Original Research

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Development and evaluation of the effectiveness of caries prevention in patients who have had coronavirus infection

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Abstract

AIM of the study is to improve the effectiveness of dental caries prevention by creating new organizational and methodological principles for patients who have had a coronavirus infection.

MATERIALS AND METHODS. A single-center, retrospective, non-randomized study was conducted to identify the impact of inflammatory periodontal diseases on the effectiveness of the applied complex of products on the level of oral hygiene and caries reduction in patients who had previously had a coronavirus infection. The study involved 150 patients aged 28 to 56 years, who were divided into 3 groups (50 people in each): the control group (group 1) included patients with inflammatory periodontal diseases who did not have COVID-19, with traditional treatment for inflammatory periodontal diseases under regular monitoring by a periodontist. The comparison group (group 2) included patients with inflammatory periodontal diseases who had recovered from COVID-19 with traditional treatment for inflammatory periodontal diseases under regular supervision of a periodontist. The main group (group 3) included patients with inflammatory periodontal diseases who had recovered from COVID-19 with traditional treatment of inflammatory periodontal diseases with regular monitoring by a periodontist and the appointment of additional local ("Fagodent" bacteriophage gel, ROCS PRO Moisturizing toothpaste) and general treatments ("Immunofan", "Dentobalance"). Research methods: OHI-S, PMA index, SBI index, tooth sensitivity index, deodorizing action index of S.B. Ulitovsky, functional indicators of saliva.

RESULTS. The increase in caries was minimal in the study group. Over 18 months, 1.4 new cases of caries were recorded, compared to the initial indicator of 0 cases. In the control group, an increase of 0 to 3.1 new cases of dental caries was recorded, while in the comparison group, it increased to 4.3 new cases. The effectiveness of the preventive programs was assessed by the reduction in the number of new cases of dental caries in the study groups. The best result was achieved in the study group, where additional interventions to restore normal oral flora and moisturizing components of the hygiene product reduced the incidence of new cases by 67%. In the comparison group, which used standard prophylaxis, the reduction was 28%, with a 39% difference between the groups.

CONCLUSIONS. An individualized prevention program for patients who recovered from COVID-19 reduced the incidence of primary dental caries by 2.21 times compared to a general prevention program not based on restoring normal oral flora.

Keywords: oral cavity, coronavirus infection, inflammatory periodontal diseases, caries prevention, hygiene products

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Разработка и оценка эффективности профилактики кариеса у пациентов, перенесших коронавирусную инфекцию

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Резюме

ЦЕЛЬ. Повышение эффективности профилактики кариеса зубов путем создания новых организационных и методических принципов для пациентов, перенесших коронавирусную инфекцию.

МАТЕРИАЛЫ И МЕТОДЫ. Было проведено одноцентровое ретроспективное исследование с отсутствием рандомизации и выявлением влияния воспалительных заболеваний пародонта на эффективность применённого комплекса средств на уровень гигиены полости рта и редукцию кариеса у пациентов, ранее перенесших коронавирусную инфекцию. Пациентов, общим количеством 150 человек, в возрасте от 28 до 56 лет, разделили на 3 группы (по 50 чел. в каждой): контрольная группа (группа 1) включала пациентов с воспалительными заболеваниями пародонта, не болевших COVID-19, с традиционным лечением воспалительных заболеваний пародонта при регулярном наблюдении пародонтолога. Группа сравнения (группа 2) включала пациентов с воспалительными заболеваниями пародонта, переболевших COVID-19 с традиционным лечением воспалительных заболеваний пародонта при регулярном наблюдении пародонтолога. Основная группа (группа 3) включала пациентов с воспалительными заболеваниями пародонта, переболевших COVID-19 с традиционным лечением воспалительных заболеваний пародонта при регулярном наблюдении пародонтолога и назначением дополнительных местных (Гель с бактериофагами «Фагодент», зубная паста ROCS «PRO Moisturizing. Увлажняющая») и общих («Иммунофан», «Дентобаланс») средств лечения. Методы исследования: OHI-S, индекс PMA, индекс SBI, индекс сенситивности зубов, индекс дезодорирующего действия С.Б. Улитовского, функциональные показатели слюны.

РЕЗУЛЬТАТЫ. Прирост кариеса оказался минимальным в основной группе. За 18 месяцев зарегистрировано 1,4 новых случая поражения кариесом после первичного показателя 0 случаев. В контрольной группе зафиксировано увеличение с 0 до 3,1 новых случаев, а в группе сравнения – до 4,3 новых случаев кариозного поражения. Эффективность профилактических программ оценивался по снижению числа новых случаев кариеса в группах исследования. Лучший результат был достигнут в основной группе, где дополнительные воздействия восстановления нормофлоры полости рта и увлажняющие компоненты средства гигиены, позволили снизить частоту новых случаев на 67%. В группе сравнения, где применялась стандартная профилактика, снижение составило 28%, разница в группах составила 39%.

ВЫВОДЫ. Индивидуальная программа профилактики, проводимая пациентам, перенесшим COVID-19, снизила заболеваемость первичным кариесом зубов в 2,21 раза по сравнению с общей профилактикой, не основанной на восстановлении нормофлоры полости рта.

Ключевые слова: полость рта, короновирусная инфекция, воспалительные заболевания пародонта, профилактика кариеса, средства гигиены

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INTRODUCTION

Analysis of symptoms and complaints reported by patients who have recovered from coronavirus infection suggests that COVID-19 and post-COVID syndrome have a negative impact on oral health [1–3]. The variety of clinical manifestations is noteworthy: the majority of patients report xerostomia and disturbances in taste and smell, indicating a dose-dependent relationship between disease severity and its effects on dental health. In many individuals who have recovered from COVID-19, clinical examination of the oral cavity may reveal pathological changes in the mucosa, including erythema, vesicles, and papules; furthermore, patients with post-COVID syndrome more frequently present with diseases of the oral mucosa, tongue, and periodontal tissues [4–7]. From a clinical perspective,

it is essential to assess the prevalence and severity of periodontal disease, oral mucosal pathology, and hard dental tissue disorders, taking into account the influence of background factors, including post-COVID syndrome [8–11].

Dental caries is also significantly affected by post-COVID syndrome. Studies have shown that the prevalence of dental caries and caries-related complications is directly associated with the severity of COVID-19 infection and post-COVID syndrome [2; 12]. Moreover, patients with COVID-19 demonstrate a higher incidence of dental caries and periodontal diseases compared to healthy individuals [13–15]. A positive correlation between oral pathology and COVID-19 highlights the need for targeted prevention and treatment strategies [16–21].

AIM

The aim of the study is to improve the effectiveness of dental caries prevention through the development of new organizational and methodological principles for patients who have recovered from coronavirus infection.

MATERIALS AND METHODS

A single-center retrospective, non-randomized study was conducted to evaluate the impact of inflammatory periodontal diseases on the effectiveness of a therapeutic complex, oral hygiene status, and caries reduction in patients who had previously recovered from coronavirus infection.

Dental complaints in the post-COVID period demonstrated a wide range of clinical manifestations. A comparative analysis of clinical changes in the dental status of patients who had recovered from COVID-19 versus healthy individuals revealed the necessity of incorporating agents aimed at restoring both systemic and local immune defense within oral health rehabilitation programs. For this purpose, the following preventive and therapeutic measures were included in the protocol:

1. **Imunofan solution** – administered intramuscularly at a dose of 1 ml every other day for 20 days.

2. **Dentobalance Fresh Effect Synbiotic (7 biocomponents)** – powder for oral solution, sachets of 5 g (No. 10). Its pharmacological action is based on a natural complex formulation containing probiotics, prebiotics, plant extracts, and other active components aimed at correcting conditions associated with halitosis (bad breath).

3. **Phagodent gel with bacteriophages for gums** – used to normalize oral microbiota and prevent inflammatory diseases of the oral cavity.

4. As a hygiene measure, **R.O.C.S. PRO Moisturizing toothpaste** was prescribed. One of its key properties is hydration. Clinical studies have shown that this toothpaste, containing a specialized complex, alleviates xerostomia, including in patients with diabetes mellitus and post-COVID syndrome.

The study included 150 patients aged 28 to 56 years. All participants were divided into three equal groups ($n = 50$ each):

– **Control group (Group 1):** patients with inflammatory periodontal diseases (IPD) who had not contracted COVID-19 and received standard periodontal therapy under regular specialist supervision.

– **Comparison group (Group 2):** patients with IPD who had recovered from COVID-19 and received standard periodontal therapy under regular specialist supervision.

– **Main group (Group 3):** patients with IPD who had recovered from COVID-19 and received standard periodontal therapy under regular specialist supervision, supplemented with additional local (Phagodent gel, R.O.C.S. PRO Moisturizing toothpaste) and systemic (Imunofan, Dentobalance) agents.

Methods of investigation included OHI-S, PMA index, SBI index, Tooth Sensitivity Index (TSI), Ulitovsky's deodorizing effect index (UDEI), and salivary functional parameters. Measurements were recorded in all groups at baseline, one week after initiation, at one month, and at three months.

Statistical analysis was performed using STATISTICA 6.0 software package (StatSoft Inc., USA) for Windows, with the application of purpose-built modules developed with author participation. Primary quantitative data were tabulated in Microsoft Excel (version 7.0) and subsequently transferred to the statistical software for analysis using descriptive statistics modules. The threshold for statistical significance was set at $p < 0.05$.

RESULTS

The Oral Hygiene Index Simplified (OHI-S) in the examined patient groups demonstrated the following dynamics. Prior to treatment, all groups exhibited poor hygiene levels, with values ranging from 3.29 ± 0.10 to 3.80 ± 0.14 points, indicating baseline comparability of the groups for subsequent analytical comparison.

During the study period, a positive trend in OHI-S values was observed across all groups both in the short-term and long-term follow-up periods, with statistically significant improvements compared to baseline ($p < 0.001$) (Table 1).

Table 1. Dynamics of the OHi-S index (M ± m), points in the study groups

Таблица 1. Динамика показателей индекса OHi-S (M ± m), баллы в группах исследования

Patient groups	Baseline	1 week	1 month	3 months	*p* 0–1 week	*p* 0–1 months	*p* 0–3 months
Control group	3.29 ± 0.10	0.41 ± 0.10	0.70 ± 0.11	0.96 ± 0.16	<0.001	<0.001	<0.001
Comparison group	3.48 ± 0.08	0.60 ± 0.12	0.87 ± 0.14	1.61 ± 0.14	<0.001	<0.001	<0.001
Intervention group	3.80 ± 0.14	0.54 ± 0.11	0.78 ± 0.12	0.99 ± 0.14	<0.001	<0.001	<0.001

In the control group of patients who had not contracted COVID-19, the OHI-S index demonstrated the following dynamics over the observation period. One week after the initiation of treatment, an improvement in oral hygiene was observed, with the index increasing by 9.3 ± 0.10-fold. However, at the three-month follow-up, a tendency toward a return to baseline values was noted, with a deterioration of 2.3 ± 0.10-fold compared to the achieved short-term improvement.

In the comparison group of patients who had recovered from COVID-19 and received conventional treatment for inflammatory periodontal diseases, oral hygiene improved by 5.5 ± 0.13-fold one week after the initiation of therapy. However, at the three-month follow-up, a deterioration of 2.7 ± 0.10-fold was recorded.

In the main group, oral hygiene improved by 6.4 ± 0.12-fold, while at three months a lesser deterioration of 1.8 ± 0.10-fold was observed ($p < 0.001$).

Thus, the effectiveness of the cleansing impact of the therapeutic interventions across the studied groups can be characterized as follows: the best OHI-S outcomes were observed in patients with inflammatory periodontal diseases who had not experienced COVID-19, showing results 1.69 ± 0.10 times better than in patients who had recovered from COVID-19 and received conventional periodontal therapy, and 1.45 ± 0.10 times better than in patients who had recovered from COVID-19 and received an enhanced therapeutic protocol. However, the sustainability of the achieved results was superior in the main group, being 1.5 ± 0.13 times higher than in the comparison group and 1.27 ± 0.13 times higher than in the control group.

Baseline PMA index values corresponded to a "pronounced prevalence and intensity of the inflammatory process" in all study groups, ranging from 49.86 ± 1.03% to 53.95 ± 0.72%, which reflects the upper limit of moderate severity of periodontal inflammation (Table 2).

During the study period, changes in PMA index values were observed across all patient groups, with the corresponding numerical dynamics presented in Table 2. A positive trend was recorded in all groups, with the inflammatory process corresponding to a mild degree.

The most pronounced improvement after treatment was observed in the control group, showing a 2.57 ± 0.03-fold reduction. In the main group, the improvement amounted to 2.35 ± 0.01-fold, while in the comparison group it reached 2.11 ± 0.03-fold ($p < 0.001$).

At the three-month follow-up, PMA index values in both the control and main groups remained consistent with a "mild degree of inflammatory process," whereas in the comparison group the values returned to a "moderate degree of gingival inflammation."

The most effective long-term maintenance of the anti-inflammatory effect, based on PMA index reduction, was observed in the main group, with a 1.1 ± 0.03-fold decrease. In contrast, outcomes in the control and comparison groups demonstrated deterioration, with increases of 1.3 ± 0.03-fold and 1.4 ± 0.02-fold, respectively.

One of the primary clinical markers of periodontal inflammation is the presence and progression of bleeding on probing. At baseline examination, prior to treatment, the SBI index ranged from 2.45 ± 0.07 to 2.47 ± 0.02 points (Table 3).

At the one-week follow-up after treatment initiation, gingival bleeding was virtually eliminated across all study groups. By the third month, however, mild bleeding reappeared in 60.00 ± 2.68% of patients in the control group, 86.00 ± 3.16% of patients in the comparison group, and only 13.00 ± 1.03% of patients in the main group.

The most sustained suppression of gingival bleeding was achieved in the main group. In the comparison group, outcomes were 2.05 ± 0.08 times less favorable, while in the control group they were 1.98 ± 0.03 times less favorable than in the main group.

Table 2. Dynamics of the PMA index indicators (M ± m), %

Таблица 2. Динамика показателей индекса PMA (M ± m), %

Patient groups	Baseline	1 week	1 month	3 months	*p* 0–1 week	*p* 0–1 months	*p* 0–3 months
Control group	49.86 ± 1.03	19.35 ± 2.35	22.91 ± 2.72	24.16 ± 3.09	<0.001	<0.001	<0.001
Comparison group	51.21 ± 1.03	24.21 ± 2.68	27.86 ± 2.95	34.04 ± 3.16	<0.001	<0.001	<0.001
Intervention group	53.95 ± 0.72	22.93 ± 2.53	25.42 ± 2.77	25.42 ± 2.93	<0.001	<0.001	<0.001

Table 3. Dynamics of the bleeding index SBI (M ± m), points

Таблица 3. Динамика показателей индекса кровоточивости SBI (M ± m), баллы

Patient groups	Baseline	1 week	1 month	3 months	*p* 0–1 week	*p* 0–1 months	*p* 0–3 months
Control group	2.45 ± 0.07	0.61 ± 0.09	0.79 ± 0.09	1.21 ± 0.16	<0.001	<0.001	<0.001
Comparison group	2.47 ± 0.06	0.77 ± 0.18	1.03 ± 0.20	1.58 ± 0.21	<0.001	<0.001	0.001
Intervention group	2.47 ± 0.02	0.66 ± 0.12	0.94 ± 0.12	0.99 ± 0.13	<0.001	<0.001	<0.001

Dentin hypersensitivity was also recorded in all study groups. At baseline, the Tooth Sensitivity Index (TSI) ranged from 35.29±2.66% in the control group to 57.48±1.52% in the comparison group and 59.29±1.01% in the main group. During the study period, a reduction in this index was observed across all groups (Table 4).

In the control group, at the three-month follow-up, dentin sensitivity decreased by 1.2-fold, while in the comparison group it decreased by 1.8-fold. In contrast, in the main group, dentin hypersensitivity was reduced by 2.7-fold, indicating its clinical resolution.

Halitosis in the examined patients with a history of COVID-19 was detected in 36.52% of cases (84 patients). During the observation period, all study groups demonstrated a positive trend in the deodorizing index.

At baseline, the deodorizing effect index ranged from 0.49±0.03 points in the control group to 0.61±0.01 points in the comparison group and 0.60±0.02 points in the main group. Throughout the study period, a reduction in this index was observed across all groups (Table 5).

In the control group, at the three-month follow-up, dentin sensitivity decreased by 1.96-fold, while in the comparison group it decreased by 1.74-fold. In contrast, in the main group, dentin hypersensitivity was reduced by 4.03-fold, indicating its clinical resolution.

Table 4. Dynamics of the L.Yu. Orekhova – S.B. Ulitovsky tooth sensitivity index (M±m), %

Таблица 4. Динамика показателей индекса сенситивности зубов Л.Ю. Ореховой – С.Б. Улитовского (M±m), %

Patient groups	Baseline	1 week	1 month	3 months	*p* 0–1 week	*p* 0–1 months	*p* 0–3 months
Control group	35.29±2.66	35.29±2.66	34.29±2.66	29.45±2.36	0.068	<0.001	<0.001
Comparison group	57.48±1.52	55.18±1.43	33.60±2.16	31.08±1.77	<0.001	<0.001	<0.001
Intervention group	59.29±1.01	55.87±0.83	28.26±0.68	22.10±0.49	0.116	<0.001	<0.001

Table 5. Dynamics of the deodorizing action index of S.B. Ulitovsky (2008) (M±m), points

Таблица 5. Динамика показателей индекса дезодорирующего действия С.Б. Улитовского (2008) (M±m), баллы

Patient groups	Before treatment	1 week	1 month	3 months	*p* 0–1 week	*p* 0–1 months	*p* 0–3 months
Control group	0.49±0.03	0.39±0.03	0.36±0.04	0.25±0.03	0.002	0.002	0.001
Comparison group	0.61±0.01	0.47±0.04	0.35±0.01	0.35±0.01	0.012	0.005	0.005
Intervention group	0.60±0.02	0.33±0.01	0.23±0.01	0.15±0.01	0.002	0.002	0.002

Table 6. Average indicators of changes in functional parameters of saliva over time

Таблица 6. Средние показатели изменнение функциональные параметры слюны в динамике

Monitoring period	Salivary functional parameters	Control group	Comparison group	Main group
Baseline values	pH	6.4±0.2	6.6±0.22	6.3±0.18
	Buffer capacity	5.3 ± 0.19^{ooo}	6.0±0.16	5.6±0.16
	Salivary secretion rate (mL/min)	0.3 ± 0.01^{o}	0.4±0.01	0.3 ± 0.01^{o}
After 6 months	pH	6.6±0.21	6.7±0.25	6.7±0.3
	Buffer capacity	5.6±0.16	6.1±0.19	6.01±0.22
	Salivary secretion rate (mL/min)	$0.4\pm0.004^{o*\Delta}$	0.5±0.01	$0.5\pm0.01^{\Delta}$
After 12 months	pH	6.8±0.17	6.7±0.23	7.2±0.3
	Buffer capacity	6.0±0.23	5.8±0.02	6.5 ± 0.21^{oo}
	Salivary secretion rate (mL/min)	$0.5\pm0.01^{o*\Delta}$	0.4±0.01	$0.7\pm0.01^{o\Delta}$
After 18 months	pH	7.0 ± 0.17^{ooo}	6.6±0.24	6.3±0.22
	Buffer capacity	6.4 ± 0.19^{oo}	$5.9\pm0.15^{***}$	$5.5\pm0.14^{\Delta\Delta}$
	Salivary secretion rate (mL/min)	$0.6\pm0.02^{o\Delta}$	$0.3\pm0.01^{\Delta\Delta}$	$0.3\pm0.01^{\Delta}$

Note: ○ Versus the control group (^{ooo} $p < 0.05$; ^{oo} $p < 0.01$; ^{o} $p < 0.001$); ✖ versus the main group (*** $p < 0.05$; ** $p < 0.01$; * $p < 0.001$); △ versus the comparison group ($^{\Delta\Delta\Delta}$ $p < 0.05$; $^{\Delta\Delta}$ $p < 0.01$; $^{\Delta}$ $p < 0.001$); the differences between arithmetic mean values were determined.

Примечание: ○ к контрольной группе (^{ooo} $p < 0,05$; ^{oo} $p < 0,01$; ^{o} $p < 0,001$); ✖ к основной группе (*** $p < 0,05$; ** $p < 0,01$; * $p < 0,001$); △ относительно группы сравнения ($^{\Delta\Delta\Delta}$ $p < 0,05$; $^{\Delta\Delta}$ $p < 0,01$; $^{\Delta}$ $p < 0,001$); определяется разница между средними арифметическими значениями.

The analysis of salivary functional parameters (pH, buffer capacity, salivary flow rate) and microbiological indicators (Streptococcus mutans, Lactobacillus) demonstrated dynamic changes across all study groups during the observation period. The most favorable outcomes were recorded in the main group, where the administration of additional local and systemic agents aimed at restoring oral normobiota contributed to a significant reduction in subclinical caries risk indicators (Tables 6, 7).

According to the study results, the increase in caries incidence was minimal in the main group. Over an 18-month period, 1.4 new cases of carious lesions were recorded, compared to a baseline of 0 cases. In the control group, an increase from 0 to 3.1 new cases was observed, while in the comparison group the number of new carious lesions increased to 4.3 cases (Fig. 1).

The effectiveness of preventive programs was assessed based on the reduction in the number of new caries cases across the study groups. The best outcome was achieved in the main group, where additional interventions aimed at restoring oral normobiota, as well as the use of moisturizing components in oral hygiene products, resulted in a 67% reduction in the incidence of new cases. In the comparison group, where standard preventive measures were applied, the reduction amounted to 28%, with a between-group difference of 39% (Fig. 2).

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In the comparison group, where standard preventive measures were applied, the reduction amounted to 28%, with a between-group difference of 39% (Fig. 2).

DISCUSSION

One of the currently relevant issues in dentistry is the association between oral diseases and COVID-19, including oral signs and symptoms such as taste disorders, nonspecific oral ulcers, desquamative gingivitis, petechiae, and coinfections such as candidiasis. The prevalence of these clinical manifestations remains insufficiently studied. Moreover, individuals with pre-existing dental conditions are considered a risk group for SARS-CoV-2 infection, and the spectrum of oral manifestations of COVID-19 remains of significant clinical interest.

Table 7. Average indicators of changes in the bacterial composition of saliva over time

Таблица 7. Средние показатели изменение бактериального состава слюны в динамике

Groups	Salivary bacterial composition	Baseline	6 months	12 months	18 months
Control group	Streptococcus mutans, $\times10^5$ КОЕ/мл	$15.00\pm0.64^{○✖}$	$10.00\pm0.36^{○△}$	$5.00\pm0.15^{○○△}$	$4.00\pm0.18^{○✖△△}$
	Lactobacillus, $\times10^3$ КОЕ/мл	$8.00\pm0.25^{○✖}$	$6.00\pm0.26^{○△△}$	$3.00\pm0.13^{△}$	$2.00\pm0.05^{○✖△}$
Comparison group	Streptococcus mutans, $\times10^5$ КОЕ/мл	8.00 ± 0.32	$7.00\pm0.17^{△△△}$	$6.00\pm0.2^{✖△△}$	$9.00\pm0.30^{△}$
	Lactobacillus, $\times10^3$ КОЕ/мл	5.00 ± 0.20	$4.00\pm0.13^{△△}$	$3.00\pm0.11^{✖△}$	$4.00\pm0.10^{△}$
Main group	Streptococcus mutans, $\times10^5$ КОЕ/мл	$20.00\pm0.62^{○}$	$8.01\pm0.24^{○○△}$	$2.00\pm0.07^{○△}$	$1.00\pm0.03^{○△}$
	Lactobacillus, $\times10^3$ КОЕ/мл	$100.00\pm2.33^{○}$	$50.00\pm1.14^{○△}$	$10.00\pm0.39^{○△}$	$5.00\pm0.12^{○△}$

Note: ○ Versus the control group ($^{○○○}$ $p < 0.05$; $^{○○}$ $p < 0.01$; $^{○}$ $p < 0.001$); ✖ versus the main group ($^{✖✖✖}$ $p < 0.05$; $^{✖✖}$ $p < 0.01$; $^{✖}$ $p < 0.001$); △ versus the comparison group ($^{△△△}$ $p < 0.05$; $^{△△}$ $p < 0.01$; $^{△}$ $p < 0.001$); the differences between arithmetic mean values were determined.

Примечание: ○ к контрольной группе ($^{○○○}$ $p < 0,05$; $^{○○}$ $p < 0,01$; $^{○}$ $p < 0,001$); ✖ к основной группе ($^{✖✖✖}$ $p < 0,05$; $^{✖✖}$ $p < 0,01$; $^{✖}$ $p < 0,001$); △ относительно группы сравнения ($^{△△△}$ $p < 0,05$; $^{△△}$ $p < 0,01$; $^{△}$ $p < 0,001$); определяется разница между средними арифметическими значениями.

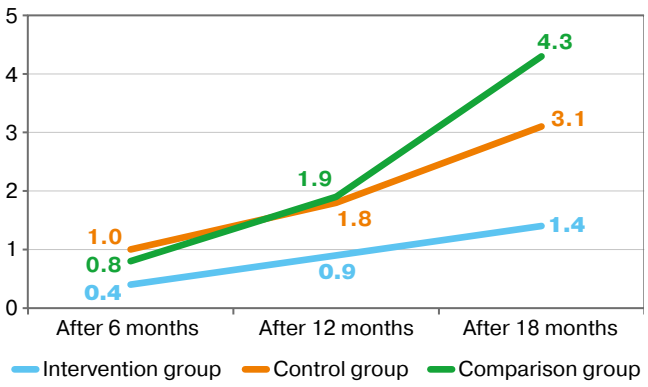

Fig. 1. Indicators of dental caries growth

Рис. 1. Показатели прироста кариеса зубов

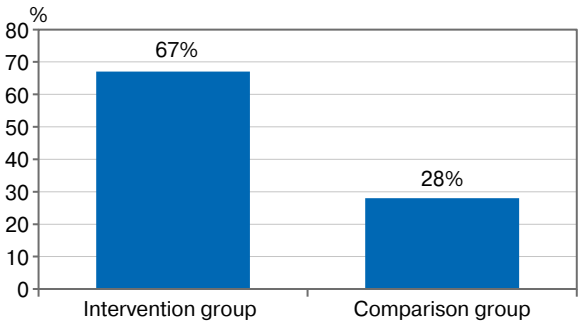

Fig. 2. Indicators of the effectiveness of the prevention method

Рис. 2. Показатели эффективности метода профилактики

Literature data suggest that the oral cavity represents a favorable environment for SARS-CoV-2 invasion due to the high expression of angiotensin-converting enzyme 2 (ACE2) receptors in tissues such as the respiratory tract, oral mucosa, tongue, and salivary glands. Oral manifestations, including taste loss, xerostomia, and mucosal lesions, are reported in approximately half of COVID-19 cases. However, it remains unclear whether SARS-CoV-2 can directly infect and replicate in oral tissues such as salivary glands or oral mucosa.

Taste disorders represent the most frequently reported oral symptom in patients with COVID-19, most likely resulting from local inflammatory responses triggered by rhinitis-associated mechanisms that may impair normal taste receptor function. In addition, oral mucosal lesions have been described during SARS-CoV-2 infection. Several recent studies have reported oral lesions associated with COVID-19, including ulcers, aphthae, and macular lesions, as well as exacerbation and progression of inflammatory periodontal diseases.

We conducted a comparative analysis of the dental status in patients who had recovered from COVID-19. The examined patients reported various complaints, including oral eruptions, defects, plaque formation, fissures in the oral cavity, and inflammation of periodontal tissues. No clear temporal distinction could be established regarding whether these pathological manifestations developed during the acute phase of COVID-19 or after recovery.

The majority of patients (115; 97%) primarily recovery, whereas 25 reported halitosis, which was associated with disturbances in taste and olfactory function. It should be noted that olfactory and taste dysfunctions may be absolute or relative. It is well known that COVID-19 leads to temporary disturbances in gustatory and olfactory perception. All patients reported recovery of taste at different time points after clinical % (30 patients) reported persistent reduction in olfactory function after recovery.

Periodontal diseases were present in 100% of cases. Depending on age and severity of the previous COVID-19 infection, clinical signs of gingivitis and periodontitis were observed. Oral hygiene status was unsatisfactory, with a significant accumulation of soft dental plaque as well as supra- and subgingival calculus. It may be assumed that the development or exacerbation of periodontal diseases is associated with antibiotic therapy and subsequent disruption of the oral microbiota balance, which indirectly contributes to increased caries incidence.

Thus, the obtained results demonstrate a wide range of oral manifestations in patients who have recovered from COVID-19. These findings justify the necessity of including dental examination in the long-term follow-up of this patient group, even after clinical recovery. The role of the dentist is to timely diagnose oral manifestations in post-COVID patients and to select an appropriate treatment algorithm depending on the clinical presentation. The question of preventive and therapeutic strategies aimed at preventing disease progression and complications remains open.

Even asymptomatic COVID-19 infection may lead to long-term adverse effects, including immune dysregulation or a predisposition to autoimmune processes, including those affecting the oral cavity. Periodontitis, as a chronic focus of infection and sensitization, has a direct impact on multiple body systems, contributing to the development and exacerbation of systemic diseases, including severe infectious conditions such as COVID-19. Within the peri-caries system, periodontitis may act as a triggering factor in caries progression.

In our study, the assessment of dental status in patients who had recovered from coronavirus infection revealed a high prevalence of periodontitis in young individuals, accompanied by a tendency toward decreased levels of interleukin-2 and interleukin-6, increased pathogenic microbiota, and reduced functional salivary parameters.

These changes in the oral health status of patients necessitate the implementation of comprehensive rehabilitation measures aimed at restoring physiological salivary parameters, oral normobiota, and local immune homeostasis within the oral cavity. The most effective approach was the combined use of a therapeutic complex, including an IMUNOFAN solution, the synbiotic agent Dentabalance Fresh, a periodontal gel containing bacteriophages (“Phagodent”), and R.O.C.S. PRO Moisturizing toothpaste as a daily oral hygiene product.

This multimodal regimen resulted in rapid resolution of the inflammatory process and ensured the most sustained maintenance of the achieved clinical effect, without the need for systemic pharmacotherapy. This approach consequently reduced overall medication burden and minimized potential systemic toxic effects in this patient cohort.

The applied therapeutic complex enabled effective control of periodontal inflammation, restoration of oral microbial balance and local immune function, as well as normalization of salivary physiological parameters. As a result, a reduction in caries incidence was observed among patients in this clinical group.

CONCLUSION

Thus, the developed diagnostic and treatment program for oral diseases in patients with a history of COVID-19 enabled the identification of caries risk through the assessment of local risk factors associated with dental caries development. It also allowed optimization of the recommended comprehensive therapeutic approach, improved treatment effectiveness in this patient population, and contributed to a more rational use of healthcare resources, thereby substantiating the social effectiveness of the study outcomes.

The implementation of an integrated approach aimed at restoring oral microbial balance demonstrated economic benefits. The individualized caries prevention strategy applied to post-COVID-19 patients reduced the incidence of new carious lesions by up to 45% compared to conventional preventive methods. As a result, an average of up to three carious lesions per patient were prevented, corresponding to estimated treatment cost savings of 15,000–30,000 RUB per patient.

Individual preventive programs in post-COVID-19 patients reduced the incidence of primary dental caries by 2.21-fold compared to standard prevention approaches not focused on oral normobiota restoration.

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