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Achieving effectiveness by improving methods of using local phytopreparations in the treatment of inflammatory lesions of periodontal tissues

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Abstract

In recent years, the incidence of periodontal tissue pathologies in dental practice has markedly increased. However, conventional treatment approaches have often failed to yield satisfactory outcomes. Optimizing the oral microflora through the use of local phytotherapeutic agents represents a crucial solution for clinical practitioners in addressing periodontal diseases. This study aims to scientifically validate advanced methods for the application of local phytopreparations in the treatment of chronic hypertrophic gingivitis. A total of 326 patients diagnosed with "Moderate Chronic Hypertrophic Gingivitis" (K05.5) were enrolled between 2023 and 2025. Participants were divided into two age groups: 20–29 years (n=146) and 30–39 years (n=180), comprising 165 males and 161 females in total. The phytopreparations "Inflamdent," "Essential Oil Solution of Jasmine Flower," and "Infusion of Peganum Harmala" were administered either independently or in combination with "Chlorhexidine Bigluconate." Clinical-functional and clinical-laboratory assessments of oral tissues were performed at various treatment intervals. At baseline, microbial counts were similar across groups (1580.5 ± 248.41 CFU/mL). Neutrophilic infiltration was 11.2 ± 1.75 cells/field in Group 1, 10.3 ± 1.95 in Group 2, and 9.2 ± 1.34 in Group 3, with no statistically significant differences ($p > 0.05$). Periodontal pocket depths were recorded as 4.8 ± 0.06 mm, 4.2 ± 0.09 mm, and 4.4 ± 0.04 mm, respectively ($p > 0.05$), and 100% of cases exhibited gingival bleeding. Following treatment, microbial (*Candida* spp.) prevalence decreased to 5.3%, 6.7%, and 6.3% across groups, respectively. Allergic manifestations were reduced to 9.8%, 9.6%, and 14.5%, while mucosal atrophy rates improved to 18.7%, 17.3%, and 16.3%. Comparative analysis conducted on Days 10 and 20 demonstrated statistically significant improvements through the use of the phytopreparations, both alone and combined with Chlorhexidine Bigluconate, as evidenced by univariate and multivariate statistical models. The application of phytopreparations, both individually and in combination with Chlorhexidine Bigluconate, demonstrated significant antiseptic, reparative, and anti-inflammatory activities, along with a reduction in complication rates and practical feasibility depending on clinical conditions. In terms of integral clinical effectiveness, the following ranking was established.

1. "Inflamdent + Chlorhexidine Bigluconate,"
2. "Essential Oil Solution of Jasmine Flower + Chlorhexidine Bigluconate,"
3. "Infusion of Peganum Harmala + Chlorhexidine Bigluconate."

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1. Introduction

The increasing frequency, severity, and clinical manifestations of periodontal tissue pathologies, including chronic hypertrophic gingivitis, present a pressing issue that awaits resolution by dental professionals [1-3]. In many cases, traditional treatment methods for these pathologies have proven to be insufficient, which remains a common challenge for specialists today. As a result, the demand for alternative treatment approaches, including the use of phytopreparations, is growing. Phytopreparations have shown positive effects in the treatment of periodontal tissue pathologies, improving oral microflora, restoring gut flora, eliminating dysbiosis, normalizing the functioning of internal organs, and enhancing the overall immune system [4-6].

Other studies have highlighted the negative impact of poor oral hygiene and changes in the composition of oral fluids during pregnancy on the state of periodontal tissue [7-10]. Additionally, cyclosporine's effect on the proliferation and differentiation of T cells, along with changes in lymphocyte function and the hypertrophy of gingival tissues in response to calcium (Ca²⁺) channel blockers, which cause excessive ACTH secretion due to a reduction in the "zona glomerulosa," has been documented. Literature reviews and the potential for preparing phytopreparations from medicinal plants available in the country have revealed a growing need for advanced methodologies in the treatment of periodontal tissue pathologies in dental practice [11-13].

2. Objective of the Study

The objective of this study is to scientifically substantiate improved methods for the application of local phytopreparations in the treatment of chronic hypertrophic gingivitis.

3. Research Object and Methods

The study involved 326 patients diagnosed with "Moderate Chronic Hypertrophic Gingivitis" (ICD-10 Code: K05.5) who visited the clinics of the Andijan State Medical Institute (ADMI) and the "Center for the Development of Professional Skills of Medical Workers" (CDPSMW) of the Republic of Uzbekistan from 2023 to 2025. Among these, 146 individuals were aged 20–29 years, and 180 individuals were aged 30–39 years; 165 males and 161 females in total. The study utilized standard dental methods, including:

- Caries distribution, CPITN (Caries- K; Fillings - F; Extractions - E);
- Oral hygiene index (GI) [8];
- Periodontal tissue condition [14] and periodontal index (PI);
- Gingival bleeding (IGB) [15];
- The need for periodontal treatment (CPITN);
- Function of the mucosal microcapillaries in the oral cavity (Stomatoscope and Autofluorescent Luminescent Photodiagnostoscope Model-611);
- Immunological parameters of the oral cavity: IgA, IgM, IgG, as well as IL-4, IL-8 through enzyme-linked immunosorbent assays, neutrophil activity, and sIgA (Human) using [15] method.

For the treatment of chronic hypertrophic gingivitis, local phytopreparations were used: "Inflamdent" gel (UzR Ministry of Justice No. MG 48749, dated 08.09.2022); "Essential Oil Solution of Jasmine Flower," and "Infusion of Peganum Harmala," either individually or in combination with "Chlorhexidine Bigluconate" 0.05%. The treatments were administered before, 10 days after, and 20 days after the treatment. Parameters studied included (Table 1):

- Microbial counts in the oral cavity;
- Neutrophil infiltration;
- Periodontal pocket depth;
- Papillary-marginal-alveolar (PMA) index;
- Periodontal index (PI);
- Gingival bleeding index;
- Local allergies and other functional conditions.

Table 1.Age, Gender, and Treatment Groups of Study Participants ($M \pm n, \%$).

Amount Groups	n	M (%)
	1-stage	
MG-1 (Inflamdent)	35	33.33%
MG-2 (Essential Oil Solution of Jasmine Flower)	38	36.19%
MG-3 (Infusion of Peganum Harmala)	32	30.47%
Overall, by the main group	105	100% / 32.20%
CG (Chlorhexidine Bigluconate).	47	30.92%
Number of study groups and % in the 1-stage	152	46.62% / 100%
The total number of study participants	326	100%
2-stage		
EG-1 (Chlorhexidine+Inflamdent")	55	38.19%
EG-2 (Chlorhexidine+Essential Oil Solution of Jasmine Flower)	45	31.25%
EG-3 (Chlorhexidine+Infusion of Peganum Harmala)	44	30.55%
Overall, by EG	144	100% / 44.17%
CG (Chlorhexidine Bigluconate).	30	17.24%
Number of study groups and % in the 2-stage	174	53.37% / 100%
The total number of study participants	326	100%

Note: MG-main group; EG-experimental group; Stage 1 – Separate treatment groups with phytopreparations; Stage 2 – Combined treatment with phytopreparations and synthetic drugs.

Effectiveness of the obtained results – sample size (representativeness); determination of the optimal sample size using mathematical expression methods [16] with three-group parallel comparison in variational statistics [13] ANOVA – analysis of variance (English) evaluated using the plan implemented in the Microsoft Windows® XP Professional Service Pack 3 version 5.1 operating system [14, 15, 17].

4. Results and Analysis

In the study population, the prevalence of caries (C) was found to be 94%. The Caries and Periodontal Index (CPE) was 13.3, with the following breakdown: C = 6.45, P = 4.45, E = 2.4. Non-caries lesions accounted for 44.17%, including pathological wear (9.81%), enamel erosion and necrosis (10.73%), mechanical damage (15.03%), and tartar and stains (8.58%).

As for periodontal tissue pathology, 100% of the patients showed symptoms, with 23.9% exhibiting oral mucosal diseases, including leukokeratosis (4.9%), cheilitis (4.29%), leukoplakia (10.12%), and glossitis (4.6%). Only 4% of patients did not require dental prosthetics, while 4.6% had existing dental prostheses, 34.04% needed prosthetic treatment, and 21.16% had malocclusion and deformities. Of the 326 patients in the study, 155 (47.54%) used toothbrushes at least twice a day despite experiencing gum bleeding and pain. However, 268 (82.20%) had unsatisfactory oral hygiene. Only 58 (17.8%) patients, including 33 (10.1%) from the 20-30 age group, had satisfactory oral hygiene. Survey results showed that 199 (61.04%) patients suffered from oral discomfort, while 85 (26.07%) were negligent or careless about oral hygiene. In contrast, 42 (12.9%) patients paid attention to their oral health but still had chronic hypertrophic gingivitis. Additionally, 157 (48.15%) patients experienced a decrease in taste sensation, and 68 (20.85%) had hypersalivation. It was observed that worsening oral hygiene with age and the shift in the pH of saliva towards acidity were particularly correlated with female patients [16, 18-20].

In the study, patients were divided into groups based on their need for dental prosthetics, existing prosthetics, or need for prosthetics and malocclusion. The analysis of the results from the table shows the following:

- Need for dental prosthetics:
 - Group MG-1 and EG-1: 7.2%
 - Group MG-2 and EG-2: 9.5%
 - Group MG-3 and EG-3: 26.3%
 - Group CG-1 and CG-2: 60.6%
- Existing dental prosthetics:
 - Group MG-1 and EG-1: 8.2%
 - Group MG-2 and EG-2: 12.0%
 - Group MG-3 and EG-3: 15.1%
 - Group CG-1 and CG-2: 41.5%
- Need for prosthetics:
 - Group MG-1 and EG-1: 61.6%
 - Group MG-2 and EG-2: 61.2%
 - Group MG-3 and EG-3: 50.5%
 - Group CG-1 and CG-2: 50.5%
- Malocclusion presence:

- Group MG-1 and EG-1: 38.3%
- Group MG-2 and EG-2: 35.5%
- Group MG-3 and EG-3: 39.4%
- Group CG-1 and CG-2: 9.16%

Initially, caries (C) and its complications were treated, and food residue and stains on the teeth were cleaned. After this, the dental hygiene and oral mucosa status were assessed, with the patients being divided into groups based on treatment with local phytopreparations. These treatments included "Inflamdent," "Essential Oil Solution of Jasmine Flower," "Infusion of Peganum Harmala," and "Chlorhexidine Bigluconate" solutions, either alone or in combination. The treatment dynamics were periodically evaluated.

4.1. Chronic Hypertrophic Gingivitis Progression

Regarding the clinical-functional state of the oral cavity during chronic hypertrophic gingivitis:

- Microbial count remained almost the same across all groups: 1580.5 ± 248.41 CFU/ml.
- Neutrophil infiltration:
 - Group 1: 11.2 ± 1.75 cells per field of view (p/z)
 - Group 2: 10.3 ± 1.95 cells per field of view (p/z)
 - Group 3: 9.2 ± 1.34 cells per field of view (p/z)
- Comparison between groups: $p=0.111112$ (Group 1), $p=0.111218$ (Group 2).
- Periodontal pocket depth:
 - Group 1: -4.8 ± 0.06 mm
 - Group 2: -4.2 ± 0.09 mm
 - Group 3: -4.4 ± 0.04 mm
- Comparison between groups: $p=0.111422$ (no significant difference).

Additionally, 100% of the patients had identified bleeding gums, and 5.3%, 6.7%, and 6.3% of patients in different groups were diagnosed with candidiasis.

Local allergic reactions were observed in 9.8%, 9.6%, and 14.5% of the patients in their respective groups, while the atrophy of the oral mucosa was seen in 18.7%, 17.3%, and 16.3%, showing positive results.

The treatment results at 10 and 20 days of using "Inflamdent," "Essential Oil Solution of Jasmine Flower," "Infusion of Peganum harmala," and "Chlorhexidine bigluconate," both individually and in combination (Table 2).

Microbial Count:

Stage 1:

- Group 1: 335.7 ± 33.12 CFU/ml
- Group 2: 562.85 ± 41.24 CFU/ml
- Group 3: 581.4 ± 39.82 CFU/ml

Stage 2:

- Group 1: 114.8 ± 21.44 CFU/ml
- Group 2: 146.6 ± 14.52 CFU/ml
- Group 3: 187.6 ± 12.82 CFU/ml

The microbial counts were significantly reduced in all groups by the end of the treatment, showing a positive response to the treatments. However, the Essential Oil Solution of Jasmine Flower and Chlorhexidine treatments showed no statistically significant difference when compared using Student's t-test and ANOVA ($p = 0.111112$ for the Essential Oil Solution of Jasmine Flower and $p = 0.1111$ for Chlorhexidine).

Neutrophil Infiltration: After 10 and 20 days of treatment, a decrease in neutrophil infiltration was observed in all groups. The most significant reduction was noted in Groups 1 and 2, showing an improvement in the inflammatory response, particularly in the groups treated with Inflamdent and the Essential Oil Solution of Jasmine Flower.

Periodontal Pocket Depth: The periodontal pocket depth showed a dynamic decrease in all treatment groups. The most significant reduction was observed in the group treated with Inflamdent and the Essential Oil Solution of Jasmine Flower, indicating the effectiveness of these treatments in reducing periodontal tissue damage.

These results suggest that both "Inflamdent" and "Essential Oil Solution of Jasmine Flower" are effective in treating chronic hypertrophic gingivitis, with improvements in microbial count, neutrophil infiltration, and periodontal pocket depth. The treatments not only show clinical efficacy but also help improve oral hygiene and the inflammatory status of the patients.

Table 2.

The description of the dynamics of indicators in the second stage when combining phytopreparations in hypertrophic gingivitis.

Material	n		M ± s					
microbial count								
Groups Total n=174.	Chlorhexidine + Inflamdent (n=55)		Chlorhexidine +Jasmine oil (n=45)		Chlorhexidine +Infusion of Peganum Harmala (n=44)		CG-2 (n=30)	
	10 days later	20 days later	10 days later	20 days later	10 days later	20 days later	10 days later	20 days later
Chlorhexidine + Inflamdent" (EG-1)	298.83	99.60	44.71	20.32	271.66	90.97	4.47	2.03
Chlorhexidine +Jasmine oil(EG-2)	491.92	96.45	46.85	23.30	447.20	154.22	4.68	2.34
Chlorhexidine +Infusion of Peganum Harmala (EG-3).	316.75	102.17	46.06	21.93	277.09	94.33	4.60	2.46
Chlorhexidine (CG-2)	521.43	103.66	49.19	22.35	480.55	165.71	4.91	2.23
Comparison of groups was performed using parametric tests for independent samples. including Student’s t-test. one-way ANOVA (analysis of variance). and the Scheffé post hoc test. Statistical significance was considered at p < 0.05								
Chlorhexidine + Inflamdent" (EG-1)	0.10387	0.01703	0.10386	0.01649	0.10386	0.01701	0.10385	0.04037
Chlorhexidine +Jasmine oil(EG-2)	0.10387	0.01704	0.10386	0.01650	0.10387	0.01702	0.10386	0.04037
Chlorhexidine +Infusion of Peganum Harmala (EG-3).	0.10387	0.01704	0.10386	0.01650	0.10387	0.01702	0.10386	0.04037
Chlorhexidine (CG-2)	0.10387	0.01704	0.10386	0.01651	0.10387	0.01703	0.10387	0.04037
neutrophilic infiltration								
Chlorhexidine + Inflamdent" (EG-1)	7.12150	3.37383	1.70093	0.59813	5.29907	2.18692	0.17009	0.05981
Chlorhexidine +Jasmine oil(EG-2)	7.63551	4.42991	1.39252	0.49533	6.96262	2.57009	0.13925	0.04953
Chlorhexidine +Infusion of Peganum Harmala (EG-3).	7.32710	3.63551	1.57009	0.53271	5.77570	2.28037	0.15701	0.05327
Chlorhexidine (CG-2)	7.80374	5.00935	1.24299	0.45794	7.08411	2.68224	0.12430	0.04579
Comparison of groups was performed using parametric tests for independent samples. including Student’s t-test. one-way ANOVA (analysis of variance). and the Scheffé post hoc test. Statistical significance was considered at p < 0.05								
Chlorhexidine + Inflamdent" (EG-1)	0.02867	0.00143	0.03226	0.00161	0.02975	0.00149	0.03300	0.00170
Chlorhexidine +Jasmine oil(EG-2)	0.03858	0.00193	0.03296	0.00152	0.03905	0.00276	0.03900	0.00197
Chlorhexidine +Infusion of Peganum Harmala (EG-3).	0.02900	0.00145	0.03181	0.00159	0.03001	0.00150	0.03350	0.00163
Chlorhexidine (CG-2)	0.02650	0.00132	0.03079	0.00154	0.02723	0.00136	0.02831	0.00141
periodontal pocket depth								
Chlorhexidine + Inflamdent" (EG-1)	2.33645	1.30841	0.06542	0.03271	1.77570	0.65421	0.00654	0.00093
Chlorhexidine +Jasmine oil(EG-2)	1.96262	0.84112	0.02804	0.04019	1.40187	0.42056	0.00280	0.00093
Chlorhexidine +Infusion of Peganum Harmala (EG-3).	2.24299	1.12150	0.04673	0.04860	1.68224	0.56075	0.00467	0.00093
Chlorhexidine (CG-2)	2.05607	0.93458	0.03738	0.05701	1.49533	0.46729	0.00374	0.00093
Comparison of groups was performed using parametric tests for independent samples. including Student’s t-test. one-way ANOVA (analysis of variance). and the Scheffé post hoc test. Statistical significance was considered at p < 0.05								
Chlorhexidine + Inflamdent" (EG-1)	0.10386	0.01694	0.10385	0.01640	0.10386	0.01692	0.10384	0.03943
Chlorhexidine +Jasmine oil(EG-2)	0.10386	0.01694	0.10385	0.01641	0.10387	0.01693	0.10385	0.03944
Chlorhexidine +Infusion of Peganum Harmala (EG-3).	0.10386	0.01694	0.10385	0.01640	0.10387	0.01693	0.10386	0.03944
Chlorhexidine (CG-2)	0.10386	0.01695	0.10386	0.01641	0.10387	0.01693	0.10386	0.03944

"Papillary-Marginal-Alveolar (PMA) Index								
Chlorhexidine + Inflamdent" (EG-1)	24.20561	11.12150	1.96262	0.10280	18.41121	4.29907	0.19626	0.01028
Chlorhexidine +Jasmine oil(EG-2)	22.24299	10.84112	2.33645	0.13084	17.66355	3.83178	0.23364	0.0.13
Chlorhexidine +Infusion of Peganum Harmala (EG-3).	18.41121	10.37383	2.14953	0.11215	16.91589	3.17757	0.21495	0.01121
Chlorhexidine (CG-2)	13.55140	9.90654	1.77570	0.14019	16.54206	2.89720	0.17757	0.0.15
Comparison of groups was performed using parametric tests for independent samples. including Student's t-test. one-way ANOVA (analysis of variance). and the Scheffé post hoc test. Statistical significance was considered at $p < 0.05$								
Chlorhexidine + Inflamdent" (EG-1)	0.03574	0.00179	0.03451	0.00173	0.03483	0.00183	0.03332	0.00118
Chlorhexidine +Jasmine oil(EG-2)	0.04597	0.00230	0.03769	0.00188	0.03890	0.00194	0.03659	0.00104
Chlorhexidine +Infusion of Peganum Harmala (EG-3).	0.03959	0.00198	0.03566	0.00178	0.03687	0.00184	0.03422	0.01143
Chlorhexidine (CG-2)	0.05350	0.00268	0.04073	0.00203	0.04922	0.00246	0.03871	0.01085
Periodontal Index (PI)								
Chlorhexidine + Inflamdent" (EG-1)	0.39252	0.11215	0.00010	0.00093	0.20654	0.00093	0.00093	0.00001
Chlorhexidine +Jasmine oil(EG-2)	0.47664	0.22430	0.00040	0.00196	0.28318	0.00280	0.00280	0.00004
Chlorhexidine +Infusion of Peganum Harmala (EG-3).	0.43925	0.14953	0.00021	0.00140	0.22991	0.00187	0.00187	0.00003
Chlorhexidine (CG-2)	0.52336	0.26168	0.00048	0.00224	0.31963	0.00374	0.00467	0.00006
Comparison of groups was performed using parametric tests for independent samples. including Student's t-test. one-way ANOVA (analysis of variance). and the Scheffé post hoc test. Statistical significance was considered at $p < 0.05$								
Chlorhexidine + Inflamdent" (EG-1)	0.03831	0.00785	0.03905	0.00222	0.03763	0.00188	0.03909	0.00188
Chlorhexidine +Jasmine oil(EG-2)	0.03998	0.00811	0.04011	0.00233	0.04002	0.00200	0.04030	0.00245
Chlorhexidine +Infusion of Peganum Harmala (EG-3).	0.03857	0.00796	0.03921	0.00224	0.03864	0.00193	0.03984	0.00199
Chlorhexidine (CG-2)	0.04068	0.00844	0.04099	0.00235	0.04079	0.00204	0.04160	0.00212
Gingival sulcus bleeding								
Chlorhexidine + Inflamdent" (EG-1)	22.24299	12.52336	0.00010	0.00093	13.36449	6.82243	0.00093	0.00001
Chlorhexidine +Jasmine oil(EG-2)	28.69159	16.72897	0.00040	0.00196	17.66355	8.78505	0.00280	0.00004
Chlorhexidine +Infusion of Peganum Harmala (EG-3).	24.20561	14.29907	0.00021	0.00140	15.70093	7.57009	0.00187	0.00003
Chlorhexidine (CG-2)	40.37383	20.18692	0.00048	0.00224	18.78505	9.53271	0.00467	0.00006
Comparison of groups was performed using parametric tests for independent samples. including Student's t-test. one-way ANOVA (analysis of variance). and the Scheffé post hoc test. Statistical significance was considered at $p < 0.05$								
Chlorhexidine + Inflamdent" (EG-1)	0.00559	0.00275	0.00238	0.00119	0.00389	0.00190	0.00135	0.00031
Chlorhexidine +Jasmine oil(EG-2)	0.00684	0.00348	0.00460	0.00225	0.00649	0.00357	0.00273	0.00014
Chlorhexidine +Infusion of Peganum Harmala (EG-3).	0.00576	0.00286	0.00473	0.00236	0.00492	0.00255	0.00394	0.00020
Chlorhexidine (CG-2)	0.00911	0.00423	0.00593	0.00292	0.00669	0.00349	0.00520	0.00017
Candida								
Chlorhexidine + Inflamdent" (EG-1)	0.00488	0.00243	0.00314	0.00166	0.00385	0.00192	0.00125	0.00001
Chlorhexidine +Jasmine oil(EG-2)	0.00520	0.00254	0.00345	0.00170	0.00412	0.00206	0.00172	0.00004
Chlorhexidine +Infusion of Peganum Harmala (EG-3).	0.00510	0.00245	0.00334	0.00168	0.00396	0.00198	0.00142	0.00002
Chlorhexidine (CG-2)	0.00534	0.00263	0.00363	0.00181	0.00440	0.00216	0.00232	0.00005
Comparison of groups was performed using parametric tests for independent samples. including Student's t-test. one-way ANOVA (analysis of variance). and the Scheffé post hoc test. Statistical significance was considered at $p < 0.05$								

Chlorhexidine + Inflamdent" (EG-1)	0.00243	0.00009	0.02693	0.00037	0.02571	0.01291	0.02735	0.00019
Chlorhexidine +Jasmine oil(EG-2)	0.00272	0.00047	0.02917	0.00075	0.02828	0.01416	0.03009	0.00047
Chlorhexidine +Infusion of Peganum Harmala (EG-3).	0.00264	0.00037	0.02852	0.00065	0.02725	0.01373	0.02952	0.00028
Chlorhexidine (CG-2)	0.00367	0.00065	0.04029	0.00084	0.03882	0.02018	0.04115	0.00084
Local Allergy								
Chlorhexidine + Inflamdent" (EG-1)	0.04127	0.00009	0.04039	0.00009	0.03957	0.00020	0.03856	0.00020
Chlorhexidine +Jasmine oil(EG-2)	0.03768	0.00047	0.03328	0.00047	0.03519	0.00058	0.02049	0.00058
Chlorhexidine +Infusion of Peganum Harmala (EG-3).	0.03976	0.00037	0.03610	0.00037	0.03656	0.00050	0.03294	0.00040
Chlorhexidine (CG-2)	0.03567	0.00065	0.03104	0.00065	0.03286	0.00076	0.01791	0.00086
Comparison of groups was performed using parametric tests for independent samples. including Student's t-test. one-way ANOVA (analysis of variance). and the Scheffé post hoc test. Statistical significance was considered at $p < 0.05$								
Chlorhexidine + Inflamdent" (EG-1)	0.04505	0.00021	0.00118	0.00019	0.02012	0.00019	0.00045	0.00000
Chlorhexidine +Jasmine oil(EG-2)	0.01981	0.00040	0.00768	0.00084	0.00855	0.00084	0.00020	0.00000
Chlorhexidine +Infusion of Peganum Harmala (EG-3).	0.03037	0.00033	0.00099	0.00047	0.01172	0.00047	0.00030	0.00000
Chlorhexidine (CG-2)	0.01598	0.00038	0.00679	0.00140	0.00771	0.00140	0.00016	0.00001

Note: MG- main group; EG-experimental group.

In the study, the PMA (Papillary-Marginal-Alveolar) index for periodontal tissue in the groups treated with 'Inflamdent' and Jasmine oil was as follows: In group 1, the index value was $26.1 \pm 1.8\%$; in group 2, $22.4 \pm 2.7\%$; and in group 3, $15.1 \pm 1.9\%$. This was significantly lower when compared to the 'Chlorhexidine bigluconate' group. The Periodontal Index (PI) was as follows: In group 1, PI was 0.44 ± 0.01 ; in group 2, 0.36 ± 0.001 ; and in group 3, 0.58 ± 0.02 . Regarding bleeding from the gingival sulcus, the effectiveness in the group using 'Chlorhexidine' was 12% lower in group 1 and 15% lower in group 2, indicating a reduction in bleeding. However, the decrease in bleeding for the group using 'Inflamdent' and Jasmine oil solution was consistently between 90% and 95%. In the treatment of chronic hypertrophic gingivitis, the effectiveness in reducing bleeding from the gingival sulcus and papillae was lower in the 'Chlorhexidine' group, with a rating of 28%, compared to 'Inflamdent' (24%), Jasmine oil (22%), and Infusion of Peganum Harmala (8%). Local allergic reactions and adverse conditions showed a more favorable response for 'Inflamdent' and Jasmine oil as compared to 'Chlorhexidine,' which demonstrated less effectiveness in these cases.

In the study, an increase in IgG concentration was observed in patients with chronic hypertrophic gingivitis before treatment, indicating the activation of humoral immunity in response to previously known antigens. An increase in IgA levels was noted, which serves as a protective mechanism against damage to the oral mucosa and acts as a barrier against pathogenic microorganisms. A decrease in IgM levels was observed, which could be explained by insufficient synthesis of larger molecules. In the second stage, no changes in IgA concentration were recorded. In adolescents with chronic hypertrophic gingivitis, there were distinct shifts in local immunity, including elevated levels of IgG, sIgA, IL-4, IL-8, and functional reserves of neutrophils. An increase in the stimulation index, as well as a decrease in IgM levels and a reduction in the concentration of oxygen-dependent enzymes in the cytoplasm of phagocytes, were noted in the NBT-spontaneous test.

The results obtained confirm the significance and effectiveness of 'Inflamdent', Jasmine oil, and the infusion of Peganum Harmala in the treatment of chronic hypertrophic gingivitis, both individually and in combination, with their impact characteristics and representative indicators, the correctness of the study design, and the various statistical qualities of the results. In particular, multiple comparisons (4 patient groups, two parallel stages, and respectively 7 and 3 indicators) support the assessment of the overall effectiveness and integral indicators. The main results of the first phase of the study regarding the preparations include: individual indicators and characteristics, antiseptic activity, anti-inflammatory activity, reparative activity, effectiveness in treating chronic hypertrophic gingivitis, bleeding from the gingival papilla, degree of complications, organoleptic qualities, availability according to the situation, clinical effectiveness as an integrated index, additional application conditions, and ratings of the final effectiveness integrated complex indicators. The results allowed for the formation of a comparative framework of the complex characteristics of the four preparation groups.

The 'Inflamdent Gel' demonstrated effective antiseptic activity, situational availability, and additional application effectiveness. It showed improvement in the condition of periodontal tissues, complication rates (including candidiasis at 7%, local allergic reactions at 15%, and positive changes in the oral mucosa at 2%), organoleptic qualities, and clinical effectiveness as an integrated index, which were rated as 'good'. The anti-inflammatory and reparative activity was rated 'average'. The Jasmine oil showed high anti-inflammatory and reparative activity, a short healing time, a low complication rate (only candidiasis at 2%), and minimal allergic reactions (1%). There were no negative changes in the oral mucosa. The periodontal tissue condition and clinical effectiveness as an integrated index were rated 'excellent'. However, it had minimal antiseptic activity and relatively low situational availability, which are considered drawbacks.

The infusion of Peganum harmala showed positive results in terms of neutrophil count, anti-inflammatory and reparative activity, improvement in periodontal tissue indices (GI, PI, PMA), complication rate, and situational availability, which were all rated 'excellent'. Antiseptic activity, organoleptic quality, and integrated clinical effectiveness were rated as 'satisfactory'. Moreover, its effectiveness in reducing bleeding from the gingival papilla and additional application conditions was partially rated as 'positive'. The 'Chlorhexidine Bigluconate' did not show significant effectiveness in any indicator or characteristic (except for neutrophil count). It was rated as 'unsatisfactory' for anti-inflammatory and reparative activity, periodontal tissue condition indices, complication rates, and situational availability. The effectiveness in terms of gingival bleeding and additional application conditions was also rated 'unsatisfactory'.

Results of the second phase of the study: improvement in the effectiveness of chronic hypertrophic gingivitis treatment. The number of patients in whom the disease symptoms were completely eliminated: Group 1: 76%, Group 2: 49%, Group 3: 54%. Compared to conventional (C/G) or 'standard' treatment (27%), the results were positive. Final results: In groups 1, 2, and 3, the effectiveness reached 93-100% (compared to 67% in the C/G group). The risk of candidiasis was 3-5% in each stage of the treatment. Prevention of mucosal atrophy changes in the oral cavity was successfully achieved, with no progression (less than 2%). Overall complications decreased by 3-4 times, supported by both univariate and multivariate statistical results showing an integral relationship.

5. Conclusions

1. In patients diagnosed with chronic hypertrophic gingivitis in the study, moderate and severe forms (78.2%) were predominantly identified. Against the backdrop of the pathology: K-distribution: 94%; CPO intensity: 13.3; Nodular keratosis: 44.17%; Oral mucosa pathology: 23.9%; Need for dental prostheses: 34.04%; Poor oral hygiene: 82.2%; Difficult sensations: 61.04%; Gingival bleeding: 47.54%; Salivary pH and acidity: Abnormal; Local immune indicators (IgG, sIgA, IgM, IL-4, IL-8, and neutrophils): Negative shifts; Parakeratosis and hyperkeratosis intensification in the gingival tissue, along with swelling and venous stasis, indicate the progression of diffuse inflammation.
2. In the study, the clinical-functional state of the oral cavity and tissues in the patients, specifically the periodontal and oral mucosal tissues, the biochemical properties of oral fluids, and the pathogenic mechanisms of inflammation in the

gingival papillae, were directed towards a positive shift. This was achieved through complex dental treatment, supported by local herbal medicinal preparations. The antiseptic, reparative, anti-allergic properties ('Inflamdent'), pain relief, and anti-inflammatory effects (Jasmine oil), as well as regenerative and local immune restoration (Infusion of Peganum Harmala), were highly effective. The results were confirmed by modern univariate and multivariate statistical analyses.

3. Second phase of the study, when phytopreparations and 'Chlorhexidine Bigluconate' were used together: antiseptic activity; anti-inflammatory activity; reparative activity; complication rate; situational availability; clinical effectiveness based on integrated indicators. The rankings were as follows: 1st place: "Inflamdent + Chlorhexidine"; 2nd place: "Jasmine oil + Chlorhexidine"; 3rd place: "Infusion of Peganum harmala + Chlorhexidine".

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