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Ivanchyshyn V. V., Stadnyk U. O., Furdychko A. I.

## Dynamics of Morphological Changes in Oral Fluid in the Prevention of Fissure Caries in Children

Danylo Halytsky Lviv National Medical University,  
Lviv, Ukraine

*The purpose of the study* was to investigate the morphological properties of oral fluid in dynamics in the application of the developed set of measures for the prevention of fissure caries of the first permanent molars in children.

*Materials and methods.* 62 children aged 6 years with fissure caries of the first permanent molars (main group) and 31 children without signs of carious lesions (control group) were examined. The study of the crystal formation of oral fluid was carried out according to the method of Leus P. A. (1977). The mineralizing potential of oral fluid was expressed as an average score depending on the types of crystals detected.

*Results and discussion.* The analysis of the results of the study showed that 6 months after the start of preventive measures in the oral fluid of the children of the main group, a slight increase in type I crystals was noted in comparison with the initial data ( $40.18 \pm 4.65\%$  of cases,  $p>0.5$ ), at the same time, the number of children, in whom type III crystals were observed, decreased in the main group ( $16.45 \pm 2.32\%$ ,  $p>0.5$ ), and increased in the control group ( $19.32 \pm 2.47\%$  of cases,  $p>0.5$ ) in comparison with the initial data. After two years of observation, in the children of the main group, type I crystals were most often detected in the oral fluid ( $48.41 \pm 4.23\%$  of cases), in the children of the control group, on the contrary, the number of children with this type of crystals decreased and was almost one and a half times less than among children of the main group ( $p<0.05$ ). On the other hand, the number of children in the control group, in whom type III crystals were detected, was two times higher than among children in the main group ( $22.34 \pm 2.87\%$  and  $11.51 \pm 2.56\%$  of cases, respectively,  $p<0.05$ ).

*Conclusion.* It was established that in children who received a complex of preventive measures, 6 months after the implementation of preventive measures, the mineralizing potential of oral fluid was, on average,  $2.73 \pm 0.07$  points, which is slightly higher compared to the fissure detected at the beginning

of caries prevention ( $2.57 \pm 0.12$  points respectively,  $p>0.05$ ). In the children of the control group, the mineralizing potential of oral fluid changed less noticeably (from  $2.64 \pm 0.11$  points at the beginning of observation to  $2.66 \pm 0.11$  points,  $p>0.5$ ). After two years of observation, it was found that in the main group the mineralizing potential of oral fluid continued to increase, while in the children of the control group it decreased and reached almost the initial level ( $2.65 \pm 0.07$  points in the second year of observation and  $2.64 \pm 0.08$  points at the beginning,  $p>0.05$ ). Thus, it can be concluded that the proposed measures are quite effective.

**Keywords:** caries, oral fluid, morphological properties, children.

**Connection of the study with scientific programs, plans, topics.** This study is a fragment of scientific research work "The state of dental health and its correction based on a systematic analysis of clinical and laboratory, radiological, morphological, functional, aesthetic parameters in people of all ages", state registration number 0120U002143.

**Introduction.** In spite of certain achievements of modern caries science and the attention of researchers, dental caries remains an urgent problem in dentistry in the future, due to its high prevalence and intensity [1, 2, 3, 4]. A significant prevalence of fissure caries in the children in the first years after the eruption of permanent teeth [5, 6, 7, 8] requires an in-depth study of risk factors for its occurrence and methods of preventing the development of this pathology. In the development of caries, the composition and properties of the oral fluid are of great importance, since the oral fluid is a complex biochemical fluid that provides mineralization of the tooth tissues after their eruption [9, 10, 11, 12]. Given this, it is important to study the mineralizing properties of oral fluid as a marker of the effectiveness of methods for the prevention of caries fissures of permanent teeth in the children.

**The purpose of the study** was to study changes in the morphological properties of oral fluid in dynamics in the application of the developed set of measures for the prevention of fissure caries of the first permanent molars in children.

**Materials and methods.** The results of clinical and laboratory studies [13, 14, 15] served as the basis for the development of a set of measures aimed at preventing the development of caries in the children of this localization. Clinical examinations were conducted at the Department of Pediatric Dentistry of Danilo Halytsky National Medical University, Lviv.

Preventive complex provided for the hygienic education of the children, professional oral hygiene, use of tooth pastes with fluoride (Lacalut Kids, PresiDENT Junior), sealing of fissures immediately after eruption of the tooth (Fissurit F, Helio Seal F), local remineralisation therapy (Belagel Sa/R, Ferroplan, Bifluorid-12). For the children in the control group fluorine-containing toothpastes were prescribed, hygiene and professional oral hygiene was conducted. To study the morphological properties of oral fluid in dynamics in the application of the developed set of measures for the prevention of fissure caries, 62 children aged 6 years with fissure of the first permanent molars (main group) and 31 children without signs of carious lesions (control group) were examined.

**Ethical considerations.** The study was conducted following the principles of the Declaration of Helsinki (1997), the Council of Europe Convention on Human Rights and Biomedicine (1997), the International Code of Medical Ethics (1983), ICHGSP (2002), and the relevant laws of Ukraine. The Local Ethics Committee approved the study protocol for all participants. Informed parental consent was obtained for the study,

as well as for the collection and processing of patient data.

Study of crystal formation in the oral fluid were carried out according to the method of Leus P. A. (1977). Mineralization potential of oral fluid (MPOF) expressed an average score depending on the identified types of crystals.

Statistical processing of research results was carried out using Microsoft Excel and Statistica application programs for statistical analysis of medical and biological research data.

**Research results.** Analysis of the results of the study showed that at the beginning of the observation in oral fluid of most of the children in the study and control groups type II crystals dominated (accounting period by  $43.46 \pm 3.23\%$  and  $44.47 \pm 5.47\%$ , respectively,  $p > 0.05$ ) (**Table 1**).

Number of children with type I crystals in oral fluid were found, which were also almost identical in both groups and slightly smaller in comparison with the children, in whose oral fluid type II crystals were observed ( $p > 0.05$ ). Type III crystals at the beginning of observation were revealed in only  $18.39 \pm 2.13\%$  of the children of the main group and  $18.06 \pm 2.56\%$  of the children of the control group ( $p > 0.05$ ).

In 6 months after the beginning of preventive measures it was revealed that in the oral fluid of the children of the control group the number of type I crystals decreased slightly compared to the initial data ( $36.45 \pm 4.47\%$  of cases,  $p > 0.5$ ). Instead, the children of the main group showed a slight increase in crystals of this type compared with the initial data ( $40.18 \pm 4.65\%$  of cases,  $p > 0.5$ ). It was found that in the children of both the main and control groups in the future type II crystals prevailed, their number increased slightly in both

**Table 1** – Types of microcrystallization of oral fluid in the examined children at different periods of observation (in %)

Terms of observation	Control group			Main group			p
	Types of crystals			Types of crystals			
	I	II	III	I	II	III	
Before the start	38.45±4.32	44.47±5.47	18.06±2.56	39.14±4.57	43.46±3.23	18.39±2.13	* >0.05 ** >0.05 *** >0.05
6 months	36.45±4.47	45.23±5.71	19.32±2.47	40.18±4.65	44.41±3.53	16.45±2.32	* >0.05 ** >0.05 *** >0.05
12 months	33.55±4.65	46.07±6.07	21.75±2.07	45.42±3.56	42.26±3.78	13.46±2.54	* <0.05 ** >0.05 *** <0.05
24 months	31.87±4.18	47.45±6.21	22.34±2.87	48.41±4.23	41.51±4.24	11.51±2.56	* <0.05 ** <0.05 *** <0.05
p	>0.05	>0.05	>0.05	<0.05	>0.05	<0.05	

**Notes:** \* – the degree of reliability between the crystals and type I in the children of the main and control group; \*\* – the degree of reliability between the crystals and type II in the children of the main and control group; \*\*\* – the degree of reliability between the crystals and type III in the children of the main and control group; p – the degree of confidence between the types of crystals before and after 24 months of observation.

groups of the children compared with the initial data ( $44.41 \pm 3.53\%$  in the main and  $45.23 \pm 5.71\%$  in the control group,  $p>0.05$ ). At the same time, the number of the children with type III crystals decreased in the main group ( $16.45 \pm 2.32\%$ ,  $p>0.5$ ), and increased in the control group ( $19.32 \pm 2.47\%$  of cases,  $p>0.5$ ) compared with the initial data.

The results of the study of microcrystallization of oral fluid in the examined children after 12 months of observation were somewhat different. In the children treated with the developed set of prophylactic measures, the type of crystals prevailed ( $45.42 \pm 3.56\%$  of the children) in the control group, the number of the children with this type of crystals was much lower (accounting period by  $33.55 \pm 4.65\%$  of cases,  $p<0.05$ ). Instead, in the control group there was the largest number of the children in the oral fluid of whom crystals of type II were detected ( $46.07 \pm 6.07\%$  of cases), in the children of the main group this type of crystals was observed in  $42.26 \pm 3.78\%$  of the children ( $p>0.05$ ). With respect to type III crystals, it was found that in the control group the number of the children with this type of crystals continued to grow compared to the initial data and amounted to  $21.75 \pm 2.07\%$  ( $p>0.05$ ). This is significantly more than in the children of the main group ( $13.46 \pm 2.54\%$ , respectively,  $p<0.05$ ). The number of the children with this type of crystals in the main group decreased in comparison with the initial data ( $p>0.05$ ).

Two years later, a similar pattern was revealed. Therefore, type I crystals ( $48.41 \pm 4.23\%$ ) were found most frequently in oral fluid in the children of the main group, which is significantly more than at the beginning of the observation ( $p<0.05$ ). In contrast, the number of children with this type of crystals decreased in comparison with the initial data and amounted to  $31.87 \pm 4.18\%$  ( $p>0.05$ ), and was almost one and a half times less than among the children of the main group ( $p<0.05$ ). On the other hand, the number of the children of the control group with type III crystals increased slightly compared to the initial data ( $p>0.05$ ) and was twice higher than among the children of the main group ( $22.34 \pm 2.87\%$  and  $11.51 \pm 2.56\%$ , respectively,  $p<0.05$ ). In the children of the main group, on the contrary, there was a further decrease in the number of the children in whose oral fluid crystals of type III were found, compared with the initial data ( $p<0.05$ ).

The effectiveness of the prophylactic complex used by us is also evidenced by the results of the study of the mineralization potential of the oral fluid (MPOF) of the examined children at different observation periods (Fig. 1).

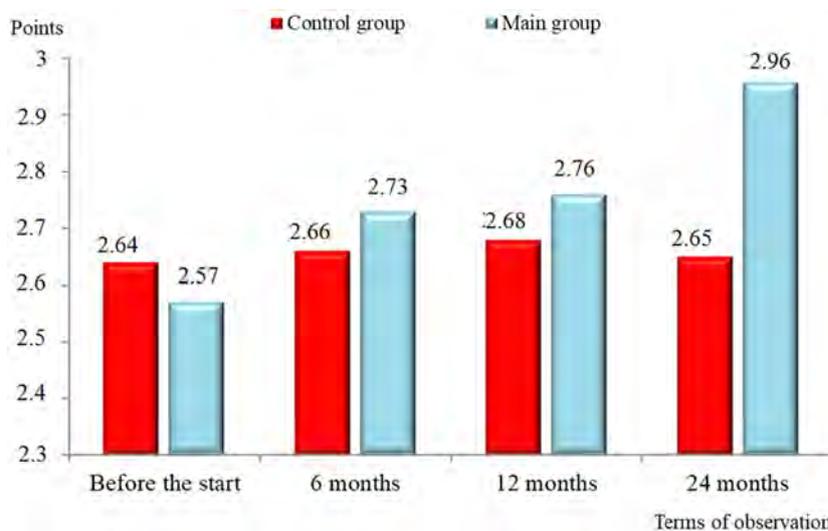


Fig. 1 – Mineralization potential of oral fluid in the examined children

It was found that in children who received a set of preventive measures, the MPOF is growing at the time, while in the children, for whom preventive measures were not carried out, its value remains almost unchanged during the entire observation period. So, 6 months after the preventive measures were carried out in the children of the main group the MPOF established, on average, at  $2.73 \pm 0.07$  points, which is slightly higher compared with the detected early prevention of fissure caries ( $2.57 \pm 0.12$  points, respectively,  $p>0.05$ ). In the children of the control group the MPOF changed less significantly (from  $2.64 \pm 0.11$  points at the beginning of observation to  $2.66 \pm 0.11$  points,  $p>0.5$ ). 12 months after the beginning of the use of the developed complex of preventive measures the MPOF in the children of the main group established, on average, at  $2.76 \pm 0.09$  points, its value was slightly higher compared with the detected early prevention of fissure caries ( $2.57 \pm 0.12$  points, respectively,  $p>0.05$ ). In the children of the control group, this indicator changed less significantly (from  $2.64 \pm 0.11$  points at the beginning of observation to  $2.68 \pm 0.12$  points at the end of the first year of observation,  $p>0.05$ ). As for the results revealed at the 24<sup>th</sup> month of the observation, it was found that in the main group the MPOF continued to grow while in the children of the control group it decreased and reached almost the initial level ( $2.65 \pm 0.07$  points in the second year of the observation and  $2.64 \pm 0.08$  points at the beginning,  $p>0.05$ ).

Thus, it was established that in the oral fluid of children whose teeth are affected by fissure caries, type II and III crystals predominate, and the MPOF, on average, is  $1.75 \pm 0.42$  points, which corresponds to a low level in contrast to children with intact fissures. In the children who used the prophylactic complex, there was a steady increase in mineral potential and after two years of observation its value was significantly higher than in the children of the control group and type I and II crystals predominated in the oral fluid.

**Discussion.** According to a number of authors, the prevalence of the fissure caries in children in the 1<sup>st</sup> and 2<sup>nd</sup> years after the eruption of permanent teeth requires an in-depth study of the risk factors for its occurrence and methods of preventing the development of this pathology [5, 6, 7, 8]. A number of studies have been conducted, which testify to the significant influence of the composition and properties of the oral fluid on the development of the carious process [9, 10, 11, 12]. However, many questions remain open related to the study of the mineralizing properties of the

oral fluid, as a marker of the effectiveness of methods of prevention of the fissure caries of permanent teeth in children.

Results of the research showed that the proposed measures for the prevention of the fissure caries of permanent teeth are quite effective, as evidenced by the improvement of the mineralizing properties of the oral fluid.

**Conclusion.** Thus, when analyzing the results of morphological observation of the oral fluid of the examined children within two years of implementation of the developed complex of measures for the prevention of fissure caries of permanent teeth, it can be concluded that the proposed measures are quite effective, as evidenced by the improvement of its mineralizing properties in the children who received the developed preventive complex, compared with the children who did not take special preventive measures.

**Perspectives of further research.** The results of this study can be used in planning the prevention and treatment of fissure caries in children.

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### ДИНАМІКА МОРФОЛОГІЧНИХ ЗМІН РОТОВОЇ РІДИНИ ПРИ ПРОФІЛАКТИЦІ ФІСУРНОГО КАРІЕСУ У ДІТЕЙ

*Іванчишин В. В., Стадник У. О., Фурдичко А. І.*

**Резюме.** *Мета* - дослідити зміни морфологічних властивостей ротової рідини в динаміці при застосуванні розпрацьованого комплексу заходів для профілактики карієсу фісур перших постійних молярів у дітей.

*Об'єкт та методи.* Було обстежено 62 дитини віком 6 років з карієсом фісур перших постійних молярів та 31 дитина без ознак карієзного ураження (контрольна група). Дослідження кристалоутворення ротової рідини проводили за методикою Леуса П.А. (1977). Мінералізувальний потенціал ротової рідини (МППР) виражали середнім балом залежно від виявлених типів кристалів.

*Результати.* Аналіз результатів дослідження показав, що через 6 місяців після початку проведення профілактичних заходів у ротовій рідині дітей основної групи відмічалось незначне збільшення кристалів I типу у порівнянні з вихідними даними (40,18±4,65% випадків,  $p>0,5$ ), у той же час кількість дітей, у яких спостерігали кристали III типу, в основній групі знижувалась (16,45±2,32%,  $p>0,5$ ), а в контрольній групі підвищувалась (19,32±2,47% випадків,  $p>0,5$ ) у порівнянні з початковими даними. Через два роки спостереження у дітей основної групи найбільш часто в ротовій рідині виявляли кристали I типу (48,41±4,23% випадків), у дітей контрольної групи, навпаки, кількість дітей з таким типом кристалів зменшувалась і була практично у півтора рази меншою, ніж серед дітей основної групи ( $p<0,05$ ). Натомість, кількість дітей контрольної групи, у яких виявлено кристали III типу, була у два рази вищою, ніж серед дітей основної групи (22,34±2,87% та 11,51±2,56% випадків відповідно,  $p<0,05$ ).

*Висновки.* Встановлено, що у дітей, які отримували комплекс профілактичних заходів, через 6 місяців після проведення профілактичних заходів МППР становив, в середньому, 2,73±0,07 бала, що дещо вище у порівнянні з виявленим на початку профілактики карієсу фісур (2,57±0,12 бала відповідно,  $p>0,05$ ). У дітей контрольної групи МППР змінювався менш помітно (з 2,64±0,11 бала на початку спостереження до 2,66±0,11 бала,  $p>0,5$ ). Через два роки спостереження виявлено, що в основній групі МППР продовжував зростати у той час, як у дітей контрольної групи – зменшувався й досягав практично вихідного рівня (2,65±0,07 бала на другому році спостереження та 2,64±0,08 бала на початку,  $p>0,05$ ).

**Ключові слова:** карієс, ротова рідина, морфологічні властивості, діти.

#### ORCID and contributionship:

Victoriya V. Ivanchyshyn : 0000-0002-7523-144X <sup>A,B</sup>

Uliana O. Stadnyk : 0000-0002-5389-6547 <sup>D,F</sup>

Anastasiya I. Furdychko : 0000-0002-8677-428X <sup>C,E</sup>

A – Work concept and design, B – Data collection and analysis,  
C – Responsibility for statistical analysis, D – Writing the article,  
E – Critical review, F – Final approval of the article

#### CORRESPONDING AUTHOR:

##### Anastasiya I. Furdychko

Danylo Halytsky Lviv National Medical University,

Department of Therapeutic Dentistry

69, Pekarska Str., Lviv 79010, Ukraine

phone: +380676880214, e-mail: anfurd111@gmail.com

*The authors of this study confirm that the research and publication of the results were not associated with any conflicts regarding commercial or financial relations, relations with organizations and/or individuals who may have been related to the study, and interrelations of coauthors of the article.*

*Recommended for publication by a meeting of the editorial board after review*