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# DIAGNOSIS AND PREVENTION OF CARIES DEVELOPMENT IN ORTHODONTIC TREATMENT

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**Abstract:**

The aim of study is to improve the diagnosis and prevention of the development of caries and its complications during orthodontic treatment.

**Keywords:** Orthodontic Treatment, Caries, Calcium Fluoride Crystals

## RELEVANCE.

A wide range of scientific research is carried out in the world to predict and identify early manifestations of caries in children during orthodontic treatment, as well as to optimize the effectiveness of diagnostic and therapeutic and preventive measures, existing diagnostic methods are already insufficient, therefore there is an urgent need for additional research methods. From these positions, it seems promising to study diagnostic and therapeutic measures aimed at improving the quality of orthodontic care for children [1.2.3.5.7.9.11.13.15].

The development of the closest approach to the diagnosis and treatment of caries in the process of orthodontic treatment at the early stages will contribute to obtaining a stable aesthetic outcome in the treatment of orthodontic patients, as well as to avoid relapses [4.6.8.10.12.18.19].

Among the additional methods of diagnosing the initial forms of the carious process, modern devices that can cause fluorescence of the hard tissues of the tooth, which increases with enamel demineralization, deserve attention. It is known that fluorescence occurs if light having one wavelength hits a fluorescent material, which then emits light with a different wavelength, always shifted in the direction of the red spectrum according to the law of conservation of energy. In this regard, intact and caries-affected enamel fluoresces after absorbing light with different wavelengths [14.16.17].

The modern arsenal of diagnostic devices is able to effectively assess the initial stage of enamel demineralization using laser fluorescence and quantitative light-induced laser fluorescence (Khudanov B.O. et al., 2016).

To prevent such complications, various preparations with calcium and fluoride content have been proposed. However, they do not always give the desired effect, since 65-67% of the examined patients have poor oral hygiene, and local fluoridation is not effective enough due to the rapid loss of calcium fluoride crystals [20.21].

## THE AIM OF THE STUDY

Is to improve the diagnosis and prevention of the development of caries and its complications during orthodontic treatment.

## Objectives of the study:

Negative changes in the mineralization of hard dental tissues in children who received removable and non-removable orthodontic devices revealed the effectiveness of the kappa effect with the complex application of modern methods of studying oral hygiene and periodontal tissues;

Installation and constant monitoring of orthodontic devices using dental floss, fluorescent caps and modern fillings is a guarantee of healthy formation of the mineral composition of the hard tissues of the tooth;

The effectiveness of the kappa-fixed method in eliminating the identified foci of demineralization in the hard tissues of teeth in children who received removable and non-removable orthodontic devices was determined;

Improved diagnosis and primary prevention of caries and its complications in patients treated with removable and non-removable orthodontic methods by light induction fluorescence.

The object of the study. In accordance with the tasks, 201 children aged 7 to 18 years with dental anomalies and deformities were examined in the Bukhara Regional Children's Dental polyclinic.

Subject of research: school-age children with developing dental anomalies and deformities, oral fluid was used for biochemical studies.

## RESEARCH METHODS:

Dental, instrumental, biochemical studies and statistical processing of the data obtained.

Negative changes in the mineralization of hard dental tissues in children who received removable and non-removable orthodontic devices revealed the

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effectiveness of the kappa effect with the complex application of modern methods for the study of oral hygiene and periodontal tissues;

installation and constant monitoring of orthodontic devices using dental floss using fluorescent caps and modern fillings is a guarantee of healthy formation of the mineral composition of the hard tissues of the tooth;

Confirmed by the use of modern, complementary clinical and instrumental studies in research, as well as a sufficient number of examined patients, improvement of diagnostic and prognostic criteria for the development of caries in children during orthodontic treatment, a reasonable set of statistical analysis methods; the results obtained are based on comparison with foreign and domestic studies; in conclusion, the results are confirmed by authorized structures.

The condition of the hard tissues of teeth in children with caries during orthodontic treatment with fixed and removable equipment according to hygienic and periodontal indicators; the condition of the hard tissues of teeth around braces during orthodontic treatment was evaluated; remineralizing agents were demonstrated, as well as the effectiveness of mouthguards using light-induced fluorescence; and the fixation of mouthguards using "R.O.C.S. Medical Minerals" to prevent enamel demineralization using fixed and removable equipment proved their effectiveness.

## RESULTS.

Based on the obtained scientific results on optimizing the prevention of caries development in orthodontic treatment:

The relevance and relevance of the topic of the dissertation is substantiated, goals and objectives are formulated, as well as the object and subject of research, the correspondence of research to priority areas of development of science and technology of the Republic of Uzbekistan is given, the scientific novelty and practical results of research are outlined, the theoretical and practical significance of the results obtained is disclosed, the reliability of the data obtained is substantiated, information on the implementation of research results in practice, published works and the structure of the dissertation is given.

To solve the tasks, 201 patients with dental anomalies aged 7 to 15 years were examined, who were treated using removable in 22.9% of cases and non-removable equipment in 77.1% of cases, of which girls - 51.7%, boys - 48.3%. Of all the examined patients, 22.9% were treated with removable (SOT) orthodontic equipment, and 77.1% - with non-removable (NOT) orthodontic equipment.

Preventive measures at all stages of orthodontic treatment were carried out in the dental office after professional dental cleaning. To optimize the endogenous prevention of dental caries and periodontal diseases, all patients of preventive subgroups were prescribed the mineral vitamin preparation "Oligovit" 1 tablet a day, for 1 month 1 time a year, the immunostimulating drug "Immunal" 10 drops 3 times a day for 5 weeks 1 time a year.

The obtained data were subjected to statistical processing on a personal computer using programs developed in the EXCEL package using a library of statistical functions. The differences in the mean values were considered significant at a significance level of $P<0.05$.

Taking into account the obvious relationship between the appearance of caries, periodontal diseases and the hygienic condition of the oral cavity, before starting orthodontic treatment, all our patients were surveyed and assessed manual skills of patients, studied hygienic knowledge and skills. The analysis of the results revealed a low level of knowledge in the prevention of oral diseases and manual oral hygiene skills.

Analysis of manual oral hygiene skills showed that only 10.4% of patients were able to brush their teeth properly, which we considered good. Satisfactory manual oral hygiene skills were recorded by us in 19% of children, unsatisfactory - in 69.7% of patients on orthodontic treatment.

Taking into account the low initial level of knowledge of our patients in the issues of oral care and a large number of patients with unsatisfactory manual skills, there is a need for long-term training, educational work and motivation of children, as well as monitoring at each stage of orthodontic treatment.

Taking into account the strong relationship between the state of oral hygiene and the occurrence of dental caries and periodontal diseases, it is necessary to understand that educational and motivational work, professional dental hygiene of the oral cavity, which combines the training of manual oral hygiene techniques, compliance with the multiplicity and time of brushing teeth, as well as the consolidation of acquired skills and self-control of actions to feel the smoothness of teeth and the surfaces of the orthodontic apparatus, as an essential element of the preventive complex of measures.

Before starting orthodontic treatment, after professionally conducted oral hygiene and individual hygiene training

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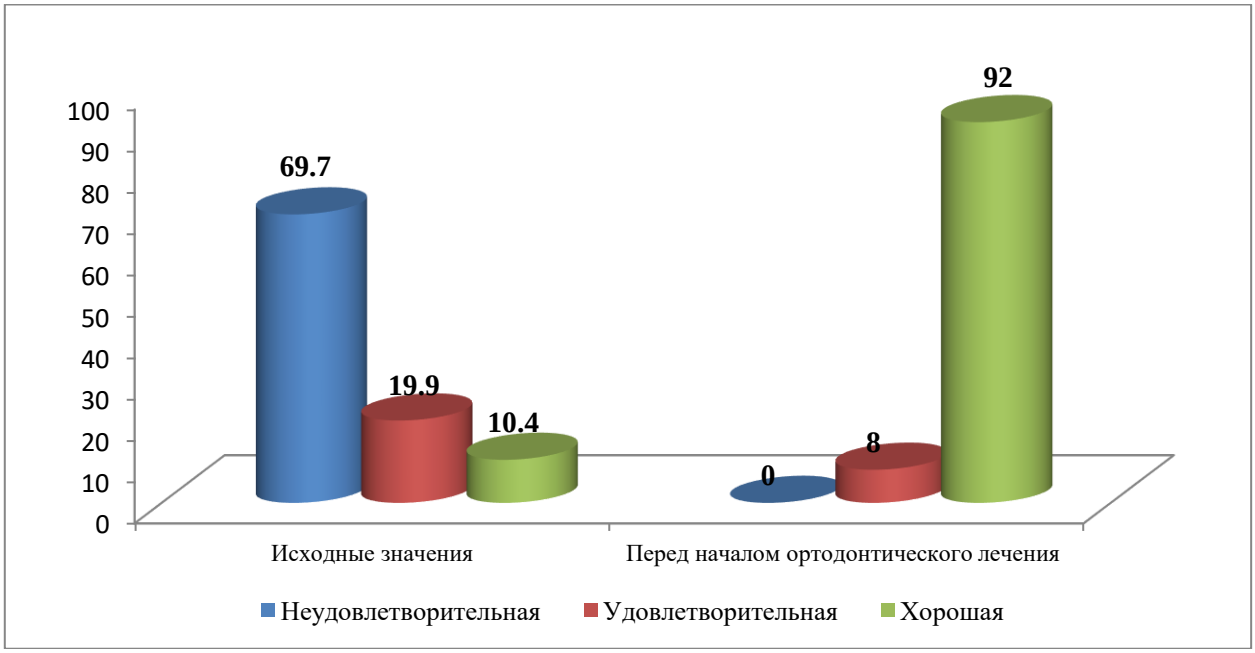


**Fig. 1. Assessment of the quality of manual skills in patients before orthodontic treatment**

The manual skills acquired by the patients were re-evaluated (Fig. 1).

Satisfactory quality of manual dental hygiene was found in 8% of children, and good was recorded in 92%, such were taken for being prepared in terms of oral hygiene for orthodontic treatment with non-removable equipment. Before fixing braces, after professional oral hygiene and training in individual hygiene measures, a significant decrease in the OHI-S and RNR indices was noted in all patients (Table 1). At the same time, if good values of the OHI-S index were recorded in patients (no more than 0.7), then the results of the RNR index were satisfactory, about 1.6.

**Table 1**
**Indicators of occupational hygiene of the mouth and periodontal tissues (n=201)**

| Indexes | | COT (n=46) | HOT (n=155) |
|---|---|---|---|
| PHP | Initial data (before educational work with patients) | 3,15±0,12 | 3,34±0,07 |
| | Before starting orthodontic treatment | 1,10±0,03*** | 1,6±0,04*** |
| OHI-S | Initial data (before educational work with patients) | 1,78±0,10 | 1,84±0,06 |
| | Before starting orthodontic treatment | 0,58±0,04*** | 0,54±0,02*** |
| PMA | Initial data (before educational work with patients) | 6,72±0,13 | 8,12±0,15 |
| | Before starting orthodontic treatment | 2,6±0,09*** | 3,5±0,07*** |

Note: * - reliability of the data to the initial indicators (P<0.01)

Analyzing the informativeness of these indices, it is necessary to note a significantly more significant reliability of the assessment by the RNR index, which makes it possible to detect plaque in the cervical and approximal areas of the teeth by segment.

At the initial dental examination, periodontal inflammation was detected in all patients, the values of the PMA index ranged from 6.72 ± 0.13 to 8.12 ± 0.15%. The indicators of the PMA index, studied after a complex of therapeutic and preventive manipulations and professional oral hygiene immediately before the fixation of orthodontic equipment, stated an improvement in oral hygiene in all patients in comparison with the initial examination.

The effect of the quantitative light-induced fluorescence apparatus is based on a decrease in the fluorescence of hard tooth tissues during demineralization. The diagnosis of demineralization and latent carious lesions was confirmed by the use of light-induced fluorescence of the green (530nm) and red wave spectra (625nm). The transition from the green spectrum to the red spectrum was observed in 56.5%

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of children with SOT and in 58.1% of children with SOT (Table 2).

**Table 2**

**Enamel condition in patients with orthodontic devices in the diagnosis of light-induced fluorescence**

| Enamel condition | Group 1 | | Group 2 | |
|---|---|---|---|---|
| | Abs. % | Abs. % | Abs. % | Abs. % |
| Intact enamel | 20 | 43,48 | 65 | 41,94 |
| Caries in the white spot stage | 12 | 26,09 | 47 | 30,32 |
| Superficial caries | 10 | 21,74 | 26 | 16,78 |
| Medium caries | 2 | 4,35 | 8 | 5,16 |
| Deep caries | 2 | 4,35 | 9 | 5,81 |
| Total | 46 | 100,00 | 155 | 100,00 |

**Note: data reliability between 1 and 2 treated groups (r <0.05)**

As can be seen from the data presented, intact enamel before the start of preventive measures was observed in 43.5% of children with SOT and in 41.9% with NOTES. The processes of enamel demineralization in the form of caries in the white spot stage were observed in 26.1% of cases with SOT and in 30.3% of cases with NOT. Superficial caries was observed in 21.74% and 16.78%, respectively. In children with SOT, medium and deep caries were recorded with the same frequency of 4.4%, respectively, whereas in children with SOT, average caries was 5.2%, and deep caries was 5.8%.

As a result of laboratory methods of studying mineral metabolism in the cavity of children, the following results were obtained (Fig. 3): the pH of the oral fluid in group 1 was 6.9 ± 0.3 hydrogen units, in group 2 - 6.5 ± 0.3 hydrogen units.

There were no statistically significant differences in the indicator in the groups (P>0.05). This indicates the stability of this parameter of oral fluid in children, which is associated with the active work of buffer systems in the oral cavity during this period of child development.

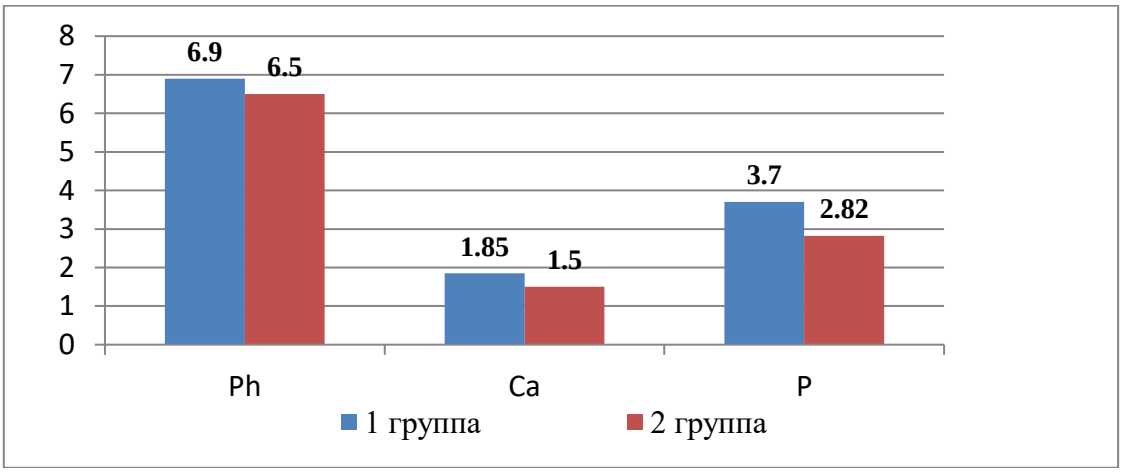


**Fig. 2. Laboratory parameters of oral homeostasis in patients with orthodontic treatment**

When studying the indicator of total calcium in the oral fluid, the following results were obtained: in group 1, the indicator was 1.85 ± 0.2 mmol/l, in group 2 – 1.5 ± 0.3 mmol/l. There were no statistically significant differences in the indicator in the groups (P

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> 0.05). However, a significant decrease was found in relation to the normative values (2.02-2.6 mmol/L).

The phosphorus index in the oral fluid in group 1 was 3.7±0.5 mmol/l, in group 2 - 2.8±0.6 mmol/l, which was statistically significant (P<0.05). There was a statistically significant increase in P indices in children with orthodontic treatment in relation to the normative values (P<0.05; 0.87-1.45 mmol/l).

Thus, in children in both group 1 and group 2, pH values were within the normal range, Ca indicators were reduced, especially in group 2, while the P level was almost 2 times higher than normal, which was significant.

As can be seen from the above data, during the diagnosis of caries by the QrayviewC device in the comparison group, in contrast to the initial data, caries in the white spot stage was most often isolated, which proves the effectiveness of this technique in early detection of damage to the demineralization of hard tooth tissue. The obtained data increase the effectiveness of the diagnosis of caries in the early stages using the QrayviewC device by 3 times.

The fourth chapter "Evaluation of the effectiveness of remineralizing agents in the treatment of removable and non-removable orthodontic techniques in children" of the dissertation is devoted to the study of the prevalence and intensity of carious lesions in children undergoing orthodontic treatment.

1 month after the installation of orthodontic equipment, a significant increase in the OHI-S and RNR indices was observed in all patients of the 1st and 2nd groups in comparison with the indices at the previous examination, which demonstrates a deterioration in the state of oral hygiene (Fig. 3).

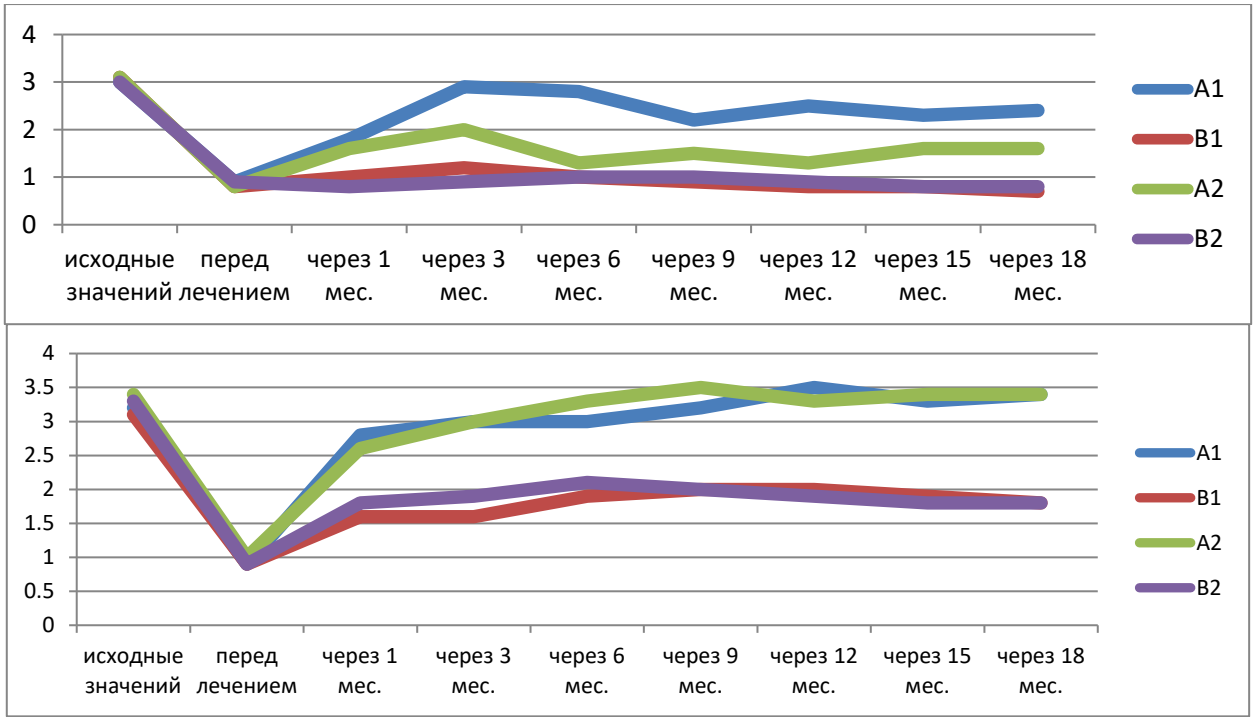


**Fig. 3. Dynamics of hygiene indices (RNR and OHI-S) in the oral cavity in the treatment process**

Thus, in groups A1 and A2, the values of the OHI-S index were 2.28 and 3.27 times higher, respectively, and the RNR index was 2.49 and 2.54 times higher, which was stated as an unsatisfactory state of oral hygiene. In groups B1 and B2, the indicators of the OHI-S index did not exceed the initial indicators of a satisfactory level, and the RNR index was unsatisfactory. In further monitoring, minor changes in hygiene indices were found, differing little from the results of preventive groups, until the completion of orthodontic correction, they did not exceed the limits of the satisfactory limits of the OHI-S index and the unsatisfactory limits of the RNR index, but were significantly better than the indicators of the initial dental examination.

In children of group A1, the increase in caries was stated as 0.17, and in group B1 – 0.09. In children of group B1, the appearance of caries was detected on the chewing and contact surfaces of the teeth. In patients of groups A1 and A2 (without preventive

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measures), the increase in caries was recorded at the level of 0.17 to 1.57, respectively (Table 3). The decrease in caries after the use of the drug "R.O.C.S. Medical Minerals" was 90.2% and 68.5%.

**Table 3**
**Indicators of the intensity and reduction of dental caries in patients in the dynamics of treatment**

| Subgroups | Number of | CPU patients | CPU structure | | Caries reduction (%) |
|---|---|---|---|---|---|
| A1 | 26 | 4,84±0,13 | 0,17±0,01 | 4,67±0,39 | |
| B1 | 20 | 2,53±0,21* | 0,09±0,07 | 2,44±0,11* | 90,2 |
| A2 | 77 | 5,82±0,09 | 1,57±0,06 | 4,25±0,18 | |
| B2 | 78 | 2,29±0,19* | 0,29±0,03 | 1,96±0,07* | 68,5 |

Note: * - reliability of data between treatment groups A and B (p<0.05)

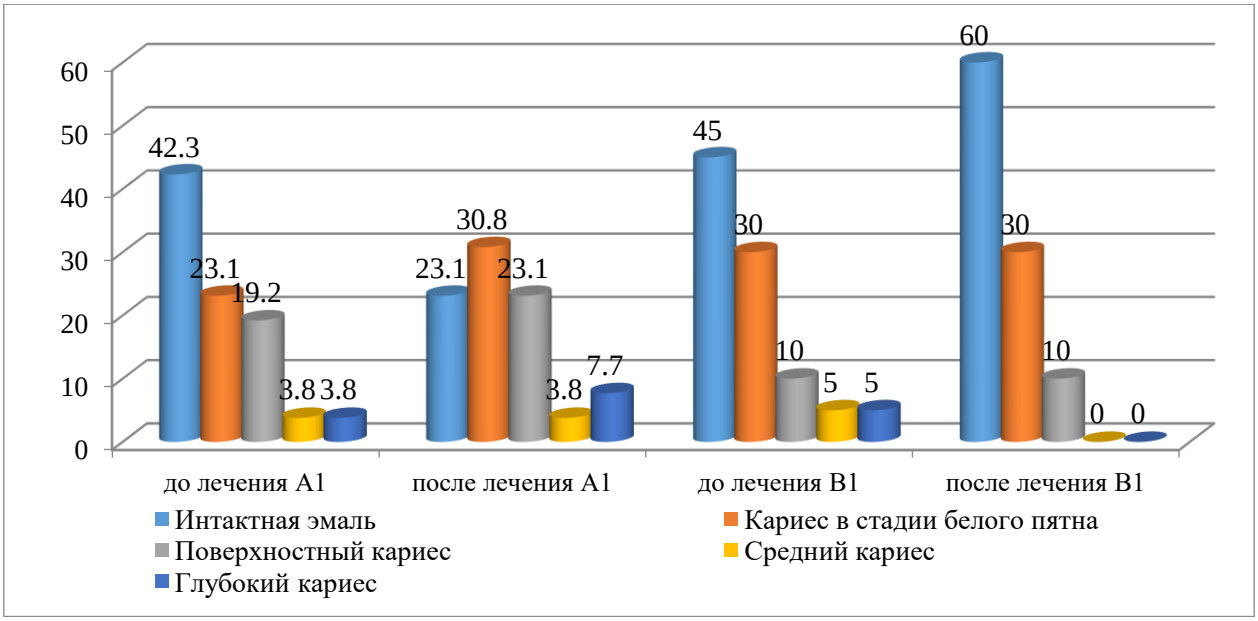


**Fig. 4. Dynamics of indicators of clinical assessment of the condition of hard tooth tissues using light-induced fluorescence in patients with removable orthodontic apparatus (SOT)**

Thus, in subgroup B1, compact enamel was observed 20% more often than in group A1, and the development of medium and deep caries was not registered, whereas in group A1, the development of a white spot was noted in 30.8%, superficial caries in 23.1%, respectively, medium and deep caries in 3.8 and 7.7%, respectively.

It was stated that the demineralization of tooth enamel around braces in our patients was directly dependent on the therapeutic and prophylactic agents used. At the end of orthodontic treatment (18 months) in patients using "R.O.C.S. Medical Minerals" and kapp, intact enamel was registered in 83.3% of cases, which was significantly significant in relation to the data before treatment and group B2. Also, medium and deep caries were not observed in group B2, and caries in the white spot stage was registered in 15.4% of cases, while superficial caries was 1.3% of the case, which is a significantly low percentage in relation to the indicators of group A2 (Fig. 6). Thus, the use of "R.O.C.S. Medical Minerals" and mouthguards increase the resistance of tooth enamel, stabilize the development of the initial stages of caries, which is confirmed by light-induced fluorescence.

Thus, sanitary and educational work, individual and professional oral hygiene using the preparation "R.O.C.S. Medical Minerals" and mouthguards allowed to increase the resistance of hard dental tissues after 18 months of orthodontic treatment, to stabilize the development of initial forms of caries, which is

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confirmed by light-induced fluorescence.

## CONCLUSION.

Before orthodontic treatment, all examined patients revealed poor oral hygiene and insufficient motivation for the prevention of dental diseases and oral care. In 12% of patients with an increased risk of dental caries, manual oral care skills were good, in 67% unsatisfactory. At the final stage of the study, the hygienic condition in the preventive subgroups according to the OHI-S index was satisfactory, and according to the RNR index - unsatisfactory, ranging from 1.83 ± 0.14 to 2.21±0.36.

The main regularities of the process of demineralization of hard tissues of teeth in the dynamics of orthodontic treatment are revealed, manifested in an increase in the wavelength and the transition from the green spectrum to the red enamel around braces. At the final examination of patients, the indicators of light-induced fluorescence of hard dental tissues in children with caries of control groups A1 and A2 were almost 2 times higher than in children of the main groups B1 and B2.

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