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Cover

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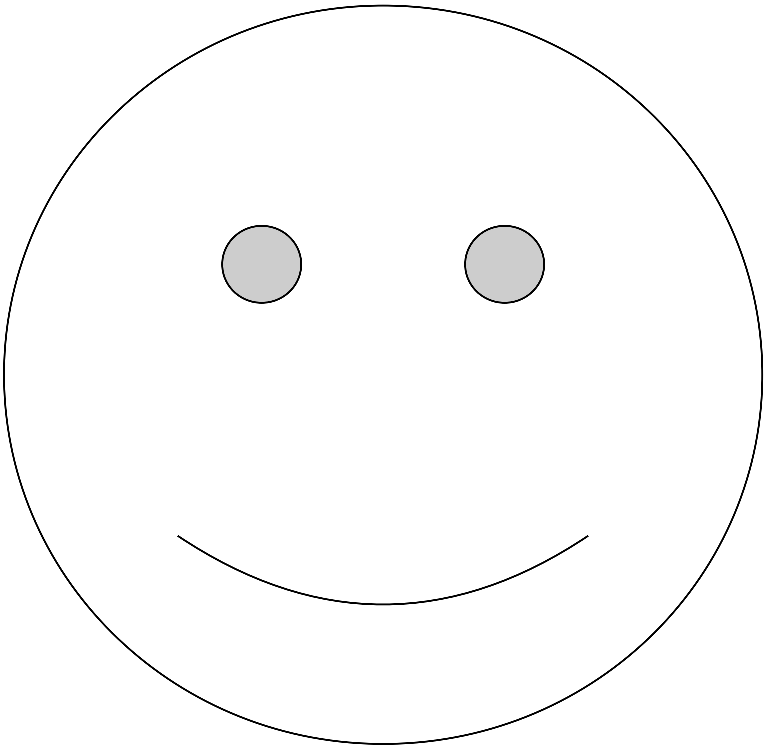

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Early prevention and treatment of dental caries during teething in children

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In the monograph, based on the analysis of the results of our own research, the duration of the process of lifetime mineralization of enamel 1pM, as well as the state of mixed saliva during the period of teething and with the use of caries- preventive agents, was studied.

The monograph is intended for dentists and specialists dealing with this problem, as well as for practicing physicians.

LIST OF ABBREVIATIONS

1pM	- first permanent molars
VL-c	- vestibulo-lingual diameter of the crown
MD-c	- mesio-distal diameter of the crown
DMF(t)	- decayed, missing, filled index (teeth)
DMF(s)	- decayed, missing, filled index (surfaces)
HI	- hygiene index
FDE	- focal demineralization of enamel
H-c	- crown height
CL	- chemiluminescence
Ca	- calcium
P	- phosphorus
V	- the rate of saliva secretion
FP	- Fluor Protector

INTRODUCTION

The eruption of teeth and their mineralization are complex biological processes, which are based on the phenomena of tissue formation and growth in both the ante- and postnatal periods , occurring under the influence of neurohumoral influences from the whole organism and environmental conditions (Leontiev V.K., 2000; Demchina G., 2001).

Teeth eruption occurs at specific times and in a strict sequence. Thus, the eruption of permanent teeth begins at the age of 5-6 years, when the first molar erupts. Currently, due to the general acceleration of physical development in children, a slight acceleration in the development of the dentoalveolar system is observed, expressed in the eruption of teeth at an earlier age, the rapid replacement of primary teeth by permanent ones, and the comparatively early formation of the permanent dentition (Kiselnikova L.P., 1996; Pashayev K.P., 1998; Fursik D.I., 1999).

It has been established that after tooth eruption, incompletely mineralized areas of enamel remain, the maturation of which occurs in the oral cavity and is gradually completed on the tubercles, fissures, equator and cervical area through the gradual replacement of enamel carbonate with phosphate, calcium, fluorine and other macro- and microelements, thereby ensuring the resistance of dental tissues (Elizarova V.M., Petrovich Yu.A., 1997; Morozova N.V., 1998). This physiological process occurs under conditions of supersaturation of saliva with Ca^{+} and HPO_4^{2-} ions (Elizarov V.M., Petrovich Yu.A., 1997). Under the influence of unfavorable factors, there is a decrease in the mineralizing properties of saliva in children (Gavrilova O.A. et al., 1996; Leontyev V.K. et al., 1996; Yuldashkhanova A.S., 2000).

The presence of areas with incomplete mineralization of tooth enamel creates the preconditions for the development of dental caries already in the first years after their eruption , at the stage of enamel maturation, which is confirmed by the wide prevalence and high intensity of caries in children (Saifulina Kh.M., 1990; Yuldashkhanova A.S., 1996; Kuzmina L.N., 1996). According to L.P. Kiselnikov and V.K. Leontiev (1996), caries mainly affects chewing teeth, which is observed in 46% of cases in 8-year-old children, and 56% in 14-year-olds .

In connection with the above, the study of the timing of eruption and mineralization of the first permanent molars in children is very relevant and has great practical and theoretical significance, since the results obtained will be taken into account when organizing dental care for the child population of our Republic.

CHAPTER I .
QUESTIONS OF DIAGNOSIS AND PREVENTION OF CARIES OF THE FIRST PERMANENT MOLARS

The eruption and mineralization of the first permanent molar (1pM) are crucial for the formation and growth of the jaws and, consequently, for the proper development of the body as a whole. Throughout the period of primary tooth replacement (from 6 to 11 years), the first permanent molar bears the primary load during chewing, ensures proper development of the dental arches, and determines the bite height. The normal position of the 1pM in the dental arch promotes the harmonious alignment of erupting permanent teeth [8,9,11,104].

For the normal development of the permanent dentition and physiological transition, it is important to maintain the integrity of the primary teeth, especially the first permanent molar. Various complications and injuries lead to early tooth extraction, which, in turn, contributes to disruption of the permanent dentition and the development of dental anomalies [6,103].

At present, there is no doubt that early tooth loss in children becomes the etiological factor for most anomalies and deformations of the dental system [172]. As a result of premature removal of the first permanent molar or destruction of the crown of the tooth, curvature of the dental arches, the Popov- Godon phenomenon, and deep bite are most often formed [64].

The presented data indicate the enormous role of the first molar in the correct formation and growth of the facial skeleton and the development of orthognathic occlusion.

The timing of tooth eruption positively correlates with resistance to caries, being the key to occlusion and erupting earlier than other permanent teeth, the first molars are significantly more susceptible to caries [3,6,8,98,136]. In connection with this, the issues of eruption of permanent teeth have attracted the attention of many scientists in recent years [35,100]. It has been established that the first molars erupt in girls at an earlier age than in boys [56], and earlier in urban residents than in rural residents [1,80].

It has been found that the longer the time it takes for a tooth to erupt , the more significant the deviations in the sequence of this process, and therefore , the more often space deficiencies in the dental arch occur.

It turned out that the earlier the teeth begin to erupt, the shorter the period of eruption, and vice versa, the later the teeth erupt, the more frequently various disturbances in the onset and duration of the period of eruption occur [73,75,88,92,96].

Therefore, the exceptional importance of studying the characteristics and timing of eruption of the IM, the dynamics of the incidence and localization of caries, as well as the development of methods for the early diagnosis and prevention of the carious process becomes clear.

The timing of tooth eruption, especially the first permanent molar, is a key criterion for assessing the morphofunctional maturity of a child's body [24,34]. It is known that the first permanent molars erupt earlier than other permanent teeth. However, the literature data on the onset, average timing, and completion of the first permanent molar eruption are quite contradictory.

According to the generally accepted position, the onset of eruption is considered to be the age at which a given tooth has erupted in at least 5% of those examined [39,100]. The average age is considered to be the age at which a given tooth has erupted in 50% of those examined.

The end of eruption is considered to be the age at which a given tooth has erupted in more than 95% of those examined.

The number of erupted teeth is the arithmetic mean of the total number of teeth erupted at a given age.

The intensity (rate) of eruption is the magnitude of the annual increase in the number of newly erupted teeth [100].

The range of teeth eruption periods is the period limited by the beginning and end of teeth eruption [138].

S.D. Fedorov et al. [146], having studied the processes of eruption of permanent teeth in children of Transbaikalia, observed a wider time range for the onset of eruption: 1pM – 5–6 years.

At the end of the last century, I.V. Groitsky (1089 - cited by E.I. Goncharova, 1979) determined the time of eruption of the 1pM between 4.5 and 6.5 years, indicating that earlier appearance of teeth (from 4 years) and later (after 7 years) should be considered exceptions.

During the same period, the eruption of the 1pM was observed in children from Riga [11,121], Arkhangelsk region [48], Kemerovo [125], Moscow [149].

Along with this, there is information about a later (from 5 years) eruption of the 1pM in children in Kuibyshev, Perm, Leningrad [88,90], and in children living in Moscow, Kiev and Karaganda, the 1pM erupts even later - from 6 years.

At the same time, studies conducted in later years by N.F. Androsik et al. [9] showed that the eruption of the sixth tooth in children in Leningrad begins at an earlier age - at 4 years. However, the proportion of children who have at least one sixth tooth by the age of 4 is only 2.12%.

Worthy of attention are the studies of V.G. Suntsov et al. [131], who found a pronounced tendency for the eruption of the first molars to begin earlier in Omsk children – at 4 years of age. By this age, 7.7% of those examined had erupted first molars .

It should be noted that due to the lack of a unified terminology, which often gives rise to various methodological errors [35,100], researchers do not always provide accurate data on the average age, duration of the period, completion, and intensity (rate) of eruption of the 1pm. Unfortunately, in most publications these concepts are not clearly distinguished.

Many authors [132,146] believe that the duration of the main period of eruption of the 1pM is 2 years.

N.M. Danilkovich [39] reports a longer main period of eruption of the first molars: for the upper first molars it is 2 years 4 months , for the lower - 2 years 8 months. According to K.T. Somov and V.T. Malkov [125], the average period of eruption of the upper first molars is 5.7 years, for the lower - 6 years.

As can be seen from the results of studies conducted in Moldova , girls living in this republic begin to teethe earlier than boys (1103 versus 1024) – at 5-14 years of age. The change of teeth also begins at an earlier age [126] than in residents of other regions.

As can be seen from the analysis of the literature available to us, the intensity (rate) of eruption of the IM in children has not been sufficiently studied, although, as experience shows, when comparing the timing of eruption, it is important to know not only the beginning or average age of eruption, but also, most importantly, the rate of eruption [100].

As is known, all permanent teeth on the lower jaw, with the exception of the fourth and fifth, erupt significantly faster than those on the upper jaw. At the same time, the fourth and V teeth erupt more intensively on the upper jaw [6]. This is apparently explained by the fact that the lower jaw is more mobile and has more opportunities for the manifestation of irritating factors that contribute to the eruption and formation of the bite. A. V. Alimsky [6] believes that optimal conditions for the normal eruption of permanent teeth arise only when the temporary bite is completely preserved. Thus, VI teeth begin to erupt in children as early as four years of age following the V milk teeth , resting, on one hand, on the latter, and on the other, on the alveolar process of the upper or lower jaw.

Thus, an analysis of the literature data allows us to conclude that the timing of eruption of the first permanent molar varies significantly across different geographic regions. However, the timing of first permanent molar eruption in children in the Central Asian region, and in the Republic of Uzbekistan in particular, remains largely unstudied. Available information on the timing of eruption of the first permanent molar is incomplete; there is a lack of clear, methodologically sound data on the onset, average age, and end of eruption, the duration of the main period, and the intensity of eruption of the first permanent molar in children living in

Tashkent. At the same time, it is clear that a thorough understanding of the mechanisms of eruption of the first permanent molar will facilitate the timely planning of sanitation and caries-preventive measures.

One of the important conditions for the development of tooth enamel stability is its complete maturation [14]. This concept refers to the totality of age-related changes in tooth enamel, the leading one being the level of its mineralization. The dynamics of age-related changes in enamel composition have been the subject of research by many authors [17,19,102,140,172].

It is known that after eruption, constant dynamic changes occur in the hard tissues of an already formed tooth, caused by the processes of de- and remineralization. One of the main factors affecting the tooth after its eruption is mixed saliva, which performs a mineralizing function [168]. The majority of mineral ions enter the enamel from saliva [25]. Permanent molars in children erupt with incomplete enamel mineralization; its further maturation occurs in the oral cavity under the influence of mixed saliva [65,66,116].

The resistance of a tooth to the effects of unfavorable factors depends on the degree of maturity of the enamel [83,140]. The enamel of children's teeth is less resistant to the effects of damaging factors, since it contains approximately 20% less mineral substances than that of adults [108]. According to literature data, the enamel of elderly teeth has a greater resistance to acid demineralization due to their higher mineralization .

An important indicator of enamel condition is the Ca/P ratio: the higher this indicator, the more resistant it is to acid destruction. According to many authors [16,128,129], the Ca/P ratio of enamel in adults is 1.61-2.01. Information on this indicator in children is very limited: according to research results, it varies from 1.55 to 1.75.

The supersaturation of saliva with Ca and HPO ions is maintained due to the micellar state, which determines its structural properties [33,89,107].

The level of total Ca in mixed unstimulated saliva of children with multiple caries is somewhat higher than in the compensated form of the disease in children aged 4–12 years [43].

In the process of mineralization, according to the latest data, after teeth eruption, the content of calcium, phosphorus, fluorine and other components in the enamel increases, and its structure improves [10, 32, 46].

Three to five years after the end of tooth eruption, the level of enamel mineralization in the most calcified areas (neck, grooves, contact surfaces) increases from 70–75% to 90–95%, which indicates its “maturity ”.

The final maturation of teeth occurs in the oral cavity under the influence of oral fluid during the first 2-3 years after eruption .

The significant activity of metabolic processes after tooth eruption is evidenced by the fact that the use of caries-preventive drugs of general and especially local action is especially effective during this period, while their use at a later date often proves ineffective.

During the period of incomplete mineralization, the greatest susceptibility of teeth to caries occurs, accompanied by the lowest acid resistance of enamel [106].

There is evidence indicating the possibility of incomplete maturation of tooth enamel in children, caused by the influence of factors such as fluoride deficiency, local decrease in the pH of saliva as a result of excess carbohydrate content in food, insufficient oral care, and a decrease in the crystal-forming capacity of mixed saliva [22,71].

The structural properties of saliva in a simulated cariogenic situation have been established experimentally. A pH level of 6.2 is critical: under these conditions, the structural properties of saliva are disrupted and its mineralizing potential is reduced [86].

The physiological course of the mineralization process of permanent teeth is of great importance in the prevention of caries, one of the most common diseases of childhood.

As studies show, the sixth teeth erupt completely in 57.35% of six-year-old children, partially in 22.06%, and do not erupt in 20.59%. Focal demineralization of enamel in the 1pm is diagnosed in 100% of six-year-old children and in 82.76% of seven-year-old children. In six-year-old children, foci of demineralization are localized mainly on the chewing surfaces [53,122]. This phenomenon can be explained by the peculiarities of the anatomical structure, poor washing of the fissures of the first permanent molar with saliva, the low initial level of their mineralization during eruption, and the long stage of enamel maturation in this area of the tooth [90,91].

Thus, the described patterns of the enamel mineralization process in permanent teeth can serve as a theoretical basis for developing measures for the prevention, early diagnosis and treatment of anomalies of the dental- jaw system.

The enormous importance of the first permanent molars in the development of oral pathology explains the high and early incidence of dental caries in these teeth. Peak dental caries incidence occurs during the period of tooth eruption and enamel maturation. Teeth during this period are considered most vulnerable to the development of caries. Thus, the prevalence of caries in five-year-old children in the city of Omsk was 13.2% [8]. By the age of seven, the incidence of caries reaches 27.9%, and by the age of 14, it increases to 82.8%.

After the eruption of the first permanent molar, complicated caries often occurs, the treatment of which presents significant difficulties due to the unformed root of the tooth [27,28,134].

In recent years, much interesting data has been obtained on the general and local factors that determine the resistance or susceptibility of teeth to caries [38,76]. However, to date, the size of teeth, the structural features of the crowns, and the relief of the chewing surface of molars in caries-resistant and caries-susceptible individuals have not been adequately studied [87,150]. Fissure caries of the first molars, which occurs in the first 2-3 years after their eruption, is a process that occurs in incompletely mineralized enamel and, therefore, 1pM are teeth with a high risk of developing caries. Low caries resistance is due to the fact that the process of mineralization of fissure enamel of the first molars takes longer than in the cervical and contact areas [48,58,115].

The chewing surface of human molars is covered with a complex pattern of grooves lying between the cusps and on the cusps, separated from each other by elevated areas of the crowns. There is evidence that the incidence of caries is inversely proportional to the number of cusps [87]. Many authors have studied the size, shape, and depth of fissures [106,115].

Molars are affected by caries immediately after eruption. It has been established that resistance to caries positively correlates with the timing of tooth eruption. In the first years after molar eruption, the intensity and severity of caries in them is higher than later [119].

It is known that caries most often develops in molars, both in the primary and permanent dentition [28,147]. All researchers studying caries of the first molars note that the lower first molars are affected by caries significantly more often than the upper ones [20,147]. Thus, according to G.G. Ivanova et al. [55], the incidence of caries of the lower first molars is 81.7%, and of the upper ones - 67.00% of cases. At the same time, the opinions of scientists about the dynamics of the incidence of caries of the first molars differ somewhat. Thus, S.I. Kukhta [78] believes that the incidence of caries of the first molars increases rapidly 3-4 years after their eruption, that is, in children aged 10-11 years, and slows down somewhat in the period from 12 to 15 years.

However, other authors have concluded that the incidence of 1pM caries increases sharply by the age of 7, that is, in the first years after their eruption [8,82,97,136]. They explain this by the special susceptibility of teeth to caries during the period of enamel maturation.

As is known, enamel development occurs in 2 phases: the first is the formation of the organic base (matrix) of enamel and its primary calcification, the second is the final maturation of enamel after tooth eruption. Enamel maturation after tooth eruption consists of the final calcification of enamel prisms, which is the combined effect of calcium and phosphorus accumulation in the erupted enamel . The process of calcium and phosphorus accumulation occurs after tooth eruption, during which time the crystal lattice changes, the volume of microspaces in the enamel decreases, due to which its density increases [109]. It is known that the calcium content in human tooth enamel normally fluctuates within the range of 33-39%, phosphorus 16-18%, the Ca/P (molar coefficient) value is 1.48-1.67; Ca/P (weight coefficient) - 1.92-2.17) [117].

The degree of enamel maturity is higher, the smaller the difference between the Ca/P ratio of intact enamel in adults and erupted permanent teeth. The calcium and phosphorus content in the enamel of different areas of molars (cusps, incisal edge, fissures, etc.) does not differ significantly [23]. Thus, in samples from the cusp of the tooth, "mature" enamel is detected after 3 years, and from the cervical region - only 6 years after tooth eruption. This indicates that the enamel of the cusps matures earlier than that of the necks of the teeth. Consequently, enamel with a high Ca/P ratio is more mature and resistant to the action of unfavorable factors.

It is characteristic that the frequency of carious lesions of the IpM in the first years after their eruption increases almost exclusively due to the increase in the number of cases of fissure caries [14,22]. The first caries lesions of the anterior and posterior surfaces of the 1pMin children are recorded at the age of 10 years [136]. The high susceptibility of the chewing surfaces of the 1pMto caries is reported by W. P. Roch et al. [178], Z. Rajic, Z. O. Zilic-Duric [174], J. C. Meiers, [169], G. Goto, Y. Hosoya [162]. These data are consistent with the results of studies by G. T. Ivanova, R. P. Buyankin, T. N. Zhorova [55], who believe that the fissures of the chewing surface of the tooth are the most susceptible to caries zones [55].

Thus, despite the fact that the incidence of caries in the lower permanent molars reaches 81.7%, and in the upper permanent molars it is 70%, in the available literature we found only a few studies devoted to the study of the characteristics of the eruption of permanent molars [14,55].

N.A. Kodola [69], E.B. Pozyukova [109], V.A. Butz et al . [158] believe that mineralization of molar fissures continues for a longer period than that of the enamel of the cervical and contact areas of the tooth. Their conclusions were confirmed in the works of many other authors, who established that the maturation of enamel in the fissure area significantly lags behind this process on other surfaces of the teeth.

Thus, fissure caries of the first permanent molars, which occurs in the first 2-3 years after eruption, affects teeth with incomplete mineralization. Low levels of caries resistance of the first permanent molars increase the risk of caries occurrence in these groups of teeth [136]. It should be especially emphasized that the condition of the first permanent molars can serve as a specific criterion for the caries resistance or caries susceptibility of the entire dental system .

As early as 1952, I.O. Novik [97] wrote that in individuals predisposed to caries, the 1pM are affected by the carious process already at the age of 7-8 years. The early loss of all first molars serves as a signal of insufficient calcification of the teeth, a disturbance of mineral metabolism in them. This conclusion was subsequently confirmed by E.E. Grigorieva [37]. The results of her studies showed that the caries-susceptible structure of permanent teeth begins to manifest itself from the age of 9-10 years, therefore the condition of permanent teeth in patients at this age can become a criterion for assessing the caries situation [15].

In connection with the widespread prevalence of caries, the study of the influence of evolutionary processes in the human dentoalveolar system on the increased susceptibility of teeth to caries is of great interest. It is assumed that caries occurs more frequently in individuals with larger teeth, a more differentiated structure, etc. I.A. Balchyunene [12] established that the frequency of caries of the chewing surface depends on the structure of the teeth, but a direct relationship exists between the frequency of caries development and the features of the relief of the chewing surface.

As literature analysis has shown, children already experience a significant increase in caries incidence by the age of 9-10 years, that is, by the time the hard tissues of the oral cavity have fully matured . This clearly highlights the need to develop methods for predicting caries even at the stage of incomplete mineralization, that is, in children under 9-10 years of age.

Dental caries prevention remains one of the most pressing issues in practical dentistry. The development of methods for predicting dental caries at the stage of incomplete mineralization will enable the selection of approaches to individualized caries prevention in incompletely mineralized teeth, specifically regulating enamel maturation processes.

Prevention of dental caries should be aimed at the formation of full-fledged enamel, that is, the development of caries can be prevented during the period of tooth formation and maturation in the oral cavity after its eruption.

Situated at the interface with the external environment, enamel is exposed to a variety of damaging factors. Maintaining its properties and structure is only possible if it maintains a constant dynamic equilibrium with saliva through the physicochemical exchange of its components with this biological fluid, as demonstrated by experiments with radioactive isotopes or solubility, and remineralization occur. The processes of de- and remineralization ensure the continuous renewal of the mineral components of tooth enamel [72]. This is associated with changes in some properties of enamel depending on its composition, characteristics of mineral metabolism, and nutritional status. At the same time, new knowledge about the mechanisms of mineralization opens up the prospect of targeted interventions on tooth enamel for the purpose of preventing and treating pathological processes developing in it [44,102].

In pediatric dentistry, the sign of caries compensation is used as the main diagnostic criterion for the depth and prevalence of the carious process [27]. The absence of caries or isolated lesions is considered to be compensated caries. In the subcompensated form, lesions of 4-6 teeth are noted. The decompensated form assumes the presence of multiple dental lesions. This classification ensures an individualized approach to patients during dental examinations of the pediatric population. However, this criterion, which allows for planning the scope of therapeutic and preventive measures, cannot serve as a basis for deciding on dental caries prevention, since it does not take into account the causes of caries development, especially during the period of eruption of permanent teeth.

One of the most well-known effective methods of preventing caries of the chewing surface today remains fissure sealing [41,82] for both baby and permanent teeth.

To improve caries resistance in permanent first molars in children with varying eruption times and caries severity, differentiated use of anticaries agents and local preventive methods is recommended. For children with early and late eruption of permanent molars, fissure sealing (the anatomical depressions on the chewing surface of the molars) with a fluoride sealant is advisable. Fissure sealing and fluoride varnish coating are also effective.

The effectiveness of using fluoridated salt in the diet of preschool children for one year has been clinically proven [92]. Children with low enamel acidity are recommended to use sodium fluoride tablets with simultaneous coating of teeth with fluoride varnish. An anti-caries effect is observed after just 6 months.

Calcium phosphate containing a remineralizing gel has proven itself as a prophylactic agent for preventing caries. Its caries-preventive effect was determined by the DMF+df index, the increase in caries, and the amount of focal demineralization of enamel [151].

A highly effective preventative method is enriching tooth enamel with calcium. Increasing the proportion of hydroxyapatite ensures the highest possible content of calcium ions [140].

It is known [5,49] that regular oral hygiene care causes positive structural changes in the mixed saliva of a person. The most effective methods of preventing dental caries, according to both domestic and foreign authors [4,141], are the complex use of fluorides, regular teeth brushing, and a rational, balanced diet.

Therefore, targeted prevention, taking into account the most important caries-causing factors, is the basis of the anti-caries program.

When planning caries prevention measures, special attention should be paid to identifying retention points of cariogenic factors, which are determined by the anatomical structure and structural features of the surface of the tooth crown. The predominant caries affecting the fissures of molars is explained by the significant accumulation of dental plaque [48].

Modern dentistry has methods for predicting dental caries based on determining the functional state of enamel. The criteria for its assessment are the composition of hard dental tissues, their resistance to acid action, and some other indicators [114,115]. However, methods for determining the chemical composition of enamel and its microhardness are labor-intensive and require specialized equipment; therefore, they are used primarily in scientific research.

A method for determining the structural and functional stability of enamel and its ability to remineralize (the Cosre Test) has a high prognostic reliability [113]. A pre-etched area of enamel is stained with a 2% solution of methylene blue, and then the time and degree of staining are assessed. The remineralizing capacity of saliva is determined by the time during which the acid-treated tooth surface completely loses its ability to stain. Depending on the Cosre Test results, a group of caries-resistant individuals can be identified in whom the intensity of staining of the etched area of enamel is less than 40% and lasts less than 3 days. Individuals whose enamel staining persisted for more than 3 days, and its intensity exceeded 40%, are considered caries-susceptible [38].

The high prevalence of fissure caries (IpM) makes it urgent to diagnose it early in teeth with incomplete mineralization. Electrometric methods for caries diagnosis are widely used in clinical practice. One method involves passing a direct current of a predetermined magnitude through the tooth tissue.

There is also another electrometric method [54] that allows for the diagnosis of caries localized in hard-to-reach areas of the tooth (fissure caries). Depending on the degree of damage, carious tissues are capable of conducting electric current of varying magnitudes when reliable contact is established between the active surface of the electrode and the tooth surface being examined using an electrolyte solution. A microdrop of electrolyte applied to the fissure mouth, due to its capillary action, penetrates into the fissure, filling its entire volume, including areas inaccessible to a dental probe—the bottom, walls, branches, and sinuses. The authors propose using an M-2001 type device, which is included in the state register of measuring instruments, as a measuring device.

To assess the degree of enamel maturity, T.N. Zhorova [44] used the following technique: a load current (100 μA at a voltage of 3.0 W) is applied to an electrical circuit consisting of an active electrode, an electrical measuring device, and a passive electrode while the electrodes are "short-circuited." To determine the degree of enamel "maturation" of an erupted tooth, the active electrode is pressed against the tooth surface, and the passive electrode is pressed against the oral mucosa. If a moment does not occur when the enamel resistance becomes higher and the electrical conductivity of a given area of the tooth decreases, this means that full maturation of the tooth tissue in this area has not occurred.

The chewing surface of molars is known to have a complex pattern . Variations in the chewing surface patterns of human teeth are studied by a branch of anthropological dentistry. Odontometric parameters are one of the stable and constant characteristics of the dental system, upon which many concepts in archaeology and forensic medicine are based.

Currently, the morphological features of the dental system, which are of interest from the perspective of ethnic anthropology, have been studied quite thoroughly. Scientists from the CIS countries have also made significant contributions to this area of science. Odontoscopy has become an important part of the dental program, primarily determining the presence or absence of a number of alternative dental morphological features. Research has shown that disruptions in the development and mineralization process alter the size of crowns and the structure of hard dental tissues. The use of odontoglyphics in the differentiation analysis of human populations has yielded reliable data on the odontoglyphic features common to representatives of different races, age groups, and other groups.

There is also evidence of a connection between the odontoglyphic features of the chewing surface structure of the first permanent molars and caries. A direct relationship has been established between the complexity of the odontoglyphic pattern of permanent teeth and the susceptibility of fissures to caries.

Using odontoglyphic analysis, a relationship was found between the caries susceptibility of the occlusal surfaces of the upper and lower molars and some morphological features of the teeth. These data allow the use of odontoglyphic features of the first permanent molars as a prognostic criterion for caries resistance [40].

One of the promising areas in modern preventive dentistry is the use of helium-neon laser light for the treatment and prevention of dental caries [91]. Under the influence of helium-neon laser, both in healthy teeth and in teeth with initial caries, there is a decrease in the solubility of the surface layer of enamel and a lower release of Ca and P into the enamel biopsy. A change in the content of calcium and phosphorus in the oral fluid was observed, a decrease in its coefficient and in the initial forms of caries, which by the end of treatment approached that of practically healthy individuals.

The current state of dentistry does not allow us to regulate the timing of the formation and mineralization of tooth rudiments, but it is possible to influence the process of maturation of teeth after their eruption.

Thus, the analysis of literary data allows us to form a fairly complete picture of the timing of the eruption of the first permanent molars, their importance in the formation of a permanent bite, the incidence of caries in the first years after eruption, as well as optimal preventive measures.

CHAPTER II.
RESULTS OF CLINICAL STUDIES DURING THE PERIOD OF ERUPTION AND FORMATION OF THE FIRST PERMANENT MOLARS

This work is based on the results of an examination of 516 intact first permanent molars in 129 children aged 4-11 years, both boys and girls, in organized children's groups of the Shaikhantaur district of Tashkent for the period 1999-2001. The main observation group consisted of preschool children of kindergartens No. 461 and No. 607, who successively attended the junior, middle and senior groups of the above-mentioned kindergartens. The examination of school-age children was conducted in grades 1-4 of school No. 61 of the Khamza district of Tashkent. Of the total number of children examined, 70 were boys (54.3%) and 59 girls (45.7%).

The distribution of preschool and school children by age is as follows: the number of examined children aged 4-4.5 years was 22 (17%); aged 5 years - 35 (27.1%); aged 6 years - 29 (22.7%); aged 7 years - 10 (7.7%); aged 8 years - 11 (8.5%); aged 9 years - 12 (9.3%); aged 10 years - 5 (3.8%) and aged 11 years - 5 (3.8%) children.

In order to study the characteristics of the eruption of the first molar, observation was conducted in 101 children of preschool and school age, of which 58 (57.4%) were boys and 43 (42.6%) were girls. This was at the beginning of the observation. 86 children after a month, of which 40 (46.5%) were boys and 46 (53.5%) were girls. In the 2nd and 3rd months, 86 children, of which 52 (60.5%) were boys and 34 (39.5%) were girls, from Tashkent aged from 4.5 to 11 years.

It was established for the first time that in the city of Tashkent, permanent first molars begin to erupt and a tubercle appears at the age of 4.5 years in 38 (29.4%) children. However, the onset and average age of eruption of the first molars is 7-8 years, while the end of eruption occurs at 8-9 years—this is 7.7% and 8.5%, respectively.

The duration of the main period of eruption of the upper permanent molars ranges from 1.5 to 2 years, and that of the lower permanent molars is 1 to 1.5 years. Studying the rate of eruption of the first permanent molar is of particular interest. The results of these observations are presented in Table 1.

Active eruption of the 1pM cusps occurs during the first 4 months. Thus, at the beginning of the observation, the lower left 1pM - tooth 36 showed the following trend. The greatest number of cusps corresponds to the eruption of the mesiobuccal cusps in 27.7% of boys and in 33.7% of girls, mesiolingual cusps in 26.7% versus 41.6%; distobuccal cusps in 23.8% and distolingual cusps in 34.6% , respectively.

Table 1.

Timing of eruption of the cusps of the first permanent molars

Indicators	**At the beginning of observation, n = 101**		**After 1 month, n = 86**		**After 2 months, n = 86**		**After 3 months, n = 86**	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
	Abs(%)	Abs(%)	Abs(%)	Abs(%)	Abs(%)	Abs(%)	Abs(%)	Abs(%)
Distal-buccal - 16	27(26.7)	23(22.8)	3 (3.49)	3 (3.49)	5(5.81)	3 (3.49)	9(10.46)	5(5.81)
Medio-buccal -16	28(27.7)	19(18.8)	4 (4.65)	3 (3.49)	7 (8.14)	4 (4.65)	15(17.4)	2(2.32)
Medio-palatine - 16	29(28.7)	22(21.8)	9 (10.46)	5(5.81)	7(8.14)	4 (4.65)	19(22.1)	6(6.98)
Distal-palatine - 16	29(28.7)	23(22.8)	-	1(1.16)	3 (3.49)	4 (4.65)	8(9.3)	6(6.98)
Medio-buccal - 26	6 (5.94)	7 (6.93)	6 (6.98)	3 (3.49)	4 (4.65)	3 (3.49)	6 (6.98)	6(6.98)
Distal-buccal - 26	9 (8.9)	5 (4.95)	6 (6.98)	2 (2.32)	3 (3.49)	3 (3.49)	7(8.14)	3(3.49)
Medio-palatine - 26	10(9.9)	6 (5.94)	9 (10.46)	3 (3.49)	9(10.46)	3 (3.49)	12(13.95)	9(10.46)
Distal-palatal - 26	9 (8.9)	8 (7.92)	7(8.14)	1(1.16)	6 (6.98)	1(1.16)	10(11.6)	2(2.32)
Medio-buccal - 36	34(33.7)	28(27.7)	16(18.6)	5(5.81)	16(18.6)	7(8.14)	18(20.9)	14(16.3)
Distal-buccal - 36	35(34.6)	24(23.8)	14(16.3)	7(8.14)	17(19.77)	10(11.6)	13(15.1)	13(15.1)
Media-lingual -36	42(41.6)	27(26.7)	13(15.1)	4 (4.65)	15(17.4)	6 (6.98)	14(16.3)	11(12.8)
Distal-lingual - 36	35(34.6)	25(24.7)	12(13.95)	11(12.8)	15(17.4)	5(5.81)	22(25.58)	10(11.6)
Medio-buccal - 46	34(33.7)	23(22.8)	7(8.14)	5(5.81)	12(13.95)	8(9.3)	17(19.77)	15(17.4)
Distal-buccal - 46	57(56.4)	44(43.6)	6 (6.98)	9(10.46)	15(17.4)	11(12.8)	17(19.77)	9(10.46)
Medial-lingual - 46	29(28.7)	27(26.7)	8 (9.3)	9(10.46)	12(13.95)	12(13.95)	26(30.2)	15(17.4)
Distal-lingual - 46	37(36.6)	31(30.7)	11(12.8)	5 (5.81)	9(10.46)	3 (3.49)	16(18.6)	15(17.4)

The lower 1pM - 46 tooth had an erupted mesio-buccal cusp in 22.8% of cases in boys and 33.7% in girls; mesio-lingual in 26.7% and 28.7%; disto-buccal in 43.6% and 56.4% and disto-lingual in 30.7% and 36.6%, respectively.

Thus, at the beginning of the observation, in terms of the number of erupted tubercles, the distal-buccal tubercle of tooth 46 was in first place, which was present in all children, and the distal-buccal tubercle of tooth 36 was in second place at the end of eruption.

At the beginning of the observation, the distal-palatal cusp of tooth 16 was present in 52 (51.5%) children, and tooth 26 was present in only 17 (16.8%) children. The mesio-buccal cusp had completed eruption in 62 (61.4%) teeth 36, in 57 (56.4%) teeth 46, in 47 (46.5%) teeth 16, and only in 13 (12.9%) teeth 26.

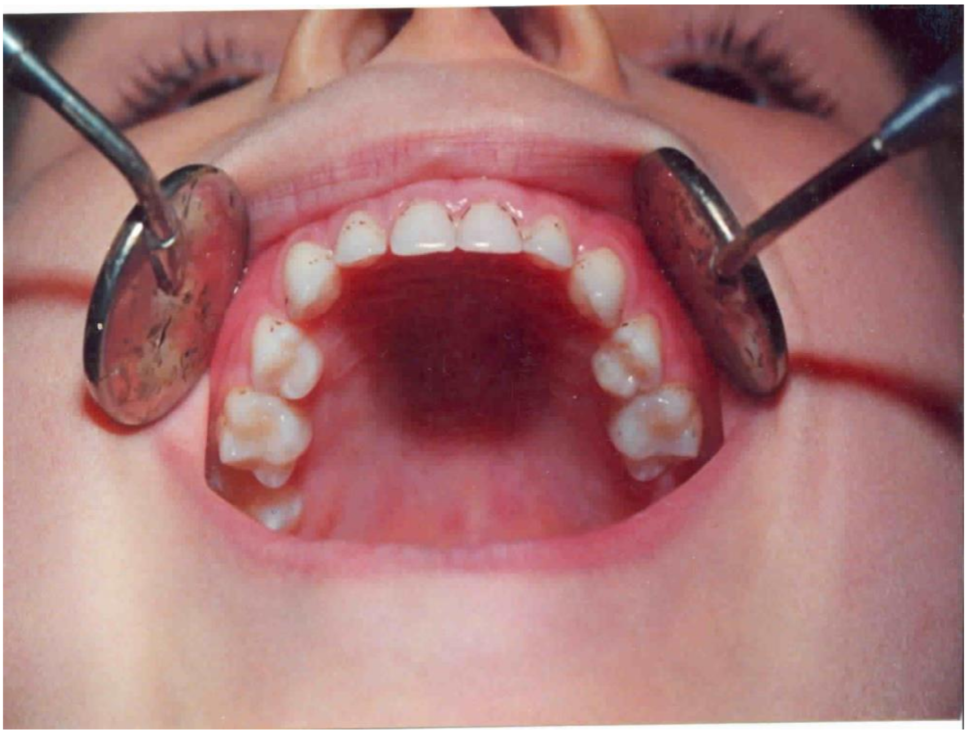


Photo 1.

The medial-palatine cusp predominates in tooth 16. This is 51 (50.5%) versus 16 (15.8%) in tooth 26 (Photo 1). The mesial-lingual cusp predominated in tooth 36 at 69 (68.3%) versus 56 (55.4%) in tooth 46, and the distal-lingual cusp in most cases completed its eruption in tooth 46. This is 68 (67.3%) versus 60 (59.4%) in tooth 36.

Thus, the analysis of the initial observation showed that in the upper jaw, the eruption of all cusps of tooth 16 has completed in 46 children, of which 19 are boys and 27 are girls; in 11 children - tooth 26, of which 5 are boys and 6 are girls; in 58, 24 and 34 - tooth 36 and in 52, 23 and 29 children - tooth 46, respectively. Consequently, the cusps of the upper incisors at the beginning of the observation were completely erupted in 11 (10.9%) children.

Observations after a month show preference for the eruption of the distal - lingual cusp of tooth 36 in 23 (26.7%) cases, then the mesial-buccal and distal-buccal cusps of the same tooth in 21 children (24.4%).

In terms of the number of cusps of the 1pm that have completed eruption, tooth 46 is in second place, when the mesial-lingual cusp erupted in 17 children, which amounted to 19.8%; in 16 children, the distal-lingual cusp erupted in 18.6% of cases.

In third place in terms of the number of tubercles that have completed their eruptions is tooth 26. The majority of the existing cusps in this tooth are located on the mesial-palatal cusp – in 12 children (13.9%) (Photo 2) and the mesial-buccal cusp – in 9 (10.5%). In tooth 16, the mesial-palatal cusp ranks first in terms of the number of erupted cusps – in 14 children (16.3%), of which 9 are boys and 5 are girls.

Photo 2.

Thus, after a month, the maximum eruption of the 1pM tubercles occurs on the 36th tooth - 82 tubercles (95.3%) and the minimum - on the 16th tooth - 28 tubercles (18.6%).

Consequently, after one month, complete eruption of the 1pM cusps occurred in only one child on the upper right jaw, and in eight children on the left. On the lower jaw, this occurred in 17 and 12 children, respectively.

At the 2nd month, the study of the dynamics of the eruption of the cusps of the 1pM led to the conclusion that the largest number of erupted cusps was on the 36th tooth, where 27 children had a distal-buccal cusp, 23 had a mesial-buccal cusp, 21 had a mesial-lingual cusp, and 20 had a distal-lingual cusp.

In second place in the 2nd month, in terms of the frequency of erupted tubercles, is also the distal-buccal - in 26 children, then the medial-lingual - in 24, the medial-buccal - in 20 and the distal-lingual - in 12 children.

In teeth 16 and 26, an almost identical pattern of eruption is observed. Thus, the distal-buccal cusp appeared in 8 children in tooth 16 and 6 in tooth 26; distal-palatal in 7 children on both sides; mesial-buccal - in 11 and 7; mesial -palatal in 7 and 12 children, respectively.

Based on the above, it can be concluded that complete eruption of all 4 tubercles of the 1 pm on the upper jaw on the right and left was observed in 6 children. On the lower jaw, in 12 and 20, respectively.

After 3 months, the lower 1pm are erupting most actively, both on the right and left. The mesiobuccal cusp of tooth 36 has completed eruption in 32 (37.2%) children (photo 3); the distobuccal cusp in 26 (30.2%); the mesiolingual cusp in 25 (29%); and the distolingual cusp in 32 (37.2%) children.

Photo 3.

The dynamics of the eruption of the cusps of tooth 46 is observed with slight differences. These are mesio-buccal in 32 (37.2%); disto-buccal in 26 (30.2%);

mesio-lingual in 41 (47.7%) and disto-lingual in 31 (36%) children.

On the upper jaw, the distal-buccal cusp of tooth 16 erupted in 14 (16.3%) children; the mesial-buccal cusp - in 17 (19.8%); the mesial-palatal cusp - in 25 (29.1%) and the distal-palatal cusp - in 14 (16.3%) children.

In the 26th tooth in the 3rd month of observation, the greater number of cusps falls on the mesial-palatine in 21 (24.4%) children, the smaller number - on the disto- buccal - in 10 (11.6%), of which 7 boys and 3 girls. Thus, after 3 months, complete eruption of all 4 cusps of the 1pm on the right is observed in 14 children, on the left - in 10. On the lower jaw - in 26 and 25 children, respectively.

Thus, in the course of studying the timing of the eruption of the tubercles of the 1pm, we observed a violation of the paired eruption of both the upper and lower jaws.

On the maxilla, the mesial-palatal and distal -palatal cusps were the first to erupt, while on the mandible, the distobuccal and distal- lingual cusps of the first permanent molar erupted first. In 78% of cases, the eruption of the first permanent molar was accompanied by changes in the mucous membrane surrounding the tooth. Edema and hyperemia of the mucous membrane were observed in the area of the erupting cusps. The children complained of pain during eating and became more capricious. No treatment was administered during this period, and all symptoms resolved spontaneously after complete eruption of the chewing surface of the first permanent molar.

The chewing surface of the upper IM teeth was fully erupted within 3 months in 58 children, and the lower jaw was fully erupted in all 101 children. The process of complete crown eruption is quite lengthy and individual, and caries often develops during this period.

Thus, given the data obtained, it should be noted that caries prevention in the lower jaw should begin immediately after the eruption of the chewing surface, starting at 5-6 years of age and no later. This is especially true for the lower jaw, where the chewing surface develops more quickly and the period of complete crown eruption is quite long. Therefore, preventive measures should not be initiated until the entire crown has completely erupted and the process of tooth mineralization has been completed.

2.1. Results of the study of the level of oral hygiene.

Education about oral hygiene plays a crucial role in dental practice. At the time of presentation, only 53 (41.1%) of the 129 children brushed their teeth regularly, either independently or under parental supervision (Table 2). Of these, 24.0% were boys and 17.14% were girls. However, 57 (44.2%) children brushed their teeth irregularly, 2-3 times a week, including 28 boys and 29 girls. 14.7% of children did not take care of their oral hygiene at all. Of the children who brushed their teeth correctly and twice a day, 18 (33.9%) brushed their teeth regularly; the remaining 35 children had not been taught the correct technique and brushed their teeth only once a day.

Information about oral care at home, in kindergarten, school, and at the clinic was received by 70 (54.3%) children, and 59 (45.7%) children were not familiar with this information.

In this regard, we have conducted repeated conversations with children and parents about the need to follow the rules of oral hygiene and demonstrated standard teeth cleaning according to Pakhomov G.N., the selection of toothpastes and brushes.

In order to assess the hygienic condition of the oral cavity in children aged 4.5 to 11 years, we analyzed the values of the oral hygiene indices using the Fedorov-Volodkina method (Tables 3, 4, Figs. 1, 2, 3).

Before teaching children the rules of oral hygiene, the hygiene index at the beginning of the observation was studied in 123 children. The results show that 33.3% of children had a good HI, 32.8% in boys, and 36.4% in girls. 37.3% of children had a satisfactory HI, of which 28.7% were boys and 11.5% were girls. Unsatisfactory HI was 18.6%, 44.2%, and 28.3%, respectively, and a poor indicator was found in 8.9% of children with an average value of 2.71 ± 0.05. Very poor indicators were not detected.

Table 2.

Teeth brushing indicators

Indicators	Start of observation, n = 129		After 1 month, n = 86		After 2 months, n = 86		After 3 months, n = 86	
	Boys n=70	Girls n=59	Boys	Girls	Boys	Girls	Boys	Girls
Regular	31(24.0%)	22(17.1%)	48(55.8%)	20(23.3%)	50(58.1%)	22(25.6%)	54(62.8%)	23(26.7%)
Irregular	28(21.7%)	29 (22.5%)	14(16.3%)	3(3.5%)	12(13.9%)	1(1.2%)	9(10.5%)	0(0)
Doesn't care	12(9.3%)	7 (5.4%)	1(1.2%)	0(0)	1(1.2%)	0(0)	0(0)	0(0)

Table 3.

HI according to Fedorov-Volodkina at the beginning of observation

HI values	Boys, n=71		Girls, n=51		Total, n=122	
	abs (%)	M±t	abs (%)	M±t	abs (%)	M±t
1.1-1.5 - good	23 (32.8)	1.48±0.01	18(34.0)	1.37±0.04	41 (33.3)	1.43±0.02
1.6-2.0 - satisfactory	31(44.2)	1.7±0.02	15(28.3)	1.69±0.04	46 (37.3)	1.70±0.02
2.1-2.5 - unsatisfactory	10(14.2)	2.3±0.05	13 (24.5)	2.21±0.04	23(18.6)	2.25±0.03
2.6-3.4 - bad	6 (8.6)	2.71±0.08	5 (9.4)	2.7±0.06	11 (8.9)	2.71±0.05
3.5-5.0 - very bad						

Table 4.

HI according to Fedorov-Volodkina after 3 years

HI values	Boys, n = 26		Girls, n=24		Total, n = 50	
	abs (%)	M±t	abs (%)	M±t	abs (%)	M±t
1.1-1.5 - good	12(46.1)	1.32±0.03	12 (50.0)	1.38±0.12	10(58.8)	1.35±0.15
1.6-2.0 satisfactory	10(38.5)	1.73±0.04	10(41.7)	0.0±0.0	3(17.65)	1.73±0.07
2.1-2.5 unsatisfactory	4(15.4)	2.39±0.03	2 (8.3)	2.5±0.0	4 (23.55)	2.4±0.1
2.6-3.4 - bad	0	0.0±0.0	0	0.0±0.0	0	0.0±0.0
3.5-5.0 very bad	0	0.0±0.0	0	0.0±0.0	0	0.0±0.0

Observations after a month show that good HI was detected in only 12.6% of children, satisfactory - in 36.5%, of which 24 boys with values of 1.76±0.03 and 21 girls - 1.71±0.03 (Fig. 1).

Figure 1. Hygiene index according to Fedorov-Volodkina (after month)

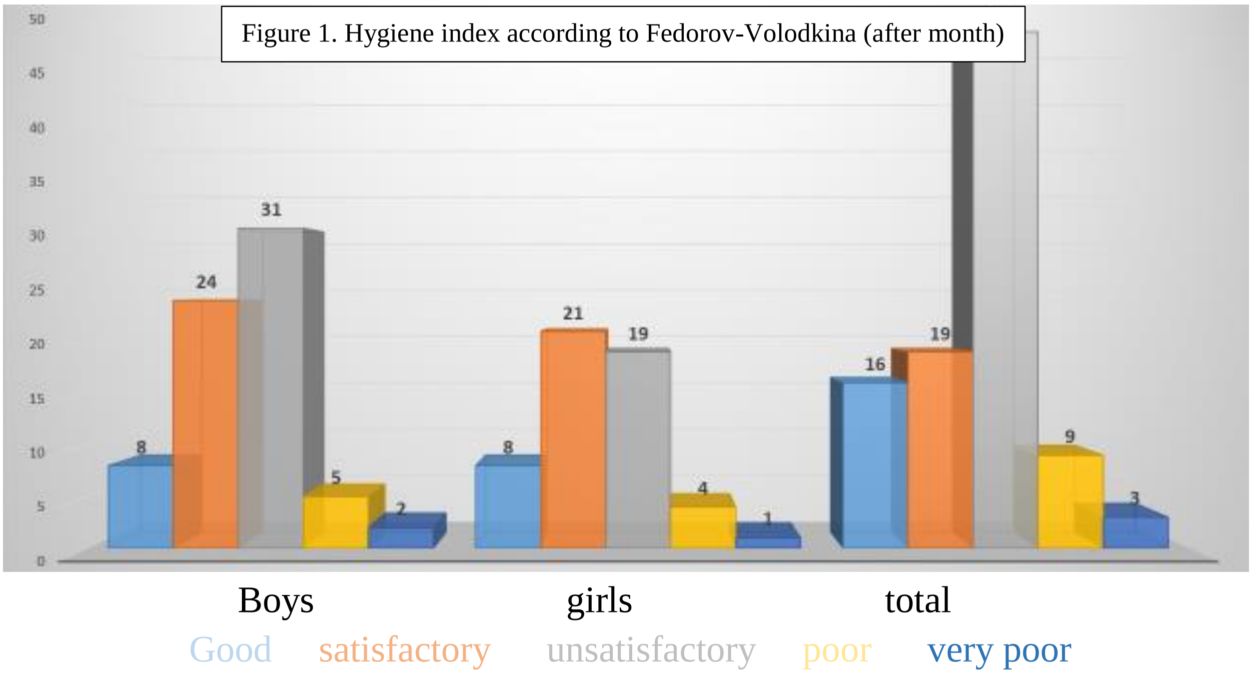


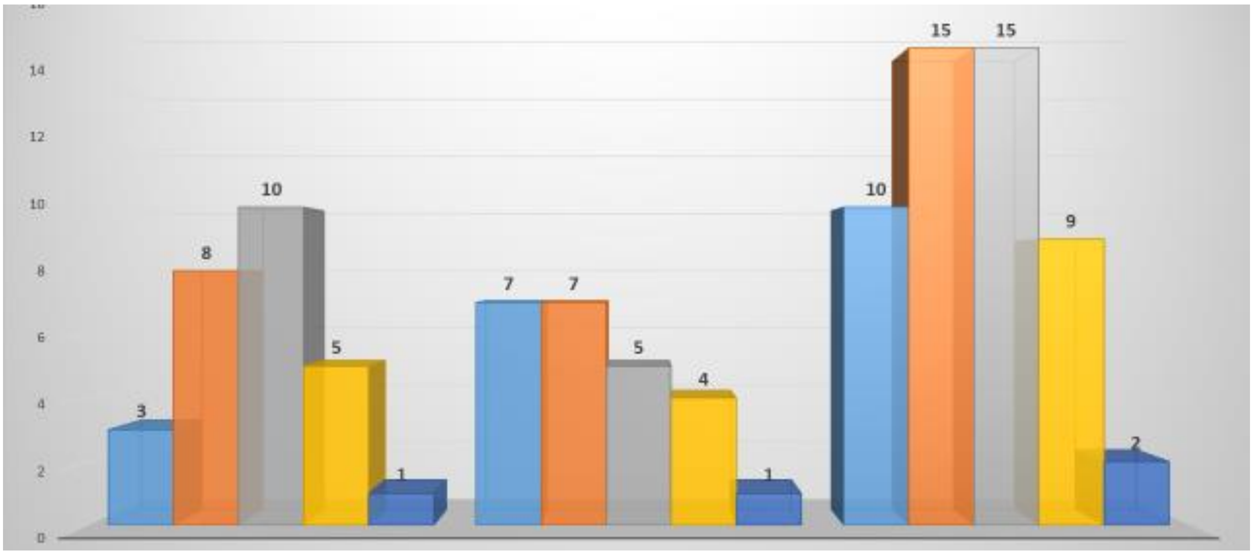
Figure 1. Hygiene index according to Fedorov-Volodkina (after month)

The proportion of children with unsatisfactory oral hygiene significantly increased compared to the start of the study (P < 0.01), from 18.6% to 40.5%, with the proportion of boys also increasing. Despite repeated hygiene training for children and parents, poor oral hygiene was observed in 9 children (7.3%), and very poor hygiene in 3 children (2.4%).

A similar picture is observed after 2 and 3 months (Figs. 2, 3). As the crown of the 1pM erupts and forms, the state of the HI remains virtually unchanged. This is likely due to multiple caries, a change in bite, and the presence of partially erupted teeth.

However, after 3 years, as the initial molars fully erupted and repeated training in toothbrushing techniques occurred, we obtained positive results (Table 4). Thus, a good level of hygiene was observed in 48% of children, with an average value of 1.35±0.02. 46% of children had a satisfactory HI, and 10% had an unsatisfactory HI. There were no indicators of poor or very poor hygiene index in either boys or girls, and the index was equal to 0.0±0.0, which is highly reliable (P<0.001).

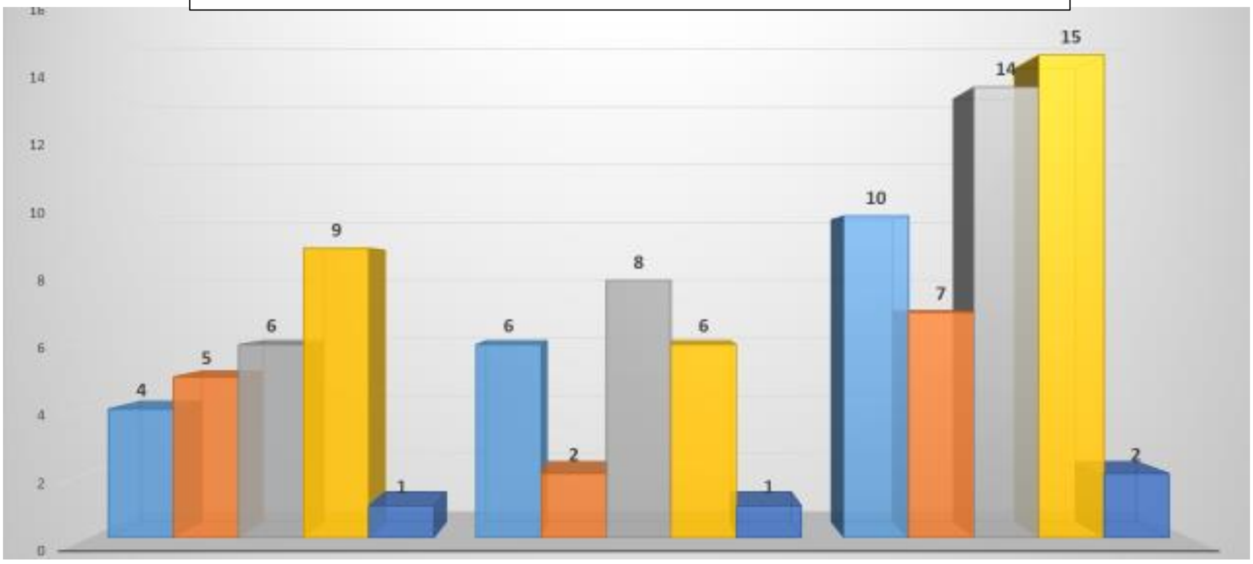
Figure 2. Hygiene index according to Fedorov-Volodkina (after 2 months)



Boys girls total

Good satisfactory unsatisfactory poor very poor

Figure 3. Hygiene index according to Fedorov-Volodkina (after 3 months)



Boys girls total

Good satisfactory unsatisfactory poor very poor

Thus, we have achieved an increase in the HI in children with poor oral hygiene, and increased the good hygienic condition of the 1pM, which is very important for the further development of the child's bite.

2.2. Determination of the level of intensity of dental caries and surfaces

The first permanent molars are most frequently affected by caries, especially immediately after their eruption. Therefore, studying the processes of eruption, final maturation, and the degree of mineralization in the regions of our Republic is of great practical importance.

There are isolated works concerning the study of mineralization of tooth enamel after their eruption (Kiselnikova L.P., Leontiev V.K., 1995).

For this purpose, we tracked the dynamics of eruption of 1pM in preschool and school-age children from 4.5 to 11 years old in the Shaykhantakhur district of Tashkent.

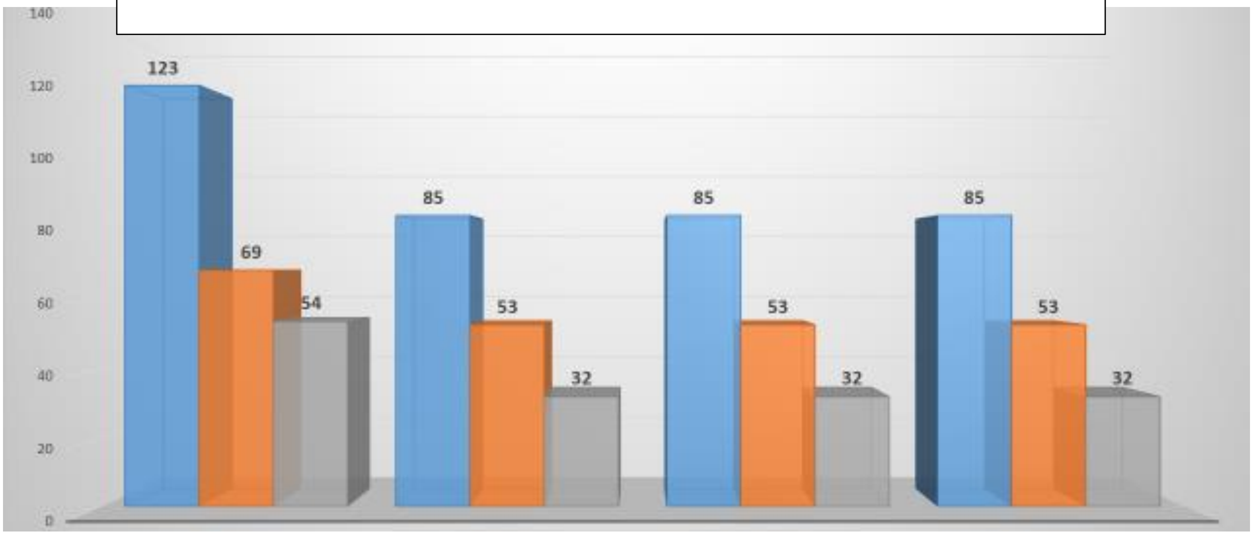
One of the main indices for determining the level of oral health is the intensity of dental caries: DMF+df of teeth and surfaces for mixed dentition.

This method allows for an objective assessment of the level of intensity of caries lesions in 129 children of all ages.

Figures 4 and 5 present the indicators of the intensity of dental caries and surfaces by months of observation for both girls and boys.

The study of DMF+df (t) was conducted in 123 children, of which 69 (56.1%) were boys and 54 (43.9%) were girls (Fig. 4).

Figure 4. Indicators (DMF+df(t) of caries intensity of the first permanent molars



At the beginning after 6 month after 12 month after 3 years

Total indicator boys girls

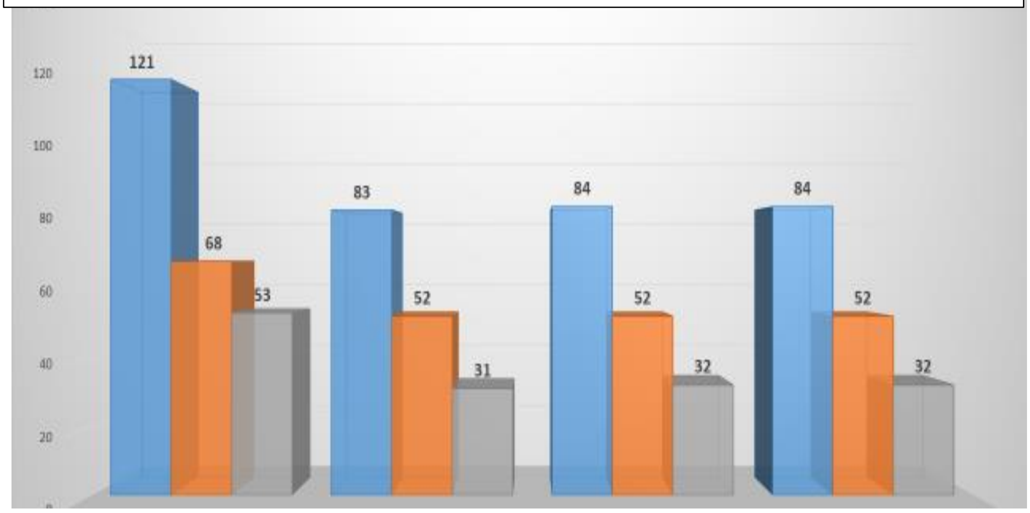
It turns out that the prevalence of dental caries in both sexes at the beginning of the study is practically the same: 1.51±0.07 in boys versus 1.59±0.08 in girls at the beginning of the observation. However, in terms of prevalence as a percentage, there is a reliable difference ($P < 0.01$) in boys 56.1% and in girls 43.9%.

After 6 months, the DMF+df (t) indicator reached 1.85±0.07 and 1.91±0.11, respectively.

After 12 months, the level of chemiluminescence increases and the pH of saliva changes towards the acidic side, the DMF+df (t) index increases to 2.30±0.06 and 2.40±0.09, respectively. Despite the high prevalence of dental caries in boys, the intensity level is significantly higher in girls (P<0.01). After 3 years, the intensity of caries increased to 2.73±0.05. In boys it was 62.4%, in girls 37.6%, 2.7±0.06 and 2.78±0.07, respectively.

A similar picture was revealed when studying the DMF+df (s) (Fig. 5). The total indicator from 1.62 ± 0.09 at the beginning of the observation, after 6 months increases to 1.94 ± 0.06, and then, just like the DMF+df (t), it rises to 2.29 ± 0.12 at 12 months. In girls, a reliable difference in the indicators is also observed towards an increase after 6 and 12 months to 2.0 ± 0.10 and 2.72 ± 0.08 against 1.90 ± 0.08 and 2.02 ± 0.06 in boys, respectively. After 3 years, the indicator increases to 3.2 ± 0.04, in boys 61.9%, in girls 38.1%.

Figure 5. Caries (DMF+df(s) intensity indicators of the first permanent molars



At the beginning after 6 month after 12 month after 3 years

Total indicator boys girls

Thus, the intensity index of dental caries and surfaces is an indicator of the degree of dental caries damage and indicates the need for methods of diagnosing focal demineralization of enamel and serves as an indicator for early prevention of caries in the first permanent molars.

Table 5 presents the data on the intensity of the caries process during the observation period. The higher the intensity, the lower the degree of mineralization of the tooth enamel. Thus, at the beginning of the observation, a high intensity of the DMF(t) was observed in 116 (94.3%) children and equaled 6.92 ± 0.03, after 12 months in 93.1% of children with an average value of 7.1 ± 0.18 and 91.3% with an average value of 8.0 ± 0.08, respectively. After 3 years, a high intensity level was observed in 81.6% of children.

At the beginning of the observation, a moderate level of intensity was observed in 5.7% of children: from 3.71±0.29 it increased to 4.0±0.58 after 6 months, then increased to 4.67±0.33 at 12 months, after 3 years, as teeth erupted and formed, a moderate level of intensity was observed in 13.1% of children.

A low level of DMF (t) was observed in 7 children, after 12 months from the beginning of observation in 3 (4.3%) 1.3±0.33 and after 3 years in 4 (5.3%) 1.75±0.25.

A high level of intensity of cavities of the pulmonary vascular system (p) is found in 95.0% of children at the beginning of observation, after 6 months in 98.5% with an average value of 7.6±0.18, and after 12 months in 91% of children (8.37±0.4) and 82.4% after 3 years.

A moderate level of DMF (s) was observed in 6 children. However, after 6 and 12 months, 1.4% had 4.0±0.04 and 6% had 4.75±0.25, respectively. After 3 years, 13.5% had the same value, with an average value of 5.0±0.0.

A low level of intensity of the DMF (s) was not observed at the beginning of the observation and after 6 months, after 12 months in 3% of children 1.5±0.5 and after 3 years in 4% of children with an average value of 2.0±0.0.

Thus, the obtained data indicate a decrease in the degree of mineralization of enamel lpM as teeth erupt and form, contribute to the development of foci of enamel demineralization, an increase in the intensity of fissure caries lpM timely prevention from the very beginning of the erupted crowns of the first permanent molars.

Table 5.

The level of intensity of the carious process during the observation period

Indicators	**Start of observation (n=123)**		**After 6 months (n=70)**		**After 12 months (n=69)**		**After 3 years (n=76)**	
DMF (t)	abs (%)	M±t	Abs (%)	M±t	abs (%)	M±t	abs (%)	M±t
Tall 6-10	116(94.3)	6.92±0.13	67(95.7)	7.1±0.18	63(91.3)	8.0±0.08**	62(81.6)	9.3±0.06**
Moderate 3-5	7 (5.7)	3.71±0.29	3 (4.3)	4.0±0.58	3 (4.3)	4.67±0.33	10(13.1)	5.0±0.0
Low 1-2	0	-	0	-	3 (4.3)	1.3±0.33	4 (5.3)	1.75±0.25
DMF (s)	**Start of observation (n=121)**		**After 6 months (n=69)**		**After 12 months (n=66)**		**After 3 years (n=73)**	
Tall 6-10	115(95.0)	7.08±0.14	68(98.5)	7.60±0.18*	60(91)	8.37±0.11**	61(82.4)	9.79±0.06**
Moderate 3-5	6(49)	3.83±0.17	1 (1.4)	4.04±0.0	4 (6.0)	4.75±0.25**	10(13.5)	5.0±0.0**
Low 1-2	0	-	0	-	2 (3.0)	1.5±0.5	3 (4.0)	2.0±0.0

Note: * - P<0.05; ** - P<0.001 - reliability of subsequent months in relation to the beginning of observation.

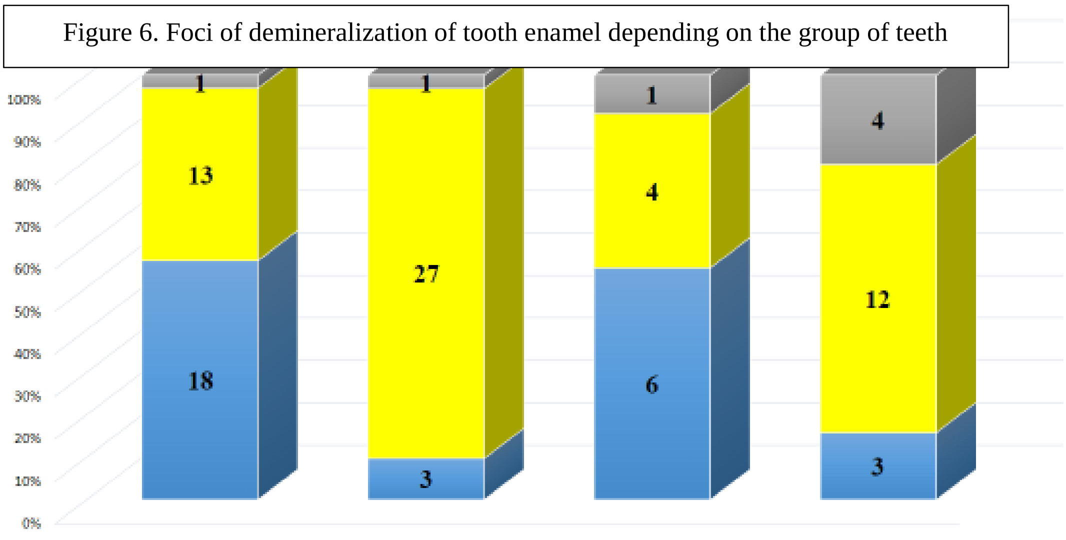
2.3. Intensity of focal demineralization of tooth enamel during the period of eruption of the first permanent molars

The method of determining the permeability of enamel according to the method of E.V. Borovsky, P.A. Leus, and L.A. Aksamit, 1979, has acquired particular significance for the diagnosis of the initial manifestation of dental caries.

The teeth were first isolated from saliva using a cotton swab, and the surface was thoroughly cleaned of plaque. A cotton swab soaked in methylene blue solution was then applied to the areas to be examined. The degree of focal demineralization of tooth enamel (FDE) was determined visually by staining the affected areas using a standard 10-point blue grayscale.

Thus, focal enamel demineralization (FDE) was determined in the area of the teeth present in the oral cavity. The FDE staining intensity of the teeth ranged from 10 to 100 on the standard blue color scale (Fig. 6). The figure shows that in most children, spots with grade II staining (from 40 to 60) were detected, and only 25.3% of spots had grade I staining (10-30%). Grade III staining was observed in only 3.8% of children. A total of 340 carious teeth were detected, of which 79 (14.6%) were carious spots. On average, there were 2.6±0.13 dental caries cases per child. Mainly, the central primary teeth and molars were affected, both primary and in the 1pM, the FDE of which fluctuated in values of 0.73 ± 0.13 per child, of which in the 1pM it was detected in 21 (26.6%) children and on average amounted to 0.5 ± 0.16 per child

.Figure 6. Foci of demineralization of tooth enamel depending on the group of teeth



1st premolar incisors canines molars

Intensity grade 1 (0-30) intensity grade 2 (40-60) intensity grade 3 (70-100)

Chalky carious spots were most often located on the central primary canines and incisors, lower and upper molars, and first permanent molars in the fissure and contact surface areas. The spots were round or oval in shape and 0.5-1 mm in size.

Focal enamel demineralization of grades II and III indicates changes in enamel permeability and a low degree of mineralization. According to the data obtained, grade II staining intensity was more pronounced, indicating progression of enamel demineralization processes.

In the upper jaw, the central primary incisors are most often affected, while in the lower jaw, the contact and chewing surfaces of the primary molars are affected. This is likely explained by the fact that the upper molars and lower central incisors are better washed by saliva. A 1pM FDE indicates low mineralization and poor oral hygiene in children.

The smallest size and number of spots were found on the canines. Spot size and intensity depend on the shape and flow of the spot, not on the group affiliation.

Thus, from the above, it follows that the initial form of caries, manifested as a chalky spot, is relatively common. Degenerative disc disease (FDE) can also be observed in incompletely erupted and formed 1pM, which demonstrates the need for timely detection of FDE areas in the first permanent molar for the prevention and treatment of caries in the early stages.

2.4. Study of the biochemical composition of saliva and its dynamics in children during the period of eruption of the first permanent molars

The physiological course of the mineralization process of permanent teeth is of great importance in the prevention of caries, which is one of the most common diseases of childhood.

It is known that in the process of enamel mineralization of permanent teeth, saliva plays a leading role, which is the main source of mineral components entering the tooth enamel after its eruption.

In this regard, the study of the biochemical composition of saliva in children is of great importance, since the timing of teeth eruption, the formation of stable enamel and the level of its mineralization depend on its content.

This chapter presents the results of a study of the biochemical composition of saliva and its dynamics in children during the period of eruption of the first permanent molars.

For this purpose, we studied the biochemical composition of saliva in 30 children from senior groups of kindergarten during the period of eruption of the first permanent molars.

The biochemical study included determination of chemiluminescence products, quantitative determination of the peroxidase enzyme, calcium and phosphorus content, and the pH of mixed saliva. Additionally, the salivary secretion rate and calcium-to-phosphorus ratio (Ca/P) were determined.

In the dynamics of the eruption of the first permanent molars, the studied biochemical parameters of saliva before and after the use of a fluoroprotector changed to varying degrees.

As can be seen from the data in Table 6, when studying the biochemical parameters of saliva at the beginning of the observation before using the fluoroprotector, the level of chemiluminescence products averaged 16.38±0.12 imp/s, the peroxidase content averaged 30.53±0.23 imp/s, calcium - 2.61±0.04 mmol/l and phosphorus - 7.12±0.12 mmol/l. The Ca/P ratio averaged 0.35±0.03. The pH of saliva during this observation period was slightly acidic and averaged 6.31±0.19. The rate of saliva secretion at the beginning of the observation averaged 0.54±0.03 ml/min.

Chemiluminescence products are known to participate in the regulation of various reactions in the body. However, when present in excess, they stimulate the formation of endoperoxides, which subsequently activate the arachidonic cascade and increase prostaglandin levels in tissues. This increased prostaglandin level, in turn, negatively impacts the regulation of various reactions in the body.

The obtained data show that in the dynamics of the eruption of the first permanent molars after the use of a fluoroprotector at the beginning of the observation, the level of CL products significantly decreases (15.24±0.24) compared to the data at the beginning of the observation ($P<0.001$). Subsequently, after 2 and 3 months of observation, the indicator significantly increases to 18.36±0.50 and 20.70±0.57 imp/sec ($P<0.05$ and $P<0.01$, respectively) compared to the data at the beginning of the observation. When studying the levels of CL products after 3 years, a reliable decrease in this indicator to 7.92±0.32 imp/sec against 16.38±0.12 imp/sec is noted (Table 6).

Based on chemiluminescence data, it can be assumed that during the maturation period of permanent teeth, 2-3 months after the formation of tubercles, the possibility of developing carious lesions of the tooth appears, since during this period the highest level of production of chemiluminescence products is observed.

The enzyme peroxidase plays a role in teething. Peroxidase is involved in the detoxification of the toxic compound hydrogen peroxide, which, when present in excess, initiates lipid peroxidation (LPO) and exerts a cytotoxic effect.

At the beginning of the observation, the amount of peroxidase was on average 28.34±0.30 mmol/l, after a month it increased to 43.29±0.55, after 2 months it decreased to 35.29±0.76 and 3 months it increased to 41.33±0.79 mmol/l.

Our research shows that at all examination periods, a significant increase in the peroxidase enzyme level is observed compared to the data at the beginning of the observation ($P < 0.05$ and $P < 0.001$, respectively). The most pronounced increase in the peroxidase level is observed after 3 years and averaged 68.69 ± 1.02 imp/s compared to 30.53 ± 1.69 imp/s at the beginning of the observation. This indicates that during the eruption of permanent molars, toxic hydrogen peroxide compounds appear in saliva in large quantities, which adversely affect tooth mineralization and contribute to the development of caries.

During the period of eruption and mineralization of permanent teeth, the content of calcium (Ca) and phosphorus (P) in mixed saliva is of particular importance.

The results of the study showed that in the initial periods of eruption of the first permanent molars, a decrease in calcium content is noted compared to the data at the beginning of the observation and, on average, it was equal to 2.03 ± 0.09 mmol / l after 1 month, 2.44 ± 0.07 mmol / l after 2 months and 2.58 ± 0.06 mmol / l after 3 months with 2.61 ± 0.04 mmol / l at the beginning of the observation. And 3 years after the observation, an increase in the Ca level in saliva was noted (4.54 ± 0.10 mmol / l) in relation to the data at the beginning of the observation.

The obtained data indicate that a significant decrease in the concentration of calcium in saliva occurs already at the stage of eruption of the first permanent molars.

The phosphorus concentration was higher than that of calcium in saliva, which is consistent with literature data. This predominance of phosphorus in saliva has certain physiological significance. It is known that the supersaturation of saliva with calcium and phosphorus ions is created by the high concentration of phosphate, the excess of which in a neutral and slightly acidic environment prevents the release of calcium and phosphate ions from the teeth, helping to maintain the physiological situation at the enamel-saliva interface.

Table 6.

Dynamics of biochemical parameters of children's saliva during the period of eruption of the first permanent molars before and after the use of a fluoroprotector

Indicators	Beginning of observation	After use	in 1 month	in 2 months	in 3 months	in 3 years
Chemiluminescence, imp/s	16.38±0.12	15.22±0.24***	9.33±0.21***	18.16±0.50***	20.70±0.57***	7.92±0.38***
Peroxidase	30.53±0.23	28.34±1.33***	43.29±0.55***	35.29±0.76***	40.33±0.88***	68.69±1.02***
Calcium (Ca), mmol/l	2.61±0.06	2.75±0.05	2.03±0.09***	2.44±0.07	2.58±0.06	4.54±0.10***
Phosphorus (P), mmol/l	7.12±0.12	7.21±0.11	6.80±0.10	7.18±0.11	7.31±0.13	9.22±0.28***
Ca/P ratio	0.35±0.03	0.40±0.04	0.34±0.03	0.34±0.03	0.37±0.04	0.27±0.02
pH of saliva	6.31±0.19	6.57±0.4	6.6±0.24***	6.91±0.32	7.13±0.24	7.40±0.10***
Rate (V) of saliva secretion, ml/min.	0.54±0.03	0.98±0.04***	0.92±0.05***	2.24±0.08***	2.50±0.06***	2.92±0.11***

Note: *** - P<0.001 - reliability of subsequent months in relation to the beginning of observation.

The study shows that during the eruption of the first permanent molars, the phosphorus content in saliva shows a clear downward trend (Table 6). Thus, after 1 month, the phosphorus level in saliva decreased on average to 6.80±0.10 mmol/l, after 2 months – to 7.18±0.11 mmol/l and after 3 months – to 7.31±0.13 mmol/l against 7.12±0.12 mmol/l at the beginning of the observation, which is statistically highly reliable ($P<0.001$, $P<0.05$ and $P<0.001$, respectively). When studying the phosphorus concentration after 3 years, a reliable increase in this indicator was revealed compared to the data at the beginning of the observation ($P<0.001$).

The observed unidirectional changes in the content of calcium and phosphorus in the saliva of children contribute to minor fluctuations in the Ca/P ratio compared to the data at the beginning of the observation.

The saliva pH after 1 month was (6.6±0.24), after 2 and 3 months it was slightly acidic (6.91±0.32 and 7.13±0.15, respectively), and after 3 years it was (7.40±0.18). Acidic changes in saliva pH in children during the observation period of 2 and 3 months contribute to a favorable opportunity for the development of caries, which can lead to early damage by carious disease IpM.

A study of the rate of saliva secretion showed that during the eruption of the first permanent molars, an increase in saliva secretion was observed at all observation periods. Thus, if at the beginning of the observation, the rate of saliva secretion averaged 0.54 ± 0.01 ml/min, then after 1 month this indicator increased to an average of 0.92 ± 0.04 ml/min, and after 3 years it reached 2.92 ± 0.11 ml/min. This indicates that during the eruption of permanent molars, an increase in saliva secretion is observed to ensure tooth mineralization.

Thus, analysis of the obtained data suggests that the eruption of the first permanent molars is accompanied by a decrease in the mineralizing function of saliva, which is expressed by a high level of production of chemiluminescence products, a decrease in the calcium and phosphorus content of mixed saliva, and a shift in salivary pH toward the acidic side at the onset of the eruption of the first permanent molars. All of this, taken together, leads to early carious disease of the first permanent molars and increases their incidence.

Thus, the possibility of dynamically studying the biochemical composition of saliva in children during the period of eruption of the first permanent molars allows, when carrying out various preventive measures, to specify the individual characteristics, etiology and pathogenesis of the disease, to predict the possibility of its prevention and indicates the need for preventive measures during the period of eruption of the first permanent molars.

CHAPTER III.
THE DYNAMICS OF THE ERUPTION OF THE FIRST PERMANENT MOLARS

3.1. Dynamics of mineralization of hard dental tissues during the period of eruption of 1pM

In dental practice, visual examination and probing of the examined areas of the teeth are widely used to determine the degree of mineralization of hard dental tissues. This method determines the fissure width and density. However, fissure width alone does not always indicate the degree of mineralization, as the width at the orifice can be very small.

Therefore, to assess the degree of mineralization of hard tissues of erupted InM, the method developed by V.K. Leontiev et al. (1983) was used. The electrical conductivity of hard dental tissues is associated with their permeability with a decrease in the degree of mineralization, which depends on the size of the microspace of the intercrystalline spaces of the enamel. An increase in enamel mineralization occurs due to the accumulation of Ca and P, as well as other microelements.

The degree of enamel maturity and the dynamics of its mineralization are determined by the decrease in the level of electrical conductivity of dental tissues. Mature enamel in intact areas of teeth does not transmit electrical current at a current of 100 μA and a voltage of 3.0 V, and the electrical conductivity is zero.

We examined 30 children without focal enamel demineralization. The IpM of both the upper and lower jaws was examined. The conductivity of the hard tissues of the teeth to electric current was measured in specific areas.

The results of the study of electrical conductivity of permanent first molars are shown in Figure 7.

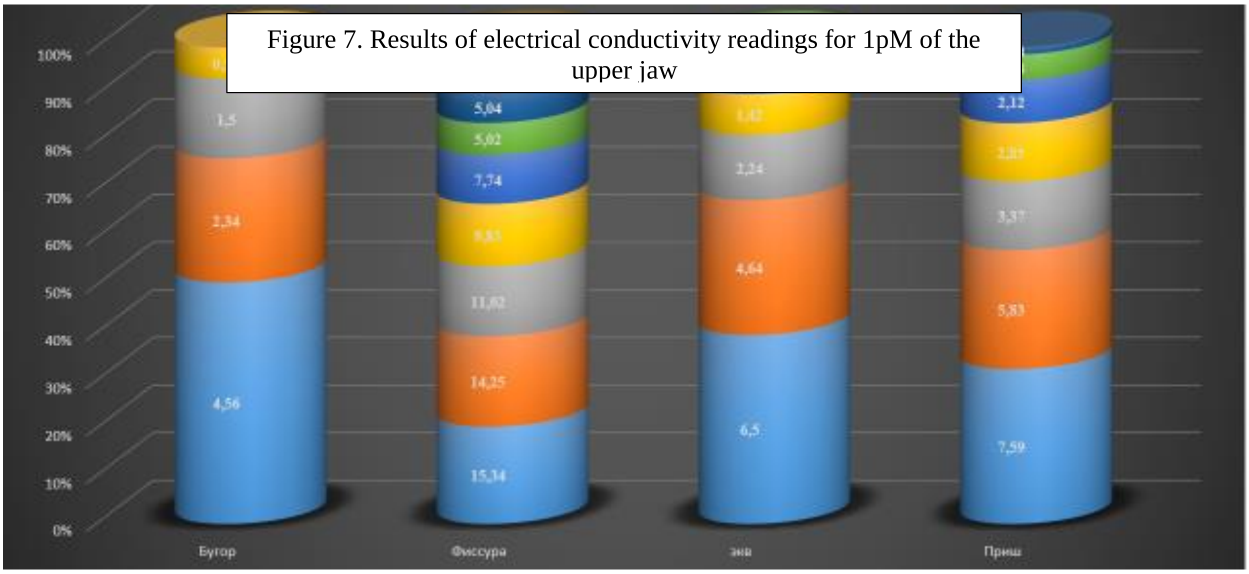
The process of mineralization of hard tissues of the 1pM was studied in the area of tubercles, fissures, equator and cervical region.

As can be seen from Figures 7 and 8, the mineralization process occurs most rapidly on the cusps of the molars on both the upper and lower jaws.

At the beginning of the observation, the electrical conductivity of the tuberosity of the upper lpM was equal to 4.56±0.13. After a month, this value decreased to 2.34±0.10. In the 2nd month of observation, there was a significant reliable decrease ($P<0.01$) to 1.50±0.07, in the 3rd month - to 0.59±0.09. After 4 months, the electrical conductivity of the tuberosities of the lpM was equal to 0, which indicated the absence of ODE and a high degree of mineralization of the tuberosities.

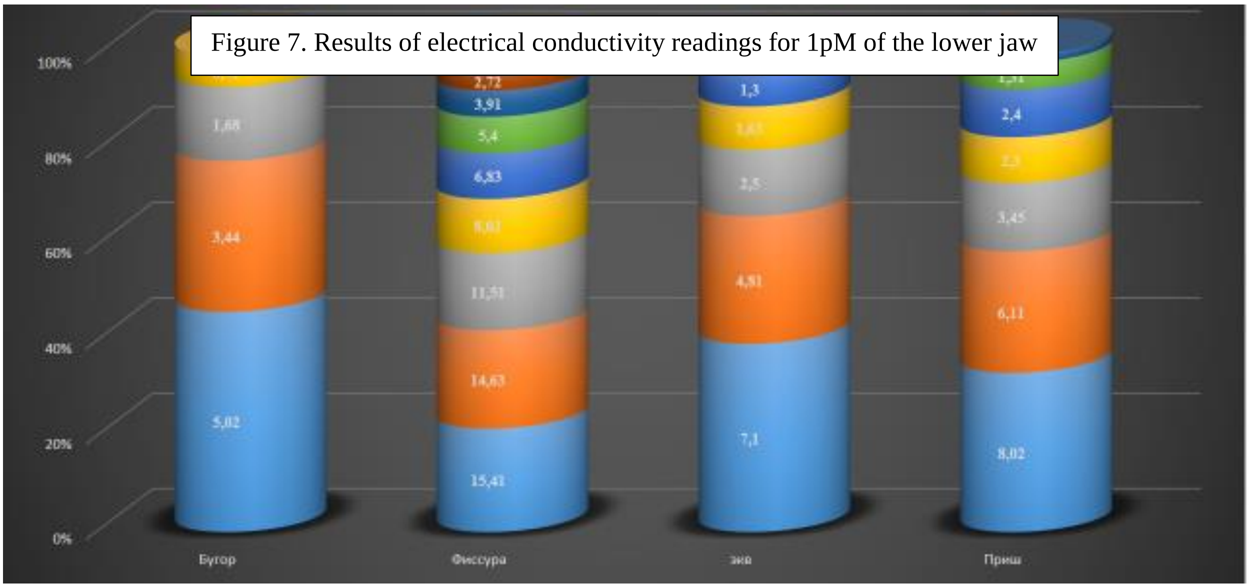
The process of mineralization of hard tissues in the fissure area of the 1pM is slower compared to that in the tubercle area. At the time of the study, at the beginning of the observation, it was equal to 15.34 ± 0.17. As the teeth erupted, the degree of mineralization increased, and the electrical conductivity decreased. By the 2nd month, it dropped to 11.02 ± 0.25, by the 6th month it decreased by 5.04 ± 0.08, after 12 months it was 3.62 ± 0.11, by the 15th month 2.60 ± 0.05, and after 3 years it was equal to 0.59 ± 0.03, which is highly reliable ($P < 0.001$).

Figure 7. Results of electrical conductivity readings for 1pM of the upper jaw



At the beinning 1 month 2 month 3 month 4 month 5 month 6 month 12 month 15 month 3 years

Figure 7. Results of electrical conductivity readings for 1pM of the lower jaw



At the beinning 1 month 2 month 3 month 4 month 5 month 6 month 12 month 15 month 3 years

At the beginning of the observation, the electrical conductivity in the equatorial zone of the upper permanent first molars was 6.50±0.16, and by the 4th month the current strength decreased to 1.08±0.03. Only after the 6th month did the degree of mineralization increase and the electrical conductivity equaled zero.

The electrical conductivity of the upper 1pM in the cervical region at the beginning of the observation was equal to 7.59±0.14, after 6 months it reached 0.34±0.02. After 12 months, the electrical conductivity decreased to zero.

A similar pattern is observed in the lower jaw. In the area of the lower jaw cusps, the initial current conducted by the hard tissues of the teeth was 5.02±0.12, which then significantly decreased, reaching 0.72±0.03 by the third month, and then dropping to zero by the fourth month.

The mineralization process in the fissure area of the lower IpM occurred similarly to the fissures of the upper IpM. From the initial level of 15.41±0.14, it decreased to 6.83±0.09 after 4 months. Three years later, as the mineralization of the tooth crown formed and increased, this indicator was equal to 0.38±0.07.

The equatorial zone of the lower 1pM responded to the current strength at the beginning of the observation equal to 7.10±0.13 and significantly decreased to 4.81±0.13, after a month to 2.50±0.08 - at month 2 and 1.30±0.05 - at month 4. After 6 months, the electrical conductivity in the equatorial region was equal to 0.

The cervical region of the vestibular surface of the lower jaw was practically no different from that of the upper jaw, and a slow decrease in current strength values was observed from 8.02±0.12 initially to 0.40±0.03 after 6 months. After 1 year, it dropped to zero.

Therefore, it can be concluded that the rate of enamel mineralization in the upper 1pM occurs similarly to the lower IpM. The mineralization processes are completed faster in the tubercle area (4 months), then in the equatorial zone (6 months), the cervical area closer to 10-12 months, and in the fissure area the electrical conductivity of hard dental tissues decreases, but not to zero even after 3 years. The entire mineralization process of healthy 1pM is directly related to the content of Ca and P in saliva, which increases after 3 years and reaches Ca - up to 4.54 ± 0.10 mmol / l, against 2.61 ± 0.04 mmol / l, and P - up to 9.22 ± 0.28 against 7.12 ± 0.08 at the beginning of the observation, which is highly reliable ($P < 0.001$). A decrease in the content of microelements in mixed saliva and a shift in the pH of saliva to the acidic side leads to a low degree of mineralization of tooth enamel and creates conditions for the development of dental caries.

3.2. Results of changes in the state of periodontal soft tissues in the area of the first permanent molars

The condition of the oral mucosa in the area of the erupted 1pM was determined by questionnaire surveys using the Schiller-Pisarev method. The degree of periodontal soft tissue inflammation in the 1pM area was determined. This included the presence of hyperemia, edema, and overhanging gingival margins during the eruption of the 1pM cusps.

The dynamics of changes in the oral mucosa during the eruption of the 1pM tubercles was monitored during the first 4 months.

The results are presented in Table 7.

We examined 30 children, of which 17 (56.7%) were boys and 13 (43.3%) were girls aged from 4.5 to 6 years. Thus, at the beginning of the observation in the area of the 1pM, it was revealed that hyperemia was observed in 14 (46.7%) children, and in boys it was manifested to a greater extent - in 26.7%, than in girls - 20%.

After one month, with an increase in the number of tubercles, hyperemia is present in 33.3% of boys and 23.3% of girls. After two months, signs of hyperemia increase to 36.7% and 23.3%, respectively, and after three months, the number of children with severe hyperemia reaches 26.7% and 20.0%, respectively. It should be noted that during the 1-4 month observation period, hyperemia is detected more often in boys.

Significantly fewer children experienced swelling in the area of the erupting 1pM.

At the beginning of the observation, edema was detected in 2 (6.7%) children in both boys and girls. After a month, this indicator increased to 10.0% in boys, and 6.7% in girls, as at the beginning of the observation. After 2 months, swelling was observed in the area of 3 teeth (10.0%) in both boys and girls. By the end of the study, the number of children with severe swelling of the mucous membrane in the area of the 1pM in boys was 16.7%, while in girls it decreased by 3.3%, which is highly reliable ($P < 0.001$).

With the appearance of the first cusps, overhanging gum margins were visible, but only in 3 (10%) children, and increased as all cusps erupted. At 3 months, this figure was 6.7% for both boys and girls.

At the beginning of the observation, 40% of children were within the normal range, but after 1-2 months, 16.7% and 6.7%, respectively. After 3 months, 16.7% were found in boys and 13.3% in girls.

Thus, based on the above data, it can be concluded that, although inflammatory elements are present, they are not the primary clinical sign during the period of eruption of the 1pM. However, it should be noted that all signs of inflammation of the oral mucosa are more pronounced in boys.

Table 7.

Signs of inflammation of the gingival mucosa in the 1pM area.

Indicators	Start, n = 30		in a month, n = 30		After 2 months, n = 30		After 3 months, n = 30	
	boys, n=17	girls, n=13	boys	girls	boys	girls	boys	girls
Hyperemia	8(26.7%)	6 (20.0%)	10(33.3%)	7 (23.3%)	11(36.7%)	7 (23.3%)	8 (26.7%)	6 (20.0%)
Edema	2 (6.7%)	2 (6.7%)	3 (10.0%)	2 (6.7%)	3 (10.0%)	3 (10.0%)	2 (6.7%)	1 (3.3%)
Overhanging gum margins	-	-	2 (6.7%)	1 (3.3%)	2 (6.7%)	2 (6.7%)	2 (6.7%)	2 (6.7%)
Within normal limits	7(23.3%)	5(16.7%)	2 (6.7%)	3 (10.0%)	1 (3.3%)	1 (3.3%)	5 (16.7%)	4(13.3%)

3.3. Research and relationship of odontoglyphics of the first permanent molars with the incidence of fissure caries

We examined the erupted crowns of 240 1pM in 60 children aged 4.5–8 years, of which 32 (53.3%) were boys and 28 (46.6%) were girls.

The examination of children included an assessment of the dental status, identification of the anatomical structure of the chewing surface of the 1pM, and the architecture of the chewing surface.

During the eruption of the 1pM, three types of fissures were distinguished. Type I was an "open" fissure with signs of mineralization disturbance—in the presence of matte enamel, when the probe could easily penetrate. Type II was a deep, "open," healthy fissure, when the probe could easily penetrate the fissure, but the enamel color did not change. Type III was a shallow or deep, "closed" fissure, when the probe did not penetrate the fissure and the enamel was normal in color.

As the crown of the incisor tooth erupts, the likelihood of caries affecting this tooth increases, primarily in the fissure area, and manifests as caries in the spot stage or ODE in 18 (85.7%) children. Initial caries was detected in 3 (14.3%) children. A decrease in the hygiene level to 2.56 ± 0.08 was noted, especially in the area of the erupted tooth.

During the study, it was revealed that the chewing surface of the maxillary 1pM has an uneven relief (Table 8). Teeth emerge with 4-5 and 6 cusps, and the fissures of these tooth groups have various shapes, most often resembling the letters "Ж" or "H" in 70% of cases. On the mandible, the pattern is distorted in 25% of cases (Photo 4).

Table 8.

Distribution of the first permanent molars in children depending on the architecture of the chewing surface of the teeth

Localization of 1pM	Number of first permanent molars, abs. (%), n = 240		
	4-tuberculate	5-tuberculate	6-tuberculate
Lower jaw:	44(18.3%)	72 (30.0%)	4 (1.6%)
On the right	25 (10.4%)	37(15.4%)	2 (0.8%)
Left	19(7.9%)	35 (14.5%)	2 (0.8%)
Upper jaw:	93 (38.7%)	27(11.2%)	-
On the right	53 (22.0%)	13 (5.4%)	-
Left	40 (16.7%)	14 (5.8%)	-

As a result of the research, it was established that in intact LPs, type III fissures - closed - predominate , however, in 19.2% of cases, type II - open deep - was encountered, and in 18 (85.7%) cases, type I open fissures with signs of demineralization.

The study of the structure of the chewing surface of the 1pM on plaster models made it possible to identify 3 variants of its architecture and determine the frequency of their occurrence.

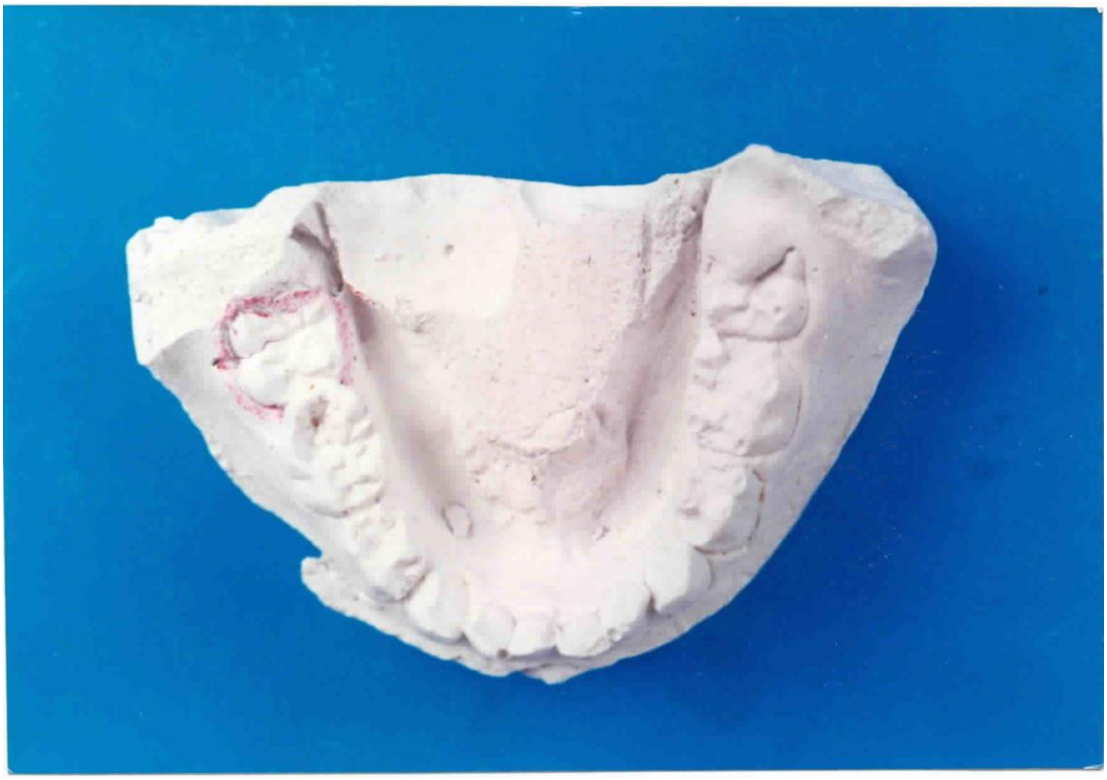


Photo 4

The 1pM has a deep, difficult-to-reach fissure. As can be seen from Table 10, 4-cusp 1pMs are more common in the maxilla – 38.7% versus 18.3% in the mandible (Photo 5), with a higher prevalence on the right than on the left in both the maxilla and mandible: 22.0% versus 10.7% and 10.4% versus 7.9%, respectively.

Five-cusp 1pM teeth, on the other hand, are more common on the mandible (30.0%) and on the maxilla (11.2%). Similarly, four-cusp 1pM teeth are more common on the right side of the mandible (15.4%) versus the left (14.5%), while on the maxilla they are almost identical.

Six-tubercled 1pM are very rare and occur in isolated cases, most often on the lower jaw in 4-tubercled 1pM. They have not been detected on the upper jaw.

Photo 5.

Naturally, the more tubercles there are, the more tortuous the shape of the fissures and, therefore, the teeth are more susceptible to the risk of caries.

Thus, our research revealed the complexity of the odontoglyphics of the IpM, poor salivary penetration of the fissures of this tooth, and a decrease in the mineralizing function of saliva during the eruption period. The combination of these changes leads to early caries in the IpM, which requires frequent caries-preventive measures beginning during the eruption period and is a pathogenetically justified approach that promotes accelerated enamel mineralization in the IpM.

3.4. Results of electrometric studies of hard tissues of the first permanent molars

In order to determine the initial level of mineralization of the erupting first permanent molars, an electrometric study of the hard tissues of the teeth of the upper and lower permanent molars was conducted in 120 permanent molars in 85 children aged 6-11 years. To assess the degree of maturity of the hard tissues of the erupting teeth, the electrometric diagnostic method according to Ivanova G.G. et al. (1985) was used.

The results of the initial electrical conductivity of enamel 1pM in the most typical locations of caries: in fissures and natural pits are presented in Table 9.

Data analysis confirms the idea that teeth erupt with incomplete mineralization. In all studied areas, the electrical conductivity of hard tissues (1pM) is significantly higher than zero.

The highest current values are observed in the deepest pits and natural fissures. According to the table, the electrical conductivity of hard tissues in the area of the central fossa of the upper first permanent molars is 15.2 ± 4.16. A more moderate value is observed in the area of the distal sulcus - 12.6 ± 3.53, and the lowest current values are determined in the area of the vestibular sulcus - 9.45 ± 2.44, which in turn indicates a higher degree of mineralization of this area.

Table 9.

Electrical conductivity of hard tissues of the first permanent molars

Study areas, n = 120	Current strength, M±m, μA.	
	Upper 1pM	Bottom 1pM
Central fossa	15.2 ±4.16	14.6 ±3.10
Distal groove	12.6 ±3.53	12.9 ±3.09
Vestibular groove	9.45 ± 2.44	9.3 ±2.91

The results of electrometry in the region of the lower first permanent molars are practically no different from those of the upper 1pm. In the region of the central fossa, the hard tissue responds to a current of 14.6±3.10 μA, in the region of the distal sulcus to 12.9±3.09 and the vestibular sulcus to 9.3±2.91, respectively.

A study of the initial level of electrical conductivity of erupting first permanent molars revealed that the parameters studied in the examined children fluctuate significantly within the range from 2-6 to 20-25 μA.

A thorough clinical examination of erupting first permanent molars using a dental probe revealed that in areas where smooth and shiny fissures were present, the probe glided over the enamel surface. In these cases, the current readings were minimal. In cases where chalky, matte-colored spots, especially softened ones, were present, the electrical conductivity of the hard tissues during probing (1pM) was significantly higher.

Analysis of electrometric data and assessment of the clinical state of hard tissues of 1pM made it possible to identify 3 groups of children depending on the initial level of mineralization.

The criterion for group formation was the maximum current value in the studied areas of the first permanent molar. The numerical values are presented in Table 10.

We examined the upper first permanent molars of 52 children and the lower first permanent molars of 68 children. The first group included 12 children with high levels of mineralization of the first permanent molars in the upper jaw. The maximum current passing through the hard tissue in the examined areas did not exceed 8 μA. In these cases, the enamel was smooth and shiny, and the probe glided over the tooth surface.

The second group consisted of 22 children with an average initial level of mineralization, when the maximum value of the electrical conductivity of hard tissues (1pM) ranged from 9 to 15 μA. In this group of children, chalky spots with a matte tint were detected, and the probe was retained in 1-2 fissures.

In cases where the current exceeded 15 μA, the child was assigned to the third group, with low initial mineralization levels. These children had enamel that lacked its natural luster, fissures that were chalky and matte, and significant probe retention in 2-3 deep fissures.

A similar distribution of children into groups was carried out on the lower jaw.

The electrical conductivity of the upper 1pM in the fossa region with a high level of mineralization was equal to 6.15±0.07 μA. The average electrical conductivity value in group II was 13.37±0.24, and in group III with a low degree of mineralization it was equal to an average of 23.4±0.29.

As expected, the electrical conductivity values in the distal groove area were significantly lower. In Group I, the average value was 1.53±0.04 μA; in Group II with an average initial level of mineralization, it was 11.0±0.35 μA; and in Group III with a low initial level, it was 21.9 ± 0.45.

The study of the electrical conductivity of hard tissues of the upper permanent molars in the vestibular sulcus area showed that a high level of mineralization was observed in 36 (69.2%) children versus 12 (23.1%) in the central fossa area and was equal to 3.97 ± 0.03, which is highly reliable ($P < 0.001$). The average level of mineralization was determined in 14 (26.9%) children and corresponded to 14.56 ± 0.27. A low level of mineralization in the vestibular sulcus area of the upper permanent molars was observed only in two children and showed current strength values of 20.1 ± 0.0.

Table 10

Electrical conductivity indices of the studied fissures 1pM with different levels of mineralization.

Original mineral level tooth lysis	Upper 1pM, n = 52			Lower 1pM, n = 68		
	Central Pit	Distal furrow	Vestibular Furrow	Central pit	Distal furrow	Vestibular furrow
	Ma			μA		
High level mineralization	12(23.1%) 6.15 ±0.07	12(23.1%) 1.53 ±0.04	36 (69.2%) 3.97 ±0.03	20(29.4%) 5.72 ± 0.03	20 (29.4%) 3.57 ±0.03	30(44.12%) 3.31 ±0.01
Intermediate level mineralization	22(42.3%), 13.37 ±0.24	22 (42.3%) 11.0 ±0.35	14(26.9%) 14.56 ±0.27	24 (35.3%) 14.35 ± 0.26	28(41.2%) 12.7 ± 0.29	34 (50%) 3.3 ± 0.33
Low level mineralization	18(34.6%), 23.4 ± 0.29	18(34.6%) 21.9 ±0.45	2 (3.9%) 20.1 ±0.05	24 (35.3%) 13.92 ±0.21	20 (29.4%) 22.62 ± 0.36	4 (5.88%) 20.45 ± 0.23

In the lower jaw, a high level of electrical conductivity of hard tissues of the first permanent molars in the area of the central fossa was determined in 20 children with values of 5.72 ± 0.03. The average level of mineralization in the area of the central fossa was determined in 24 children and corresponded to 14.35 ± 0.26. A low level of electrical conductivity in group III was also detected in 24 children with values of 13.92 ± 0.21 μA.

The electrometry values in the area of the distal groove of the lower first permanent molars were equal to 3.57±0.03 in 20 children of group I. In group II , the average level of mineralization corresponded to a current strength equal to an average of 12.7±0.29 μA in 28 children and in group III - 22.62±0.36 μA in 20 children, respectively .

As in the upper 1pm, low mineralization in the area of the vestibular groove of the lower 1pM was observed in only 4 children, with values of 20.45±0.23 μA. The average level of hard tissue electrical conductivity of the first permanent molar on the lower jaw was 13.3 ± 0.33 in 34 children, and high mineralization corresponded to values of 3.31±0.01 in 30 children.

The digital values of the 1pM mineralization levels in both jaws differed almost insignificantly from each other. The difference could only be seen in the number of children with different degrees of hard tissue electrical conductivity in the first teeth. A relationship was observed across all the fissures studied: the lower the initial level of mineralization of the erupting first permanent molars, the higher the current values. The lowest initial conductivity values were found in the group of children with high mineralization (Group 1), while the highest current values were found in the group of children with low initial values (Group 3). Highly significant differences between the groups were found in almost all studied areas of the IpM.

It is noteworthy that the number of children with a high level of mineralization of the erupted first permanent molars on the upper and lower jaws is observed to a greater extent in the area of the vestibular groove, and the largest number of children account for the average level of mineralization in all studied areas of both jaws.

Thus, the obtained data indicate that the degree of mineralization of erupting teeth is incomplete, which indicates the possibility of increased damage by dental caries, especially in the fissure area, and the need to apply caries-preventive measures simultaneously with the onset of eruption of the tubercles of the first permanent molars.

We further studied the degree of mineralization of fissures in which no foci of enamel demineralization developed during the eruption of the chewing surface of the first permanent molars. These fissures included all unchanged fissures in which dental examination revealed no caries at the spot or defect stage. However, even in these children, incomplete mineralization was observed as the teeth grew and the initial molars formed.

The results of the study of the maturation processes of the studied areas of the first permanent molars without caries are presented in Table 11.

At the moment of teeth eruption, the initial data of electrical conductivity values in the area of the studied sites were corresponding. In the upper 1pM in the area of the central fossa, the current values were equal to 29.68±0.48 μA, in the distal sulcus - 28.20±0.56 and in the vestibular sulcus - 16.13±0.15 μA. One month after the moment of eruption, the electrical conductivity of hard tissues 1pM decreased to the following values: in the central fossa up to 26.12±0.52; in the distal sulcus up to 17.61±0.38 and in the vestibular sulcus up to 15.17 ± 0.23 μA ($P < 0.01$).

Subsequent changes in current strength during electrometry in the studied areas, with gradual decreases in parameters, were highly reliable compared to the initial survey. However, the rate of decrease in electrical conductivity did not increase, but rather actively decreased over the first three months.

Thus, the current strength values after 2 months from the beginning of observation in the area of the central fossa of the upper 1pM corresponded to 20.07±0.39 μA; in the area of the distal sulcus - 15.9±0.25; vestibular sulcus - 14.18±0.23 μA. After three months, the current strength was equal to - 16.06±0.35; 13.90±0.32; 12.10±0.40 μA, respectively.

The electrometry values in the lower first permanent molars differed little from those in the upper 1pm. Thus, at the beginning of the observation, the electrical conductivity of the hard tissues of the teeth in the central fossa area was equal to 22.27±0.41 μA; in the distal groove area - 23.40±0.40; in the vestibular groove area - 20.10 ±0.37 μA. After 1 month, as well as in the upper jaw, a tendency towards a decrease in all current strength values was observed. The central fossa of the lower 1pm responded to 20.07±0.44 μA; the distal groove - to 19.15 ±0.36 and the vestibular groove - to 16.04 ±0.14.

Table 11

Electrometric characteristics of fissure maturation 1pM

Time of examination after eruption of the chewing surface	Upper 1pM M±m, µA, n = 52			Lower 1pM M±m, µA, n = 68		
	Central fossa	Distal groove	Vestibular groove	Central fossa	Distal groove	Vestibular groove
Beginning of observation	29.67±0.48	28.20 ± 0.56	16.13 ±0.15	22.27 ±0.41	23.41 ±0.40	20.10 ±0.37
1 month	26.12 ±0.52*	17.61 ±0.38*	15.17 ±0.23*	20.07 ± 0.44*	19.15 ±0.36*	16.04 ±0.14*
2 month	20.07 ± 0.39*	15.9 ±0.25*	14.18 ±0.23*	19.28 ± 0.34*	16.40 ±0.39*	14.10 ±0.17*
3 month	16.06 ±0.39*	13.90 ±0.32*	12.10 ±0.40*	18.32 ±0.44*	14.18 ±0.20*	9.0 ±0.17* vg
12 months	10.2±0.42*	8.0±0.12*	4.91 ±0.13*	15.8 ±0.19*	9.31 ±0.40*	3.90 ±0.14*
2 years	4.3±0.19*	4.6±0.12*	3.70 ± 0.07*	6.5 0 ±0.23*	5.10±0.13*	1.31 ±0.05*
3 years	0.0±0.0*	0.003±0.0*	0.002 ± 0.0*	0.003 ± 0.0*	0.003 ± 0.0*	0.002 ± 0.0*

Note: * - P<0.001 - reliability of subsequent months in relation to the beginning of observation.

At the 2nd month of observation, the values of electrical conductivity of hard tissues 1pM changed as follows: in the central fossa - 19.28 ± 0.34 μA; in the distal sulcus - 16.40 ± 0.39; in the vestibular sulcus - 14.10 ± 0.17 μA. After 3 months: 18.32 ± 0.44 μA; 14.18 ± 0.20 and 9.00 ± 0.17, respectively. By the 12th month 15.8 ± 0.19; 9.31 ± 0.40; 3.90 ± 0.14, after 2 years 6.5 ± 0.23; 5.10 ± 0.30; 1.31 ± 0.05 μA. Three years after the complete eruption of the tooth, the electrical conductivity of the hard tissues of the first permanent molars of both jaws dropped to zero.

Thus, during the first three months from the onset of eruption of the chewing surface, a sharp decrease in hard tissue conductivity (IpM) occurs in the studied areas. This indicates that the final mineralization process is very rapid and then slows, beginning at the 12th month. However, by the age of three, enamel maturation in intact teeth free of caries at the spot and defect stage is complete and equal to zero. However, if enamel demineralization begins as maturation is completed, i.e., initial caries develops in immature fissures, the current increases.

Therefore, in children with low initial mineralization of the first permanent molar, the risk of developing dental caries is very high and requires preventive interventions as early as the period of eruption of the chewing surface, as the mineralization process is not completely complete. In children with high mineralization, focal demineralization is virtually nonexistent. In these teeth, the process of fissure minimization is completed approximately 2.5-3 years after tooth eruption. The rate of enamel maturation in teeth with medium and especially low initial mineralization is significantly slower than in teeth with high initial mineralization.

3.5. The influence of preventive measures on the process of mineralization of hard tissues of the first permanent molars

Currently, considerable attention is being paid to the problem of regulating dental resistance to cariogenic factors as one of the main areas of caries prevention. The formation of a healthy structure and chemical composition of tooth enamel is of primary importance here.

We used an electrometric method for the intravital determination of the degree of mineralization of hard tissues of the first permanent molar in practically healthy children without concomitant background aged 4.5-11 years.

A comparison was made of the results of maturation of intact enamel, as well as in the presence of focal demineralization of enamel in the form of a chalky spot with a matte shade and various defects when using remineralizing preparations.

One of the most common topical dental caries prevention methods is varnishes, which are used to prolong the exposure of fluoride to tooth enamel. They form a film adjacent to the enamel that remains on the tooth surface for a long time —up to 12 hours, and even for several days in fissures, crevices, and microspaces.

We used this method on all areas of the chewing surface from the moment of eruption of the 1pm cusps in children with a high caries severity, where there is a high risk of developing caries. Fluoride varnish was applied to the dried and cleaned surface of the cusps, fissures, and pits once every 3-4 days, after teaching the children rational oral hygiene. Five to six coated teeth were used per course of treatment, for a total of 5-6 applications.

The caries-preventive measures taken accelerated the rate of enamel mineralization after the eruption of the 1pM. Thus, if the highest electrical conductivity of the hard tissues of the first permanent molars in the central fossa area at the beginning of the observation period was 29.67±0.48 μA, then after remineralizing therapy with fluoride varnish, the current dropped to 16.12±0.58 μA one month later. Subsequently, a significant decrease in the electrical conductivity of the hard tissues of the 1pm to 20.07±0.39 μA in the 2nd month and 15.90±0.25 in the 4th month of observation was also observed. Three years after remineralizing therapy, the values decreased to zero. This indicates the degree of maturity of the tooth enamel. The lower the electrical conductivity, the higher the level of mineralization.

Analysis of the obtained data allows us to conclude that the process of enamel mineralization in teeth, in this case the first permanent molar, is actively regulated by various remineralization methods, particularly fluoride varnish. Based on the above, we can conclude that active regulation of enamel mineralization in the first permanent molar is a primary and direct indicator for the use of a comprehensive caries-preventive program in teeth that have not yet fully erupted.

Thus, during the period of eruption of the first permanent molars, an increase in the vulnerability of tooth enamel to caries is observed, mainly in the area of the fissures of the teeth, a decrease in the level of oral hygiene, the presence of inflammatory reactions in the gums, that is, a local cariogenic situation is created that is more pronounced in the area of a given tooth.

The above-mentioned research results provide a basis for using caries-preventive measures with IpM not after tooth eruption, but starting from the very beginning of eruption, even with the emergence of partially erupted chewing surfaces. Thus, after thorough plaque removal and drying, it is recommended to immediately coat non-demineralized fissures with fluoride varnish or a fluoroprotector. The erupted portion of the chewing surface with IpM should be coated with fluoride varnish 5-6 times every other day. If fissure demineralization is present, fluoride varnish should be applied daily for 5-6 days, with a course of treatment consisting of 5-6 coatings.

A comparative study of 1pM coated with fluoride varnish or fluoroprotector during the eruption period and without coating showed that the use of anticaries treatment led to a reduction in fissure caries.

Application of Fluor Protector, along with rational oral hygiene from the very beginning of tooth eruption, is a pathogenetically justified, effective, simple and affordable caries-preventive agent, as well as a method for accelerating the processes of tooth enamel mineralization.

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