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## FEATURES OF ORTHODONTIC TREATMENT OF CHILDREN WITH FOOD INTOLERANCE

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**ABSTRACT.** Food intolerance in childhood is manifested by various disorders on the part of the body when eating food. In this condition, there are violations of the work of many organs and systems in the body and the problem affects not only the work of the gastrointestinal tract, as well as other life-support systems of the body. With such disorders, metabolism and metabolic processes change. It is important for dentists to understand this problem, since the disease alters the local status localis in the oral cavity, which is the initial department of the gastrointestinal tract. This is expressed in a change in the physico-chemical properties of the oral fluid, causes dryness, a burning sensation on the part of the mucous membranes of the oral cavity. In the orthodontic treatment of such patients, it is necessary to carefully approach the issues of manufacturing removable devices and using non-removable ones, exclude the use of dyes from the composition of removable devices, OT-correctors and install non-removable equipment (braces) without nickel content.

**KEYWORDS:** *food intolerance, malocclusion, allergy, orthodontic treatment*

## ОСОБЕННОСТИ ОРТОДОНТИЧЕСКОГО ЛЕЧЕНИЯ ДЕТЕЙ С ПИЩЕВОЙ НЕПЕРЕНОСИМОСТЬЮ

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**РЕЗЮМЕ.** Пищевая непереносимость в детском возрасте проявляется различными нарушениями со стороны организма при употреблении продуктов питания. При этом состоянии в организме имеются нарушения работы многих органов и систем, и проблема затрагивает не только работу желудочно-кишечного тракта, но и остальные системы жизнеобеспечения организма. При таких нарушениях меняется метаболизм, обменные процессы. Для стоматологов важно понимать эту проблему, поскольку заболевание изменяет местный *status localis* в полости рта, который является начальным отделом желудочно-кишечного тракта. Это выражается в изменении физико-химических свойств ротовой жидкости, вызывает сухость, чувство жжения со стороны слизистых оболочек полости рта. При ортодонтическом лечении таких пациентов надо внимательно подходить к вопросам изготовления съемных аппаратов и использования несъемных, исключать из состава съемных аппаратов использование красителей, использовать ОТ-корректоры, устанавливать несъемную технику (брекеты) без содержания никеля.

**КЛЮЧЕВЫЕ СЛОВА:** пищевая непереносимость, патология прикуса, аллергия, ортодонтическое лечение



## INTRODUCTION

The problem of food intolerance (FI) is widely represented in pediatrics. Its clinical manifestations develop with genetic predisposition. The main target organs are the gastrointestinal tract (GIT), skin, and respiratory system [1]. Adverse reactions to food include immune-mediated food allergy and non-immune-mediated food intolerance. FI is often confused by health care providers, patients, and the public with food allergy, which is one of its manifestations.

The spectrum of FI mechanisms includes:

- food allergies;
- non-allergic reactions to food (caused by chemicals, irritants, toxins);
- enzymopathies and absorption disorders;
- psychogenic reactions to food;
- food intolerance caused by GI diseases.

MEDLINE, EMBASE, and Cochrane databases were used to search for terms related to food allergy and intolerance [3].

Cumulatively, one fifth of the population believe they have adverse reactions to food. Estimates of true IgE-mediated food allergy vary, but in some countries it can be as high as 4–7% among preschool children. The most common food allergens are cow's milk, eggs, peanuts, nuts, soy, shellfish, and fin fish. It has been observed that food allergies are more common in children and can be life-threatening in some cases. However, tolerance to many foods develops with age. Estimates of IgE-mediated food allergies in adults approach 1–2%. Non-IgE-mediated food allergies, such as enterocolitis syndrome caused by food proteins, are less common and are detected predominantly in childhood. Eosinophilic gastrointestinal disorders, including eosinophilic esophagitis, are conditions with mixed IgE- and non-IgE-mediated food allergies that improve when such foods are eliminated from the diet. Food intolerance is nonspecific, and the resulting symptoms resemble other common, medically unexplained complaints, often overlapping with symptoms found in functional disorders such as irritable bowel syndrome. Food intolerance may pose some risk, but because functional disorders are common, more effort

is needed to understand the adverse effects of food in functional disorders.

Dentistry has traced the role of FI in the etiology of hypomineralization of molars [4]. Molar incisor hypomineralization (MIH) is an enamel condition characterized by white to brown lesions that indicate rapid caries progression. The permanent first molars and incisors are mostly affected. These enamel defects usually arise from abnormalities in the mineralization or amelogenesis stage. Environmental factors such as respiratory problems, poor diet, infections of any kind and medication intake affecting children aged 3 years and above are also thought to cause the development of MIH.

In the 2021 study, 1,065 saliva samples were obtained from four different cohorts and DNA was extracted from each sample and genotyped for nine different single nucleotide polymorphisms. Association tests and logistic regression implemented in PLINK were used for analysis. Potential interactions were identified between TGFA rs930655 with all markers tested in the cohort. These interactions were not detected in the other cohorts. Associations ( $p < 0.05$ ) were also found between medication intake after age three, suggesting that conditions acquired at an age when children are beginning to socialize may contribute to the development of MIH. The relationship between poor nutrition and infection is also confirmed. The relevance of this concept to the practice of clinical medicine, dentistry, and public health is supported by an impressive body of evidence from both the clinic, laboratory, and field. Improper nutrition can affect any body mechanism that acts as a barrier to the multiplication or progression of infectious agents. This includes the formation of specific antibodies, the number and activity of phagocytes, and the integrity of skin, mucous membranes, and other tissues. Some of the less defined, nonspecific defenses found in body fluids are also affected by poor nutrition. Infectious disease adversely affects nutritional status in several indirect ways. Loss of appetite and food intolerance lead to metabolic changes. Cultural factors lead to substitution of less nutritious diets as a presumed therapeutic measure and to the prescription of laxatives, antibiotics, and other drugs that impair digestion or absorption of certain nutrients. In

well-nourished individuals, body reserves and normal food intake ensure that malnutrition will not lead to GI damage unless the infection is prolonged.

FI has been found to affect 15–20% of the general population and may be due to pharmacological effects of food components, non-celiac gluten sensitivity, or enzyme and transport defects [5]. Significant advances have been made in understanding the scientific basis of gastrointestinal food intolerance due to fermentable short-chain fermentable oligo-, di-, and monosaccharides and polyols (FODMAPs). The most useful diagnostic test for food intolerance is food elimination to achieve improvement in symptoms, followed by gradual resumption of food intake. A low-FODMAP diet is effective, but it affects the GI microbiota and restoring FODMAP tolerance is part of the treatment strategy.

There is growing evidence for the use of a low-FODMAP diet to treat functional gastrointestinal symptoms in suspected food intolerance. Exclusion diets should be used for as short a time as possible to induce improvement in symptoms and should be followed by gradual reintroduction of foods to establish individual tolerance. This will increase dietary diversity, ensure adequate nutrition and minimize the impact on the GI microbiota.

With regard to the orthodontic treatment of children with FI, it should be noted that the orthodontist most often encounters food allergies, followed by non-food agents: dust, pollen, animal hair, certain types of drugs.

## AIM

To describe the specifics of orthodontic treatment for children with food allergies.

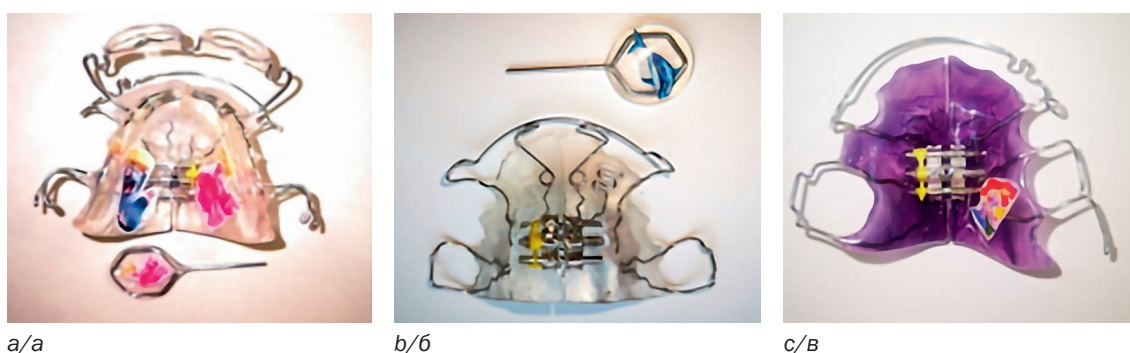
## MATERIALS AND METHODS

The clinic analyzed 132 health questionnaires filled out by legal representatives (parents) of children from 8 to 14 years of age. A group of 8–11 years old patients was identified, a total of 54 patients who were treated with removable appliances. It should be noted that 27 patients 8–11 years old, which amounted to 50% of cases, had allergic reactions to food and non-food agents and medications in the questionnaires. Of this group, 18 had confirmation of allergy as an independent disease, and the children were registered and treated by an allergologist.

## RESULTS

In the group of patients with confirmed allergic manifestations who required treatment with removable appliances, orthodontic appliances were fabricated without the use of dyes (Fig. 1).

In addition to the fact that appliances should be fabricated without the use of chemical staining reagents, the technique of changing the position of the arch adjacent to the incisors and the clasps that are adjacent to the molars should be considered during treatment. These are the teeth that, according



**Fig. 1.** Orthodontic removable devices: a, b — without dye content (recommendation for patients with food intolerance); c — a device with the use of a dye

**Рис. 1.** Ортодонтические съемные аппараты: а, б — без содержания красителей (рекомендованы для пациентов с пищевой непереносимостью); в — аппарат с применением красителя

to the literature, have a MIH state. In such a case, when the appliance elements contact at the same points, we may get even more enamel damage in these teeth during orthodontic treatment (Fig. 2). It should be noted that clinically the MIH condition is not always pronounced, so such recommendations should be considered in the treatment process for all patients.

In the same group of patients, myofunctional corrector appliances were used as indicated (Fig. 3). These are hypoallergenic single-patient devices made

of FDA-approved medical-grade materials (FDA (*Food and Drug Administration*) Code of Federal Regulations, Title 21), free of bisphenol (BPB, BPF, or BPS), phthalates, latex, and silicone, and free of hazardous chemicals identified by the FDA [6]. The OT-corrector series devices have passed many different biocompatibility tests (cytotoxicity, pyrogenicity, Kligman test, injection, and chemical characterization extraction and leaching test) and in the opinion of a GLP accredited laboratory. All were found to be in compliance with ISO 10993-1:2018 (as surface devices with prolonged



**Fig. 2.** Individual removable orthodontic device. Rigid metal elements adhere to the enamel of the teeth

**Рис. 2.** Индивидуальный съемный ортодонтический аппарат. Металлические жесткие элементы прилегают к эмали зубов



**Fig. 3.** Various types of OT-correctors: corrector of bad habits (a), Nite-Guide corrector (b), Occlus-O-Guide corrector (c), which are recommendation for patients with food intolerance

**Рис. 3.** Различные виды ОТ-корректоров: корректор вредных привычек (а), Nite-Guide корректор (б), Occlus-O-Guide корректор (в), которые рекомендованы для пациентов с пищевой непереносимостью



**Fig. 4.** Myofunctional OT-corrector. The device does not have a point fit to the teeth. It is preferred for patients with food intolerance

**Рис. 4.** Миофункциональный ОТ-корректор. Аппарат не имеет точечного прилегания к зубам. Предпочтителен для пациентов с пищевой непереносимостью



mucosal contact). Biological considerations for this standard include studies for cytotoxicity, sensitization, irritation, acute systemic toxicity, subacute/subchronic toxicity, genotoxicity, implantation, and chronic toxicity and are considered biocompatible.

These devices are designed to interact gently with the enamel of the teeth, without specific points of support (Fig. 4). In addition, the design of the appliance itself allows for home remodeling procedures. Therefore, in FI patients, the use of such appliances made



**Fig. 5.** The result of orthodontic treatment using nickel-free braces in patients with food intolerance

**Рис. 5.** Результат ортодонтического лечения с применением брекетов, не содержащих никель, у пациентов с пищевой непереносимостью

of soft material is preferable if they are suitable for the treatment of occlusal disorders and do not cause any enamel deterioration during treatment if a MIH condition is diagnosed.

In a group of 78 patients aged 11–14 years, fixed appliances were placed as indicated. In this group, 23 children had an established allergy-related diagnosis. A nickel-free bracket system was used (Fig. 5).

Braces are chosen in a design where their site, which is attached to the tooth enamel, has a distinct pattern for secure retention. This helps patients with MIH to avoid debonding of the bracket throughout the treatment phase (Fig. 6).

We would like to emphasize the special protocol of arc replacement. As you know, the first arc that is placed on patients at the initial stage is an arc containing nickel. This element is the first to be allergic to it. Instead of nickel-containing arches, braided flexi steel arches should be used, which before the era of nickel-containing arches were used in the initial stages of orthodontic treatment. Thereafter, treatment should continue on full-length steel arches. This applies to all patients with severe FI. In special cases, an allergic reaction to the metals in the steel arches may occur. In this case, treatment with customized eliners (Fig. 7) is possible. During treatment,

they can be used as a device for home reMODELING IN PATIENTS WITH MIH.

After braces are removed, fixed and removable retainers are fitted according to clinical guidelines (Fig. 8). The non-removable retainer is made of braided steel wire. For patients with MIH, this type of retention should be used with caution because the fixed retainer is fixed to the incisors on the palatal side, making it difficult to perform hygiene procedures.

In addition, the prolonged presence of steel in the oral cavity contributes to the release of metal ions into the oral fluid [2], which is unacceptable for patients with FI. In such cases, the fixed retainer should be replaced with a retention mouth guard.

## CONCLUSION

Patients diagnosed with food intolerance have a variety of clinical manifestations that are not specific to the disease. Orthodontists treating these patients should pay careful attention to the information in the patient's health questionnaire and, when removable appliances are indicated, opt for OT-correctors or customized removable appliances without the use of dyes. At older ages, when fixed appliances or eliners are indicated, in the absence of MIH, nickel-free braces can be



**Fig. 6.** Pronounced bracket pad recommended for patients with MIH

**Рис. 6.** Выраженная площадка брекета, рекомендованная для пациентов с МИН





**Fig. 7.** The stages of treatment of a patient with MIH on aligners

**Рис. 7.** Этапы лечения пациента с МИН на элайнерах



a/a

б/б

**Fig. 8.** Non-removable retainer (a); removable retainer in the form of a mouth guard (b)

**Рис. 8.** Несъемный ретейнер (а); съемный ретейнер в виде капы (б)

fixed and steel bars can be used; in other cases, eliners can be used. In the retention period in these patients, removable retainers in the form of mouthguards are preferable.

### ADDITIONAL INFORMATION

**Author contribution.** Thereby, all authors made a substantial contribution to the conception of the study, acquisition, analysis, interpretation of data for the work, drafting and revising the article, final approval of the version to be published and agree to be accountable for all aspects of the study.

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