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Evaiuation of Dental Caries Development Risk among Children with Genetic Pathology

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Abstract: This study presents data on detection of local risk factors of the main dental disease dental caries by means of express diagnostics methods in children with Down's syndrome. The task was implemented with the orion-diagnostica diagnostic tool (Finland) that ensures determination of 5 main saliva characteristics and evaluation of dental caries development risk: concentration of *Streptococcus mutans*, lactobacilli, salivation speed and buffer capacity of saliva (with Dentobuff test strips).

Key words: Down's syndrome, dental caries development risk, salivation speed, buffer capacity of saliva, cariogenic microbiosis

INTRODUCTION

The availability of somatic status characteristics in children with genetic pathology specifies the need to study the dental status, the prevalence of dental caries and periodontal disease and to identify risk factors for the development of major dental diseases in these patients (Alekhina, 2003; Barenfeld, 2001).

As for the prevalence of dental caries in children with a Down's syndrome, studying the scientific papers by the largest research schools in Europe has faced us with conflicting opinions. For example, the study of the prevalence of dental caries by Brown and Schodel (1975) did not revealed any significant differences in healthy children and children with Down's syndrome (Denisova, 2011; Zigmond *et al*., 2006).

Caldwell (2000) published data on that the teeth of children and adolescents with Down's syndrome are less prone to caries than teeth of healthy children, due to several reasons such as late teething, microdentism which facilitates the removal of plaque from the interdental space. Moreover, most children with Down's syndrome are overweight, so their diet is to be strictly monitored. For preventing obese, children hsve to reduce the consumption of cariogenic foods and beverages (Denisova, 2011).

The literature provides information on a large significant difference in the tooth caries incidence of first permanent molars in children with genetic disorders compared with healthy children aged 9-11 years (Scully, 2005; Gorbunova, 2006). The number of healthy children having already received treatment for dental caries of first permanent molars and children with Down's syndrome in two age groups of 12-14 years ($p<0.001$) and 15-17 years ($p<0$) differs significantly.

The study of the dental status of children with Down's syndrome has revealed (Oredugba, 2006; Platonova, 2007) that the average value of the index of Decayed, Extracted and Filled teeth (DEF) in the group with hereditary disorders was 0.23±0.64 and in the control group 0.09±0.29 ($p<0.05$).

Data on the prevalence of caries and diseases of hard tooth tissues is very controversial and requires further research. Purpose of the study is to determine the risk of caries in children with genetic pathology.

MATERIALS AND METHODS

To study the dental status and identify risk factors for dental caries we examined 102 children aged 8-12 years. All experimental subjects were divided into two main groups:

- Group 1 (38 persons): children with Down's syndrome
- Group 2 (64 persons): practically healthy children without any hereditary disorder

External stigmatization was pathognomonic for Down's syndrome flat, wide face, Mongoloid eye shape, epicanthic fold, short saddle nose, flat nasal bridge, flattened head, dysplastic ear auricles, "gothic" palate, open or half-open mouth, short wide neck, clinodactyly, brachymesophalangia, hyperextension of the metacarpophalangeal joints, megalopsia, 'Asandal' gap on the feet, etc.

Identification of risk factors for caries in patients was carried out by using the inventions by orion-diagnostika

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(Finland), specifically, the diagnostic sets dentobuff strip, dentocult CA, dentocult LB and dentocult SM strip mutans. Diagnostic tests are approved for use in the territory of the Russian Federation Registration.

RESULTS AND DISCUSSION

***Streptococcus mutans* and lactobacilli concentration determination:** Total 38 children with Down's syndrome and 40 healthy children (control group) aged 8-12 years were examined for *Streptococcus mutans* and lactobacilli. The results of studying the concentration of *Streptococcus mutans* were as follows. The 17 persons (45%) had 10,000-100,000 CFU mL^{-1} saliva (Class I) detected, 37% (14 persons)100,000-1,000,000 CFU mL^{-1} saliva (Class II) and 7 persons (18%) had <10,000 CFU mL^{-1} saliva (Class 0). No cases of exceeding 1,000,000 CFU mL^{-1} saliva were detected.

Thus, as we can see from Fig. 1, a group of children with genetic disorders had 82% of subjects with predominant medium and high caries risk in terms of *Streptococcus mutans*.

The 27 persons (68%) of control group had 10,000-100,000 CFU of streptococci in 1 mL of saliva (Class 1) and 30% (12 persons) had <10,000 CFU mL^{-1} saliva (Class 0) and only 1 child (2%) had 100,000-1,000,000 CFU mL^{-1} saliva diagnosed (Class 2). Mostly low and medium risk of caries prevails.

We obtained the following values when studying the concentration of lactobacilli in saliva (Group I). Figure 2 shows the results of studying the saliva in patients with Down's syndrome.

The 14 persons (37%) had 10,000-100,000 CFU mL^{-1} saliva (Class II) detected, 42% (16 persons) 1,000-10,000 lactobacilli in 1 mL of saliva (Class I) and 4 persons (10.5%) had 100,000-1,000,000 CFU mL^{-1} saliva (Class III). The 10.5% (4 persons) had <1,000 CFU of lactobacilli in 1 mL of saliva. The lactobacilli concentration in the saliva indicated medium and high caries risk prevailing.

The salivation rate was significantly higher in the control group than in patients with Down's syndrome and was 0.89±0.17 and 0.55±0.22, respectively by $p<0.005$.

However, the children with chromosome disorders had high saliva viscosity revealed. The average value was 2.0±0.52 centipoise, whereas the same in the control group was 1.8±0.4 centipoise ($p<0.01$).

In the Group II, 11 persons (28%) had 1,000-10,000 CFU mL^{-1} saliva (Class I) detected, 55% (22 persons) 10,000-100,000 CFU mL^{-1} saliva (Class II) and 6 patients (15%) had <1,000 CFU mL^{-1} saliva (Class 0). Only 1 child (2%) had lactobacilli concentration over 100,000 CFU mL^{-1} (Class III) (Fig. 3-6).

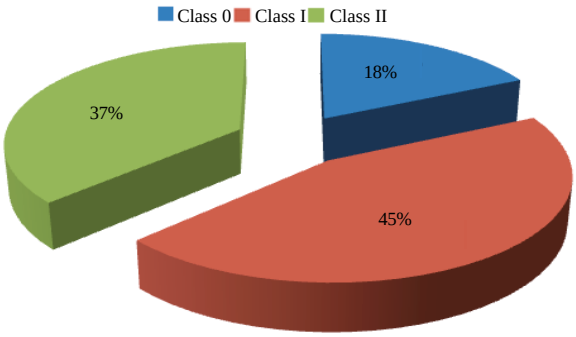

Fig. 1: The concentration of the *Streptococcus mutans* in the saliva of children with Down's syndrome; Class 0: <10,000 CFU mL^{-1} saliva; Class I: <100,000 CFU mL^{-1} saliva; Class II: 100,000-1,000,000 CFU mL^{-1} of saliva

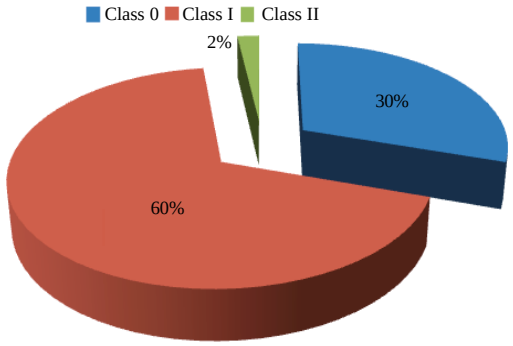

Fig. 2: The concentration of *Streptococcus mutans* in the saliva of the patients in the comparison group: Class 0: <10,000 CFU mL^{-1} saliva; Class I: <100,000 CFU mL^{-1} saliva; Class II: 100,000-1,000,000 CFU mL^{-1} of saliva

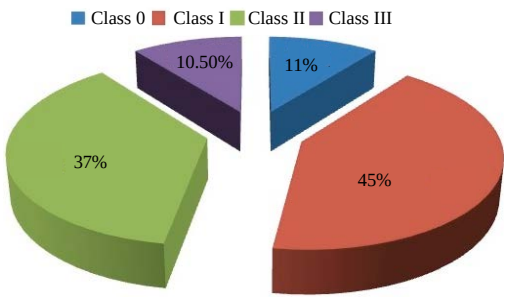

Fig. 3: Concentration of Lactobacillus in saliva in patients with Down's syndrome: Class 0: <1,000 CFU mL^{-1} saliva, Class I: discovered by 10,000-100,000 CFU mL^{-1} of saliva; Class II: 100,000 CFU-1,000,000 CFU mL^{-1} saliva; Class III: <1,000,000 CFU mL^{-1} saliva

Fig. 4: Concentration of Lactobacillus in saliva in patients from the control group: Class 0: <1,000 CFU mL^{-1} saliva, Class I: discovered by 10,000-100,000 CFU mL^{-1} of saliva; Class II: 100,000 CFU-1,000,000 CFU mL^{-1} saliva; Class III: <1,000,000 CFU mL^{-1} saliva

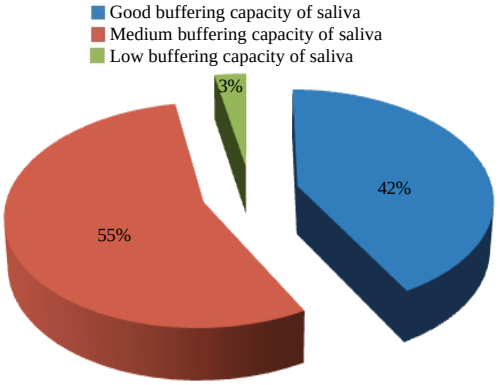

Fig. 5: The buffer capacity of saliva of children with Down's syndrome

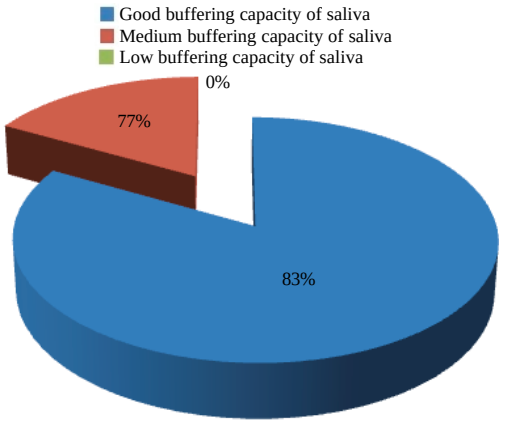

Fig. 6: The buffering capacity of saliva of children in the comparison group

Thus, we revealed in the saliva of the majority of children with Down's syndrome a high concentration of cariogenic microorganisms in 1 mL of saliva which activation promotes further the caries progression.

Table 1: Teeth and surfaces DEF values in the examined groups

Investigated parameters	Group with down's syndrome	Control group	p-values
DEFt	5.2±1.48	4.1±2.40	p<0.010
DEFs	7.9±2.85	5.7±4.71	p<0.005

We studied buffering capacity of saliva by using the diagnostic indicators dentobuff (orion-diagnostika) in 38 patients with chromosomal pathology (Group I). Mean salivary pH was 5.6±1.06 .The 16 persons (42%) had normal buffering capacity (blue indicator) diagnosed, 21 children (55%) had decreased capacity (green) and 3% (1 child) had low capacity.

In the control group, 33 persons (83%) had normal buffering saliva capacity and 7 children (17%) had decreased one. No cases of low capacity (yellow) was detected in the control group. Mean saliva pH in patients of control group was 6.64±0.78P (p<0.02).

One of the main indices is the intensity of carious dental injury DEF (both teeth and surfaces). The results of the study of both teeth and surfaces DEF indices in Group I and II are shown in Table 1.

As we can see from Table 1, the teeth and surfaces DEF values in the group of patients with chromosomal abnormalities (Group I) differ from those in the control group. The patients with Down's syndrome have more teeth affected by caries than in patients of the control group (5.2±1.48 Group I, 4.1±2.4 Group II). The differences are significant (p<0.01). The average DEF index for surfaces in the Group I is much higher than the surface DEF index in the Group II (Group I: 7.9±2.85; Group II: 5.7±4.71) (p<0.05).

CONCLUSION

The analysis of the above results of research allows arguing that children with genetic pathology have a higher risk of tooth decay due to poor oral hygiene and improper diet as evidenced by the high concentration of cariogenic microorganisms detected in their saliva. In addition, low buffering capacity of saliva and increased viscosity foster the development of caries in children with Down's syndrome.

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