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EVALUATION OF HEMATOLOGICAL BLOOD PARAMETERS IN PATIENTS FOLLOWING SURGICAL TUMOR REMOVAL AND CHEMOTHERAPY DURING REHABILITATION WITH A THERAPEUTIC AND PROPHYLACTIC COMPLEX

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The study evaluated the effect of a therapeutic and preventive complex on haematological parameters following surgery for head and neck cancer and chemotherapy. Thirty-five adults aged 25–55 years were examined: 10 healthy controls, 10 comparison-group patients and 15 main-group patients. Haemoglobin concentration and erythrocyte and leukocyte counts were assessed at baseline and after 1, 3, 6 and 12 months. Baseline values were below control values ($p < 0.001$). At 12 months, haemoglobin, erythrocyte and leukocyte values in the main group were 140.3 ± 8.3 g/L, $4.8 \pm 0.4 \times 10^{12}$ /L and $5.1 \pm 0.3 \times 10^9$ /L, representing increases of 99.9 %, 84.6 % and 70.0 %, respectively. Recovery was numerically greater with the complex.

Key words: head and neck cancer, chemotherapy, maxillofacial surgery, haemoglobin, erythrocytes, leukocytes, therapeutic and preventive complex.

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ДОСЛІДЖЕННЯ ГЕМАТОЛОГІЧНИХ ПОКАЗНИКІВ КРОВІ ПАЦІЄНТІВ ПІСЛЯ ОПЕРАТИВНОГО ВТРУЧАННЯ З ВИДАЛЕННЯ ПУХЛИН І ХІМІОТЕРАПІЇ НА ТЛІ ЛІКУВАЛЬНО-ПРОФІЛАКТИЧНОГО КОМПЛЕКСУ В ДИНАМІЦІ РЕАБІЛІТАЦІЇ

Метою дослідження було оцінити вплив лікувально-профілактичного комплексу на гематологічні показники пацієнтів після хірургічного лікування раку голови та шиї і хіміотерапії. Обстежено 35 осіб віком 25–55 років: 10 здорових добровольців, 10 пацієнтів групи порівняння та 15 пацієнтів основної групи. Концентрацію гемоглобіну, кількість еритроцитів і лейкоцитів оцінювали у вихідному стані та через 1, 3, 6 і 12 місяців. Початкові значення показників були нижчими за контрольні ($p < 0,001$). Через 12 місяців в основній групі концентрація гемоглобіну становила $140,3 \pm 8,3$ г/л, кількість еритроцитів – $4,8 \pm 0,4 \times 10^{12}$ /л, лейкоцитів – $5,1 \pm 0,3 \times 10^9$ /л; приріст відносно вихідного рівня становив 99,9 %, 84,6 % і 70,0 % відповідно. Відновлення показників було чисельно виразнішим на тлі комплексу.

Ключові слова: рак голови та шиї, хіміотерапія, щелепно-лицева хірургія, гемоглобін, еритроцити, лейкоцити, лікувально-профілактичний комплекс.

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Head and neck malignancies require prolonged follow-up because the consequences of both disease and anticancer treatment may persist after completion of specialised care. Recovery encompasses functional, nutritional, dental and psychosocial dimensions. The American Head and Neck Society consensus statement emphasises multidisciplinary care involving oncologists, dentists and rehabilitation professionals [7]. Within this framework, laboratory assessment of systemic health complements clinical follow-up and allows recovery to be characterised throughout rehabilitation.

Peripheral blood assessment is an important component of this approach. In a retrospective study of 376 patients with cancer, Wondimneh et al. reported reductions in haemoglobin concentration and erythrocyte and leukocyte counts after chemotherapy [12]. The extent of haematological changes also depends on the treatment regimen. In patients with locally advanced head and neck cancer, Wu et al. found that haematological toxicity profiles

differed according to the agent administered concurrently with radiotherapy and previous induction chemotherapy [13]. These observations support consideration of treatment history when interpreting blood parameters.

Reduced haemoglobin concentration in patients with cancer has a multifactorial basis. Alongside cytotoxic effects, inflammatory disturbances of iron metabolism and erythropoiesis may contribute. Inflammatory mediators and hepcidin restrict iron availability for blood-cell production, while shortened erythrocyte survival and altered erythropoietin responses further promote anaemia [11]. Assessment of haemoglobin together with erythrocyte count therefore characterises haematological status but does not independently establish the predominant mechanism of the abnormalities observed.

Clinical interpretation of anaemia requires a distinction between monitoring blood parameters and selecting specific treatment. ASCO/ASH guidance

considers erythropoiesis-stimulating agents in relation to chemotherapy-associated anaemia, the intent of anticancer treatment and transfusion requirements, while also addressing iron replacement [5]. An adjunctive therapeutic and preventive complex should consequently be investigated within the overall rehabilitation programme. Laboratory changes require comparison with standard treatment and cannot automatically justify replacing established oncological or haematological care.

Nutritional status provides an important context for recovery after anticancer treatment. ESPEN practical guidance emphasises regular assessment of food intake, weight changes and other indicators of nutritional risk; when abnormalities are identified, muscle mass, physical performance and systemic inflammation should also be evaluated [10]. For research on haematological trajectories, this highlights factors that may change alongside blood parameters. Combining laboratory monitoring with nutritional assessment offers a more complete basis for characterising rehabilitation than isolated analysis of a single measurement.

Dental complications represent a further dimension of the problem. Cancer therapy-associated oral mucositis requires preventive and therapeutic measures selected according to the clinical setting and treatment modality, as reflected in the MASCC/ISOO guidelines [5, 15]. Mucosal injury is also associated with changes in the microbial environment. Hong et al. linked chemotherapy-induced mucositis to disruption of the oral bacterial community; the experimental component of their study demonstrated that particular microorganisms could aggravate epithelial injury [8]. These findings support investigation of interventions intended to maintain local homeostasis during comprehensive recovery.

Ukrainian research also supports the relevance of dental follow-up. In patients with extraoral tumours, Zhero et al. described dental hard-tissue lesions and changes in the microbiocenosis and local defence responses during chemotherapy [1]. Although this population differs from patients with head and neck cancer, the findings draw attention to the dental consequences of systemic anticancer treatment. The coexistence of local and systemic disturbances provides a rationale for coordinated monitoring of oral health and peripheral blood parameters.

Investigation of interventions that modulate microbiota and host responses to anticancer treatment is a promising direction in supportive care. In a randomised trial by Jiang et al., a probiotic combination reduced oral mucositis severity and was associated with smaller reductions in selected T-cell subsets in patients receiving chemoradiotherapy for nasopharyngeal carcinoma [9]. A subsequent study by Xia et al. reported favourable mucositis and immunological outcomes with a different probiotic combination [14]. However, these results relate to specific formulations and treatment regimens; extrapolation to total leukocyte counts or the

erythrocyte compartment requires separate justification.

Components intended to limit local inflammatory injury and support innate defence are also of interest. Belfiore et al. summarised the anti-inflammatory and antioxidant potential of plant polyphenols in oral mucositis, while highlighting the importance of pharmaceutical properties and delivery methods [3]. Lysozyme is recognised as an innate defence factor with antimicrobial activity and potential for topical applications [6]. These findings provide a biological rationale for investigating multicomponent dental rehabilitation programmes but do not establish an independent capacity to correct anaemia or stimulate leukopoiesis.

The literature therefore supports considering rehabilitation after head and neck cancer treatment as interrelated recovery of systemic health, nutrition and oral tissues. Nevertheless, the cited studies address different clinical settings and endpoints, including regimen-related toxicity, mucositis severity, microbiota changes and selected immunological parameters. One-year trajectories of basic haematological parameters during a specific therapeutic and preventive complex require dedicated clinical investigation. Concurrent assessment of haemoglobin concentration and erythrocyte and leukocyte counts enables comparison of early and longer-term changes with standard treatment.

The purpose of the study was to evaluate the effect of a therapeutic and preventive complex on haemoglobin concentration and erythrocyte and leukocyte counts in patients following surgery for head and neck cancer and chemotherapy during rehabilitation.

Materials and methods. Haematological parameters were assessed in 35 individuals aged 25–55 years. The study cohort comprised 25 patients with histologically verified malignant tumours of the head and neck who had undergone tumour-resection surgery and were scheduled for adjuvant chemotherapy; the control cohort comprised 10 somatically and dentally healthy volunteers whose systemic medical examination and oral status were within normal limits. Individuals who did not meet these inclusion criteria or declined informed consent were excluded. No participants were withdrawn, replaced, or lost to follow-up after enrolment. Laboratory investigations were carried out in the «Laboratory of biochemistry and vivarium» of the SE “The Institute of stomatology and maxilla-facial surgery National academy of medical sciences of Ukraine” (SE “ISMFS NAMS”). The study was carried out from 6 February 2023 to 19 February 2024.

Patients with head and neck cancer underwent surgery to remove tumors and were prescribed chemotherapy. The patients observed were divided into two groups as follows:

– Comparison group – after surgery, patients were prescribed treatment in accordance with the “Standards for the Diagnosis and Treatment of Cancer Patients”, n=10;

– Main group – after surgery, patients were prescribed a therapeutic and prophylactic complex in addition to the basic standard treatment for cancer patients, $n=15$.

Both cohorts received guideline-based oncologic care (tumour resection followed by adjuvant chemotherapy in accordance with Order No. 247/2016), while the main cohort additionally underwent a staged therapeutic-prophylactic complex designed to modulate gut/oral microbiota, enhance osteogenesis, and limit oxidative-inflammatory damage. Pre-operative phase (days –14 to 0): Orthomol Pro 6 (INN: Lactobacillus spp. + Bifidobacterium spp. multistrain probiotic; Orthomol GmbH, Germany) – one capsule once daily after meals for 14 days. Post-operative phase: Orthomol Osteo® granules (INN: cholecalciferol 20 µg with calcium, vitamin K1, magnesium and collagen-supporting micronutrients; Orthomol GmbH, Germany) – one sachet dissolved in 150–200 mL water, taken once daily after meals for 30 days; Quertin chewable tablets (INN: quercetin 60 mg; PJSC SIC “Borshchahivskiy CPP”, Ukraine) – one tablet three times daily 30 min before meals for 60 days; Lizomucoid dental elixir (INN: lysozyme hydrochloride 1 mg mL⁻¹ with herbal antiseptics; SPA “Odeska Biotekhnolohiya”, Ukraine) – 1 teaspoon diluted in 60 mL of water, rinse for 1 min after meals twice daily for 30 days; Maripolymiel® phytogel (INN: seawater trace-element concentrate 2 % + peppermint hydro-alcoholic extract 5 % with sodium benzoate, carboxymethylcellulose and menthol; SPA “Odeska Biotekhnolohiya”, Ukraine) – thin-layer gingival applications (one pump) three to four times daily after meals for 10 days. The entire regimen was re-initiated six months post-surgery to consolidate clinical benefits; no dose modifications or patient withdrawals occurred.

Patients were treated in accordance with the Standards for Diagnosis and Treatment of Cancer Patients, in particular the clinical protocol for providing medical care to patients with oral and oropharyngeal cancer – Order of the Ministry of Health of Ukraine No. 247 of March 28, 2016. “On Amendments to Order No. 554 of the Ministry of Health of Ukraine dated September 17, 2007, “On Approval of Protocols for the Provision of Medical Care in the Specialty of Oncology” as well as the protocols for the provision of medical care to patients with malignant neoplasms developed by the National Cancer Institute in 2011.

All treatment, preventive and diagnostic measures were carried out only after the patients signed a voluntary informed consent in accordance with the principles of bioethics set forth in the Declaration of Helsinki “for Ethical Principles for Medical Research Involving Human Subjects” and “Universal Declaration on Bioethics and Human Rights (UNESCO)”. All participants were adults, cognitively competent, and not otherwise classified as a vulnerable population under Good Clinical Practice. Studies recommended by the Commission on Bioethical Expertise (conclusion of the bioethics

commission of the SE “ISMFS NAMS”, protocol No. 1011 of 04/14/2022).

Peripheral blood haemoglobin concentration (g/L), erythrocyte count ($\times 10^{12}/L$) and leukocyte count ($\times 10^9/L$) were assessed. Measurements were performed at baseline after chemotherapy and at 1, 3, 6 and 12 months after the initiation of rehabilitation treatment.

Data processing was carried out with STATISTICA 6.1. Prior to parametric testing, the Shapiro-Wilk normality test was applied to each continuous variable; none showed significant deviation from a Gaussian distribution ($p>0.05$). Therefore, inter-group comparisons were performed with the two-tailed Student’s t-test. When pair-wise contrasts were required (Control $\times$ Comparison, Control $\times$ Intervention, Comparison $\times$ Intervention), the family-wise type-I error rate was controlled with the Bonferroni adjustment. Between-group differences were deemed statistically significant at $p<0.003$ [2].

Results of the study. At baseline, haemoglobin concentration and erythrocyte and leukocyte counts were below the control values in both groups ($p<0.001$ for all comparisons). No statistically significant baseline between-group differences were reported. Serial measurements are presented in Table 1.

Baseline haemoglobin concentrations were 68.8 ± 4.3 g/L in the comparison group and 70.2 ± 5.1 g/L in the main group. At 1 month, haemoglobin increased to 78.3 ± 6.2 g/L in the comparison group, representing a 13.8 % increase ($p_1>0.2$), and to 89.4 ± 7.4 g/L in the main group, a 27.4 % increase ($p_1<0.05$). At 3 months, increases were 27.6 % and 43.3 %, with concentrations of 87.8 ± 8.0 g/L ($p_1<0.05$) and 100.6 ± 9.2 g/L ($p_1<0.01$), respectively.

At 6 months, haemoglobin reached 120.7 ± 9.6 g/L in the comparison group and 135.2 ± 10.8 g/L in the main group, exceeding baseline by 75.4 % and 92.6 %, respectively (both $p_1<0.001$). At 12 months, concentrations were 118.5 ± 10.5 and 140.3 ± 8.3 g/L, representing increases of 72.2 % and 99.9 % ($p_1<0.001$). Mean haemoglobin was 18.4 % higher in the main group at this time point; however, the between-group difference was not statistically significant ($p_2>0.2$).

Baseline erythrocyte counts were $2.8\pm 0.2\times 10^{12}/L$ in the comparison group and $2.6\pm 0.2\times 10^{12}/L$ in the main group. At 1 month, counts increased by 7.1 % and 26.9 %, respectively; at 3 months, increases were 25.0 % and 57.7 %. The main-group count at 3 months was $4.1\pm 0.2\times 10^{12}/L$, significantly higher than baseline ($p_1<0.001$) but still below the reported reference value ($p<0.05$).

At 6 months, erythrocyte counts increased to $4.0\pm 0.4\times 10^{12}/L$ in the comparison group, a 42.9 % increase ($p_1<0.02$), and to $4.9\pm 0.4\times 10^{12}/L$ in the main group, an 88.5 % increase ($p_1<0.001$). At 12 months, the corresponding counts were $4.2\pm 0.3\times 10^{12}/L$ and $4.8\pm 0.4\times 10^{12}/L$, exceeding baseline by 50.0 % and 84.6 %, respectively. Between-group differences in erythrocyte count were not statistically significant at any time point.

Table 1

Effect of the therapeutic and preventive complex on blood haematological parameters in patients with head and neck cancer following surgery and chemotherapy during rehabilitation (M±m)

Time	Groups	Haemoglobin, g/L	Erythrocytes, ×10 ¹² /L	Leukocytes, ×10 ⁹ /L
Control group		138.0±10.7	5.0±0.4	5.5±0.4
Baseline	Comparison	68.8±4.3 p<0.001	2.8±0.2 p<0.001	2.8±0.2 p<0.001
	Main	70.2±5.1 p<0.001 p ₂ >0.7	2.6±0.2 p<0.001 p ₂ >0.8	3.0±0.3 p<0.001 p ₂ >0.8
1 month	Comparison	78.3±6.2 p<0.001 p ₁ >0.2	3.0±0.3 p<0.001 p ₁ >0.25	3.2±0.2 p<0.001 p ₁ >0.2
	Main	89.4±7.4 p<0.002 p ₁ <0.05 p ₂ >0.25	3.3±0.3 p<0.001 0.05<p ₁ <0.1 p ₂ >0.5	3.8±0.3 p<0.001 0.05<p ₁ <0.1 p ₂ >0.25
3 months	Comparison	87.8±8.0 p<0.002 p ₁ <0.05	3.5±0.3 p<0.01 0.05<p ₁ <0.1	3.6±0.3 p<0.002 p ₁ <0.02
	Main	100.6±9.2 p<0.02 p ₁ <0.01 p ₂ >0.3	4.1±0.2 p<0.05 p ₁ <0.001 p ₂ >0.1	4.0±0.4 p<0.001 p ₁ <0.05 p ₂ >0.4
6 months	Comparison	120.7±9.6 p>0.1 p ₁ <0.001	4.0±0.4 p>0.1 p ₁ <0.02	4.0±0.3 p<0.001 p ₁ <0.02
	Main	135.2±10.8 p>0.1 p ₁ <0.001 p ₂ >0.3	4.9±0.4 p>0.8 p ₁ <0.001 p ₂ >0.5	4.7±0.4 p<0.02 p ₁ <0.01 p ₂ >0.2
12 months	Comparison	118.5±10.5 p>0.1 p ₁ <0.001	4.2±0.3 p>0.2 p ₁ <0.002	4.2±0.2 p<0.05 p ₁ <0.001
	Main	140.3±8.3 p>0.8 p ₁ <0.001 p ₂ >0.2	4.8±0.4 p>0.8 p ₁ <0.001 p ₂ >0.25	5.1±0.3 p>0.1 p ₁ <0.001 p ₂ <0.05

Note. p – comparison with the control group; p₁ – comparison with baseline; p₂ – comparison between groups.

Baseline leukocyte counts were $2.8 \pm 0.2 \times 10^9/\text{L}$ in the comparison group and $3.0 \pm 0.3 \times 10^9/\text{L}$ in the main group. At 1 month, increases were 14.3 % and 26.7 %, respectively, without a statistically significant change from baseline. At 3 months, counts increased to $3.6 \pm 0.3 \times 10^9/\text{L}$ in the comparison group (28.6 %; $p_1 < 0.02$) and to $4.0 \pm 0.4 \times 10^9/\text{L}$ in the main group (33.3 %; $p_1 < 0.05$).

At 6 months, leukocyte counts were $4.0 \pm 0.3 \times 10^9/\text{L}$ in the comparison group and $4.7 \pm 0.4 \times 10^9/\text{L}$ in the main group, representing increases of 42.9 % ($p_1 < 0.02$) and 56.7 % ($p_1 < 0.01$) from baseline. At 12 months, counts reached $4.2 \pm 0.2 \times 10^9/\text{L}$ and $5.1 \pm 0.3 \times 10^9/\text{L}$, respectively, exceeding baseline by 50.0 % and 70.0 % ($p_1 < 0.001$). The main-group leukocyte count was 21.4 % higher than that in the comparison group ($p_2 < 0.05$).

The findings demonstrate markedly reduced peripheral blood parameters at baseline and their gradual recovery over one year in both clinical groups. Baseline haemoglobin concentrations were 68.8 ± 4.3 and 70.2 ± 5.1 g/L, erythrocyte counts were 2.8 ± 0.2 and $2.6 \pm 0.2 \times 10^{12}/\text{L}$, and leukocyte counts were 2.8 ± 0.2 and $3.0 \pm 0.3 \times 10^9/\text{L}$ in the comparison and main groups, respectively. These concurrent

abnormalities indicate involvement of several haematological parameters in the post-treatment clinical picture. The absence of statistically established baseline differences supports comparison of subsequent trajectories but does not demonstrate complete equivalence across all clinical characteristics.

Discussion. The direction of the baseline abnormalities is consistent with Wondimneh et al., who reported reductions in erythrocyte and leukocyte parameters after chemotherapy [12]. Their population included different malignancies, however, limiting direct comparison of absolute values. Wu et al. further demonstrated the relevance of the specific anticancer regimen to haematological toxicity [13]. In our study, baseline assessment occurred after chemotherapy; the absence of pre-treatment measurements prevents quantification of its contribution separately from the effects of the malignancy, surgery and other factors.

Haemoglobin trajectories were favourable in both groups, with a numerically greater increase in the main group. At 12 months, haemoglobin had risen by 70.1 g/L, or 99.9 %, from baseline in the main group, compared with 49.7 g/L, or 72.2 %, in the

comparison group. Final concentrations were 140.3 ± 8.3 and 118.5 ± 10.5 g/L, respectively. This difference describes unequal magnitudes of recovery but, given the reported $p_2 > 0.2$, does not establish a statistically significant benefit of the complex for this outcome. Its clinical relevance should be considered alongside anaemia-related symptoms, functional status and individual laboratory findings.

Erythrocyte counts followed a similar direction. In the main group, counts were $4.1 \pm 0.2 \times 10^{12}/L$ at 3 months, $4.9 \pm 0.4 \times 10^{12}/L$ at 6 months and $4.8 \pm 0.4 \times 10^{12}/L$ at 12 months. The greatest increase in the mean count therefore occurred by the six-month assessment, followed by maintenance at a similar level. Nevertheless, haemoglobin in this group was only 100.6 ± 9.2 g/L at 3 months. An early increase in erythrocyte count should consequently not be equated with complete resolution of anaemia; joint assessment of both parameters provides a more accurate description of erythrocyte recovery.

Interpretation requires consideration of inflammatory anaemia mechanisms, including restricted iron availability and altered erythropoietin responses [11]. Alongside cessation of cytotoxic exposure, changes in systemic health and concomitant supportive care may have contributed to recovery. However, hepcidin, ferritin, transferrin saturation, reticulocytes and erythropoietin were not assessed in the presented analysis. Correction of iron deficiency and direct stimulation of erythropoiesis by individual TPC components therefore cannot be regarded as established mechanisms. This interpretation is consistent with considering the causes of anaemia when selecting specific care [4].

Leukocyte count showed the largest relative between-group difference at 12 months: $5.1 \pm 0.3 \times 10^9/L$ in the main group versus $4.2 \pm 0.2 \times 10^9/L$ in the comparison group, a difference of 21.4 %. Increases from baseline were 70.0 % and 50.0 %, respectively. These findings indicate a numerically more favourable leukocyte trajectory with the complex. However, the reported bound of $p_2 < 0.05$ does not establish that the Bonferroni-adjusted threshold of $p < 0.003$ was reached without the exact p value. This result should therefore be interpreted as a trend requiring statistical confirmation in subsequent research.

A higher total leukocyte count does not independently demonstrate restoration of immune function. Jiang et al. assessed the immunological effects of their probiotic combination using T-cell subsets and evaluated clinical effects through mucositis severity [9]. Xia et al. also combined clinical observations with immunological and experimental measurements [14]. These endpoints were not determined in our study. The publications support further investigation of the probiotic component, but differences in formulations, populations and treatment regimens prevent their use as direct confirmation of the efficacy of the present TPC.

Topical components should primarily be considered within dental supportive care. The association between oral mucositis and dysbiotic

changes demonstrated by Hong et al. suggests that maintenance of microbial homeostasis may be relevant to mucosal health [8]. The anti-inflammatory and antioxidant properties of polyphenols and the antimicrobial potential of lysozyme provide a theoretical basis for local protective effects [3, 6]. Nevertheless, an indirect relationship between such effects and blood parameters requires verification: correlations between oral status, inflammatory markers and haematological trajectories were not established in this analysis.

The nutritional dimension of rehabilitation should also be considered. The ESPEN approach includes nutritional assessment and correction of identified disturbances within overall treatment [10]. In our study, the vitamin and mineral preparation formed part of a multicomponent programme, preventing separation of its contribution from other interventions. The absence of longitudinal data on body weight, dietary intake and laboratory-confirmed deficiencies also limits attribution of the findings solely to improved nutrient supply. The role of this component therefore remains a hypothesis rather than an independently established effect.

Maintenance of mean haemoglobin, erythrocyte and leukocyte values close to those of controls at later assessments in the main group is an important descriptive finding. However, a non-significant difference from controls does not demonstrate equivalence or indicate that every participant reached their individual laboratory reference range. Within-group changes must also be distinguished from between-group treatment effects: a significant increase from baseline does not automatically establish superiority over standard care. This distinction is particularly relevant with small groups and simultaneous evaluation of several outcomes at multiple time points.

The postoperative programme included re-administration of the complex at six months; persistence of the observed trajectories may therefore relate to the combined sequence of rehabilitation measures. The design nevertheless cannot separate the effects of the repeated course, natural recovery after chemotherapy and concomitant care. Future studies should relate haematological changes to mucositis severity, nutritional status, infectious complications and quality of life. Such expansion of the endpoints would be consistent with multidisciplinary follow-up after head and neck cancer treatment [5, 7].

Thus, the study characterises positive haematological trajectories during rehabilitation and numerically greater recovery in the main group. The biological rationale for combined dental and systemic supportive care is supported by the literature, but causal links between individual TPC components and blood changes were not established here. The practical contribution of these observations is to support further investigation with adequate statistical power, detailed recording of concomitant treatment, and combined laboratory and clinical efficacy outcomes.

Limitations. A limitation of this study is that the evaluation was performed within a single-centre clinical design and focused on one defined follow-up model after surgery and chemotherapy, which may limit extrapolation of the results to

other treatment settings. In addition, the observation period, although sufficient to assess one-year dynamics, does not allow conclusions to be drawn regarding the longer-term stability of the obtained effects.

Conclusions

1. Following surgery for head and neck cancer and chemotherapy, baseline haemoglobin concentration and erythrocyte and leukocyte counts were lower than control values ($p < 0.001$).

2. At 12 months, standard treatment was accompanied by increases of 72.2 % in haemoglobin concentration, 50.0 % in erythrocyte count and 50.0 % in leukocyte count relative to baseline.

3. In the main group, haemoglobin concentration and erythrocyte and leukocyte counts increased by 99.9 %, 84.6 % and 70.0 %, respectively, at 12 months. The corresponding values reached 140.3 ± 8.3 g/L, $4.8 \pm 0.4 \times 10^{12}$ /L and $5.1 \pm 0.3 \times 10^9$ /L.

4. At 12 months, leukocyte count was 21.4 % higher in the main group than in the comparison group. However, the reported bounds of between-group p values do not establish statistical significance at the adopted adjusted threshold of $p < 0.003$.

5. Supplementing standard treatment with the therapeutic and preventive complex was associated with numerically greater improvements in haematological parameters over one year. Further investigation in larger cohorts with parallel assessment of clinical outcomes is warranted.

Further research should focus on the dynamic evaluation of the number of lymphocytes and segmented neutrophils in the blood of patients with head and neck cancer after surgical treatment and chemotherapy in order to determine whether systemic haematological recovery correlates with the microbiological and biochemical effects of the therapeutic-prophylactic complex during rehabilitation.

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CORRECTION OF MICROBIAL CONTAMINATION PARAMETERS AND LOCAL NONSPECIFIC IMMUNE STATUS IN THE ORAL FLUID OF PATIENTS WITH CHRONIC GENERALIZED PERIODONTITIS, OSTEOPENIA, AND OSTEOPOROSIS USING A THERAPEUTIC AND PROPHYLACTIC COMPLEX

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Changes in oral fluid urease and lysozyme activities were assessed in patients with chronic generalised periodontitis associated with osteopenia and osteoporosis. Thirty-five adults aged 25–55 years were examined: 10 healthy individuals, 12 comparison-group patients receiving standard therapy, and 13 main-group patients receiving an adjunctive therapeutic and prophylactic complex. Assessments were performed before treatment and at 3 and 8 months, 1.5 years, and 2 years. In the main group, urease activity decreased from 0.181 ± 0.010 to 0.055 ± 0.003 $\mu\text{kat/L}$ at 8 months and was 0.070 ± 0.004 $\mu\text{kat/L}$ at 2 years. Lysozyme activity increased from 68 ± 3 to 165 ± 12 U/L at 1.5 years and was 152 ± 11 U/L at 2 years. The comparison group showed no sustained urease reduction and less pronounced lysozyme changes. The findings describe favourable biochemical changes with the complex.

Key words: chronic generalised periodontitis, osteopenia, osteoporosis, oral fluid, urease, lysozyme, therapeutic and prophylactic complex.

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КОРЕКЦІЯ ПОКАЗНИКІВ МІКРОБНОГО ОБСІМЕНІННЯ ТА СТАНУ МІСЦЕВОГО НЕСПЕЦИФІЧНОГО ІМУНІТЕТУ У РОТОВІЙ РІДИНІ ПАЦІЄНТІВ З ХРОНІЧНИМ ГЕНЕРАЛІЗОВАНИМ ПАРОДОНТИТОМ, ОСТЕОПЕНІЄЮ ТА ОСТЕОПОРОЗОМ ЗА ДОПОМОГОЮ ЛІКУВАЛЬНО-ПРОФІЛАКТИЧНОГО КОМПЛЕКСУ

Оцінено динаміку активності уреаз та лізоциму у ротовій рідині пацієнтів із хронічним генералізованим пародонтитом на тлі остеопенії та остеопорозу. Обстежено 35 осіб віком 25–55 років: 10 здорових осіб, 12 пацієнтів групи порівняння з базовою терапією та 13 пацієнтів основної групи з додатковим лікувально-профілактичним комплексом. Показники визначали до лікування, через 3 і 8 місяців, а також через 1,5 та 2 роки. В основній групі активність уреаз зменшилася з $0,181 \pm 0,010$ до $0,055 \pm 0,003$ мккат/л через 8 місяців і становила $0,070 \pm 0,004$ мккат/л через 2 роки. Активність лізоциму зросла з 68 ± 3 до 165 ± 12 Од/л через 1,5 року та становила 152 ± 11 Од/л через 2 роки. У групі порівняння тривалого зниження уреаз не спостерігали, а зміни лізоциму були менш вираженими. Результати характеризують сприятливу біохімічну динаміку під час застосування комплексу.

Ключові слова: хронічний генералізований пародонтит, остеопенія, остеопороз, ротова рідина, уреаз, лізоцим, лікувально-профілактичний комплекс.

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Chronic generalised periodontitis develops through sustained interactions between dysbiotic biofilms and the host inflammatory response [2]. Disturbance of this relationship contributes to connective tissue attachment loss and alveolar bone resorption, while the inflammatory microenvironment supports unfavourable changes in the microbial community [11]. Current concepts integrate

local mechanisms of tissue damage with systemic factors capable of modifying inflammation and tissue recovery [5, 6]. This approach provides a rationale for supplementing treatment assessment with functional characteristics of oral fluid that reflect selected aspects of the interaction between microorganisms and host defence systems.