 1737-1747, 2025*
*DOI: 10.55214/2576-8484.v9i7.9007*

In the study, the microbial count was assessed as follows: Stage 1 (pre-treatment): The baseline value of microbial contamination was almost the same for all groups, measuring 1580.5 ± 248.41 CFU/ml, indicating a high level of microbial contamination.Statistical analysis using ANOVA and Scheffe's method showed no significant differences between groups, indicating a high level of microbial contamination. The p-values were n=0.111111 for Groups 1 and 2 and n=0.111112 for Group 3, indicating that the differences between the groups were not statistically significant.

Antiseptic activity indicators at the 10th day of treatment (Stage 2) were as follows: Group 1 ("Hemostat"): 318.4 ± 33.12 CFU/ml: Group 2 ("Clove Essential Oil"): 622.5 ± 41.24 CFU/ml: Group 3 ("Chlorhexidine"): 521.4 ± 49.82 CFU/ml

Statistical analysis showed: For Group 1 ("Hemostat"): n=0.111112: For Group 2 ("Clove Essential Oil"): n=0.034854: For Group 3 ("Chlorhexidine"): n=0.34909On the 20th day of treatment (Stage 3): Group 1 ("Hemostat"): 94.32 ± 27.42 CFU/ml: Group 2 ("Clove Essential Oil"): 118.5 ± 11.08 CFU/ml: Group 3 ("Chlorhexidine"): 99.81 ± 22.42 CFU/ml. Statistical analysis revealed significant differences in the microbial counts between groups 1, 2, and 3 (p=0.111112). The analysis of microbial count indicators during the treatment phases demonstrated the effectiveness of the "Hemostat" liquid extract (Figure 5).

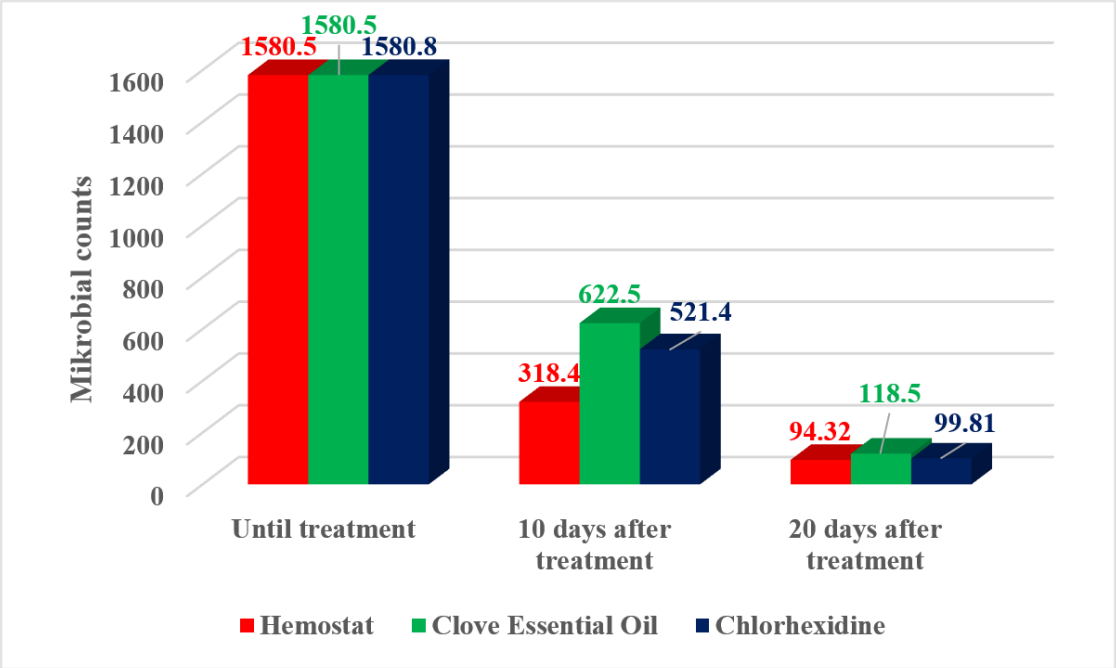


**Figure 5.**
Analysis of "microbial count" indicators during the treatment phases in study participants.

Neutrophil Infiltration Analysis: Stage 1: Group 1: 11.2 ± 1.75 cells/field; Group 2: 10.3 ± 1.95 cells/field; Group 3: 9.2 ± 1.34 cells/field. The results showed no statistically significant difference (n=0.111112). Stage 2: Group 1:8.43 ± 0.33 cells/field; Group 2:8.99 ± 0.63 cells/field; Group 3:6.55 ± 0.53 cells/field, these results demonstrate a decrease in neutrophil infiltration. Post-hoc comparison using one-way ANOVA and Scheffe's method ($p<0.05$) revealed significant differences between groups, suggesting that "Hemostat" and "Clove Essential Oil" were more effective than "Chlorhexidine" in reducing neutrophil infiltration (Figure 6). Stage 3:Group 1:4.23 ± 0.33 cells/field; Group 2:5.79 ± 0.23 cells/field; Group 3:3.45 ± 0.23 cells/field, Significant differences were observed between Groups 1 and

*Edelweiss Applied Science and Technology*
*ISSN: 2576-8484*
*Vol. 9, No. 7: 1737-1747, 2025*
*DOI: 10.55214/2576-8484.v9i7.9007*

2 (p=0.058733), with "Chlorhexidine" showing less effectiveness against inflammation compared to "Hemostat" and "Clove Essential Oil".

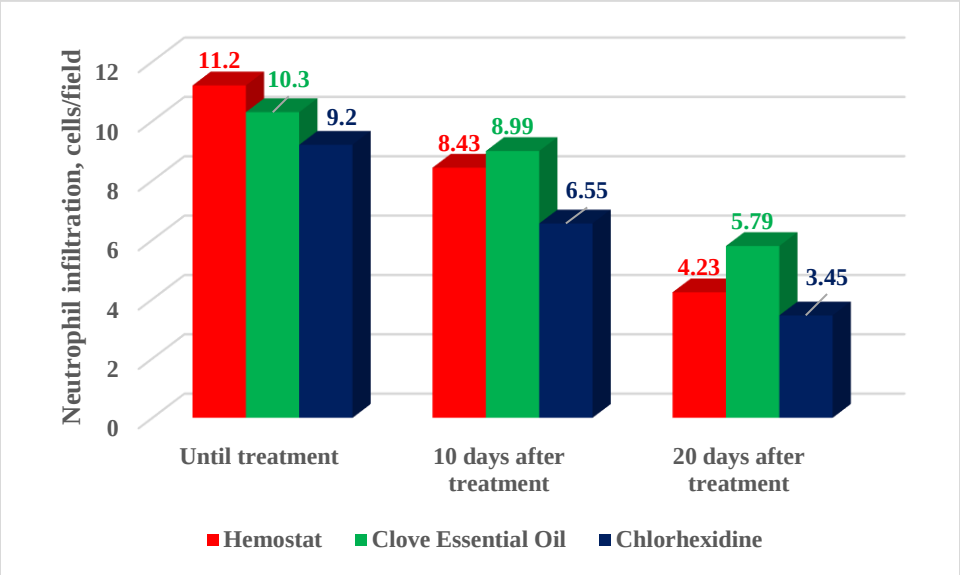


**Figure 6.**
Description of neutrophil infiltration.

Reparative Activity Indicators–Periodontal Pocket Depth Stage 1 (Pre-treatment): Group 1:5.2 ± 0.46 mm; Group 2:4.8 ± 0.48 mm; Group 3:4.9 ± 0.32 mm. The measurements showed no significant statistical differences (0.4 ± 0.02 mm). Stage 2 (10 days of treatment):Group 1: 3.3 ± 0.34 mm; Group 2: 3.7 ± 0.44 mm; Group 3: 3.8 ± 0.84 mm (p=0.077998), Stage 3 (20 days of treatment): Group 1: 1.6 ± 0.01 mm; Group 2: 1.8 ± 0.01 mm; Group 3: 2.4 ± 0.019 mm. The most noticeable improvement in periodontal pocket depth was observed in Group 1 during the 2nd and 3rd stages of treatment, highlighting the effectiveness of "Hemostat" in promoting tissue repair. Periodontal-Marginal-Alveolar (PMA) Index-Stage 1 (Pre-treatment): The average PMA index across all groups was 66.8 ± 4.6%. Stage 2 (10 days of treatment): Group 1:46.7 ± 6.8%; Group 2:34.4 ± 4.7%; Group 3:56.1 ± 1.8%, Significant reductions in the PMA index were observed in Group 1 and Group 2. Stage 3 (20 days of treatment): Group 1: 32.4 ± 2.2%; Group 2: 29.1 ± 2.6%; Group 3: 33.3 ± 2.2%. A noticeable improvement was observed in Groups 1 and 2, with a further reduction in the PMA index (**Figure 7**). In terms of clinical effectiveness, the PMA index demonstrated the highest efficacy in Group 1 (with "Hemostat"), followed by Group 2 ("Clove Essential Oil"), which was significantly more effective than Group 3 (Chlorhexidine).

*Edelweiss Applied Science and Technology*
*ISSN: 2576-8484*
*Vol. 9, No. 7: 1737-1747, 2025*
*DOI: 10.55214/2576-8484.v9i7.9007*

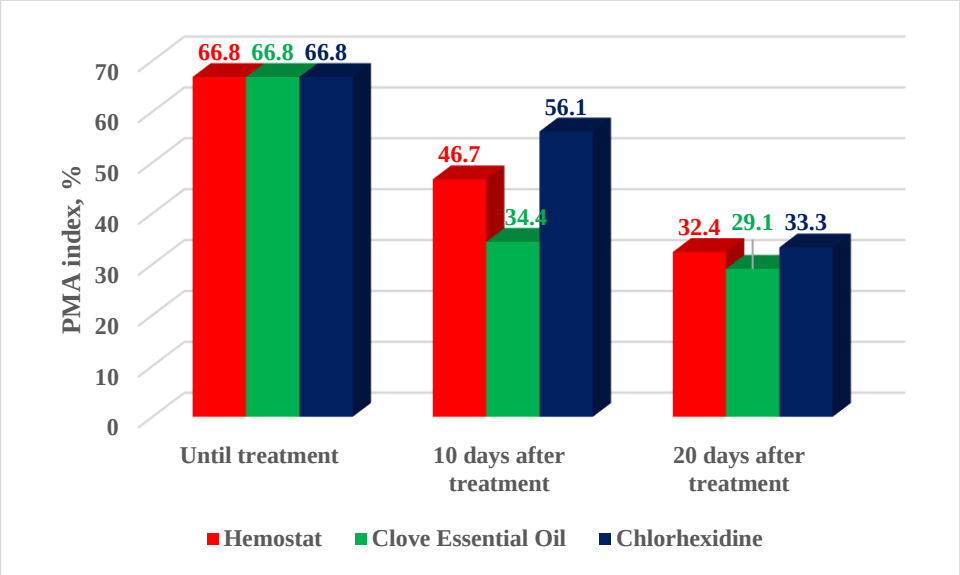


**Figure 7.**
Description of PMA Index.

PI: Periodontal Index Results: Stage 1 (pre-treatment)

The average PI was 0.88 ± 0.28, with no statistically significant differences observed between the groups (p = 0.111222).Stage 2 (10 days of treatment): The PI values in each group were as follows: Group 1: 0.42 ± 0.03; Group 2: 0.21 ± 0.01; Group 3: 0.69 ± 0.001. "Hemostat" and "Clove Essential Oil" showed normalization of the index values over the observation period. Stage 3 (20 days of treatment): The PI values in each group were: Group 1: 0.3 ± 0.01; Group 2: 0.04 ± 0.001; Group 3: 0.07 ± 0.007 (Figure 8). Statistically, Group 1 showed a less effective result than Groups 2 and 3 (p = 0.082337).

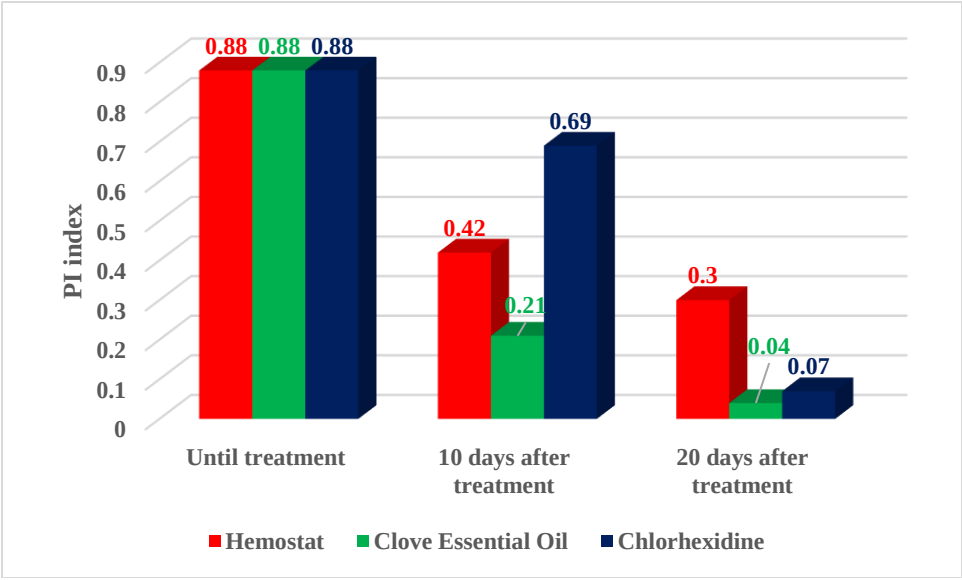


**Figure 8.**
Description of the PI Index.

*Edelweiss Applied Science and Technology*
*ISSN: 2576-8484*
*Vol. 9, No. 7: 1737-1747, 2025*
*DOI: 10.55214/2576-8484.v9i7.9007*

Tissue and Gums Bleeding (TMCH) Results-Stage 1 (Pre-treatment):All patients showed 100% positive results for bleeding of the gums. Stage 2 (10 days of treatment): The bleeding indices were as follows:Group 1 (Hemostat): 24.4 ± 0.24; Group 2 (Clove Essential Oil): 31.8 ± 0.28; Group 3 (chlorhexidine): 48.5 ± 0.86; Stage 3 (20 days of treatment), and the bleeding indices showed a significant reduction in Groups 1 and 2: Group 1: 14.2 ± 0.18; Group 2: 18.4 ± 0.44; Group 3: 24.4 ± 0.44 (Figure 9). The reduction in bleeding was more prominent in Group 1 (hemostat) and Group 2 (Clove Essential Oil), with a positive decrease ranging from 80% to 85%.

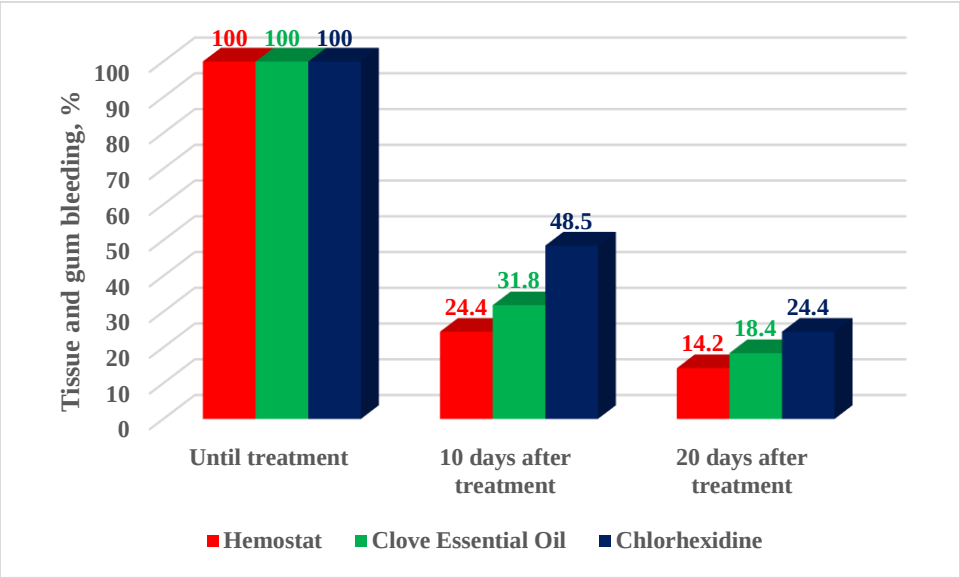


**Figure 9.**
Tissue and gum bleeding results.

Local Allergy and Microbial Species in PT: Candida Results-Stage 1 (Pre-treatment): The Candida counts were as follows: Group 1 (Hemostat): 44.3 ± 1.08 (n=50); Group 2 (Clove Essential Oil): 52.4 ± 1.48 (n=54); Group 3 (chlorhexidine): 52.4 ± 1.48 (n=59). Stage 2 (10 days of treatment): The Candida counts showed a decrease in all groups: Group 1 (Hemostat): 10.7 ± 0.24; Group 2 (Clove Essential Oil): 15.38 ± 1.24; Group 3 (Chlorhexidine): 16.36 ± 0.98. Stage 3 (20 days of treatment): The final Candida counts in the groups were significantly reduced: Group 1 (Hemostat): 2.6 ± 0.01; Group 2 (Clove Essential Oil): 3.83 ± 0.04; Group 3 (Chlorhexidine): 4.5 ± 0.44. Local Allergic Damage in the Mucosal Layer: Stage 1 (Pre-treatment): The initial allergic damage in the mucosal layer was observed as follows: Group 1 (Hemostat): 33.92 ± 1.02; Group 2 (Clove Essential Oil): 27.88 ± 1.03; Group 3 (Chlorhexidine): 23.07 ± 1.08; Stage 2 (10 days of treatment):After 10 days of treatment, the results showed a reduction in the allergic damage in the mucosal layer: Group 1 (Hemostat): 13.3 ± 0.44; Group 2 (Clove Essential Oil): 17.30 ± 0.88; Group 3 (Chlorhexidine): 14.54 ± 0.78, Stage 3 (20 days of treatment): The final values after 20 days of treatment showed continued improvement in all groups: Group 1 (Hemostat): 6.25 ± 0.08; Group 2 (Clove Essential Oil): 7.7 ± 0.44; Group 3 (Chlorhexidine): 10.9 ± 0.96. Thus, in terms of the development of complications, the "Chlorhexidine" preparation was found to be the most "problematic" and "less effective" compared to "Hemostat" and "Clove essential oil." Therefore, traditional approaches to the treatment of SCGP have significant shortcomings, as they show a higher percentage of complication development and insufficient clinical efficacy in terms of reparative activity compared to phytopreparations. Analysis of anti-inflammatory activity based on the reduction of neutrophil infiltration showed that oral antiseptic phytopreparations are more effective than synthetic drug preparations. However, there were no significant differences in the PMA and PI indices.

*Edelweiss Applied Science and Technology*
*ISSN: 2576-8484*
*Vol. 9, No. 7: 1737-1747, 2025*
*DOI: 10.55214/2576-8484.v9i7.9007*

The observations conducted on the eight criteria during the treatment of SCGP allowed the integration of clinical effectiveness indicators for the elimination of pathology, making it possible to implement an alternative method for the selection of oral antiseptics. Based on this assessment, it can be concluded that the phytopreparation "Hemostat" liquid extract is the most suitable for treating SCGP, followed by "Clove essential oil" and, with satisfactory results, the synthetic preparation "Chlorhexidine Bigluconate."

## 2. Conclusions

1. In the clinical manifestations of severe chronic generalized periodontitis (SCGP), negative changes are characterized by moderate oral hygiene (PMA = 66.8±4.6%; PI = 0.88±0.28), the number of microbes in the tooth-gum pocket (1580.5±248.41 CFU/ml) and quality indicators (candidiasis - 48.4±1.24), neutrophil infiltration (10.3±1.75 cells), local allergic reactions (27.48±1.24), gum bleeding (100%), tissue repair (4.8±0.44 mm). Evaluation of the dynamics of these indicators will be the basis for assessing the effectiveness of therapeutic and preventive measures aimed at eliminating the ongoing pathology and achieving the expected results.
2. In the treatment of SCGP, the use of natural local "Hemostat" infusion and "Clove essential oil" phytopreparations, in combination with the "Chlorhexidine bigluconate" preparation and applied separately in the second phase; in Group 1: oral hygiene (PMA = 46.7±6.8%; PI = 0.42±0.03), the number of microbes in the tooth-gum pocket (318.4±33.12 CFU/ml) and quality indicators (candidiasis - 10.7±0.24), neutrophil infiltration (8.43±0.33 cells), local allergic reactions (13.3±0.44), gum bleeding (24.4±0.24), tissue repair (3.3±0.34 mm). In the third phase, the following indicators were observed: in sequence - 29.1±2.6%; 0.3±0.01 (p = 0.082337); 94.32±27.42 CFU/ml (0.026199); 4.23±0.33 cells; 6.25±0.08; 14.2±0.18 (s = 0.000482); 1.6±0.01 mm. Positive indicators were significantly higher than those of Group 2 and markedly higher than those of Group 3. Additionally, there was a significant difference between Groups 1 and 3, as confirmed using various statistical methods.
3. The effect of the combination of "Hemostat + Chlorhexidine bigluconate" in the treatment of SCGP showed significant positive results across 8 clinical parameters of periodontal tissue, with a sharp positive difference compared to the "Chlorhexidine bigluconate" preparation. Additionally, compared to the second phase, the third phase demonstrated that the use of "Hemostat" infusion led to a reduction in neutrophil infiltration and an improvement in the local immunomicrobiological environment, contributing to the activation of PT vitality. This supports the scientific hypothesis of the integrated evaluation and proves the effectiveness of an alternative algorithm for treatment and prevention.

## Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.



## References


[1] E. D. Beltrán-Aguilar, P. I. Eke, G. Thornton-Evans, and P. E. Petersen, "Recording and surveillance systems for periodontal diseases," Periodontology, vol. 60, no. 1, pp. 40-53, 2012.

[2] F. Romano *et al.*, "Effect of non-surgical periodontal therapy on salivary metabolic fingerprint of generalized chronic periodontitis using nuclear magnetic resonance spectroscopy," Archives of Oral Biology, vol. 97, pp. 208-214, 2019/01/01/ 2019. https://doi.org/10.1016/j.archoralbio.2018.10.023



*Edelweiss Applied Science and Technology*
*ISSN: 2576-8484*
*Vol. 9, No. 7: 1737-1747, 2025*
*DOI: 10.55214/2576-8484.v9i7.9007*

[3] S. M. N. Madaminova, G. S. Amrulloyevich, N. U. b. Qahramonovich, S. A. Axmadovich, and G. S. Sunnatulloyevna, "Grounding and solutions of ecological sustainability, stomatology, and human health problems in scientific-practical-experiments," Journal of Ecohumanism, vol. 3, no. 4, pp. 886-897, 2024. https://doi.org/10.62754/joe.v3i4.3614

[4] H. Menglin *et al.*, "Data on hematological parameters and generalized severe periodontitis in the United States," Data in Brief, vol. 52, 2024.

[5] K. Mohd Aamir, N. Lal, T. Chandra, W. Ali, and H. Ismail, "Association of ABO phenotype, rhesus factor, platelet count and hemoglobin level with oral hygiene status and severity of chronic periodontitis," Journal of Oral Biology and Craniofacial Research, vol. 14, no. 6, pp. 730-734, 2024.

[6] S. Nazar, Y. Oktysyuk, and M. Rozhko, "Improving of reparative osteogenesis in patients diagnosed with chronic generalised periodontitis," Pharmacia, vol. 68, pp. 163-166, 2021.

[7] P. Basdorf *et al.*, "Periodontitis adversely affects lipoprotein subfractions–results from the cohort study SHIP-TREND: Periodontitis adversely affects lipoprotein subfractions," Diabetes & Metabolism, vol. 50, no. 6, p. 101584, 2024.

[8] M. M. Rayan, O. E. Mohamed, N. A. Afaf, A. A. Sadeq, and Y. A. Ahmed, "Clinical attachment loss may serve as a more precise, suitable, and pragmatic grading instrument for periodontitis: A clinical and radiographic validation study," Journal of Taibah University Medical Sciences, vol. 19, no. 6, pp. 1100-1107, 2024.

[9] P. Sandrine *et al.*, "Effect of switching to the tobacco heating system versus continued cigarette smoking on chronic generalized periodontitis treatment outcome: Protocol for a randomized controlled multicenter study," JMIR Research Protocols, vol. 10, no. 1, p. e15350, 2021.

[10] F. Schwendicke *et al.*, "Association, prediction, generalizability: Cross-center validity of predicting tooth loss in periodontitis patients," Journal of Dentistry, vol. 109, p. 103662, 2021.

[11] M. O. Shamsieva, S. A. Gafforov, and A. A. Sobirov, "Basing the formation of pathologies of the oral cavity in children and adolescents with cerebral palsy with the help of clinical and laboratory studies," Sciences of Europe, vol. 144, pp. 40-45, 2024. https://doi.org/10.5281/zenodo.12739930

[12] T. Shishniashvili and T. Ordenidze, "Changes of salivary cortisol levels in children with chronic gingivitis," Georgian Medical News, vol. 301, pp. 74-77, 2020.

[13] S. Alijon *et al.*, "Justification for the physiological isolation of the torus based on the pain sensitivity of the oral mucosa," in *BIO Web of Conferences*, 2025, vol. 152: EDP Sciences, p. 01008, doi: https://doi.org/10.1051/bioconf/202515201008

[14] S. Susanne, M. Porsch, I. Grosse, K. Hoffmann, H.-G. Schaller, and S. Reichert, "Comparison of the oral microbiome of patients with generalized aggressive periodontitis and periodontitis-free subjects," Archives of Oral Biology, vol. 99, pp. 169-176, 2019.

[15] N. Swet, A. B. Shivamallu, A. Prashant, P. Shashikumar, A. Ganganna, and D. Das, "Effect of non surgical periodontal therapy and vitamin C supplementation on total antioxidant capacity in patients with chronic generalised periodontitis–A randomised controlled trial," Journal of Oral Biology and Craniofacial Research, vol. 13, no. 4, pp. 511-516, 2023.

[16] N. Swet, A. B. Shivamallu, A. Prashant, M. K. Yadav, S. K. Gujjari, and P. Shashikumar, "Role of nonsurgical periodontal therapy on leptin levels and total antioxidant capacity in chronic generalised periodontitis patients–A clinical trial," Journal of Oral Biology and Craniofacial Research, vol. 12, no. 1, pp. 68-73, 2022.

[17] N. N. Tukhtakhojaevna, G. S. Amrulloevich, J. R. Sotvoldievich, G. S. Sunnatulloevna, and S. A. Axmadovich, "Comparative analysis of the oral cavity microflora state in various degrees of inflammatory conditions of periodontal tissues using comprehensive studies," International Journal of Innovative Research and Scientific Studies, pp. 1161-1168, 2025.

[18] C. Xiaoxi, J. Liu, W. Xiao, Y. Chu, and X. Ouyang, "Subgingival microbiome in Chinese patients with generalized aggressive periodontitis compared to healthy controls," Archives of Oral Biology, vol. 101, pp. 92-99, 2019.

[19] L. Yang, Z. Ji-Na, W. En-Hao, and L. Keng-Fu, "Application of weighted gene co-expression network analysis to identify key modules and hub genes in oral squamous cell carcinoma tumorigenesis," OncoTargets and Therapy, pp. 6001-6021, 2018.

[20] B. Yurii, A. Bambuliak, O. Bandrivska, I. Maika, K. Dutko, and L. Kuchyrka, "Pharmacological correction of the activity of bone remodelling markers in the oral fluid of patients with generalised periodontitis depending on blood type," Pharmacia (0428-0296), vol. 71, no. 1, 2024.

[21] Y. Bandrivsky, O. Bandrivska, N. Bandrivska, O. Bedenyuk, L. Piasetska, and K. Dutko, "The effect of complex treatment on some hematological and hemostasiological indicators during the treatment of generalized periodontitis in patients with different blood group affiliation," *Pharmacia*, vol. 69, pp. 1027-1033, 2022.