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THE STATE OF THE ANTIOXIDANT SYSTEM OF PROTECTION OF CHILDREN'S ORAL FLUID IN THE DYNAMICS OF TREATMENT OF ACUTE ODONTOGENIC PERIOSTITIS IN THE CONTEXT OF DIFFUSE NON-TOXIC GOITER

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Abstract

Introduction. The article investigates the effectiveness of treatment of acute odontogenic periostitis in children against the background of thyroid pathology that was analyzed based on the study of the state of the antioxidant system of oral fluid protection.
Materials and methods. To determine the effectiveness of the developed method of treatment of acute odontogenic periostitis in children suffering from diffuse non-toxic goiter, we treated and investigated the results in 38 children who made up two subgroups of observation: the main (IIIA) subgroup – 20 children with acute odontogenic periostitis against the background of diffuse non-toxic goiter, who were treated using the improved method and the comparison subgroup (IIIB) – 18 children with acute odontogenic periostitis against the background of diffuse non-toxic goiter, who were treated using the generally accepted method. Children of both groups were treated in accordance with the order of the Ministry of Health of Ukraine dated 27.08.04 No 426 «On approval of the Protocols for the provision of medical care to children in the specialty «Pediatric Surgical Dentistry». In addition to the generally accepted measures, children of the main group were prescribed «Imupret» and «Calcemin Advance» to normalize the main protective indicators of oral fluid. To assess the state of the antioxidant system of oral fluid protection, the following indicators were studied: diene conjugates, malonaldehyde, superoxide dismutase, reduced glutathione, glutathione transferase.
Results. Insufficiency of the antioxidant system of protection of children's oral fluid with an increase in the level of peroxidation was established, as evidenced by an increase in the level of malonaldehyde by 1.84 times ($p<0.05$), diene conjugates by 2.0 times ($p<0.05$) against the background of a decrease in catalase activity by 3.93 times ($p<0.05$), superoxide dismutase – by 85.42% ($p<0.05$). The functioning of the glutathione system is unbalanced and insufficient: a decrease in the activity of glutathione reductase by 49.02% ($p<0.05$), glutathione transferase – by 69.27% ($p<0.05$), an increase in the level of glutathione peroxidase activity by 73.29% ($p<0.05$), which leads to a decrease in the level of reduced glutathione by 4.76 times ($p<0.05$).
Conclusions. The obtained data indicate an incomplete restoration of the normal functioning of the prooxidant-antioxidant system of the oral cavity with a generally accepted method of treatment and testify in favor of an improved method of complex therapy.

Keywords: **children, acute odontogenic periostitis, diffuse non-toxic goiter, oral fluid**

INTRODUCTION

Inflammatory diseases in the maxillofacial area in children represent a major part of the work of an outpatient physician [1-3]. However, their diagnosis remains challenging. This is due to many circumstances: objective difficulties in examining children, especially young children, incorrect methodological approach and atypical course of the disease, which is more accurately interpreted today as a pathomorphosis of inflammatory processes. The analyzed statistical materials from various clinics indicate that the diagnosis of odontogenic inflammatory

processes in children, who make up from 60 to 80% of patients in hospitals, is incomplete. After all, from 20 to 50% of patients are sent to the hospital with an incorrect diagnosis [4-6]. About half of them have not had their temporary or permanent teeth extracted, which are sources of infection. Hospitalization is often delayed. All this significantly worsens the results of treatment and causes the transition of one form of inflammation to another. In addition, inflammatory processes in children often occur on a medically compromised background. Today, the problem of thyroid pathology, its impact on the health and intellectual development of the population, especially children, is extremely relevant. A number of regions of Ukraine, in particular Bukovyna, according to WHO criteria, are assessed as territories with a mild and moderate degree of iodine deficiency, which is the cause of the development of so-called iodine deficiency diseases. The leading of them is thyropathology [7]. This disease leads to many systemic changes, which necessitate the addition of correction of metabolic disorders at both the general and local levels as part of conventional treatments.

AIM

To analyze the effectiveness of treatment of acute odontogenic periostitis (AOP) in children against the background of thyroid pathology based on the study of the state of the antioxidant system of oral fluid protection.

MATERIALS AND METHODS

To determine the effectiveness of the developed method of treatment of AOP in children suffering from diffuse non-toxic goiter (DNG), we treated and investigated the results in 38 children who made up two subgroups of observation: the main (IIIA) subgroup – 20 children with AOP against the background of DNG, who were treated using the improved method and the comparison subgroup (IIIB) – 18 children with AOP against the background of DNG, who underwent treatment using the generally accepted method. Children of both groups were treated in accordance with the order of the Ministry of Health of Ukraine dated 27.08.04 No. 426 «On approval of the Protocols for the provision of medical care to children in the specialty «Pediatric Surgical Dentistry». In addition to the generally accepted measures, children of the main group were prescribed «Imupret» and «Calcemin Advance» to normalize the main protective indicators of oral fluid.

To assess the state of the antioxidant system of oral fluid protection, the following indicators were studied: diene conjugates (DC), malonaldehyde (MA), superoxide dismutase (SOD), reduced glutathione (GSN), glutathione transferase (GST).

Informed parental consent for data processing has been obtained.

The degree of reliability of the obtained results was statistically assessed in the case of normality of the distribution of both samples using the Student-Fisher criterion, in other cases – by the U-Wilkson criterion for independent samples and by the T-Wilkson criterion for dependent samples using the STATISTICA 6.1 program.

RESULTS AND DISCUSSION

Biochemical examination of children's oral fluid prior to treatment revealed the same level of changes in children of the observation subgroups (Table 1).

Table 1

Indicators of the Prooxidant-Antioxidant System of the Oral Fluid of Children by Observation Subgroups Before Treatment

Indicator	Main Subgroup	Comparison subgroup	R
DK (nmol/mg protein)	1.41±0.09	1.39±0.08	>0.05
MA (μmol/mg protein)	271.23±13.14	263.18±15.22	>0.05
catalase activity, (μmol/min^{cmg} protein)	2.16±0.13	2.15±0.11	>0.05
SOD activity, (U/min^{xmg} protein)	0.47±0.03	0.48±0.02	>0.05
HSgroup (nmol/mL)	61.87±5.17	69.35±5.31	>0.05
GSN (pmol/L)	27.84±2.15	29.32±1.78	>0.05
GST (nmol/min×mg protein)	26.03±1.23	27.12±1.65	>0.05
GP (nmol/min×mg protein)	1054.91±66.07	1010.84±87.14	>0.05
GR (nmol/min×mg protein)	10.61±0.73	10.35±1.02	>0.05

All indicators after the therapeutic correction showed a positive trend, but some indicators remained significantly different from the control data.

In particular, the level of DC and MA in the children of the main subgroup and the comparison subgroup normalized and was within the reference values, but the values in the examined IIIA subgroup were more positive (Fig. 1).

As for the activity of the main antioxidant enzymes of the oral fluid, catalase and SOD, they also restored their activity (Fig. 3, 4).

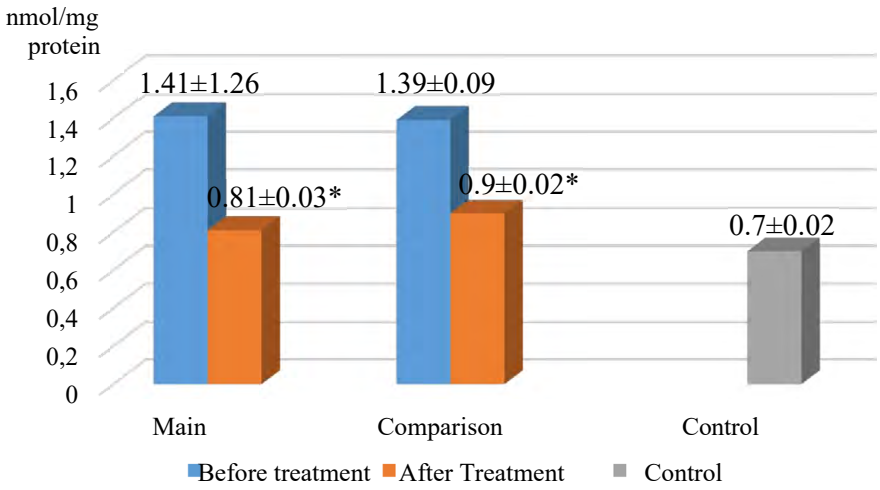

Figure 1. Level of diene conjugates in the oral fluid of children of observation subgroups in the dynamics of treatment, M±m.

Note* – probable difference between indicators before and after treatment, p<0.05.

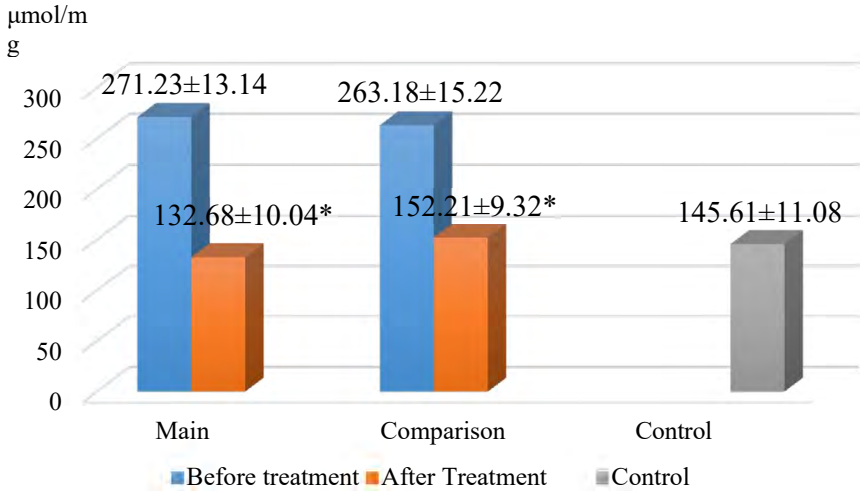

Figure 2. The level of malonaldehyde in the oral fluid of children of observation subgroups in the dynamics of treatment, M±m.

Note* – probable difference between indicators before and after treatment, p<0.05.

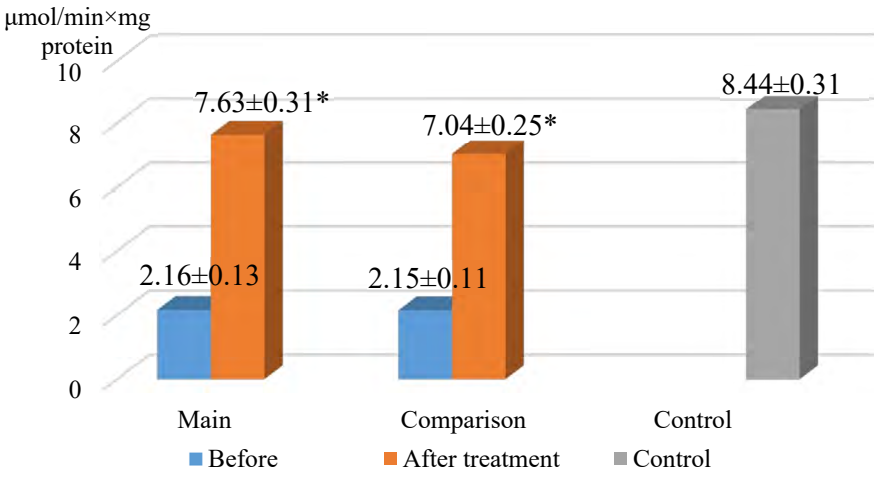

Figure 3. Level of catalase activity in the oral fluid of children of observation subgroups in the dynamics of treatment, M±m.

Note* – probable difference between indicators before and after treatment, p<0.05.

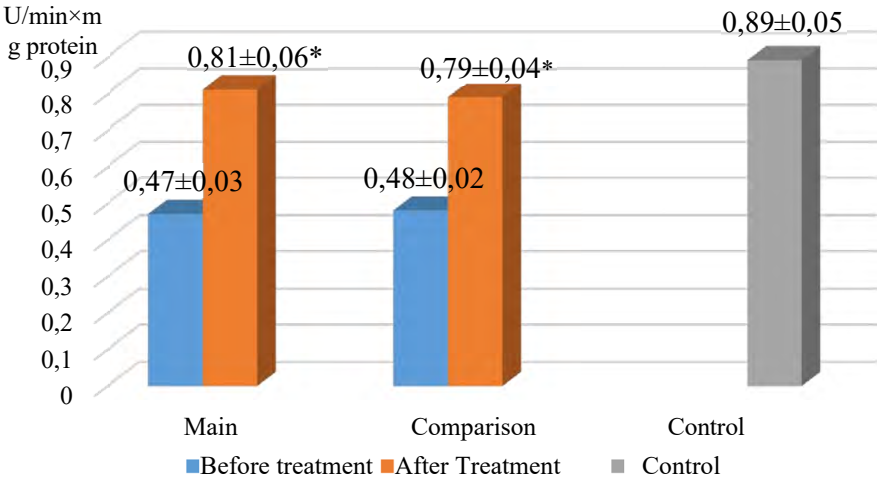

Figure 4. Level of superoxide dismutase activity in the oral fluid of children of observation subgroups in the dynamics of treatment, M±m.

Note* – probable difference between indicators before and after treatment, p<0.05.

The glutathione system was characterized by normalization of the activity of its key enzymes in both subgroups of observation. However, according to some indicators, there was a tendency towards more positive changes in the children of the main subgroup (Table 2).

Table 2

Oral Fluid Glutathione System of Children by Observation Subgroups in Dynamics of Treatment

Indicator	Before treatment		After treatment	
	Main	comparison	Main	comparison
HSgroup (nmol/mL)	61.87±5.17	69.35±5.31	156.32±7.50*	130.11±9.24*
GSH (pmol/L)	27.84±2.15	29.32±1.78	131.57±2.31*	99.45±6.03*
GST (nmol/min×mg protein)	26.03±1.23	27.12±1.65	84.18±1.50*	81.66±1.70*
GP (nmol/min×mg protein)	1054,91±66,07	1010.84±87.14	612.41±10.09*	686.91±15.63*
GR (nmol/min×mg protein)	10.61±0.73	10.35±1.02	22.41±1.65*	19.03±1.04*

Note* – probable difference between indicators before and after treatment, p<0.05.

The exception was the activity of the GP – the enzyme resumes its functioning to the level of control values. This indicates the absence of a specific role of this enzyme in the protective mechanisms of the oral cavity.

Thus, the state of FRO and AODS in the children of the main subgroup at the end of the course of treatment was identical to the control one, while in the children of the comparison subgroup was significantly worse and significantly differed from the control data.

CONCLUSIONS

The obtained data indicate an incomplete restoration of the normal functioning of the prooxidant-antioxidant system of the oral cavity with a generally accepted method of treatment and testify in favor of an improved method of complex therapy.

Prospects for further research. Prospects for further research are the development and improvement of new methods of dental care of children in the context of diffuse non-toxic goiter.

FUNDING AND CONFLICT OF INTEREST

The article is self-funded. The authors declare no conflict of interest.

COMPLIANCE WITH ETHICAL REQUIREMENTS

In line with confidentiality regulations, all data was collected anonymously and processed in accordance with applicable data protection standards (Conclusion of the Biomedical Ethics Committee of Bukovinian State Medical University, Protocol No. 2 dated October 20, 2022). All information was utilized solely within the context of this study and was provided in an aggregated form for results analysis. Before the study commenced, the parents or legal guardians of all participants were provided with detailed information regarding the objectives, procedures, potential risks, and benefits of participation. Participation was entirely voluntary. Written informed consent was obtained from the parents or legal guardians prior to the initiation of data collection. Participants retained the right to withdraw from the study at any time without providing justification. The study was

conducted in accordance with the ethical principles of the Declaration of Helsinki.

AUTHOR CONTRIBUTIONS

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Резюме

СТАН АНТИОКСИДАНТНОЇ СИСТЕМИ ЗАХИСТУ РОТОВОЇ РІДИНИ ДІТЕЙ У ДИНАМІЦІ ЛІКУВАННЯ ГОСТРОГО ОДОНТОГЕННОГО ПЕРІОСТИТУ НА ТЛІ ДИФУЗНОГО НЕТОКСИЧНОГО ЗОБУ

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Вступ. У статті проаналізували ефективність лікування гострого одонтогенного періоститу в дітей на тлі патології щитоподібної залози на основі вивчення стану антиоксидантної системи захисту ротової рідини.
Матеріали та методи. Для встановлення ефективності розробленого методу лікування ГОП у дітей, які страждають на дифузний нетоксичний зоб, нами було проліковано та досліджено результати у 38 дітей, які склали дві підгрупи спостереження: основна (ІІІА) підгрупа – 20 дітей, хворих на гострий одонтогенний періостит на тлі дифузного нетоксичного зобу, яким застосовували удосконалений метод та підгрупа порівняння (ІІІБ) – 18 дітей, хворих на гострий одонтогенний періостит на тлі дифузного нетоксичного зобу, яким застосовували загальноприйнятий метод. Дітям обох груп проводили лікування згідно з наказом МОЗ України від 27.08.04 № 426 «Про затвердження Протоколів надання медичної допомоги дітям за спеціальністю «Дитяча хірургічна стоматологія». Дітям основної групи додатково до загальноприйнятих заходів призначали засоби «Імупрет» і «Кальцемін адванс» задля нормалізації основних захисних показників ротової рідини. Для оцінки стану антиоксидантної системи захисту ротової рідини проводили дослідження таких показників: дієнові кон'югати, малоновий альдегід, супероксиддисмутаза, відновлений глутатіон, глутатіонтрансфераза.
Результати. Встановлено недостатність антиоксидантної системи захисту ротової рідини дітей при підвищенні рівня пероксидації, підвердженням чого є зростання рівня малонового альдегіду в 1,84 рази ($p<0,05$), дієнових кон'югатів у 2,0 рази ($p<0,05$) на тлі падіння активності каталази в 3,93 рази ($p<0,05$), супероксиддисмутази – на 85,42% ($p<0,05$). Функціонування глутатіонової системи є розбалансованим та недостатнім: зниження активності глутатіонредуктази на 49,02% ($p<0,05$), глутатіонтрансферази – на 69,27% ($p<0,05$), підвищення рівня активності глутатіопероксидази на 73,29% ($p<0,05$), що призводить до падіння рівня відновленого глутатіону в 4,76 рази ($p<0,05$).
Висновки. Отримані дані свідчать про неповне відновлення нормального функціонування прооксидантно-антиоксидантної системи порожнини рота при загальноприйнятому методі лікування та свідчать на користь удосконалення методу комплексної терапії.

Ключові слова: **діти, гострий одонтогенний періостит, дифузний нетоксичний зоб, ротова рідина**

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