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EVALUATION OF THE EFFECTIVENESS OF A NEW LOCAL TREATMENT METHOD IN THE EARLY POSTOPERATIVE PERIOD OF DENTAL IMPLANTATION

Background. *Following dental implantation, inflammatory processes accompanied by delayed epithelialization require timely treatment using effective local rehabilitation methods.*

Objective *– to evaluate changes in clinical indices and parameters of the oral antioxidant system as a metabolic component of nonspecific immune defense under the influence of a new local rehabilitation method in patients during the early postoperative period after dental implantation.*

Material and methods. *The study was conducted in 48 patients who underwent dental implantation (35–55 years), who were divided into 2 groups: the main group (n = 26), which received standard therapy in combination with applications of the new apigel and ultraphonophoresis for 5–8 days, and the comparison group (n = 22), which received standard therapy. Clinical indices (OHI-S, SBI, PMA), levels of immunoglobulins and cytokines in oral fluid, indicators of antioxidant protection, enzymatic activity of inflammation, and microbiological content of the oral cavity were evaluated on days 3 and 6 after dental implantation surgery.*

Research results. *In the main group, the application of the proposed rehabilitation method contributed to improved hygiene and clinical condition of the oral cavity, more rapid reduction of pain, swelling, and hyperemia (by 2 days), earlier epithelialization (on days 5–6 compared to 7–8 days) with elimination of periodontopathogens (76.8% on days 6–7). Immunological markers, including IgA, IgG, IgM and cytokine levels, normalized earlier, and antioxidant and enzymatic indicators of inflammation in oral fluid improved more rapidly in the main group; the increased activity of nonspecific antimicrobial and antioxidant defense reached baseline values.*

Conclusion. *Combined local application of the new apigel Apisan and ultraphonophoresis accelerates clinical recovery, enhances the local immune response, and promotes normalization of the microbiological state of peri-implant tissues in the early postoperative period after dental implantation, which allows recommending it for inclusion in postoperative rehabilitation protocols.*

Key words: *early postoperative period of dental implantation, healing, oral fluid, local resistance of the oral cavity, lysozyme activity.*

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ОЦІНЮВАННЯ ЕФЕКТИВНОСТІ ЗАСТОСУВАННЯ НОВОГО ЛОКАЛЬНОГО МЕТОДУ ЛІКУВАННЯ У РАННІЙ ПІСЛЯОПЕРАЦІЙНИЙ ПЕРІОД ДЕНТАЛЬНОЇ ІМПЛАНТАЦІЇ

Актуальність. *Після проведення дентальної імплантації запальні процеси з уповільненням епітелізації потребують своєчасного лікування із застосуванням ефективних локальних реабілітаційних методів.*

Мета дослідження *– оцінити зміни клінічних індексів, показників антиоксидантної системи порожнини рота як метаболічної ланки неспецифічного імунного захисту під впливом використання нового локального реабілітаційного методу у пацієнтів у ранній післяопераційний період дентальної імплантації.*

Матеріали та методи. *Дослідження проведені з 48 пацієнтами з приводу дентальної імплантації (35–55 років), які були розподілені на 2 групи: основну (n = 26), яка отримувала стандартну терапію у поєднанні з аплікаціями нового апігелю та ультрафонофорезом протягом 5–8 днів, і групу порівняння (n = 22), яка отримувала стандартну терапію. Клінічні індекси (OHI-S, SBI, PMA), рівні імуноглобулінів та цитокінів у ротовій рідині, показники антиоксидантного захисту, ферментативної активності запалення, мікробіологічного вмісту порожнини рота оцінювалися на 3-ій та 6-ий день після операції дентальної імплантації.*

Результати дослідження. *В основній групі застосування запропонованого реабілітаційного методу сприяло покращенню гігієни і клінічного стану порожнини рота, швидшому зменшенню болю, набряку та гіперемії (на 2 доби), ранній епітелізації (на 5–6-й день порівняно з 7–8-м днем), при елімінації пародонтопатогенів (76,8% на 6-й, 7-й день). Імунологічні маркери, зокрема, IgA, IgG, IgM та рівень цитокінів, нормалізувалися раніше, а антиоксидантні та ферментні показники запалення у ротовій рідині покращувалися швидше в основній групі, підвищення активності неспецифічного антимікробного та антиоксидантного захисту досягло вихідних значень.*

Висновок. *Сполучене локальне застосування нового апігелю Апісан та ультрафонофорезу прискорює клінічне відновлення, підсилює місцеву імунну відповідь і сприяє нормалізації мікробіологічного стану періімплантатних тканин у ранній післяопераційний період після дентальної імплантації, що дозволяє рекомендувати його до включення до протоколів післяопераційної реабілітації.*

Ключові слова: *ранній післяопераційний період дентальної імплантації, загоювання, ротова рідина, локальна резистентність порожнини рота, активність лізоциму.*

Actuality. Dental implantology is the most widespread field of dentistry. The number of patients choosing dental implants to restore missing teeth increases annually. At the same time, domestic and foreign specialists have identified, through clinical observations, a risk of developing inflammatory complications in the early postoperative period of dental implantation associated with surgical trauma and the stress response of

the body to injury, manifesting at both local and systemic levels (Alghamdi, 2020; Das, 2023). This is due to an imbalance in the activity of pro- and anti-stress regulatory mechanisms of the body that are activated in response to surgical intervention. It is known that disturbances in free-radical lipid oxidation contribute to suppression of the function of immunocompetent cells and the synthesis of anti-inflammatory cytokines, creating basic conditions for increased invasion of oral tissues by opportunistic microorganisms that potentiate the development of a prolonged inflammatory process in the peri-implant zone. This substantiates the need to activate the antioxidant and cytokine systems, which interact within a unified structural and functional block and perform fundamental functions in maintaining internal homeostasis. Inflammation of tissues around the implant, manifested by edema and pain, is associated with the movement of fluid into the intercellular tissue space, as well as serum proteins and cellular elements, due to increased permeability of capillary walls under the action of inflammatory cytokines. Local manifestations of prolonged healing of peri-implant tissues are associated with infection and inadequate oral hygiene (Lopez-Valverde, 2023). Therefore, during the period of early post-implantation treatment, it is important to create a favourable background for early restoration of damaged tissues using a new local rehabilitation method aimed at normalizing the oral biocenosis and correcting immunological and antioxidant disorders, which determines the relevance of this study.

Aim is to improve the treatment of inflammation in the early postoperative period of dental implantation through the combined local application of a new apigel and ultraphonophoresis.

Materials and methods. A total of 48 patients aged 35–55 years (28 women and 20 men) who underwent dental implantation were examined and treated. All patients had no systemic diseases. The patients were randomly divided into two groups: the study group and the comparison group. Both groups were homogeneous in terms of age and clinical-functional characteristics.

The study group consisted of 26 patients who, in addition to standard postoperative therapy according to the conventional implant treatment protocol, received local therapy beginning on the second postoperative day. This therapy involved the combined application of the Apisan mucosal gel based on propolis and a complex of biologically active substances with proven anti-inflammatory, antioxidant, and antimicrobial properties (Kravchenko, 2014), in conjunction with ultraphonophoresis. Patients' allergy history was assessed in advance. The Apisan gel was applied in a thin layer (0.05–0.2 g) to the surgical area, followed immediately by a session of ultraphonophoresis using a labile technique with a frequency of 830 kHz, an intensity of 0.4 W/cm², and a pulsed mode on the UZT-102 ultrasound device. Each procedure lasted 5 minutes and was performed once daily for 5–8 days.

The comparison group included 22 patients who, from the second postoperative day, received only conventional therapy according to the standard protocol, which included hygienic treatment of the postoperative site with antiseptic solutions (0.05% chlorhexidine, furacilin), analgesics, and antibiotics as indicated. Depending on the severity of the pathological process, postoperative treatment lasted from 3 to 10 days.

The dental implantation procedure in both groups was performed identically and followed generally accepted clinical standards. Comparative results were evaluated objectively based on a unified examination protocol including clinical, radiological, and laboratory studies. The early postoperative course was assessed starting from the second postoperative day and subsequently on days 6 and 10.

The control group consisted of 16 healthy individuals without indications for dental interventions. Clinical dental examination included medical history collection and inspection of the oral cavity. To assess periodontal and hygienic status, the following indices were used: the Muhlemann Sulcus Bleeding Index (SBI), the Papillary-Marginal-Alveolar Index (PMA), and the simplified Oral Hygiene Index (OHI-S) by Greene–Vermillion (Outatzis, 2024).

Laboratory examinations were performed using biochemical, immunological, and microbiological methods. The study material was oral fluid collected on an empty stomach. Local oral reactivity parameters (activities of catalase, elastase, lysozyme, and urease; malondialdehyde (MDA) levels; and IL-1, IL-4, IL-6 concentrations) (Horiachkivskyi, 2005) were determined before implantation and on postoperative days 3 and 6. Local immunity was assessed by measuring the concentrations of immunoglobulins IgA, IgG, IgM, SIgA, and lysozyme in saliva using the radial immunodiffusion method described by Mancini et al. (Horiachkivskyi, 2005). The concentrations of IL-1, IL-4, and IL-6 in saliva were measured by a solid-phase "sandwich" enzyme-linked immunosorbent assay (ELISA) using Vector-Best diagnostic kits (Horiachkivskyi, 2005). Optical density was measured at a wavelength of $\lambda = 450$ nm for all cytokines. Lysozyme content and activity in saliva were studied by a photocolorimetric method using Micrococcus lysodeikticus as the indicator microorganism (Horiachkivskyi, 2005).

Microbiological studies were performed on days 3 and 14 after implantation. Samples of wound exudate

were collected with sterile swabs, placed into sterile tubes containing glucose broth, and delivered to a bacteriological laboratory for analysis of the qualitative and quantitative composition of the microbial flora.

Statistical analysis was carried out using Microsoft Excel 2000. Quantitative data are presented as mean ± standard error of the mean (M ± m). Differences between groups were assessed using Student's t-test, and differences were considered statistically significant at $p < 0.05$.

Results and discussion. During dental examination of the teeth and oral mucosa (OM), all patients scheduled for dental implantation demonstrated clinically healthy periodontium and reported no complaints prior to surgery. The gingiva was firm, of normal moisture, pale pink in color, without pathological changes, and tightly adhered to the cervical areas of the teeth. On examination and palpation of the alveolar process in areas of missing teeth, most patients exhibited uniform atrophy with no mobile alveolar ridge. Normal occlusion and its transitional forms were noted in all patients. Although in some cases partial tooth loss was complicated by various occlusal surface deformations, mainly vertical displacement, these changes were minor and did not interfere with implantation procedures.

On the eve of dental implantation, all patients in both groups underwent professional oral hygiene measures necessary to reduce the risk of complications. The early postoperative period was assessed in all patients starting from the second day after surgery, then on days 3–6. In all patients of both groups who underwent intraosseous dental implantation, clinical signs of local inflammation and general systemic response were already observed on the second day postoperatively.

Clinical signs of local inflammation in the surgical area included pain, swelling, hyperemia of the mucosa, and fibrinous plaque along the suture line, observed in all patients. However, a systemic inflammatory response was noted in some patients, likely due to individual immune reactivity and the presence of specific oral microbiota. Notably, the combined application of the new Apisan gel with ultraphonophoresis was well tolerated by all patients, with no deterioration in clinical condition during local therapy (Kravchenko, 2020).

After 2–3 sessions of combined Apisan gel application and ultraphonophoresis, most patients experienced a reduction in pain intensity and a marked decrease in postoperative discomfort. After 5–6 sessions, the main manifestations of local inflammation were noticeably suppressed in the study group compared to the comparison group. Pain was reported by 28% of patients in the study group versus 60% in the comparison group; swelling and mucosal hyperemia were noted in 22% and 20% versus 53% and 43% in the comparison group, respectively; fibrinous plaque on the suture line was present in 28% of cases versus 40% in comparison.

Analysis of local dental status revealed a significant difference between the study and comparison groups. Hyperemia and swelling pronounced on the second day post-implantation, decreased in the study group by the third day, whereas in the comparison group, reduction was noted only by the sixth day. By day 6, hyperemia and swelling were absent in 91.7% of the study group, compared to 71.8% of comparison by day 8 ($p < 0.01$).

Thus, the clinical picture of inflammatory changes in the oral cavity of patients in the study group following combined local therapy with the Apisan mucosal gel and ultraphonophoresis, alongside standard drug therapy, demonstrated a more pronounced improvement: inflammation and swelling were resolved faster than in the comparison group receiving standard drug therapy alone.

Analysis of post-implantation wound epithelialization also showed a significant difference between the groups. Early signs of epithelialization appeared on average two days earlier in the study group (day 3) than in comparison (day 5), with 18.4% more patients showing earlier onset in the study group. Epithelialization of the post-implantation mucosal defect occurred on average two days earlier than in the comparison group. Resolution of local inflammation in the majority of the study group was observed by days 5–6: gingival tissues regained a pale pink color, wound edges were closely approximated with smooth, distinct contours. Healing predominantly occurred by days 5–6, after which the sutures were removed. In the comparison group, similar healing dynamics occurred by days 7–8 after implantation.

The clinical status of gingival tissues in the study group before and after implantation showed no signs of inflammation, confirmed by clinical indices OHI-S, PMA, and SBI, which normalized during the study period after Apisan gel combined with ultraphonophoresis. Standard therapy also showed positive dynamics in clinical indices, but normalization occurred later and did not reach the values observed in the study group. Oral hygiene improved more noticeably in the study group than in the comparison group. On day 6 post-surgery, the comparison group showed a temporary worsening of PMA index by 12.7% compared to day 3 ($p < 0.05$), which may reflect stress-related sensitivity of the papillary-marginal-alveolar index. Surgical intervention, as a stress factor, directly influences these indices (Rozhko, 2022). The study group's results suggest low risk of gingival inflammation, likely due to comprehensive local prophylaxis. Clinical recovery was achieved in 93.8% of the study group patients, versus 74.8% in the com-

parison group. Thus, patients in the study group demonstrated sustained positive clinical dynamics compared to the comparison group receiving conventional therapy, which may be attributed to the effect of the developed local method on oral hygiene quality, a key factor in preventing exacerbation of inflammatory processes.

According to microbiological studies on the third day after dental implantation, contamination of the wound surface by conditionally pathogenic and, importantly, periodontopathogenic bacteria in patients of the study group was low: only enterobacteria, actinomycetes, Prevotella intermedia, and Porphyromonas gingivalis were rarely detected. In the comparison group on day 3 post-surgery, streptococci, fusobacteria, enterococci, actinomycetes, Porphyromonas gingivalis, and Prevotella intermedia were detected more frequently than before surgery. Analysis of the microbiological state of the peri-implant zone on days 3, 7, and 14 revealed differences in the frequency of resident and periodontopathogenic microbes between the study and comparison groups. With the use of traditional chlorhexidine-containing agents in the comparison group, elimination of potential pathogens of postoperative inflammatory complications occurred in 75.8% of patients only by days 12–14 of treatment.

The combined local complex in the study group demonstrated a pronounced antibacterial effect in the early postoperative period. After 3–4 procedures, the frequency of potential pathogens decreased significantly in 76.8% of patients. By days 6–7, significant decrease in major periodontopathogenic microorganisms from the peri-implant zone was achieved in 100% of cases. Thus, microbiological studies confirmed the high antibacterial efficacy of the local application of the new Apisan gel combined with ultraphonophoresis, supporting its use for prophylaxis in patients undergoing dental implantation. Compared with traditional chlorhexidine therapy, this complex accelerated clinical and microbiological recovery, contributing to a more favorable course of wound healing after implantation.

It is known that the severity of the inflammatory reaction depends on the body's ability to resist pathogenic microflora, determined by local and systemic nonspecific and specific defense factors (Hajishengallis, 2021). In our studies, postoperative inflammatory complications developed in conditions of reduced local oral resistance, where immunoglobulins and cytokines play a major role. On the second day after surgery, low SIgA levels were detected, indicating reduced barrier and mycocidal functions of the oral mucosa, since SIgA blocks bacteria and prevents their penetration into the mucous membrane (Polishchuk, 2025). The rehabilitation measures carried out after dental implantation positively changed the level of immunoglobulins (IgA, IgG, IgM) in oral fluid in both the study and comparison groups. The use of a local rehabilitation complex in the study group led to a significant normalizing effect on the level of immunoglobulins in oral fluid by day 6, especially on the SIgA level. It was found that in both groups after recovery, the SIgA level rose to the upper values of the norm, and the patients with residual inflammatory symptoms had a tendency to a gradual decrease. In patients with early regression of the inflammatory process, the level of SIgA exceeded the baseline value, and upon the elimination of clinical signs of inflammation, no decrease in its concentration in the oral fluid was observed in any case.

By the end of the first week after the installation of intraosseous implants, the oral fluid of patients in the study group showed more active normalization of

Table 1

Dynamics of clinical index changes in the early period of dental implantation with local therapy (M ± m), points

Indices	Control group n=16	Study group, n=26			Comparison group, n=22		
		before operation	3rd day after operation	6th day after operation	before operation	3rd day after operation	6th day after operation
OHI-S, score	0.90±0.01	1.02±0.02	0.55±0.04	0.53±0.03	1.06±0.02	0.68±0.03	0.60±0.04
p			<0.05	<0.05		<0.05	<0.05
p_1						<0.05	>0.05
SBI-I, score	1.05±0.05	0.98±0.03	0.52±0.03	0.48±0.04	1.32±0.04	0.88±0.03	0.92±0.05
p			<0.05	<0.05		<0.05	<0.05
p_1						<0.05	<0.05
PMA, %	7.04±0.06	7.40±0.40	6.60±0.50	6.80±0.50	7.60±0.40	8.16±0.50	9.50±0.50
p			>0.05	>0.05		>0.05	<0.05
p_1						<0.05	<0.05

Note: p – probability of difference within groups before and after surgery; p_1 – probability of difference between the study and comparison groups.

Table 2

Changes in immunological parameters in the saliva of patients during the early postoperative period of dental implantation and their correction (M±m)

Indices	Control group n=16	Study group, n=26			Comparison group, n=22		
		before operation	3rd day after operation	10th day after operation	before operation	3rd day after operation	10th day after operation
IgA, **g/L** p p_1	0.48±0.02	0.45±0.02	0.50±0.02 >0.05	0.46±0.02 >0.05	0.51±0.02	0.52±0.02 >0.05 >0.05	0.50±0.02 >0.05 >0.05
IgG, **g/L** p p_1	0.65±0.02	1.19±0.03	0.98±0.02 <0.05	0.80±0.00 <0.05	1.18±0.04	0.89±0.03 <0.05 <0.05	0.94±0.02 <0.05 <0.05
IgM, **g/L** p p_1	0.29±0.02	0.36±0.02	0.51±0.02 <0.05	0.44±0.01 <0.05	0.28±0.02	0.44±0.01 <0.05 <0.05	0.40±0.03 <0.05 >0.05
SIgA, **g/L** p p_1	1.28±0.02	0.96±0.03	0.61±0.01 <0.05	1.22±0.05 <0.05	0.68±0.03	0.72±0.02 >0.05 <0.05	0.84±0.03 <0.05 >0.05
IL-1, **pg/mL** p p_1	120.4±1.5	134.5±2.1	149.0±3.2 <0.05	130.0±3.6 >0.05	149.0±3.8	128.4±2.8 <0.05 <0.05	120.6±1.9 <0.05 >0.05
IL-4, **pg/mL** p p_1	8.83±0.6	10.3±0.5	12.7±0.6 <0.05	16.6±0.5 <0.05	13.2±0.7	12.0±0.5 >0.05 >0.05	13.6±0.6 >0.05 <0.05
IL-6, **pg/mL** p p_1	178.5±2.8	202.5±4.3	204.5±4.2 >0.05	194.2±4.0 >0.05	211.7±3.0	203.2±3.4 >0.05 >0.05	198.0±2.6 <0.05 >0.05

Note: p – probability of difference within groups before and after surgery; p_1 – probability of difference between the study and comparison groups.

secretory immunity, as evidenced by changes in the concentration of SIgA and IL-1. In the comparison group, up to the 10th day after implantation, under the influence of traditional antibacterial therapy, there were no active shifts towards normalization of secretory immunity, as in patients in the study group. A lower rate of increase in local immune defense, along with persistent imbalance in cytokine activity (decrease in IL-1 levels) and elevated IL-6 levels in oral fluid up to 6 days after implantation indicate the persistence of inflammatory activity in the peri-implant area. (Eldzharov, 2021; Isola, 2021).

Considering that the disruption of free radical lipid oxidation processes contributes to the suppression of the function of immunocompetent cells and is a prerequisite for the formation of an incomplete immune response and the development of an inflammatory process (Amin, 2019), studies were conducted in the early post-implantation period to determine the antioxidant and radical oxidation status in patients of both groups. The results showed a greater suppression of antioxidant potential in patients in the comparison group than in the study group. On days 3–6 after implantation, the average parameters of catalase activity were lower than in healthy individuals. In the study group, the level of antioxidant protection changed less on the 3rd day after surgery (catalase activity decreased by 10%), and on the 6th day, it increased to normal values. When studying the indicators of lipoperoxidation in patients of the comparison group on the 3rd day after implantation, an increase in the level of malondialdehyde (MDA) was found, which exceeded the physiological norm. At this time, radical oxidation indicators in patients in the study group were less affected than in patients in the comparison group and clearly correlated with the clinical manifestations of inflammatory complications after dental implantation. On the 6th day after surgery, MDA indicators normalized in patients in the study group. Positive dynamics, but less pronounced, was observed in patients in the comparison group. It should be noted that in the absence of dynamics of indicators towards normalization in the implant zone, a mild inflammatory process formed, which was eliminated by professional and hygienic measures within 2 weeks.

Table 3

Changes in laboratory markers of local reactivity in patients' saliva during the early postoperative period of dental implantation under the influence of local therapy (M±m)

Labora-tory markers	Control group n=16	Study group, n=26			Comparison group, n=22		
		before operation	3rd day after operation	6th day after operation	before operation	3rd day after operation	6th day after operation
Elastase activity, μkat/L	0.35±0.06	0.42±0.04	0.63±0.06	0.45±0.05	0.48±0.04	0.90±0.08	0.50±0.05
p			<0.05	>0.05		<0.05	>0.05
p_1						<0.05	>0.05
Urease activity, μkat/L	0.058±0.01	0.062±0.03	0.073±0.01	0.064±0.04	0.067±0.05	0.118±0.07	0.083±0.06
p			<0.05	>0.05		<0.05	<0.05
p_1						<0.05	<0.05
Catalase activity, μkat/L	0.160±0.06	0.150±0.05	0.134±0.04	0.166±0.06	0.168±0.06	0.130±0.06	0.148±0.05
p			<0.05	<0.05		<0.05	<0.05
p_1						>0.05	<0.05
Lysozyme activity, U/mL	0.136±0.04	0.143±0.08	0.109±0.06	0.136±0.07	0.148±0.06	0.084±0.05	0.116±0.08
p			<0.05	>0.05		<0.05	<0.05
p_1						<0.05	>0.05
MDA. μmol/L	0.130±0.03	0.124±0.04	0.152±0.08	0.118±0.07	0.142±0.05	0.190±0.06	0.168±0.05
p			<0.05	>0.05		<0.05	<0.05
p_1						<0.05	<0.05

Note: p – probability of difference within groups before and after surgery; p_1 – probability of difference between the study and comparison groups.

The state of local nonspecific immunity and the level of microbial contamination in the oral cavity in the early postoperative period of dental implantation were studied using indicators such as lysozyme and urease activity in oral fluid (table 3). In both groups of patients, there was a decrease in the activity of lysozyme, one of the most important antibacterial enzymes in the oral cavity, which is capable of destroying the plasma membranes of microorganisms (Levytskyi, 2005). The decrease in lysozyme activity on the 3rd day after surgery in the study group was on average 24.5%, and in the comparison group 44.0%, which indicates a smaller decrease in the protective oral mucosa function against pathogenic bacteria when using the new local treatment method. On the 6th day, lysozyme activity in the study group of patients returned to normal values, while in the comparison group there was a tendency to recovery. The activity of urease, an indicator of microbial contamination, in patients in the comparison group on the 3rd day after implantation was 1.6 times higher than the initial values, which can be explained by excessive growth of microbial contamination of the oral cavity against the background of a decrease in lysozyme activity and a nonspecific immune response (Polishchuk, 2025; Levytskyi, 2010). On day 6, urease activity decreased after basic therapy, but did not reach baseline values. In the study group of patients, on days 3 and 6 after dental implantation, urease levels were within the initial values.

The onset of inflammation in the oral cavity on the third day after implantation was indicated by a 1.6–1.8-fold increase in elastase activity in both the study and comparison groups relative to baseline values. A significant increase in this enzyme in oral fluid at this particular stage of the inflammatory process in the oral cavity can be explained by the formation of an infected focus, into which neutrophils predominantly migrate, and their destruction leads to an increase in elastase activity (Levytskyi, 2010; Helei, 2025). It is by determining its activity that the effectiveness of local treatment can be assessed: when using the new local method, elastase activity was determined to be on average almost 1.5 times lower than with the traditional treatment regimen.

It should be noted that the normalization of biochemical and immunological markers of oral fluid in patients of the study group was particularly pronounced. The treatment carried out in this group had a significant effect

on inflammation indicators, restraining their increase on the 3rd day of the post-implantation period and creating a background for rapid restoration of the tissues of the peri-implant zone on the 6th day, compared with traditional local therapy. Given the insignificant number of inflammatory complications after dental implantation, their short-term clinical manifestations in patients who underwent the developed local rehabilitation measure, it can be argued that it affects the elimination of etiological and pathogenetic mechanisms, the development of inflammatory processes in the periodontium and peri-implant zone.

Conclusions. A local method was developed for the combined use of the new Apisan apigel and ultraphonophoresis to optimize postoperative care following dental implantation.

The use of the new local rehabilitation method has a positive effect on the intensity and progression of nonspecific post-implantation inflammatory reactions (hyperemia, edema, pain, and the rate of epithelialization), as confirmed by periodontal indices during objective examination.

The proposed local method ensures the stability of peri-implant tissues by modulating the local immune system, normalizing the levels of SIgA and cytokines (IL-1, IL-4), significantly reducing the number of periodontopathogens, balancing lipid peroxidation/antioxidant defense (LPO/AOD) processes, and maintaining favourable oral hygiene indices.

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Pasechnyk A.M. – formulation of the idea and design of the study; collection, compilation and systematization of data for the study; participation in writing the article; participation in the research process, conducting experiments;

Pasechnyk O.V. – collection and analysis of literature, annotations; participation in the research process, conducting experiments; participation in writing the article; conclusions, summary;

Rozumenko V.O. – participation in writing the article; correction of the article; critical review for the presence of important scientific content, collection and analysis of literature, annotations;

Rozumenko M.V. – participation in the research process, conducting experiments; participation in writing the article; collection and analysis of literature; conducting experiments.

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