CORRECTION OF MINERAL METABOLISM OF SALIVA IN CHILDREN AFFECTED BY DENTAL CARIES

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Abstract. According to WHO dental caries remains one of a major health problem in most industrialized countries, affecting 60-90% of scholars and the vast majority of adult population. The article provides the statistic that demonstrates efficiency of the vitamin-mineral complex in correction of mineral metabolism in children from different climate-geographical zones of Ivano-Frankivsk region. It has been established the high efficiency of the recommended scheme of caries prophylaxis that was confirmed by improvement of biochemical characteristics of oral liquid in children from different regions over the period of 24 month. The research indicates the decrease of Calcium contain, increase of not organic Phosphorus, decline in activity of the acid phosphatase and the growing activity of the alkaline phosphatase in children from the prophylactic groups comparing with those from the control groups.

Summary. Despite the progress in modern technologies and achievements in stomatology on the whole, dental caries is still is on the growth among children and this problem continues to be actual [1,7]. The prevalence of tooth decay in children of Ukraine is approximately from about 33,3% up to 90,22% and in some region it reaches as much as 95–98 % by intensity of damaging from 2,0 to 7,2 teeth [8].

We would like also to admit that there are well known risk factors of dental caries such as consumption of the proceeded food, access of the carbohydrates as well as bad oral hygiene, general disorders, orthodontical problems and bad environment. [4].

The role of oral liquidis vital in homeostasis of oral cavity as it provides mineralization, defense and cleanse function therefore creating the best condition for the hard dental tissues. The high concentration of calcium and phosphorus ions maintain their oversaturation in saliva and promote processes of enamel remineralisation. The quality of saliva is defined by its pH and by the potassium and sodium cations that stabilize the structure of proteins [5].

We would like to emphasize the role of climate-geographical and ecological factors that influence prevalence of dental caries in different areas of Ukraine, especially the level of insolation and balance of radiation [7]. The complicated unique etopography of Ivano-Frankivsk region causes climate diversity that is considered as a main bio-chemical risk factor in development of stomatological pathology among children. The natural fluoride and iodine deficiency in the drinking water also enhances the statistic of stomatological disorders [10]. Hence the complicity of the climate-geographycal and ecological factors of Ivano-Frankivsk region there is a need in introduction of a special preventive measures for children of this area.
The article demonstrates the results of correction of biochemical characteristics of oral liquid in 12 years old children from plains and mountain foothills of Ivano-Frankivsk region affected by different level of carious activity. The saliva was assessed by quality of vitamin-macro-microelement complex that provides enamel remineralisation. The results have proved that rational use of vitamin-bioelement complex leads to saturation of saliva with minerals such as calcium, magnesium, phosphorus and increased activity of alkaline phosphatase in children from prophylactic groups compared to those from the control groups.

Keywords: dental caries, oral liquid, biochemical characteristics.

Objective.
Advantageous efficiency of caries prophylaxis in children with biochemical correction of saliva by administration of biochemical complex “Vitrum Junior”.

Materials and methods.
We have examined 180 12 years old children affected by dental caries. There were 61 children from the plain region, 59 – from the foothills and 60 children from the mountain zones of Ivano-Frankivsk region. Each group consisted of 30 children. The control group contained 31 children in plain area, 30 children in foothills and 29 in mountain zone.

The stomatological investigation was conducted by WHO methodic. The caries activity was defined by T.F.Vynogradova: compensated caries (DMF1-3); subcompensated caries (DMF 4-6) and decompensated caries (DMF 7-9). The children from the main group were treated by sanitation and professional oral hygiene. The children of the main groups were prescribed with vitamin-bioelement complex “Vitrum Junior”. (“Yunipharm, Inc.”,USA) to be taken as follows: one tablet ones a day with a meal by chewing for 30 days twice a year at spring and autumn. Each tablet of “Vitrum Junior” contains: vitamin A 1,72 mg (5000 International units), vitamin E 30 mg (30 International units), vitamin D3 10 μg (400 International units), vitamin C 300 mg, vitamin B1 1,5 mg, vitamin B2 1,7 mg, vitamin B6 2 mg, vitamin B12 6 μg, folic acid 400 μg, nicotinamide 20 mg, pantothenic acid 10 mg, biotin 45 μg, vitamin K1 10 μg, calcium 160 mg, phosphorus 50 mg, magnesium 40 mg, iron 18 mg, copper 2 mg, zinc 15 mg, manganese 1 mg, iodine 150 μg, molybdenum 20 μg, chromium 20 μg.

We would like to admit that this vitamin-macro-micro-element complex contains a daily amount of iodine that is a part of thyroid hormones that participates in the regulation of metabolic processes of the body, function of the brain, nervous and cardiovascular systems, the child’s growth and development of intellectual abilities. The latest is of a great importance in the regions with a natural iodine deficiency.

The children from the control groups were introduced to the measures of oral hygiene and were sanated.

The efficiency of the introduced complex we have assessed by contain of general calcium, not organic phosphorus, mangnese, acitivity of acid and alkaline phosphatase in oral liquid. The saliva was collected in the morning, before breakfast from the oral cavity’s floor by a sterile pipette followed by freezing at -18 ° C. The activity of acid and alkaline phosphatases, the contain of general calcium, not organic phosphorus and mangnesewere investigated by spectrophotometry over the period of 2 years.

Results
According to our research the minimal concentrations of general calcium in saliva before the investigation were (1,02±0,08) mmol/l in children of the control group from the plain region (1,01±0,07) mmol/l – in those from the mountain foothills and (0,93±0,08)mmol/l
from the mountain. As caries progressed the role of this macro-element increased and reached (1.19±0.07) mmol/l in children with compensated caries from the plains. On the other hand, we have established the amount of general calcium (1.16±0.04) mmol/l in children with compensated caries from the mountain foothills and (1.18±0.07) mmol/l from the mountain. Furthermore, calcium in mixed saliva of children diagnosed with decompensated caries was 1.3 times higher (p<0.05) comparing to the healthy children and demonstrated the data (1.32±0.09) mmol/l in children from the plain region, (1.26±0.08) mmol/l – in those from the mountain foothills and (1.23±0.08) mmol/l in children from the mountain.

It has been proved that the amount of general calcium has declined after administration of vitamin-macro-micro-element complex by 1.2 times in children with compensated caries from the plain region and in those from the mountain foothills over 24 month in comparison to the initial level (0.97±0.03) mmol/l and (0.98±0.05) mmol/l accordingly. The level of general calcium has decreased also in children from the mountain by 1.1 times comparing to initial level up to (0.99±0.02) mmol/l (p<0.05). The statistic demonstrates the level of general calcium (1.15±0.04) mmol/l and (1.11±0.03) mmol/l in children with subcompensated caries from the plain region and from the mountain foothills after the administration of “Vitrum Junior” and (0.94±0.04) mmol/l in mountain area that is by 1.2 lower comparing to the level before treatment (p<0.05).

We have established that concentration of general calcium in oral liquid of children from the plain region diagnosed with decompensated caries after the treatment was (1.19±0.03) mmol/l, from the mountain foothills – (1.17±0.02) mmol/l and from the mountain (1.11±0.02) mmol/l proved to be 1.2 time slower that the initial data (p<0.05). We would like also to admit that general calcium of oral liquid remains approximately the same over 24 month in children from the control groups from all climate-geographical zones (p>0.05).

The research has proved that concentration of not-organic phosphorus has increased significantly in children of the main groups diagnosed with I type of caries activity after introduction of the preventive measures and was (5.79±0.31) mmol/l in children from the plain region that is an increase by 18.7%. In children from the mountain foothills the amount of not-organic phosphorus has improved by 19.6% and was (5.42±0.36) mmol/l and in children from the mountain there was an increase by 24.2% – (5.45±0.35) mmol/l (p<0.05). The analogical changes were observed also in children diagnosed with sub-compensated caries. The phosphorus has improved by 21% in children from the plain region up to (5.28±0.34) mmol/l, in children from the mountain foothills by 20.5% up to (5.32±0.29) mmol/l and in children from mountains by 24% up to (4.96±0.35) mmol/l comparing to initial data (p<0.05). There was also a progress in children with de-compensated caries after the introduction of vitamin-mineral complex. The contain of phosphorus in collected saliva has raised by19,2% up to (5.04±0.28) mmol/l in children from the plains, in children from the mountain foothills there was a progress by 25,0% up to (5.24±0.41) mmol/l and in the mountains by 20,4% up to (4.31±0.3) mmol/l (p<0.05).

On the other hand, the statistic does not demonstrate any variations in scholars of the control group over the period of 24 month as the amount of not organic phosphorus did not differ from its initial level. (p>0.05).

The further investigations exhibit also the growth of the mangnese by 9,3% up to (043.±0.03) mmol/l in children with compensated caries from the plains after usage of preventive complex, by 15,9% up to (0.44±0.04) mmol/l in children from the mountain foothills and by 14,6% up to (0.41±0.04) mmol/l in children from the mountain by comparison to the data gained before the investigations (p<0.05).

The enhance of magnese in oral liquid was not iced as well in children with sub-compensated and de-compensated type of dental caries (p>0.05). On the contrary, the indications
of the magnese in the control groups over the period of 24 month remained at the initial level and show an average (0.35±0.02) mmol/l in plain zones, (0.32±0.02) mmol/l in mountain foothills and (0.31±0.03) mmol/l in mountain area (p>0.05).

The examinations also confirmed efficiency of the introduced complex by analysis of activity of alcaline phosphatase. As has been established there is an evidence in decline of its activity by 2.6 times in children from the plains and mountain foothills up to (341.62±31.98) nmol/(s•l) and by 2.7 times in children from the mountains up to (358.94±30.49) nmol/(s•l) (p<0.05). In children of the control groups there were no changes in activity of alkaline phosphatase in each climate-geographical zones and they did not differ from the initial statistic. (p>0.05).

The analysis of the alkaline phosphatase has proved the raise of its activity in oral liquid after the introduction of vitamin-preventive complex by 2.5 times in scholars from the plains, by 2.4 times up to (904.92±34.61) nmol/(s•l) in children from the mountain foothills and by 2.8 times up to (867.86±27.01) nmol /(s•l) in the mountains compering to initial data (p<0.05). The analogical progress was detected in children of the main groups diagnosed with sub-compensated and de-compensated caries activity. The alkaline phosphatase remained the same over the period of 24 month in children from the control groups (p>0.05).

Discussion.

The epidemiological investigations of the last decade have proved lack of micro- and microelements in the diet. According to many authors this problem is a result of the decreased amount of consumed food by modern human being. The antibiotics, surgical interferences, hard physical training and bad environment also lead to vitamin deficiency [3].

Many researches in prophylaxis of dental caries in children assess the efficiency of vitamin-mineral complex in development of enamel and dentine protein matrix, mineralization of the hard dental tissues and better immunity. [9].

It is well known that calcium is the most predominant mineral of the human body and its part of enamel by 30% and more than 25% in dentine [6]. The increase of general calcium and low concentration of not-organic phosphorus in oral liquid of children affected by dental caries lead to calcium–phosphorus disbalance that indicates, in our opinion, disturbances of mineral function of oral liquid. Besides, lowering of ph by organic acids influences the loss of calcium from the hydroxyapatite [11]. The results we have gained are coordinated with the findings of other researchers that also state the increased amount of calcium in saliva, first of all its ionized fraction, especially by progression of caries activity [7].

It has to be admitted that optimal intake of calcium depends on presence of vitamins C and D, besides phosphorus, zink, magnese and other microelements are vital. For example, magnese participates in development of apatites as a part of the bone structure’s tissue by building crystals with phosphates. Zink and silicon for menamel and dentine. Moreover, silicon i manganese are essential in development of organic matrix by production of collagen and elastine. Molybdenum is important in metabolism of calcium and copper and increases dental resistance to dental caries [2, 11].

Vitamins C and B6 take part in synthesis of collage that is the most important protein of the bone tissue. Vitamin D initiates synthesis of osteocalcine that provides strong bond of calcium within hydroxiapatite. Vitamin A participates in formation of chondro-ityn-sulphates that are part of the dentine. Vitamin E provides anti-oxyde qualities and decreases contain of lactic acid in dental plaque.

We can summarize that efficient caries prophylaxis of children from bad environmental zones should include prescription of vitamin-macro-microelement complex.

Conclusions.

1. According to our investigations
conducted over the period of 24 month there was significant decrease of general calcium in oral liquid of children from the plains and from the mountain foothills diagnosed with compensated caries by 1.2 times and in those from the mountains by 1.1 times comparing to the initial level (p<0.05).

2. On the other hand, the contain of not-organic phosphorus in oral liquid of children diagnosed with compensated caries has increased by 1.2 times in scholars from the plains and from the mountain foothills and by 1.3 times in those from the mountain after the introduction of preventive measures comparing to the initial level (p<0.05).

3. There was a tendency to an increase of magnes in children of the main groups after the administration of preventive vitamin-mineral complex by 9.3% from (0.36±0.03) up to (0.41±0.03) mmol/l in children from the plains, by 15.9% from (0.34±0.04) mmol/lup to (0.39±0.03) in children from the mountain foothills and by 14.6% from (0.33±0.03) mmol/l up to (0.4±0.02) mmol/l in children from the mountain (p>0.05).

The changes in bio-chemical contain of saliva influenced by preventive program demonstrate increased mineral function of saliva followed by improvement of dental caries resistance.

Prospects for further researches.

Our goal is to investigate the efficiency of the introduced scheme on caries prophylaxis in 3-4 years.

Literature.


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