



**DEVELOPMENT OF INNOVATIVE DIAGNOSTIC AND PROPHYLACTIC DENTAL
OBTURATORS AIMED AT PREVENTING THE DEVELOPMENT OF CARIES AND ITS
COMPLICATIONS IN THE ORTHODONTIC TREATMENT OF PATIENTS**

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Resume

In medical practice, the widespread use of fixation brackets, rings, and bows to keep teeth in a certain position makes it difficult to adhere to strict oral hygiene, which in 32.7% of cases associated with dental anomalies leads to damage to the hard tissue of the teeth, mainly caries.

Keywords: Demineralization, fixation, orthodontic apparatus, TER-test, light-induced fluorescence.

Relevance of the study

Clearly, the effectiveness of modern braces is superior to the effectiveness of braces, but the percentage of complications caused by dental hard tissue is reliably higher in patients treated with braces. TYu. According to Soboleva (2015), various lesions of the hard tissues of the teeth were detected in 32.7% of 92% of patients examined after orthodontic treatment. Of these, 42.1% had focal demineralization of the enamel, 26.3% had vertical erosion, and 31.6% had erosion and necrosis of the hard tissues of the teeth [1].

Extensive research is being conducted around the world to improve the prognosis and detection of early signs of caries in children in orthodontic treatment, as well as the effectiveness of diagnostic and therapeutic measures, the existing methods of diagnosis are no longer sufficient, there is a strong need for additional research methods. In this regard, the study of diagnostic and therapeutic measures aimed at improving the quality of orthodontic care for children is promising.

According to modern notions, dental plaque and tooth decay, as well as excessive consumption of easily digestible carbohydrates play a major role in the development of dental caries. Cariogenic microorganisms of the oral cavity produce organic acids in the presence of low molecular weight carbohydrates. and structural changes occur at this or that depth [6].





A progressive cariesogenic condition is observed in patients undergoing orthodontic treatment with fixed devices. This is due to the fact that the brace is held around the rings, in other orthodontic elements, between the teeth and in the neck area due to disruption of self-cleaning and hygiene processes, and food debris accumulates for a long time [3].

In these retention areas, microorganisms that produce large amounts of organic acids accumulate [9]. This increases the cariogenic potential of the dental plaque, which leads to a decrease in the local pH (up to 5.0), an increase in enamel permeability, followed by its demineralization [8]. The detection rate of white carious spots in the treatment with the use of solid apparatus ranges from 12.6 to 50% [1]. In our practice, white carious spots of varying intensity were detected in 11.3% of all cases treated with braces.

Failure to follow the fixation protocol of orthodontic structures is another factor that can lead to complications by dental hard tissue during orthodontic treatment with fixed devices [7]. Currently, as a method of fastening orthodontic appliances and their elements to the chewing teeth are used industrially made rings or stamped individual orthodontic coatings made of chrome-nickel steel [2]. Failure to follow the basic rules when installing them can lead to the development of iatrogenic complications. The following are the main reasons that lead to the appearance of foci of demineralization in orthodontic coating or tooth enamel under the ring [7]:

- 1) Violation of the rules of mixing the fixing material (cement);
- 2) Violation of the rule of preparation of the ring (coating) for fixation.

If the liquid mixed cement melts under the influence of saliva, the thick mixed cement forms a layer in the neck area in the form of a roller, which is then filled with microbial toothpaste, where a demineralization furnace develops [5].

When an overly wide ring or coating is applied, the layer of fixing cement between the ring and the tooth increases, which soon causes it to melt and disappear with the saliva. The formation of cracks after the cement has melted, the orthodontic ring or coating is fixed, causing the demineralization of the neck area in the teeth, leading to their filling with low pH levels [1].

When making a ring or coating, it is necessary to carefully trim the edges, otherwise a "torn" contour will be formed, creating additional base points for the appearance of the look. The inner surface of the ring is then degreased with 76% alcohol or dental acetone and air-dried. The teeth on which the rings are fixed must be pre-cleaned, insulated from saliva, and air-dried [3].



If these are not done, a migration from the cement occurs with the formation of a leak, where a tooth plaque is formed, leading to demineralization of the enamel [6].

After installing the cement-coated ring, it is necessary to remove the excess with a damp cotton swab, and after the cement is completely hardened, the occlusion with the scalar, the surfaces between the gums and teeth are cleaned of excess material [7]. Failure to follow the bracket fixation protocol during the enamel treatment phase can also lead to complications [8]. Treatment of enamel with 37% orthophosphoric acid leads to demineralization, which, on the one hand, creates a micro-adhesive relief that fixes the bracket well, and on the other hand loosens the structure of enamel prisms, increases the permeability of enamel and reduces its protective properties [8]. Such damage to the enamel around the braces can be considered as a starting point of demineralization, which can be remedied due to the mineralizing properties of the saliva, due to the layers of Sa and RO4 covering the teeth [4].

The aim of the study Development of innovative diagnostic and prophylactic dental obturators aimed at preventing the development of caries and its complications in the orthodontic treatment of patients.

Research Material and Method

In order to solve the tasks, set before us, 22.9% of cases were treated using removable and 77.1% of cases were treated using fixed equipment, of which 51.7% - girls, 48.3% - boys, from 7 to 15 years of age. 201 patients with anomalies were examined. In the 10-14 age group, children made up the majority - 50.2%. 22.9% of all children in the study were treated with removable orthodontic equipment (OOT), and 77.1% - with fixed orthodontic equipment (KOT), with the calculation of KPO, OHI-S, PHP, PMA indices, TER-test, assessment of KOSRE-test, a total of 1,743 dental examinations, 201 primary, 1542 repetitions, were performed, and 1730 quantitative light-inductive fluorescence (Qrayview C) was performed before and after the application of various prophylactic agents in the dynamics. 763 preventive treatments, 431 training sessions on individual oral hygiene, 24 interviews, 123 children were surveyed, 201 children were surveyed.

Knowledge and skills in oral hygiene were identified through a survey of children participating in the study. The quality of manual skills in oral care was assessed according to a specially developed method.





All clients underwent oral sanitation for 1-2 months before starting orthodontic treatment, diet was adjusted, trained in oral hygiene and regular hygienic care using the recommended set of hygiene tools aroused interest in the performance.

Research Results

An initial assessment of the hygienic condition of the oral cavity according to the OHI-S and RNR indices revealed that the hygienic condition of the oral cavity was unsatisfactory in all groups in the study. It was observed that the values of OHI-S and RNR indices decreased convincingly in all groups before fixing the braces, after conducting professional oral hygiene, after training in individual hygienic procedures, but in the main groups the criteria for evaluating their values were different. If the hygienic condition of the oral cavity on the OHI-S index was defined as good and did not exceed 0.7, the RNR was satisfactory on the hygiene index and was around 1.6.

In the initial assessment of the hygienic condition of the oral cavity on the OHI-S, RMA and RNR indices

Indices		OOA (n=46)	EOA (n=155)
PHP	Initial performance (up to manual skills)	3,15±0,12	3,34±0,07
	Time to start orthodontic treatment	1,10±0,03***	1,6±0,04***
OHI-S	Initial performance (up to manual skills)	1,78±0,10	1,84±0,06
	Time to start orthodontic treatment	0,58±0,04***	0,54±0,02***
PMA	Initial performance (up to manual skills)	6,72±0,13	8,12±0,15
	Time to start orthodontic treatment	2,6±0,09***	3,5±0,07***

By assessing the informativeness of the index data, it is possible to note a reliable assessment of quality using the RNR index, which allows the detection of dental views in segments in the cervical and aproximal areas of the teeth. Initial dental examination revealed cases of inflammation in periodontal tissue in all patients, the RMA index was around $6.72 \pm 0.13 - 8.12 \pm 0.15\%$. the results obtained after the study indicate an improvement in the value of the RMA index among all patients compared to the initial examination. The following results were obtained using laboratory tests of mineral metabolism in the oral cavity in children: (Figure 1): in group 1 the pH of oral fluid was 6.9 ± 0.3 hydrogen units, in group 2 - 6.5 ± 0.3 hydrogen units. No statistically significant differences were found in the groups ($R > 0.05$). This indicates the stability of this parameter of oral fluid in children, which is associated with the active work of the oral cavity buffer system during this period of child development.



The study of total calcium in oral fluid yielded the following results: in group 1 the indicator was 1.85 ± 0.2 mmol / l, in group 2 - 1.5 ± 0.3 mmol / l. No statistically significant differences were identified in the groups ($R > 0.05$). However, a convincing decrease was observed relative to the normative values (2.02–2.6 mmol / l).

Conclusion

In the dynamics of orthodontic treatment revealed the basic regularity of the processes of demineralization of hard tissues of the teeth, manifested by an increase in the wavelength of enamel around the braces and the transition from the green spectrum to red. The incidence of dental hard tissue light-induced fluorescence was 2 times higher in children in control groups A1 and A2 than in children in the main groups V1 and V2.

In children undergoing orthodontic treatment, high levels of phosphorus were detected against the background of a decrease in calcium and normal pH levels.

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