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THE USE OF NATURAL MINERAL WATERS FOR THE PREVENTION OF DENTAL DISEASES IN CHILDREN AND ADOLESCENTS

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Abstract

Introduction. Water treatment is considered as one of the most natural ways of healing. Due to the unique physicochemical properties of water, all biochemical reactions take place in the aquatic environment. The novelty of this work is to develop a method for the prevention of dental caries, which includes the use of domestic mineral water "Taraz".

The aim of the study. Evaluate efficiency the use of natural mineral waters for the prevention of major dental diseases in children and adolescents.

Methods. The research was carried out at the Department of Pediatric Dentistry (Asfendiyarov Kazakh National Medical University) in cooperation with the children's regional dental clinic in Taraz city.

Results. The obtained results of clinical studies show the remineralizing activity of mineral water "Taraz". The combination of water with individual hygiene products can be used as a preventive method for the general population.

Conclusion. The study of teeth hard tissue sections in normal and pathological conditions allowed us to find out changes in enamel and dentin in the initial and developed forms of the carious process, and apparently will indicate ways to regulate mineral metabolism in order to prevent tooth decay.

Keywords: mineral water, caries, mineralization, prevention, clinic, children.

Introduction. Despite the development of pharmacology and pharmaceutical chemistry to create very valuable drugs with a narrowly focused and broad spectrum of action, as well as their undesirable side effects on the body, increasing interest is now being shown in non-drug treatments for diseases such as: mineral water, therapeutic mud, massage, therapeutic physical culture, clinical nutrition, acupuncture, and methods of traditional folk medicine [1-5]. Water treatment is considered as one of the most natural ways of healing [7]. Due to the unique physicochemical properties of water, all biochemical reactions take place in the aquatic environment [8].

Mineral waters are complex multicomponent solutions in which substances are contained in the form of ions, undissociated molecules, gases, colloidal particles. The main ionic composition of mineral waters is formed by a group of macrocomponents: cations Na^+ , K^+ , Ca^{2+} , Mg^{2+} and anions HCO_3^- , Cl^- , CO_2 . The total content of these components usually constitutes the predominant part of the total mineralization. The great importance in the therapeutic assessment of mineral waters is the acid-base index (pH). An important role is played by the physicochemical properties of water: high thermal conductivity, significant heat capacity, low viscosity, high

dielectric constant, good dissolving power [6, 9, 10, 11]. However, the originality of the therapeutic effect of mineral water cannot be reduced only by its quantitative and qualitative composition. It is certainly associated with the peculiarities of origin depending on the depth [17].

Mineral waters are formed in the bowels of the Earth under conditions that still cannot be created artificially in the laboratory [8, 12, 18]. High pressure, lack of light, temperature conditions, saturation with gases, contact with various rocks that contain rare metals - all these conditions affect the properties of water, its composition and distinguishes natural mineral waters from artificially prepared ones, which are simple solutions of salts. Fluorine in the composition of mineral water and an increased concentration of calcium (112 mg/dm³) in optimal amounts have a positive effect on normal tooth growth and pigmentation [3, 14, 19]. "Aqueous" forms of fluoride are absorbed approximately 20% better than fluoride, contained directly in food [10]. Everything in the complex is possible, and predetermines their balneological value. The infinity of raw materials, natural composition, absence of side effects, ease of procedures and preparations based on mineral waters are the advantages and rationale for the appointment of minor balneotherapy methods in dental practice [1, 2, 10, 14, 20]. **The aim of the study.** Evaluate efficiency the use of natural mineral waters for the prevention of major dental diseases in children and adolescents.

Material and methods of research. The research was carried out at the Department of Pediatric Dentistry (Asfendiyarov Kazakh National Medical University) in cooperation with the children's regional dental clinic in Taraz city. Developed and scientifically substantiated a method for the prevention of dental caries, which includes the use of domestic mineral water "Taraz". The water has a weak mineralization, the optimal content of macro and microelements (less than 100 mg/l). Microelements, although they do not determine the type of water, but affect the specifics of the composition of mineral waters. In the composition of mineral water, fluorine- 2.3 mg/l is determined and the pH of the water has boundaries within slightly alkaline.

Children with the initial form of caries were selected during preventive examinations, followed by the rehabilitation of the carious focus. 2 groups of patients were observed. This research involved 180 children of preschool institutions and elementary grades of several schools of Taraz city during 2 years. Those children who had a tendency to increase the activity of the carious process carried out further treatment and observation for three years.

Previously, the children of all two groups were sanitized for caries. The main group included children aged 6, 12 and 15 years old, 30 one in each group (Figure 1). Totally 90 people without pathology from the gastrointestinal tract. The main group received exposure to oral mineral water daily 2 times in the morning and evening. It was noticed that the remineralizing activity of water decreased during the storage in the refrigerator. So, the room temperature regime was used to keep the mineral water.

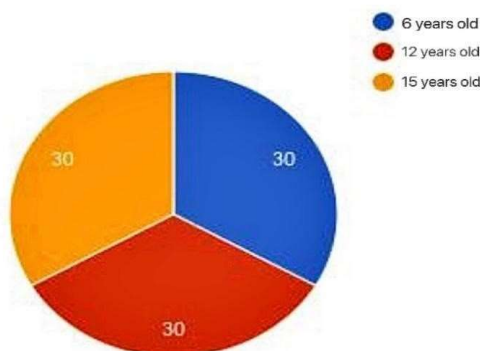


Figure 1 - Observation groups

The time of exposure to mineral water also depended on the intensity of caries and on the age of the child, which was 5 minutes, 10 minutes and 15 minutes, respectively.

The control group consist of similar age of 6, 12, 15 years old children with a similar intensity of caries and without gastrointestinal pathology. The second group did not used mineral water. The physical development of children was assessed by the results of observations by a pediatrician.

Results. According to the literature data [1], an experimental study was carried out on thin sections of extracted teeth. Children teeth were removed strictly for medical reasons.

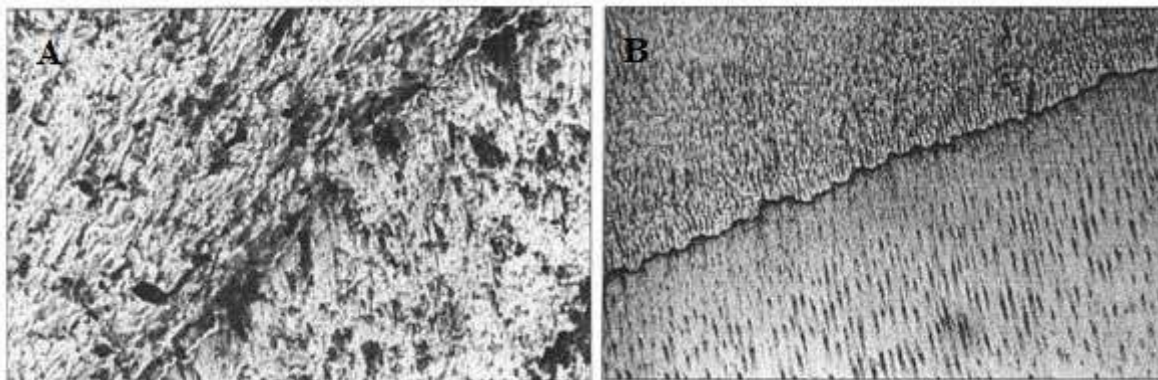


Figure 2 - Sections of the tooth enamel during adaptation a) before and b) after

On thin sections, hard tissues of the crown part of the teeth were studied, which are most susceptible to active carious process 3.6. and 4.6. permanent teeth and 7.5, 7.4, 8.4 and 8.5 temporary teeth. Subsequently, thin sections made from them by the petrography method, by sawing the tooth along the vertical axis, made it possible to study the change in the structural homogeneity of the hard tissues of the teeth during adaptation [1] (Figure 2).

Availability in the image of periodic structures and their severity. Visible differences between these tissues are due, rather, to the degree of mineralization than to the shape or size of the constituent elements.

A retrospective analysis showed that after a successful experimental model of remineralization of removed temporary and permanent teeth in vitro on microsections, it is most expedient to expose the oral cavity with mineral water in the interval 5 min, 10 and 15 min.,

depending on the intensity of the carious process. Reliable results of these studies served as a rationale for the use of this pattern to reduce the activity of the carious process already in the clinic (Figure 3).

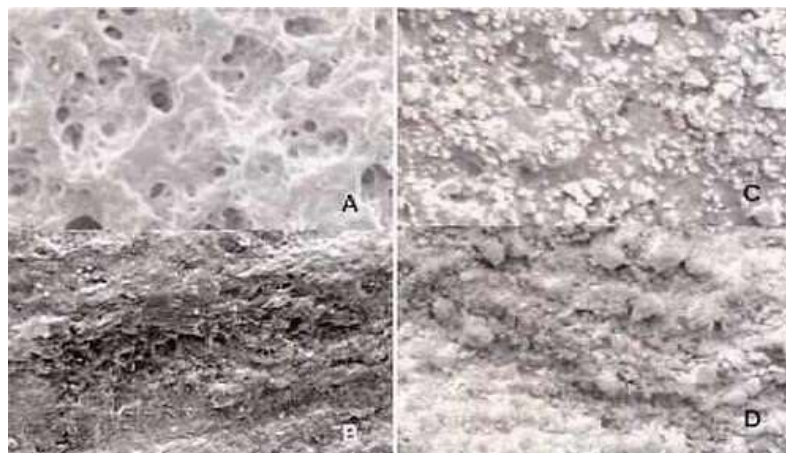


Figure 3 – The images of enamel before restoration of a) temporary teeth, b) permanent teeth and after c) temporary teeth, d) permanent teeth

Besides, it was found that the recommended exposure in the oral cavity of this natural bicarbonate-chloride sodium mineral water has a number of advantages.

At the first examination of children, it was found that in children aged 6 years, the prevalence of caries in temporary teeth was 94% (Figure 4) in this group, the caries intensity index before treatment in the 6-year-old preschool group was $k_p = 5.11 \pm 0.70$ rel. un. in adolescents, the intensity was $KPU + k_p 3.9 \pm 0.73$ (table 1).

Table 1 - Prevalence of caries permanent teeth

Prevalence of caries % permanent teeth	Intensity, relative value, teenagers 15 years old			
	C (K)	F (P)	EXT (U)	CFE (KPU)
89.0±5.3	2.3±0.41	1.77±0.29	0.56±0.16	4.63±0.49

Indicators of two observation groups (main and control). The duration of treatment in the main group was from 30, 45 and 60 days twice a year. After the treatment, stabilization of the process occurred in 46% of children.

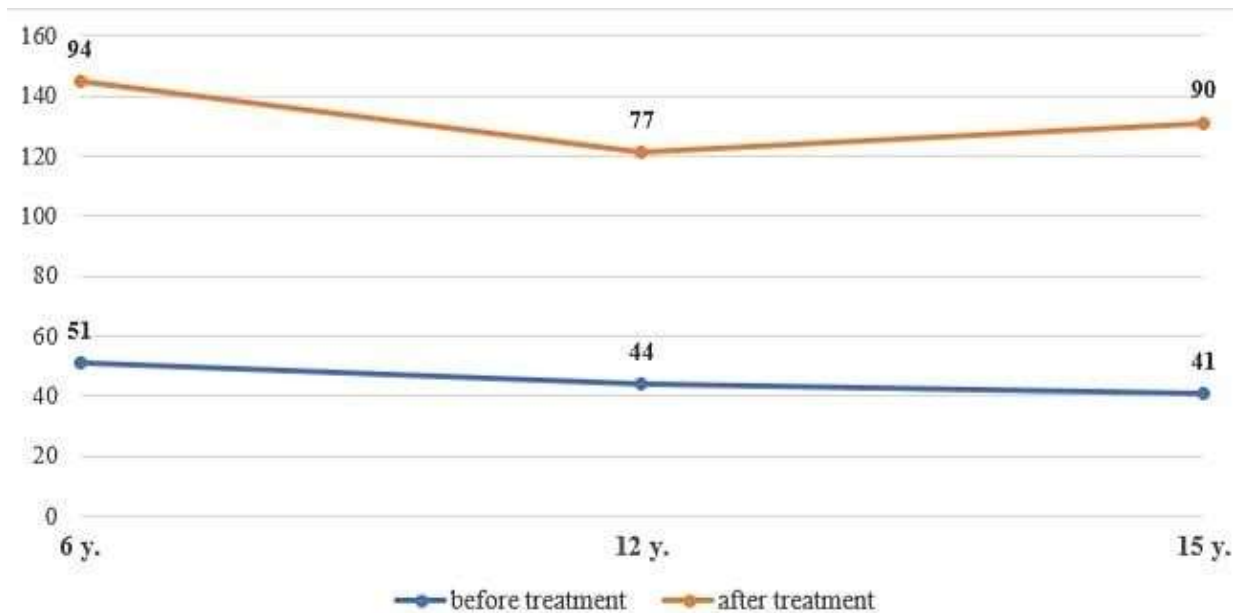


Figure 4 - Prevalence of caries in different age groups before and after treatment

Preliminary results showed a high remineralizing activity of water. Research data indicated a decrease in the prevalence of the carious process in the main group of observations one year after treatment by 51% in the group of children 6 years old and two years later to 38%. Decrease in caries up to 44% in children 12 years old one year after the treatment (Figure 4) and two years later up to 25% and in the group of 15 years old one year after therapy up to 41%, two years later a decrease up to 19% compared with the baseline.

In the control group, high rates of prevalence and intensity of the carious process remained after a year and after 2 years, respectively. The increase in the intensity of caries of temporary teeth of the main group after treatment after a year was 0.5 ± 0.2 relative units, where the indicator is "k" (0), "p" (0.5). In 12 year old children, about 0.9 ± 0.1 relative units (table 2 and 3). In the control group, 2.1 units.

Table 2 - Intensity of caries from main groups of children 12 years old

KPU + kp		
Before treatment	After a year	After 2 years
K (3.5)	K (0)	K (0)
P (1.2)	P (5)	P (1)
U (0)	U (0)	U (0)
		The intensity of caries 1.1 units due to the indicator "P"

Table 3 - Intensity of caries from control groups of children 12 years old

KPU + kp		
First examination	One year after examination	2 years after examination
K (5.6)	K (+1)	K (1+1)
P (3.0)	P (8)	P (8)
U (0)	U (0)	U (0)
		The intensity of caries 3.0 units due to the indicator “K” and “U”

All these clinical indicators confirmed the assumption of the high efficiency of this domestic mineral water as a prevention of dental caries in children.

The using of Taraz mineral water shows no undesirable effects: all the children under study tolerated the indicated solution well. Organoleptic properties did not cause discomfort. Allergic and adverse reactions have not been identified.

Conclusions. Conducted studies have confirmed the unique ability of tooth enamel to absorb mineral water and act as a "semi-permeable membrane". The obtained results of clinical studies allow to differentiate the use of mineral water, its remineralizing activity as a preventive method, in combination with individual hygiene products, for the general population. The need of the children's contingent from 6 to 15 years old in the development and implementation of prevention programs was determined in accordance with the European level of dental health. Based on the foregoing, dynamic observations will continue!

No conflicts of interest have been declared.

Authors' contributions

Concept development - A.ZH. Esim

Execution - M.M. Momynova

Processing of results - A.ZH. Esim, M.M.Momynova

Scientific interpretation of the results - H. Poureslami

Article writing - M.M. Momynova

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ТАБИҒИ МИНЕРАЛДЫ СУМЕН БАЛАЛАР МЕН ЖАСӨСПІМДЕРДІҢ ТІС ЖЕГІН АЛДЫН АЛУ ЖОЛДАРЫ

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Түйіндеме

Кіріспе. Сусыз өмір мүмкін емес, биохимиялық реакциялар сулы ортада жүреді, бұл оның ерекше физика-химиялық қасиеттеріне байланысты. С.Д.Асфендияров атындағы ҚазҰМУ-дың балалар жасындағы стоматология кафедрасында Тараз қаласының балалар Облыстық стоматологиялық емханасымен бірлесіп, профилакторийдің аттас санаторийінің көзі негізінде "Тараз" отандық минералды суын пайдалануды қамтитын тіс кариесінің алдын алу әдісі әзірленді және ғылыми негізделген.

Зерттеу әдістері. Ретроспективті талдау көрсеткендей, жойылған уақытша және тұрақты тістерді *in vitro* қалпына келтірудің сәтті эксперименттік моделінен кейін кариозды процестің қарқындылығына байланысты 5 мин, 10 және 15 мин аралықта ауыз қуысының минералды суының экспозициясын жүргізген жөн.

Нәтижелер. Біздің клиникалық зерттеулердің нәтижелері халықтың кең тобына минералды суды қолдануды, оның реминерализация белсенділігін профилактикалық әдіс ретінде саралап ұсынуға мүмкіндік береді.

Қорытынды. Қалыпты және патологиялық жағдайларда тістің қатты тіндерінің кесінділерін зерттеу кариозды процестің бастапқы және дамыған формаларында эмаль мен дентиндегі өзгерістерді анықтауға мүмкіндік берді және тіс жегісінің алдын алу үшін минералды зат алмасуды реттеу жолдарын көрсетеді.

Түйін сөздер: минералды су, кариес, минерализация, алдын алу, емхана, балалар.

ПРИМЕНЕНИЕ ЕСТЕСТВЕННЫХ МИНЕРАЛЬНЫХ ВОД ДЛЯ ПРОФИЛАКТИКИ СТОМАТОЛОГИЧЕСКИХ ЗАБОЛЕВАНИЙ У ДЕТЕЙ И ПОДРОСТКОВ

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Аннотация

Введение. Без воды жизнь невозможна, именно в водной среде протекают биохимические реакции, что обусловлено ее уникальными физикохимическими свойствами.

Материалы и методы. На кафедре стоматологии детского возраста КазНМУ имени С.Д. Асфендиярова, совместно с детской областной стоматологической поликлиникой г. Тараз, разработан и научно обоснован метод профилактики кариеса зубов, включающий в себя использование отечественной минеральной воды «Тараз».

Результаты. Ретроспективный анализ показал, что после успешно проведенной экспериментальной модели реминерализации удаленных временных и постоянных зубов *in vitro* на шлифах, целесообразнее всего проводить экспозицию минеральной водой полости рта в интервале 5, 10 и 15 мин., в зависимости от интенсивности кариозного процесса. Согласно полученным результатам клинических исследований возможно рекомендовать детскому населению применение минеральной воды, ее реминерализующую активность в качестве профилактического метода.

Заключение. Изучение срезов твердых тканей зубов в норме и патологии позволило выяснить изменения эмали и дентина при начальной и развитой формах кариозного процесса и, по-видимому, укажет пути регуляции минерального обмена с целью профилактики кариеса. Эта проблема изучается автором статьи с 1990-х годов.

Ключевые слова: минеральная вода, кариес, минерализация, профилактика, клиника, дети.