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ABSTRACT

of the dissertation for the degree of Doctor of Philosophy

**EFFICIENCY OF OZONE THERAPY IN TREATMENT
OF PERIODONTAL TISSUES IN CHILDREN WITH TYPE I
DIABETES MELLITUS**

Speciality: 3226.01 – Dentistry

Field of science: Medicine

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GENERAL CHARACTERISTICS OF THE WORK

Relevance of the topic. Diabetes is at the forefront of countries' national healthcare priority programs across the world. According to the latest estimates of the International Diabetes Federation, more than 463 million people are currently suffering from diabetes worldwide and this figure is expected to exceed 700 million by 2045¹. As in the rest of the world, the number of people with diabetes in Azerbaijan continues to increase: According to the Azerbaijan Diabetes Society, more than 200,000 people officially registered in Azerbaijan suffer from diabetes, unofficial number is estimated to be close to 400,000. Despite numerous studies, progressive increase in diabetes mellitus among children has been reported, with a higher incidence of severe form of the illness which is insulin-dependent (type 1) diabetes².

Disorders of metabolism in tissues during diabetes and the occurrence of trophic changes have a significant impact on the oral environment³. Many local and foreign researchers claim that diabetes is the leading cause of periodontal disease, which increases the severity and severity of periodontal disease⁴. Along with diabetes, vascular disorders in the gums, changes in the oral microflora, a decrease in collagen production and an increase in collagenase activity lead to an increase in inflammation in the gums. In patients with diabetes, it is difficult to stop the infection if tooth and gum infections are not prevented in the early stages. Along with the unpleasant odor and pain, the patient has trouble chewing in the oral cavity due to tooth loss, leading to gastroenteric complaints.

¹ *IDF Diabetes Atlas, 9th Edition, 2019.* – 168 p.

² *Öztürk, Ö. Çocukluk çağında diyabet // Türkiye Klinikleri Internal Medicine Nursing-Special Topics,* – 2015. 1. – №. 3. – s. 31-37.

³ *Wolf, D., Lalla, E. The influence of periodontal disease on glycemic control in diabetes // Diabetes Mellitus and Oral Health: An Interprofessional Approach,* – 2014. – p. 143-155.

⁴ *Şahbazov, K.B. Şəkərli diabet xəstələrində parodontun iltihabının klinik gedişatının xüsusiyyətləri və müalicə prinsipləri: / tibb üzrə fəlsəfə doktoru diss. avtoreferatı / – Bakı,* – 2012. – s. 23-24.

Most studies in recent years have noted that parodont diseases are one of the most common diseases in dentistry⁵. Given that without proper correction this pathology causes 5 times more tooth loss than caries complications, it is important to speak about the dangers of a process that can reduce the quality of life of patients and promote the development of other diseases⁶. Even in 1997, the American Diabetes Association declared periodontopathy the 6th complication of diabetes after, retinopathy, nephropathy, neuropathy, macroangiopathy and microangiopathy⁷.

Existing data from conducted studies do not indicate how to use more effective methods for the prevention and treatment of periodontal diseases in children with diabetes. Therefore, there is a need for a research to provide a modern, effective and better solutions for treatment of periodontal disease in children with diabetes, and the results of these studies should be presented and analyzed in detail. On the other hand, given the ever-expanding arsenal of therapeutic precursors used in parodontology and the importance of medication therapy in the treatment of parodontitis, the search for new drugs continues to be relevant⁸. Looking at the recent studies, it can be seen that ozone therapy has been shown to be one of the most effective methods in the treatment and prevention of a number of diseases. Local use has seen bactericidal, fungicidal, and antibacterial effects on ozone, and besides a number of authors point to improved local blood circulation and rapid healing of wounds caused by ozone⁹. According

⁵*Darveau, R.P.* Periodontitis: a polymicrobial disruption of host homeostasis // *Nature Reviews Microbiology*, – 2010. 8 (7), – p. 481.

⁶*Pérez Luzardo, B.* Periodontitis agresiva: Clasificación, características clínicas y etiopatogenia // *Acta Odontológica Venezolana*, – 2009. 3, – p. 153-160.

⁷*Saini, R., Saini, S., Sugandha, R.S.* Periodontal disease: The sixth complication of diabetes // *Journal of Family and Community Medicine*, – 2011. 18. – p. 31.

⁸*Məmmədov, F.Y., Orucov, Ə.V., Nəsirova, X.B.* Parodontopatologiyaların müalicə və profilaktikasında apipreprepatların tətbiqinin effektivliyi // – *Bakı: Azərbaycan Tibb jurnalı*, – 2013. 2, – s. 40-43.

⁹*Hayakumo, S.* Clinical and microbiological effects of ozone nano-bubble water irrigation as an adjunct to mechanical subgingival debridement in periodontitis patients in a randomized controlled trial / Hayakumo, S., Arakawa, S., Mano, Y. [et al.] // *Clinical oral investigations*, – 2013. 17 (2), – p. 379-388.

to the several authors, the use of ozone therapy in the form of monotherapy is similar to that of antibiotics . However, when using antibiotics, parodontal pockets form microflora that is resistant to them, causing allergic reactions to these drugs. Unlike antibiotic therapy, ozone is characterized by a broader range of therapeutic effects and does not result in the formation of drug resistant strains¹⁰. In the local use of ozone (ozone oils and solutions), its anti-inflammatory effects in the treatment of gingivitis and parodontitis are manifested by objective diagnostic criteria¹¹.

Ozone's use in parodontology is explained by the fact that its physical-chemical and biological properties create bactericidal, antihypoxic, disintoxication, immunocorrective effects, and lack of carcinogenic properties. The goals of ozone treatment are: reduction of pathogens, restoration of oxygen metabolism, creation of an ecological environment, acceleration of circulation, stimulation of the humoral antioxidant system, activation of immunity.

Considering the effectiveness of ozone therapy in various fields of medicine and especially in dentistry, it was decided to conduct a study to study the prospects for the use of ozone therapy for the treatment of oral diseases in children with diabetes.

Object of the research: children with diabetes mellitus type 1 and their periodontal tissues.

The purpose of the research – to study the effectiveness of ozonated olive oil in the treatment and prevention of dental diseases in children with diabetes mellitus type 1, and to justify the effectiveness of ozone therapy.

Research objectives:

1. To study the clinical condition of the oral cavity in children with diabetes during periodontal disease.
2. To study the frequency of occurrence of periodontal disease

¹⁰*Thanomsub, B.* Effects of ozone treatment on cell growth and ultrastructural changes in bacteria / *Thanomsub, B., Anupunpisit, V., Chanphetch, S. [et al.] // The Journal of general and applied microbiology. – 2002. 48 (4). – p. 193-199.*

¹¹*Srikanth, A., Sathish M., Harsha A.V.S.* Application of ozone in the treatment of periodontal disease // *Journal of pharmacy & bioallied sciences, – 2013. 5, – Suppl 1, – p. 89.*

in children with diabetes mellitus type 1 depending on the duration of the underlying disease and age-sex indicators.

3. To study the microflora of the gingival sulcus in children with diabetes mellitus type 1;
4. To study the microflora of the outer pockets in children with diabetes mellitus type 1 who have inflammation of the parodontic tissues during treatment with ozonated olive oil and Metrogyl denta gel.
5. To study the clinical, laboratory and functional indicators of periodontal disease in children with diabetes mellitus type 1 in the dynamics before and after treatment with ozonated olive oil.
6. To substantiate the effectiveness of the use of ozonated olive oil in the treatment and prevention of periodontal disease in children with diabetes mellitus type 1.

Research methods: anemnestic, clinical-laboratory and microbiology research methods were used.

Main thesis of dissertation for defense:

1. Since children with diabetes mellitus type 1 are at risk for the occurrence of periodontal disease and because of the periodic repetition for the treatment and prevention of this disease, the use of ozone oil in the treatment and prevention of periodontal diseases is more appropriate.

2. The same results were obtained in clinical and microbiological study of the results of the treatment with the traditional method and the treatment with ozonized olive oil in children with diabetes mellitus type 1.

3. The use of ozonated olive oil in the treatment of periodontal disease in children with diabetes mellitus type 1 did not appear to have any additional effects, and resulted in a significant reduction in inflammation of the parodont tissues against the improvement of clinical indexes and microflora of dental pockets.

Scientific novelty:

- The effects of ozone therapy are investigated in the treatment of these diseases in children with diabetes mellitus type 1 with acute catarrhal gingivitis and chronic catarrhal gingivitis

diseases in the parodont tissues.

– The use of ozone therapy in the treatment of periodontal disease in children with diabetes mellitus type 1 has been scientifically justified and the clinical efficacy of this method has been established.

– The effects of ozonated olive oil and Metrogyl denta for the treatment and prevention of acute catarrhal gingivitis and chronic catarrhal gingivitis in children with diabetes mellitus type 1 have been compared.

Practical significance of the research. The appropriateness of the use of ozonated olive oil in the treatment and prevention of acute catarrhal gingivitis and chronic catarrhal gingivitis in children with diabetes mellitus type 1 mellitus was determined on the basis of clinical and microbiological studies. The use of ozonated olive oil in the complex treatment of acute catarrhal gingivitis and chronic catarrhal gingivitis in children with diabetes mellitus type 1, combined with the high clinical effect of treatment, eliminates the drug overload of patients.

Because of the lack of side effects compared with the Metrogyl denta drug (with no microbial sensitivity and the risk of dysbacteriosis), the use of ozone-rich olive oil as an effective drug is recommended for widespread use in diabetes mellitus type 1.

Approbation. The initial discussion of the dissertation was held at a joint meeting with the participation of the Department of Pediatric Dentistry and other dental departments of the Azerbaijan Medical University (27.12.2018, protocol № 04). The results of the study as well were reported and discussed at the scientific seminar of the Dissertation Council ED 2.05 operating at Azerbaijan Medical University (19.04.2021, protocol № 02).

Introduction of outcomes of the research. Ozonated olive oil was used in the treatment and prevention of periodontal disease in children with diabetes mellitus type 1 receiving inpatient treatment in the Endocrinology department of the Children's Clinical Hospital No. 6 in Baku.

The results of scientific research are also used in the teaching process at the Department of Pediatric Dentistry of the Azerbaijan

Medical University and in the treatment and prevention of periodontal diseases in children at the Educational Dental Clinic of the Azerbaijan Medical University.

The name of the organization where the dissertation has been accomplished. The dissertation was completed at the Department of Pediatric Dentistry of Azerbaijan Medical University.

Publications. Based on the materials of the dissertation, 12 scientific works reflecting the main content of the work, including 5 articles and 2 theses were published local, of which 3 articles and 2 thesis were published abroad.

Volume and the structure of the dissertation. The dissertation consists of 137 computer pages, (200396 symbols) including an introduction (5.5 pages, 10775 symbols), a literature review (38 pages, 79133 symbols), research materials and methods (21 pages, 30118 symbols), the results of own research (33 pages, 41992 symbols), conclusion (12 pages, 27270 symbols), findings (2 pages, 3519 symbols), practical recommendations (1 page, 1215 symbols) and a list of references (20 pages). The dissertation is visualized with 20 tables, 11 figures, 3 graphs and 3 schemes. The list of references covers 188 sources. 10 of them are in Azerbaijani and 178 in foreign languages.

RESEARCH MATERIALS AND METHODS

During the course of the research, the Endocrinology department of Children's Clinical Hospital No. 6 in Baku city examined the oral cavity of children with diabetes mellitus type 1 mellitus who received inpatient treatment from 2013 to 2017 and living in Baku, as well as in other cities and regions of the Republic of Azerbaijan. The parents of the children involved in the research were explained why these examinations were conducted and their consent was obtained. Since the basic principles of ozone therapy, the choice of concentration according to age and disease, the rules and procedures for the introduction and application of ozone therapy are reflected in the Madrid Declaration of 4 July 2010, we used the main criteria and arguments of the Madrid Declaration and the AAOT (American

Academy of Ozone therapy) in our research¹².

79 (46 girls, 33 boys) children aged 7-17, who had been suffering from diabetes mellitus for 1-12 years, participated in the examinations. The diagnosis of diabetes mellitus type 1 in children was made by an endocrinologist at the endocrinology department of the Children's Clinical Hospital No. 6 in Baku as a result of laboratory tests involving biochemical analysis of blood by determining general analysis of the blood, analysis of the urine and the level of glucose in the blood. All children with diabetes mellitus type 1 were treated in hospital with a diagnosis of decompensated diabetes mellitus. After assessing periodontal status in children with diabetes mellitus type 1 mellitus by indices, acute catarrhal gingivitis was revealed in 20 of them, chronic catarrhal gingivitis in 43 of them, and no pathology was found in the periodontal tissues of 16 of them. According to the biochemical findings in the medical records of the patients we examined, the average HbA1C level in these children was 9.6%, and the majority of hospitalized children with diabetes mellitus type 1 mellitus have a stage of decompensated diabetes.

According to the results of the examination, no pathology was observed in the periodontal tissues of 16 out of 79 children with diabetes mellitus type 1. Catarrhal gingivitis was found in the periodontal tissues of 63 people. We selected 16 people as a control group and included 63 people in the treatment group. In 16 children with diabetes mellitus type 1, we did not provide treatment, but only included them in the comparison groups during microbiological studies.

In order to study the periodontal tissues of children with diabetes mellitus type 1, first of all, anamnesis was collected by learning the complaints of patients, visual inspection of the oral cavity and assessment of the periodontal status with indices was carried out. When collecting the anamnesis, the duration of the disease and

¹²*Schwartz-Tapia, A.* Madrid Declaration on Ozone Therapy / *Schwartz-Tapia, A., Martínez-Sánchez, G., Sabah, F.* – Madrid: ISCO3 (International Scientific Committee of Ozone Therapy), – 2015. – p. 2015-2020.

whether the patient received regular treatment were examined.

After collecting the anamnesis, visual inspection of children with diabetes mellitus type 1 was carried out. In this case, attention was paid to their appearance, the condition of the skin, their moisture, color and the presence of pathological elements.

We included patients with more acute and severe symptoms with acute catarrhal gingivitis (ACG) and patients with relatively less pronounced symptoms with chronic catarrhal gingivitis (CCG). In contrast to children with diabetes mellitus type 1 with CCG, deformity of the gums and bleeding of the gums during palpation were observed in children with diabetes mellitus type 1. According to the recommendations, treatment-and-prophylactic measures were implemented in accordance with the first level of improved dental care for all patients.

A number of indices were used to objectively assess oral hygiene in children with diabetes type 1, to study the degree of formation plaque and calculus and the need for treatment, and to evaluate the outcome of treatment: Gingivitis Index (Loe Silness, 1963, 1967]; Papillary Bleeding index (PBI, Saher Muhleman 1975); Complex periodontal index (CPI); periodontal-marginal-alveolar index (PMA, Massler and Sehour, 1949, Parma, 1960).

Since one of the main issues facing our research is a comparative study of the effectiveness of ozonated olive oil and Metrogyl denta in the treatment of periodontal disease in children with diabetes mellitus type 1, special attention was paid to clinical examinations and microbiological studies.

The studied patients were divided into two groups. The first group included patients treated with ozonated olive oil. The second group included patients treated with “Metrogyl denta ointment”. Both treatment groups were divided into 2 subgroups: children with diabetes mellitus type 1 diagnosed with ACG and children with diabetes mellitus type 1 diagnosed with CCG. The group to be treated with ozone therapy included 31 children, 10 of them were diagnosed with ACG, 21 with CCG, and 32 children were included in the Metrogyl denta group, 10 of them were diagnosed with acute catarrhal gingivitis and 22 with chronic catarrhal gingivitis.

Metrogyl denta is a gel for the gums and is transparent white. Manufactured by the Indian company Unik Pharmaceutical Laboratory, 1 gram of this gel contains 10 mg of metronidazole equivalent to the active ingredient Metronidazole-Benzoate, 0.5 mg of chlorhexidine gluconate (in the form of 20% chlorhexidine gluconate). Sodium edetate, menthol, sodium saccharin, propylene glycol, carbomer-940, distilled water were used as excipients.

As a pharmacotherapeutic group, this drug, which belongs to the group of antimicrobial and antiprotozoal drugs, is recommended for use in the treatment and prevention of infectious and inflammatory diseases of the oral cavity. Complications of chlorhexidine gluconate such as mucosal desquamation, cytotoxic effects on fibroblasts, changes in tooth color and taste perception require extreme caution in patients with diabetes.

In addition, because metronidazole is an antibiotic, it can cause imbalances in the oral cavity, destroying significant microflora as well as pathogenic microflora in the oral environment.

The drug we use during the ozone therapy is manufactured in Turkey and can be purchased at any pharmacy.

For microbiological research, material (gum fluid) was taken from the gingival sulcus of patients with diabetes mellitus type 1 with a sterile absorber (№ 30), then placed in a sterile container, sealed and sent to the microbiological laboratory for 2 hours.

The collection of materials was carried out before breakfast and before brushing teeth. The obtained material was delivered to the laboratory of the Department of Microbiology and Immunology of Azerbaijan Medical University within 1-2 hours and submitted for research.

Statistical processing of results. All figures obtained as a result of the research were implemented in Excel using the standard software packages Statistica version 6.0 (USA). Mean value (M), standard error (m) and standard deviation (σ) were calculated. Mean values are presented in the form $M \pm m$. The parametric criterion t-Student and the non-parametric criterion Mann-Whitney U-test were used for comparisons.

RESEARCH RESULTS AND THEIR DISCUSSION

When statistically examining the results of the current research, we divided our patients into groups by age and sex during the analysis of clinical indices. Analysis of the initial examination of children with diabetes mellitus type 1 by age and sex shows that the number of children with catarrhal gingivitis in periodontal tissues is higher than in healthy children, and the number of children with inflammatory processes in periodontal tissues increases with age¹³.

Among 43 children diagnosed with acute catarrhal gingivitis, 39.5% were boys and 60.5% were girls. On average, the clinical index was 0.58 ± 0.05 (GI) in boys and 0.68 ± 0.05 (GI) in girls, 0.60 ± 0.05 (PBI) in boys, and 0.63 ± 0.04 in girls, 0.74 ± 0.05 (CPI) in boys and 0.76 ± 0.04 (CPI) in girls, 23.32 ± 0.39 (PMA) in boys and 23.54 ± 0.30 (PMA) in girls. We see that the clinical index is lower in boys with chronic catarrhal gingivitis than in girls while in all other indicators the clinical index of girls predominated. As can be seen, girls predominate among children with diabetes mellitus type 1 diagnosed with chronic catarrhal gingivitis, and on the other hand, the average clinical performance of girls is higher than that of boys ($p < 0.01$).

Looking at the results of examination of children with diabetes mellitus type 1 mellitus with chronic catarrhal gingivitis found in periodontal tissues, chronic catarrhal gingivitis was found in 10 people in the age group of 7-11 years, and only 24 children in the age group of 12-17 years. The 12-17 age group is in the leading position among other age groups, and the number of children in this group differs sharply from other groups. Among children with chronic catarrhal gingivitis diabetes mellitus type 1, the number of children in the 12-17 age group is $55.8 \pm 7.60\%$ and this figure was 2 times

¹³*Зейналова, Г.К., Нагиева, С.А.* Состояние тканей пародонта у детей страдающих сахарным диабетом // – Вакі: Qafqazın stomatoloji yenilikləri, – 2000. № 4, – s. 40-41.

higher than other groups¹⁴.

When we look at the clinical indices of 31 children with diabetes mellitus type 1 mellitus with catarrhal gingivitis in periodontal tissues included in the ozone therapy group, it is impossible not to see the difference between the results. If the GI was 0.85 ± 0.07 before treatment, it decreased after treatment to 0.72 ± 0.07 , if the PBI index was 0.88 ± 0.07 before ozone therapy, after treatment it was 0.72 ± 0.07 , the CPI index was 0.95 ± 0.07 before treatment, but decreased after treatment and was 0.81 ± 0.07 . The mean PMA index was $26.43 \pm 1.14\%$ before treatment and decreased to $24.71 \pm 1.14\%$ after treatment. When studying the results of treatment with Metrogil denta, the similarities between the figures obtained during the results of ozone therapy are not overlooked. Thus, if the GI index values was 1.01 ± 0.07 before treatment, 0.88 ± 0.07 after treatment, if the PBI index was 0.96 ± 0.07 before treatment with Metrogil denta, after treatment decreased by 0.81 ± 0.07 , while the CPI index values were expressed as 1.06 ± 0.06 before treatment, the mean index after treatment was 0.90 ± 0.06 , and PMA index values were $28.12 \pm 0.85\%$ before treatment and decreased to $26.32 \pm 0.85\%$ after treatment¹⁵ (table 1).

While investigating the relationship between the inflammation of the parodont tissues of children with diabetes mellitus type 1 from 20 people who were in our research and had parenchymal tissue in the parenchyma, we encountered a number of different findings. The highest number of children falls in the group with a disease duration of 1-2 years, with the figure being 8 which is $40 \pm 10.9\%$, the largest among groups. The other 2 groups (diagnosed with disease less than 1 year and those diagnosed with 3-4 years) were $20 \pm 8.9\%$ (4 in each group).

¹⁴Nağiyeva, S.A. I tip şəkərli diabeti olan uşaqlarda kəskin və xronik gingivitlərin rastgəlmə tezlikləri // “Təbabətin aktual problemləri” mövzusunda elmi-praktik konfransın materialları, – Bakı, – 2018. – s. 106.

¹⁵Нагиева, С.А. Показатели клинических стоматологических индексов у детей с катаральным гингивитом на фоне сахарного диабета 1 типа в Азербайджане // – Иркутск: Сибирский Медицинский Журнал, – 2019. № 1, – с. 21-24.

Table 1

Pre-treatment and post-treatment status of clinical indices of patients in ozone therapy and Metrogil denta groups

Treatment groups	abs.	GI		PBI		CPI		PMA	
		before	after	before	after	before	after	before	after
Ozonate d oil	31	0.85± 0.07	0.72± 0.07	0.88± 0.07	0.72± 0.07	0.95± 0.07	0.81± 0.07	26.4± 1.14	24.71± 1.14
T			1.4		1.8		1.5		0.2
P			>0.05		>0.05		>0.05		>0.05
Metrogil denta	32	1.01± 0.07	0.88± 0.07	0.96± 0.07	0.81± 0.07	1.06± 0.06	0.90± 0.06	28.12± 0.85	26.32± 0.85
T			1.4		1.7		2.5		1.5
p			>0.05		>0.05		<0.05		>0.05

Only in the group with a disease duration of 5-6 years we encounter the lowest rate: 15±8.0% (3 people). When we look at the results, we see that there is no evidence of acute catarrhal gingivitis in the group who were diagnosed with disease more than 7 years. In 1 person we see high rates, but the duration of the disease was unknown, so in the unknown group it was found: GI – 1.99 ± 0.00; PBI – 1.99±0.00; CPI – 1.71±0.00; PMA – 41.12±0.00%. According to the results of clinical examinations, the lowest rate was observed in the group of children with acute catarrhal gingivitis with a diabetes duration of less than 1 year: GI – 1.36±0.07; PBI – 1.38±0.12; CPI – 1.40±0.02; PMA – 29.73±0.45%.

To compare the microflora of the gingival sulcus in children with type 1 diabetes mellitus with inflammation of the periodontal tissues and the absence of inflammatory processes in the periodontal tissues, we cultivated the gingival fluid obtained from the gingival sulcus in the laboratory.

When we compare the microflora of the gingival sulcus of children with diabetes mellitus type 1 with a diagnosis of catarrhal gingivitis of the periodontal tissues and no inflammatory processes in the periodontal tissues, we see that the types of microflora we studied were found in both groups. But we can see a big difference between

the microbial colonies. Thus, the number of microbial colonies in gingival sulcus of children with diabetes mellitus type 1 diagnosed with catarrhal gingivitis has majority (2, sometimes 3 times) than the number of microbial colonies in gingival sulcus of children with diabetes mellitus type 1 with a healthy periodontium¹⁶ (chart 1).

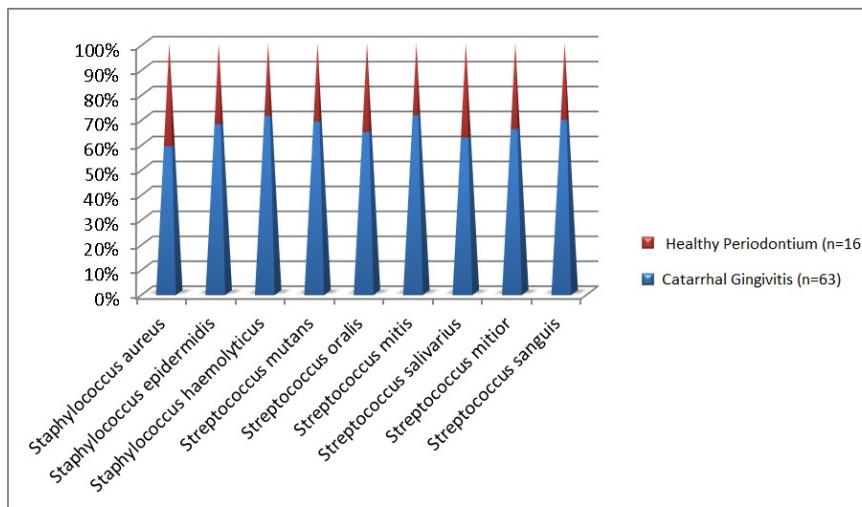


Chart 1. Catarrhal gingivitis of periodontal tissues and the type composition of bacteria studied in the gums of children with diabetes mellitus type 1 without inflammation in periodontal tissues

On the chart, the blue parts of the pyramids represent the percentage of microbial colonies in the gingival sulcus of children with diabetes mellitus type 1 with catarrhal gingivitis in the periodontal tissues, and the red parts of the pyramids in children with diabetes mellitus type 1 without pathological processes in the periodontal tissues. The number of microbial colonies is indicated as a percentage.

¹⁶Əliyeva, R.Q., Nağıyeva, S.A. I tip şəkərli diabeti olan uşaqlarda parodont xəstəliklərinin müalicəsində ozonlaşdırılmış zeytun yağının istifadəsinin öyrənilməsi // – Bakı: Qafqazın stomatoloji yenilikləri, – 2017. № 24, – s. 76-79.

From the contrasts created by colors, we can clearly see the difference between microbial colonies in the gingival sulcus of children with healthy periodontal disease and those with catarrhal gingivitis. Although the same organisms are found in both groups, the graph shows that the number of colonies in the group of children with catarrhal gingivitis is many times higher.

During treatment, ozonized olive oil and Metrogil denta ointment were applied to gingival sulcus twice a day for 7 days, respectively, for each group of patients diagnosed with gingivitis.

Patients with gingivitis of parodontic tissues were treated with ozonized olive oil and Metrogil Dentin ointment twice a day for seven days for each group.

On the last day of the treatment (7th day) dental fluid obtained from parodontal pockets of the the patients were taken to the laboratory for microbiological research.

When we examine the results obtained after treatment with ozonated olive oil in children with diabetes mellitus type 1 diagnosed with catarrhal gingivitis in periodontal tissues, we encounter obvious changes. After treatment with ozonated olive oil, the number of colonies of microorganisms in gingival sulcus of children with diabetes mellitus type 1 with catarrhal gingivitis in periodontal tissues decreased by 50-70% compared to pre-treatment indicators. Staphylococcus epidermidis, Streptococcus oralis, Streptococcus mitior colonies were not found¹⁷ (table 2).

We see a decrease in the number of Staphylococcus aureus colonies from $26.6 \pm 7.7\%$ to $10.5 \pm 2.2\%$. The previous count of Staphylococcus haemolyticus colonies was $74.7 \pm 5.3\%$ at the beginning of ozone therapy, $33.8 \pm 7.2\%$ after treatment, and the number of Streptococcus mutans colonies before treatment was $35.5 \pm 6.3\%$. we see that the values after treatment with olive oil are $14.8 \pm 8.5\%$. We see that the number of Streptococcus salivarius colonies was $40.5 \pm 7.5\%$ before treatment and decreased to $23.6 \pm 13.7\%$ after treatment ($p > 0.05$).

¹⁷Əliyeva, R.Q., Nağıyeva, S.A. I tip şəkərli diabeti olan uşaqlarda parodont xəstəliklərinin müalicəsində ozonlaşdırılmış zeytun yağının istifadəsinin öyrənilməsi // – Bakı: Qafqazın stomatoloji yenilikləri, – 2017. № 24, – s. 76-79.

Table 2

Types of bacteria studied in gingival sulcus of children with diabetes mellitus type 1 with catarrhal gingivitis of periodontal tissues before and after treatment with ozone therapy

Types of bacteria	Occurrence frequencies in%		t	p
	before	after		
Staphylococcus aureus	26.6±7.7	10.5±2.2	2.0	<0.05
Staphylococcus epidermidis	42.5±11.4	-----	4.6	<0.001
Staphylococcus haemolyticus	74.7±5.3	33.8±7.2		
Streptococcus mutans	35.5±6.3	14.8±8.5	1.9	<0.05
Streptococcus oralis	44.6±1.6	-----		
Streptococcus mitis	45.6±3.7	18.8±3.3	5.5	<0.001
Streptococcus salivarius	40.5±7.5	21.1±7.1	1.9	<0.05
Streptococcus mitior	27.3±1.6	-----		
Streptococcus sanguis	82.5±4.8	31.7±11.7	4.0	<0.001

Similarly, the number of Streptococcus mitis colonies was $45.6 \pm 3.7\%$ before ozone therapy and decreased to $18.81 \pm 3.3\%$ after treatment ($p < 0.001$). Streptococcus salivarius colonies before treatment were $40.5 \pm 7.5\%$, after treatment they decreased to $21.05 \pm 7.1\%$ ($p < 0.05$).

If before treatment Staphylococcus epidermidis colonies were found in $42.5 \pm 11.4\%$, Streptococcus oralis colonies in $44.65 \pm 1.6\%$ and Streptococcus mitior colonies in $27.3 \pm 1.6\%$, after treatment with ozonized olive oil colonies of microorganisms in children were not found, which we see in the table.

Thus, after treatment with ozonated olive oil, the number of colonies of aerobic microorganisms in the teeth of diabetes mellitus type 1 children with catarrhal gingivitis in the parodont tissues decreased by 50-70% compared to the pre-treatment rates, and there is no evidence of *Staphylococcus epidermidis*, *Streptococcus colitis*, *Streptococcus colitis* colonies.

A very similar situation is encountered when examining the data obtained after treatment with Metrogil denta gel in children with diabetes mellitus type 1 diagnosed with catarrhal gingivitis in periodontal tissues. Thus, the previous number of *Staphylococcus haemolyticus* colonies was $74.7 \pm 5.3\%$ at the beginning of ozone therapy, $35.8 \pm 9.3\%$ after treatment ($p < 0.001$), and the number of *Streptococcus mutans* colonies before treatment was $35.5 \pm 6.3\%$, we see that the post-treatment with metrogil denta is $14.9 \pm 10.6\%$ ($p > 0.05$). We see that the number of *Streptococcus salivarius* colonies decreased from $40.5 \pm 7.5\%$ before treatment to $23.6 \pm 13.7\%$ after treatment ($p > 0.05$) (table 3).

Thus, the amount of colonies of microorganisms in the gum fluid of children with diabetes mellitus type 1 with catarrhal gingivitis in periodontal tissues decreased by 50-70% compared to the previous indicators after treatment with both Metrogil denta gel and ozonated olive oil. significant changes were identified after ozone therapy. Some bacteria - *Staphylococcus aureus*, *Streptococcus mitis*, *Streptococcus oralis*, *Streptococcus mitior* colonies could not be identified¹⁸.

Our results show that local treatments for periodontal disease contribute to the reduction of inflammatory processes. At the end of the 7-day treatment, the effects on the dental caries of diabetes mellitus type 1 children were significantly reduced, hyperemia in the mucous membranes was removed, and the edges of the teeth had normal anatomical shape. Pain percussion disappeared, bleeding was not observed during sensing.

¹⁸*Nağıyeva, S.A.* I tip şəkərli diabeti olan uşaqlarda gingivitlərin müalicəsində istifadə olunmuş fərqli müalicə üsullarının təhlili // – Bakı: Sağlamlıq, – 2017. № 4, – s. 139-145.

Table 3

Types of bacteria studied in gingival sulcus of children with diabetes mellitus type 1 with catarrhal gingivitis of periodontal tissues before and after treatment with Metrogil denta

Types of bacteria	Occurrence frequencies in%		t	p
	before	after		
Staphylococcus aureus	26.6±7.7	----- -		
Staphylococcus epidermidis	42.5±11.4	24.5±10.7	1.2	>0.05
Staphylococcus haemolyticus	74.7±5.3	35.8±9.3	3.6	<0.001
Streptococcus mutans	35.5±6.3	14.9±10.6	1.7	>0.05
Streptococcus oralis	44.65±1.6	-----		
Streptococcus mitis	45.6±3.7	-----		
Streptococcus salivarius	40.5±7.5	23.6±13.7	0.8	>0.05
Streptococcus mitior	27.3±1.6	-----		
Streptococcus sanguis	82.5±4.8	41.4±12.8	3.0	<0.001

The smell of the patients' oral cavities has disappeared and the pink color of the teeth has been restored. Although some of the signs of inflammation of the parodontic tissues were observed in some patients, most patients did not have complaints anymore.

These phenomena were observed in both treatment groups. The similarity of the groups we received at the end of the treatment to the groups treated with the group treated with Metrogil Denta Gel showed that the therapeutic efficacy of the Metogil denta gel and the therapeutic efficacy of ozonated olive oil is almost identical to the

analogue chlorhexidine) and antibiotic (metronidazole). On the other hand, as a result of the effects of ozonated olive oil, trophic and regenerative improvement in the parodont tissues is confirmed by numerous studies. Since this treatment is quite affordable and harmless for patients with diabetes mellitus, we think that ozone therapy will be important in the treatment of children with diabetes. The results we receive during our research allow us to draw the following conclusions.

CONCLUSIONS

1. As a result of assessment of the condition of periodontal tissue in children with diabetes mellitus type 1 on the basis of visual indicators and clinical indices, it was determined that 20 (25.31%) out of 79 children with diabetes mellitus type 1 had acute catarrhal gingivitis and 43 had chronic catarrhal gingivitis and no pathology was found in the periodontal tissues of 16 (20.25%) people. In children with catarrhal gingivitis, edema of the gums, hyperemia of the mucous membranes was observed, the edges of the gums were thickened. There was little pain during the percussion, and the probing was painless. Some patients had bad breath and a pasty condition of the gums, deformity of the gums, bleeding gums on palpation [1, 2, 4].
2. No statistically significant dependence was found between the incidence of periodontal disease and the duration of the underlying disease in children with diabetes mellitus type 1. The most common periodontal diseases in children with diabetes mellitus type 1 are ACG and CCG. ACG was mostly found in the 7-11 age group ($75.0 \pm 8.0\%$). The incidence of CCG in periodontal tissues among children with diabetes mellitus type 1, was higher in the group of boys aged 12-17 years ($30.2 \pm 5.2\%$) [7, 10].
3. Although the incidence of gingival microflora is different in children with diabetes mellitus type 1 mellitus with periodontal disease, as well as in children with diabetes mellitus type 1

mellitus without periodontal disease, the detection of the same microflora in both groups according to the composition of the species (Staphylococcus aureus - $26.6\pm 7.7\%$ and $18.3\pm 3.7\%$, respectively, Streptococcus sanguis - $82.5\pm 4.8\%$ and $36.1\pm 13.9\%$, respectively) indicates a high risk of the formation of periodontal disease in children with healthy periodontitis diabetes mellitus type 1 [8].

4. Analysis of the findings of the research showed that in the treatment of catarrhal gingivitis in children with diabetes mellitus type 1 with both ozonated olive oil and Metrogyl denta gel, the number of colonies of microorganisms in the gingival pockets decreased by 50-70% compared to pre-treatment. The results obtained in the treatment groups with ozone therapy and Metrogyl denta gel differed slightly: The average number of bacteria in the ozone therapy group was 58.5%, and in the Metrogyl denta group it was 53.6% ($p > 0.05$). Streptococcus mutans were $14.8\pm 8.5\%$ ($p > 0.05$) and $14.9\pm 10.6\%$ ($p > 0.05$), respectively, Staphylococcus haemolyticus were $35.8\pm 9.3\%$ ($p < 0.001$) and $33.8\pm 7.2\%$ ($p < 0.001$), respectively [8].
5. In the treatment of periodontal disease in children with diabetes mellitus type 1, improvement of clinical parameters was observed as a result of ozone therapy: GI = 0.72 ± 0.07 ($p > 0.05$), PBI = 0.72 ± 0.07 ($p > 0, 05$), CPI = 0.81 ± 0.07 ($p > 0.05$), PMA = 24.71 ± 1.14 ($p > 0.05$). No side effects have been reported with the use of ozonated olive oil as an ointment in the treatment of periodontal disease in children with diabetes mellitus type 1, there was a significant reduction in inflammation of the periodontal tissues against the background of improved clinical indices and microflora of the gums. [8, 11].
6. The use of ozonated olive oil in the complex treatment of acute catarrhal gingivitis and chronic catarrhal gingivitis in children with diabetes mellitus type 1 mellitus with periodontal disease, along with the high clinical effect of the treatment, eliminated the overload of patients with drugs [12].

PRACTICAL RECOMMENDATIONS

1. The use of ozonated olive oil in the treatment of periodontal disease in children with diabetes mellitus type 1 is recommended according to the following scheme: injecting ozone oil into the gums for 2 minutes with massage movements twice a day for 7 days. Treatment can be performed in the clinic or at home by the patient himself or by his parents.
2. Due to the ability of ozonated olive oil to develop resistance to microorganisms and the absence of side effects, it is expedient to use this drug for the prevention of periodontal disease in children. For prophylaxis, ozone oil can be used once a day for 7-10 days every 2 months.
3. The use of ozonated olive oil is also recommended for the prevention of gingivitis in children with insulin-dependent (type 1) diabetes who do not complain of periodontal disease, but are at risk.
4. Due to the high prevalence of periodontal disease in children with diabetes mellitus type 1, children with diabetes mellitus type 1 should also be periodically examined by a dentist for timely detection and treatment of this pathology.

**LIST OF SCIENTIFIC REFERENCES,
PUBLISHED ON THE TOPIC OF THE DISSERTATION:**

1. Zeynalova, G.K., Nağıyeva, S.A. Şəkərli diabet xəstəliyi olan uşaqlarda dişlərin sərt toxumalarının xəstəlikləri // XI Respublika Elmi Konfransının materialları, – Bakı, – 2000. – s.123-125.
2. Зейналова, Г.К., Нагиева, С.А. Состояние тканей пародонта у детей страдающих сахарным диабетом // – Bakı: Qafqazın stomatoloji yenilikləri, – 2000. № 4, – s. 40-41.
3. Zeynalova, G.K., Naghiyeva, S.A. Childrens paradontal substantaces condition suttered from diabets // Материалы II международного конгресса стоматологов, – Тбилиси, – 2000. – с. 305.
4. Əliyeva, R.Q., Nağıyeva, S.A. I tip şəkərli diabetli uşaqlarda stomatoloji xəstəliklərin müəyyən edilməsi // “Təbabətin aktual problemləri” mövzusunda elmi konfransın materialları, – Bakı, – 2014. – s. 39-40.
5. Nağıyeva, S.A. I tip şəkərli diabeti olan uşaqlarda ağızın gigiyenasının və parodont toxumalarının vəziyyətinin qiymətləndirilməsi // – Bakı: Qafqazın stomatoloji yenilikləri, – 2016. № 23, – s.76-79.
6. Нагиева, С.А. Сравнительная оценка зависимости состояния тканей пародонта от гигиены ротовой полости у здоровых детей, а также у детей с сахарным диабетом 1-го типа // – Полтава: Вісник проблем біології і медицини, – 2017. Вип. 2 (136), – с. 372-376.
7. Nağıyeva, S.A. I tip şəkərli diabeti olan uşaqlarda gingivitlərin müalicəsində istifadə olunmuş fərqli müalicə üsullarının təhlili // – Bakı: Sağlamlıq, – 2017. № 4, – s. 139-145.
8. Əliyeva, R.Q., Nağıyeva, S.A. I tip şəkərli diabeti olan uşaqlarda parodont xəstəliklərinin müalicəsində ozonlaşdırılmış zeytun yağının istifadəsinin öyrənilməsi // – Bakı: Qafqazın stomatoloji yenilikləri, – 2017. № 24, –

s. 76-79.

9. Nağıyeva, S.A. I tip şəkərli diabeti olan uşaqlarda kəskin və xronik gingivitlərin rastgəlmə tezlikləri // “Təbabətin aktual problemləri” mövzusunda elmi-praktik konfransın materialları, – Bakı, – 2018. – s. 106.
10. Нагиева, С.А. Анализ результатов различных методов лечения, использованных в лечении острого и хронического гингивита у детей с сахарным диабетом 1 типа // Матеріали науково-практичної конференції з Міжнародною участю «Актуальна стоматологія, наука, практика, педагогіка, – Харків, – 2018. – с. 119-120.
11. Нагиева, С.А. Показатели клинических стоматологических индексов у детей с катаральным гингивитом на фоне сахарного диабета 1 типа в Азербайджане // – Иркутск: Сибирский Медицинский Журнал, – 2019. № 1, – с. 21-24.
12. Naghiyeva, S.A. Treatment of gingivitis in children with diabetes mellitus type 1: antibiotic or ozone// – Одесса: Вестник стоматологии, – 2019. № 4, – с. 39-44.

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