

# Distinctive Features of Microcrystallization of Mixed Saliva in Children with Different Levels of Activity of Carious Process

I. M. Voloshina<sup>1</sup>, V. V. Borisov<sup>2</sup>, A. V. Sevbitov<sup>2</sup>, A. A. Davidiants<sup>2</sup>,  
S. N. Mironov<sup>2</sup>, M. Yu. Kuznetsova<sup>2</sup>, E. V. Ergesheva<sup>2</sup>

<sup>1</sup>Department of Pediatric Dentistry, Prevention of Dental Diseases, Federal State Budgetary Educational Institution of Higher Education, Omsk State Medical University, The Ministry of Health of Russia, Russia,

<sup>2</sup>Department of Propaedeutics of Dental Diseases, Federal State Autonomous Educational Institution of Higher Education, I.M. Sechenov First Moscow State Medical University, Ministry of Health of the Russian Federation (Sechenov University), Moskva, Russia

## Abstract

**Aim:** Microcrystallization of oral fluid is one of the main indicators of mixed saliva. **Introduction:** This method allows to identify the effectiveness of preventive and therapeutic measures carried out in the oral cavity. **Materials and Methods:** The clinical material of 187 patients was analyzed. Oral fluid was analyzed on the basis of the following parameters: pH, general concentration of Ca and P, velocity of secretion, mass of sediment; microcrystallization was analyzed too. The study was carried out in the following terms: before the treatment of caries, after the sanitation of the oral cavity, every month for six months. **Results and Discussion:** Clinical and laboratory studies have shown that children with different intensity of the carious process revealed a number of features of mixed saliva.

**Key words:** Caries in children, carious process, Fedorov-Volodkina hygienic index, microcrystallization of mixed saliva, modification of Parma, papillary-marginal-alveolar index, velocity of secretion

## INTRODUCTION

One of the important factors, which influence the life quality, is the appearance of a person. It is difficult to imagine a successful, thriving, and happy person who has bad teeth and unpleasant smile. "Dazzling" smile has become a symbol of beauty and prestige, success, and wealth in the modern world. People have begun to think more of health and its external manifestation - their appearance; they have begun to care more for themselves: Number of visits to dentists for taking of hygienic measures of oral cavity has grown.<sup>[1-3]</sup> However, human state of health and particularly the state of the oral cavity of population remain on a low level, and a steady increase of intensity of caries in children is registered. A number of children with a decompensated form of caries course continue to grow too. Domination of the processes of demineralization over remineralization determines the absence of tendency toward limitation of a pathologic process.<sup>[4,5]</sup> When decompensated for caries lesion is detected

multiple primary caries on different teeth groups. The task of the dentist child's doctor to prevent the progression of the demineralization process is a transition from a reversible form to an enamel defect that requires invasive treatment. In many respects, this will be helped by knowledge about the peculiarities of microcrystallization of mixed saliva in children at different levels of activity of the carious process. For carious teeth, the high degree of the appearance of the dorsal or pigmented spot of the original carapace, as well as the formation of the enamel defects without the limitation for ornamentation. In young children, caries occurs with the formation of pigmentation around the tooth enamel and dentin. In the aftermath of prostration, the incidence of tooth decay increased in all age periods. In the absence of 12 years,

### Address for correspondence:

M. Voloshina Irina, Department of Pediatric Dentistry, Prevention of Dental Diseases, Omsk State Medical University, Russia.  
E-mail: 25082000.80@mail.ru

**Received:** 15-09-2018

**Revised:** 24-09-2018

**Accepted:** 30-09-2018

the risk of getting infected with the WHO allows one to judge the efficacy of the preventive mucous membranes, as well as the resistance of hard tissues of the oral cavity to caries. According to the data of the literature, up to 82% of the patients that have recently undergone permanent teeth are not active.<sup>[6-8]</sup> This is exactly why the preservation of “own” teeth is the goal of modern dentistry. Today, patients know the real “price” of health: Beauty and functionality of healthy teeth, which have been created by nature, can never be replaced by constructions even if these constructions have been produced with the help of a “supermaterial.”<sup>[9]</sup>

Modern diagnostics of the state of pre-disease and disease is performed to carry out all necessary preventive and curative measures, which take into account individual peculiarities of a patient (dental state, age, somatic health, and heredity); therefore, this diagnostics helps to reach the desired goal, i.e., to reduce growth of caries prevalence and to reduce number of children with decompensated form of course of carious process. There are no complete systematized data about this matter in literature which is available for us.<sup>[10]</sup>

### Objective of our research

For the foregoing reasons, the following goal was set to study the distinctive features of mixed saliva in children with different levels of activity of carious process; this study was conducted on the basis of data of biochemical research and microcrystallization.

To attain the set goal, the following objectives were determined:

1. Biochemical parameters of mixed saliva in children with various activities of carious process had to be analyzed.
2. Distinctive features of microcrystallization of mixed saliva in children with various activities of carious process had to be analyzed.
3. A comparative evaluation of distinctive features of biochemical composition and microcrystallization of mixed saliva in children had to be given.
4. Parameters of biochemical composition and microcrystallization of mixed saliva in children with various activities of carious process had to be analyzed in their changing.
5. Concrete practical advice about diagnostics and correction of preventive and curative measures in children had to be given on the basis of conducted work.

## MATERIALS AND METHODS

### Chemicals and reagents

Chemical were obtained from Sigma chemical company, St Louis, MO, USA. All other chemicals and reagents used were

of analytical grade with the highest purity and obtained from Glaxo Laboratories (P) Ltd.

### Methods

This work was done at Sechenov University with supported by the “Russian Academic Excellence Project 5-100”. Taking into account the purpose of the work to study the features of microcrystallization of mixed saliva in children with different levels of activity of the carious process, the inclusion criterion was the desire to participate in the study, confirmed by the presence of voluntary informed consent, as well as the lack of factors that can affect the possibility of obtaining reliable and timely data during the study (given in the exclusion criteria).

Exclusion criteria from the study:

- Unwillingness to participate in the study (inability to obtain the full amount of necessary information),
- Epilepsy or a history of convulsive disorder,
- Severe infectious processes (HIV infection, tuberculosis, syphilis, and progressive course of viral hepatitis B and C),
- Connective tissue dysplasia (diagnosed at the beginning of the study),
- The presence or appearance of conditions that make it impossible to complete and timely clinical and/or laboratory diagnosis.

To achieve this goal and objectives of the study, we conducted a dental examination of schoolchildren in Omsk at the age of 12–15 years with different intensities of the carious process. All the examined patients were divided into three groups depending on the degree of caries activity: Compensated, subcompensated, and decompensated course of caries. The article presents data only on the first and third groups, and this is due to the greater informativeness, visibility, and statistical reliability of the differences between these contingents studied.

The intensity of caries of teeth was estimated according to decayed, missing, and filled (DMF) index; during the examination of the state of hygiene of oral cavity, the Fedorov-Volodkina hygienic index (HI) was used; the state of parodont tissues was estimated according to papillary-marginal-alveolar index (PMA) in the modification of Parma (1960). Oral fluid was analyzed on the basis of the following parameters: pH, general concentration of Ca and P, velocity of secretion, and mass of sediment; microcrystallization was analyzed too. The analysis took place before treatment, then after sanitation, and then every month within a half-year.

### Statistical analysis

Statistical analysis was performed by one-way analysis of variance followed by Fisher’s LSD *post hoc* test using Software Package for the Social Science software package

version 12.0. Results were expressed as mean ± SD.  $P < 0.05$  was considered to be statistically significant.

## RESULTS AND DISCUSSION

Mean value of DMF in children with a compensated form of caries course was 1.3, HI = 2.1, PMA = 12%.

Mean value of DMF index in children with decompensated form was 10.7, HI = 3.4, PMA = 28% [Figure 1].

After active reaction of supernatant fluid of mixed saliva in children with compensated form of caries had been analyzed, the following data were obtained: Before sanitation, pH was  $6.98 \pm 0.21$ , and after carried-out complex measures such as sanitation, professional hygiene of oral cavity, and teaching of hygiene of oral cavity, it became  $7.13 \pm 0.18$  [Figure 2]. A month later, no reliable reduction of pH was registered. 2 months later, a reduction of pH by an average of 0.1 was registered and reduction of this value continued during further examinations [Figure 3].

The following values were registered in children with Level III of the activity of carious process: Before sanitation, pH was  $6.57 \pm 0.19$ , and after complex measures such as carried-out sanitation, professional hygiene of oral cavity, and teaching of hygiene of oral cavity, it shifted to neutral values ( $6.64 \pm 0.20$ ) for a little [Figure 2]. However, a month later, the pH of mixed saliva returned to initial values ( $P > 0.01$ ) [Figure 3].

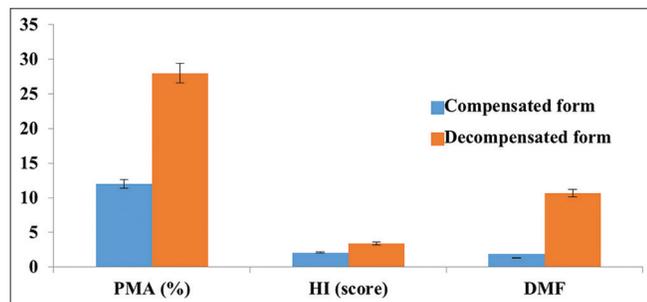


Figure 1: Representativeness of hygienic indices in schoolchildren with different intensities of carious process

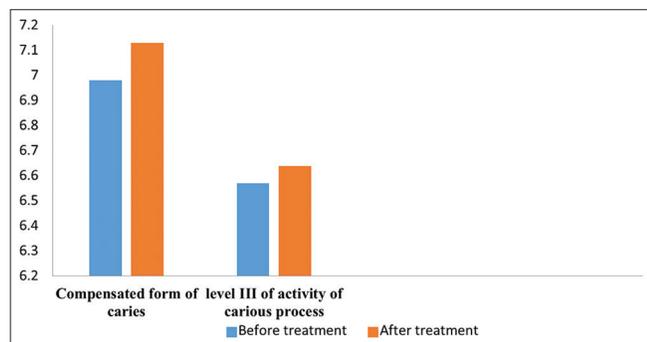


Figure 2: pH change during treatment

Initial values of the concentration of Ca and P were statistically significant ( $P < 0.05$ ) higher in children with the compensated course of caries as compared with that ones in children with decompensated form. A greater mass of sediment and lower velocity of secretion were statistically significant registered in children with Level III of the activity of carious process as compared with patients with compensated course of caries.<sup>[11]</sup>

Microcrystallization in children with Level I of caries corresponded mainly to the second type (74%), and the Type I was registered considerably more rarely.<sup>[12]</sup> After carried-out complex measures such as sanitation, professional hygiene of oral cavity, and teaching of hygiene of oral cavity, the ratio of Types I and II of microcrystallization changed; Structure of crystals of the first type was seen more often. Domination of a clear pattern of crystal structures of this type, which diverge from the center of a drop, was being registered for two following months [Figure 4]. 4 months later, a statistically significant forming of microcrystals of Type II took place.

Assessing the types of microcrystallization in children with a high degree of caries activity revealed an absolute predominance to the sanitation of the third type.<sup>[13]</sup> After carried-out complex measures, the increase of the second

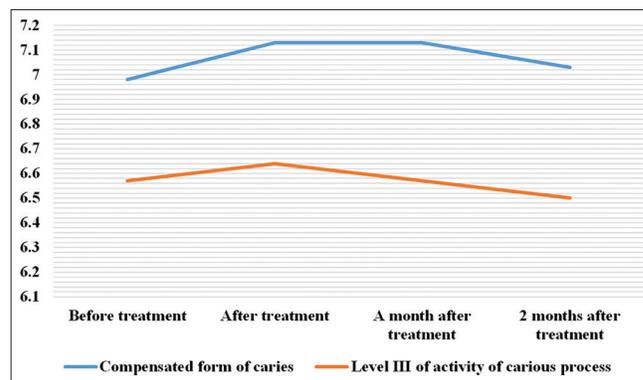


Figure 3: Dynamics of pH change

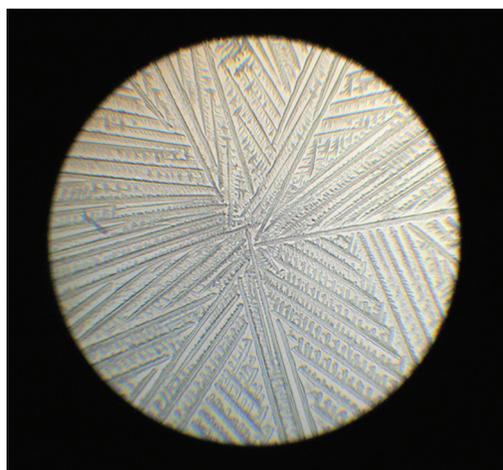


Figure 4: Type I microcrystallization

type of microcrystallization was registered (by more than 19%). However, the gained positive results were the short-term ones: A repeated analysis, which was conducted a month later, showed that data were practically identical with the initial ones.<sup>[14,15]</sup> Such changes may be evidence of constancy of saliva composition (homeostasis) and evidence of the fact that measures for the improvement of hygienic state of oral cavity are insufficient for an increase of remineralizing function of saliva.<sup>[16,17]</sup>

## CONCLUSION

1. Some distinctive features of mixed saliva were revealed in children with various insensitivities of carious process.
2. Revealed regularities of parameters of mixed saliva allow to use them for well-timed correction of preventive and curative actions that have an effect on the intensity of growth of caries prevalence and will reduce the number of children with decompensated course of process.
3. Received data enable to use microcrystallization as an integral indicator together with other parameters of mixed saliva for diagnostics and as a criterion of the effectiveness of preventive and curative measures.

## REFERENCES

1. Jepsen S, Blanco J, Buchalla W, Carvalho JC, Dietrich T, Dörfer C, *et al.* Prevention and control of dental caries and periodontal diseases at individual and population level: Consensus report of group 3 of joint EFP/ORCA workshop on the boundaries between caries and periodontal diseases. *J Clin Periodontol* 2017;44:S85-93.
2. Gupta N, Mutreja S, Kamate SK, Gupta B. Evaluation of change in salivary pH, following consumption of different snacks and beverages and estimation of their oral clearance time. *Int J Oral Care Res* 2015;3:25-31.
3. Leontev VK. *Stomatologiya M. Dentistry in Russia: State of the art and prospects for development.* Stomatologiya (Mosk) 2002;81:75-83.
4. Evstratenko VV, Sevbitov AV, Platonova VV, Selifanova EI, Dorofeev AE. Distinctive features of crystallization of mixed saliva in patients taking heroin and methadone. *Clin Lab Diagn* 2018;63:223-7.
5. Yumashev AV, Gorobets TN, Admakin OI, Kuzminov GG, Nefedova IV. Key aspects of adaptation syndrome development and anti-stress effect of mesodiencephalic modulation. *Indian J Sci Technol* 2016;9:93911.
6. Timoshin AV, Sevbitov AV, Drobot GV, Yumashev AV, Timoshina MD. Use of bioresorbable plates on the basis of collagen and digestase for treatment of diseases of oral mucosa (review of clinical cases). *Int J Green Pharm* 2018;12(S1):290-6.
7. Yumashev AV, Utyuzh AS, Volchkova IR, Mikhailova MV, Kristal EA. The influence of mesodiencephalic modulation on the course of postoperative period and osseointegration quality in case of intraosseous dental implantation. *Indian J Sci Technol* 2016;9:104307.
8. Timoshin AV, Sevbitov AV, Ergesheva EV, Boichuk AV, Sevbitova MA. Experience of treatment of aphthous lesions of oral mucosa by preparations on the basis of collagen and digestase. *Asian J Pharm* 2018;12(S1):284-7.
9. Borisov VV, Sevbitov AV, Poloneichik NM, Voloshina IM. Use of vector patterns for manufacturing of individual protective dental splints by method of thermoforming. *Indo Am J Pharm Sci* 2018;5:697-9.
10. Kuznetsova M, Nevdakh AS, Platonova VV, Sevbitov AV, Dorofeev AE. Evaluation of effectiveness of a preparation on the basis of phytoecdysteroids for treatment of traumatic injuries of oral mucosa in orthodontic patients. *Int J Green Pharm* 2018;12(S1):297-300.
11. Mekeel K, Gonzalez-Peralta R, Langham M, Hemming AW. Liver transplantation in very small infants. *HPB* 2006;8:23-87.
12. Pechalova PF, Bakardjiev AG, Beltcheva AB. Jaw cysts at children and adolescence: A single-center retrospective study of 152 cases in Southern Bulgaria. *Med Oral Patol Oral Cir Bucal* 2011;16:e767-71.
13. Oshida Y, Tuna EB, Aktoren O, Gençay K. Dental implant systems. *Int J Mol Sci* 2010;11:1580-678.
14. Kelley P, Watson T. Making long-term memories in minutes: A spaced learning pattern from memory research in education. *Front Hum Neurosci* 2013;7:589.
15. Rogers SJ, Vismara LA. Evidence-based comprehensive treatments for early autism. *J Clin Child Adolesc Psychol* 2008;37:8-38.
16. Razak PA, Richard KM, Thankachan RP, Hafiz KA, Kumar KN, Sameer KM. Geriatric oral health: A review article. *Int Oral Health* 2014;6:110-6.
17. Buzalaf MA, Hannas AR, Kato MT. Saliva and dental erosion. *J Appl Oral Sci* 2012;20:493-502.

**Source of Support:** Nil. **Conflict of Interest:** None declared.