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The development of open bite in patients with adenoid hypertrophy: clinical and radiological examination

Mariya E. Makarova ✉, Zurab S. Khabadze, Yulia A. Generalova, Alena A. Kulikova, Fikret V. Badalov, Marina Yu. Dashieva, Adam Yu. Umarov
Peoples' Friendship University of Russia named after Patrice Lumumba (RUDN University), Moscow, Russian Federation
✉ balashova_me@pfur.ru

Abstract
RELEVANCE. Adenoid hypertrophy, mouth breathing can significantly affect the development and formation of the dental system in children. One of the most difficult to correct malocclusion pathologies is anterior open bite. The literature contains isolated, sometimes contradictory reports on the effect of adenoid hypertrophy on the development of this type of malocclusion.
AIM. To study the prevalence of adenoid hypertrophy in children aged 7 to 9 years with anterior open bite, paying special attention to the characteristics of the factors determining the development of this malocclusion.
MATERIALS AND METHODS. 60 children aged 7 to 9 years with an orthodontic diagnosis of anterior open bite were included in the study. The patients were divided into two groups (comparative and control) based on otorhinolaryngological anamnesis (adenoid hypertrophy). According to the lateral cephalometry data, the tendency to skeletal anterior open bite was estimated. The correlation between the development of malocclusion and the presence of adenoid hypertrophy was assessed using the Pearson coefficient.
RESULTS. This study included 30 children with anterior open bite and 30 without malocclusion. There was no strong correlation between the formation of an anterior open bite and the presence of hypertrophy of the pharyngeal tonsil. The skeletal growth type index according to the LC data did not differ significantly in both groups, but the average vertical ratio for children with adenoid hypertrophy and mouth breathing was significantly higher for the control group ($p = 0.05$).
CONCLUSIONS. The presence of adenoid hypertrophy in a child is not one of the main factors in the open anterior bite development. However, it is necessary to consider that adenoid hypertrophy and mouth breathing, especially for a long time, increases the risk of malocclusion development, effects on the growth of maxillofacial structures, which justifies the need for consultations of pediatric patients with related specialists.

Keywords: anterior open bite, adenoid hypertrophy, lateral cephalometry

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Развитие вертикальной резцовой дизокклюзии у пациентов с гипертрофией глоточной миндалины: клинико-рентгенологическое исследование

М.Е. Макарова ✉, З.С. Хабадзе, Ю.А. Генералова, А.А. Куликова, Ф.В. Бадалов, М.Ю. Даштиева, А.Ю. Умаров
Российский университет дружбы народов им. Патриса Лумумбы, г. Москва, Российская Федерация
✉ balashova_me@pfur.ru

Резюме
АКТУАЛЬНОСТЬ. Гипертрофия глоточной миндалины, ротовое дыхание могут в значительной степени влиять на развитие и формирование зубочелюстной системы у детей. Одной из наиболее сложно корректируемых патологий прикуса является вертикальная резцовая дизокклюзия или передний открытый прикус. В литературе содержатся единичные, иногда противоречивые сообщения о влиянии гипертрофии глоточной миндалины на развитие данного типа неправильного прикуса.
ЦЕЛЬ. Изучить распространенность гипертрофии глоточной миндалины у детей в возрасте от 7 до 9 лет с вертикальной резцовой дизокклюзией, уделяя особое внимание характеристике факторов, определяющих развитие данной патологии прикуса.

МАТЕРИАЛЫ И МЕТОДЫ. В исследование были включены 60 детей в возрасте от 7 до 9 лет с ортодонтическим диагнозом вертикальная резцовая дизокклюзия. Разделение пациентов на две группы (сравнительную и контрольную) было проведено на основании данных оториноларингологического анамнеза (гипертрофия глоточной миндалины). По данным ТРГ оценивалась тенденция к скелетному открытому прикусу. Оценка корреляции между развитием патологии прикуса и наличие гипертрофии глоточной миндалины проводилась с использованием коэффициента Пирсона.
РЕЗУЛЬТАТЫ. В это исследование были включены 30 детей с вертикальной резцовой дизокклюзией и 30 без аномалий прикуса. Не было выявлено сильной корреляции между формированием переднего открытого прикуса и наличием гипертрофии глоточной миндалины (r = 0,38). Скелетный показатель типа роста по данным ТРГ в обеих группах существенно не отличались, но среднее вертикальное соотношение для детей с гипертрофией аденоидов и ротовым дыханием было значительно выше, чем у пациентов в контрольной группе (p = 0,05).
ВЫВОДЫ. Наличие у ребенка гипертрофии глоточной миндалины не является одним из ведущих факторов развития открытого переднего прикуса. Однако стоит учитывать, что гипертрофия глоточной миндалины и ротовое дыхание, особенно в течение длительного времени, увеличивает риск развития данной патологии прикуса за счет влияния на рост челюстно-лицевых структур, что обосновывает необходимость консультаций пациентов детского возраста у смежных специалистов.

Ключевые слова: вертикальная резцовая дизокклюзия, гипертрофия глоточной миндалины, телерентгенография

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INTRODUCTION

The development of malocclusion is associated with numerous factors, including genetic, environmental, and behavioral influences. Malocclusion, in turn, results in morphological, functional, and aesthetic issues. During childhood, the formation of dentoalveolar pathologies is significantly influenced by myofunctional and somatic disorders due to the plasticity of bone structures, which are more susceptible to irreversible changes. Hence, early diagnosis and prevention of malocclusion in young children are essential to mitigate skeletal abnormalities.

Anterior open bite, also known as vertical incisal disocclusion (VID), is the most common form of malocclusion in patients with ENT pathologies, impaired nasal breathing, and harmful myofunctional habits (e.g., tongue thrusting, infantile swallowing, thumb-sucking). According to various studies, the prevalence of VID ranges from 6.2% to 50%, depending on the population being studied [1–3].

Scientific data on this issue remain contradictory. Some studies confirm a pathogenetic link between the development of anterior open bite in children and adenoid hypertrophy (AH) with mouth breathing [4–6]. Prolonged mouth breathing due to adenoid hypertrophy during early childhood can lead to disorders of the masticatory system, dental-alveolar and skeletal anomalies, and reduced effectiveness of orthodontic treatment, which requires strengthening the perioral muscle tone and restoring normal breathing patterns.

Other researchers emphasize that children with chronic nasal obstruction and adenoid hypertrophy exhibit symptoms collectively described as the “adenoid facial type”. However, malocclusion does not always correspond to vertical incisal disocclusion [7–9]. There are isolated and sometimes contradictory reports on the impact of adenoid hypertrophy on malocclusion, including VID [10; 11].

OBJECTIVE

The aim of this study was to examine the prevalence of adenoid hypertrophy in children aged 7 to 9 years with vertical incisal disocclusion, paying special attention to the factors contributing to the development of this malocclusion.

MATERIALS AND METHODS

The study was conducted at the clinical base of the Department of Therapeutic Dentistry, Medical Institute, RUDN University. From 2023 to 2024, 100 patients aged 7–9 years were initially examined. Groups for further study were selected based on survey data, clinical examination, and radiological assessment.

Inclusion Criteria:

– age: 7–9 years;
– mixed dentition;
– vertical incisal disocclusion;
– history of adenoid hypertrophy.

Exclusion Criteria:

– age outside the specified range (under 7 or over 9 years);
– previous adenoidectomy;
– decline of participation.

A total of 60 patients met the criteria. They were divided into two equal groups:

1. Comparative group: 30 children with vertical incisal disocclusion.

2. Control group: 30 children without vertical incisal disocclusion.

At the time of the study, the diagnosis of adenoid hypertrophy in the patients was current and confirmed by otolaryngologist examination within the previous year.

Informed consent was obtained from legal representatives before clinical and radiological examinations. Parents completed a health questionnaire, with particular attention given to otorhinolaryngological history and breathing disorders.

For clinical examination, only children with vertical incisal disocclusion combined with minimal mesial or distal occlusion (not exceeding a 1.5 mm deviation from Angle's Class I by the first molars) were included. The severity of vertical disocclusion was determined by the interincisal distance:

Grade I: Gap up to 3 mm;

Grade II: Gap from 3 to 6 mm;

Grade III: Gap over 6 mm [12].

All 60 patients underwent lateral cephalography using a GENDEX GXDP-700 device (KAVO) in the NHP position. Growth type as a prognostic factor for VID was assessed using one cephalometric parameter: the ratio of posterior facial height to anterior facial height (SGo/NMe), with normal values ranging from 62–65%. Lower values indicate vertical growth, while higher values indicate horizontal growth [13]. This parameter was selected as the most convenient and informative for interpretation, avoiding difficulties caused by unerupted permanent teeth.

Statistical analysis was conducted using Microsoft Excel 365. Normality of data distribution was assessed using the Kolmogorov-Smirnov test. Mean values and standard deviations (SD) were calculated. The *t*-test was used to determine the statistical significance of differences, and the Pearson correlation coefficient (*r*) was used to study relationships between two variables. Results with a probability ⩽0.05 were considered statistically significant.

RESULTS

Sixty children aged 7–9 years with varying degrees of vertical incisal disocclusion were comprehensively examined and distributed by gender, age, and medical history (Table 1). All patients underwent cephalometric analysis.

The mean age of patients in both groups was 7 years. The average interincisal gap in Group 1 was 2.7–4.1 mm (Grade II severity), with the most pronounced gaps observed in children aged 7–8 years. Statistical analysis revealed that anterior open bite was more common in children aged 7–8 years ($p = 0.036$) with a history of adenoid hypertrophy and impaired nasal breathing ($p < 0.001$).

Adenoid hypertrophy was found in 14 patients with VID (46.6%) and 11 patients without VID (36.6%). Pearson correlation analysis revealed a moderate positive correlation ($r = 0.38$, $p < 0.05$) between adenoid hypertrophy and VID development.

Further details on skeletal growth types and associated correlations are represented in diagrams and tables.

DISCUSSION

Vertical incisal disocclusion (VID) is a type of malocclusion that can develop due to prolonged habitual mouth breathing associated with adenoid hypertrophy. The etiology of open bite is multifactorial, involving genetic and environmental factors as well as their combinations [14–16]. According to several studies, mouth breathing can lead to the development of anterior open bite [17; 18]. The diagnosis and etiological evaluation of malocclusion are essential for creating an appropriate orthodontic treatment plan and, if necessary, involving related specialists to address comorbid pathologies.

Table 1. Distribution of patients by age, gender, and medical history

Таблица 1. Распределение пациентов по возрасту, полу и анамнезу

Characteristic	VID, *n* (%)	Without VID, *n* (%)	Total, *n* (%)	*p*-value
Age				
7	10 (33.3)	10 (33.3)	20 (33.3)	0.036*
8	12 (40.0)	8 (26.6)	20 (33.3)	
9	8 (26.6)	12 (40.0)	20 (33.3)	
Gender				
Female	18 (60.0)	15 (50.0)	33 (55.0)	0.087*
Male	12 (40.0)	15 (50.0)	27 (45.0)	
Breathing Type				
Mouth Breathing	22 (73.3)	12 (40.0)	34 (56.6)	0.046*
Nasal Breathing	8 (26.6)	18 (60.0)	26 (43.3)	
Adenoid Hypertrophy				
Yes	14 (46.6)	11 (36.6)	25 (41.6)	<0.001*
No	16 (53.3)	19 (63.3)	35 (58.3)	

Note. * $p < 0.05$.

Примечание. * $p < 0,05$.

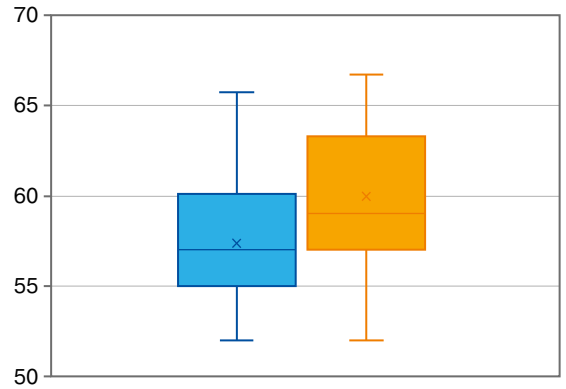

Fig. 1. The box diagram of the distribution of growth type data in patients of the comparative (with OB) and control group (without OB)

Рис. 1. Ящичная диаграмма распределения данных типа роста у пациентов сравнительной (с ВРД) и контрольной группы (без ВРД)

In this study, the Pearson correlation coefficient was used to determine the relationships between the development of VID and the presence of adenoid hypertrophy, mouth breathing, and vertical growth patterns. Analysis and comparison of these parameters revealed that adenoid hypertrophy and mouth breathing often lead to vertical growth patterns and the development of VID. However, VID was also observed in patients without adenoid hypertrophy or mouth breathing. Similarly, adenoid hypertrophy, mouth breathing, and vertical growth patterns were found in patients without VID. In our study, the subgroup of patients with mouth breathing and VID consisted solely of children with adenoid hypertrophy.

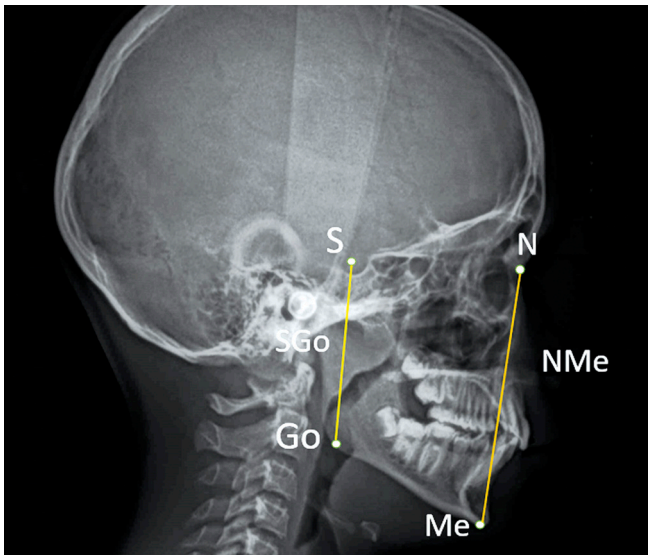

Fig. 2. An example of calculating the growth type on LC in a patient with adenoid hypertrophy without open bite and vertical growth type

Рис. 2. Пример расчета типа роста по ТРГ у пациента с гипертрофией глоточной миндалины без вертикальной резцовой дизокклюзии и вертикального типа роста

Thus, the development of VID is influenced not only by ENT pathology but also by accompanying disorders and facial skeletal growth patterns. The results obtained are consistent with data available in the scientific literature [19; 20]. Therefore, the implementation of interdisciplinary approaches for patients with VID may contribute to the prevention of developmental abnormalities, early correction of etiological factors, and the consequences of mouth breathing and adenoid hypertrophy. Special attention should be paid to improving the quality of interdisciplinary interaction between dentists and otolaryngologists.

CONCLUSIONS

Vertical incisal disocclusion occurs in children with chronic mouth breathing due to adenoid hypertrophy as well as in children without adenoid hypertrophy. In this study, the difference was statistically insignificant, suggesting that the presence of adenoid hypertrophy is not a leading factor in the development of anterior open bite and vertical growth patterns of the craniofacial region. These factors must be considered in terms of their combined influence.

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INFORMATION ABOUT THE AUTHORS

Mariya E. Makarova – Cand. Sci. (Med.), Assistant, Department of Therapeutic Dentistry, Medical Institute, Peoples' Friendship University of Russia named after Patrice Lumumba (RUDN University); 6 Miklukho-Maklaya Str., Moscow 117198, Russian Federation; https://orcid.org/0000-0002-1120-4055

Zurab S. Khabadze – Dr. Sci. (Med.), Associate Professor, Department of Therapeutic Dentistry, Medical Institute, Peoples' Friendship University of Russia named after Patrice Lumumba (RUDN University); 6 Miklukho-Maklaya Str., Moscow 117198, Russian Federation; https://orcid.org/0000-0002-7257-5503

Yulia A. Generalova – Assistant, Department of Therapeutic Dentistry, Medical Institute, Peoples' Friendship University of Russia named after Patrice Lumumba (RUDN University); 6 Miklukho-Maklaya Str., Moscow 117198, Russian Federation; https://orcid.org/0000-0003-1926-7162

Alena A. Kulikova – Assistant, Department of Therapeutic Dentistry, Medical Institute, Peoples' Friendship University of Russia named after Patrice Lumumba (RUDN University); 6 Miklukho-Maklaya Str., Moscow 117198, Russian Federation; https://orcid.org/0000-0002-7227-9966

Fikret V. Badalov – Assistant, Department of Therapeutic Dentistry, Medical Institute, Peoples' Friendship University of Russia named after Patrice Lumumba (RUDN University); 6 Miklukho-Maklaya Str., Moscow 117198, Russian Federation; https://orcid.org/0009-0008-9517-4682

Marina Yu. Dashtieva – Assistant, Department of Therapeutic Dentistry, Medical Institute, Peoples' Friendship University of Russia named after Patrice Lumumba (RUDN University); 6 Miklukho-Maklaya Str., Moscow 117198, Russian Federation; https://orcid.org/0000-0001-8903-2487

Adam Yu. Umarov – Resident Student, Department of Therapeutic Dentistry, Medical Institute, Peoples' Friendship University of Russia named after Patrice Lumumba (RUDN University); 6 Miklukho-Maklaya Str., Moscow 117198, Russian Federation; https://orcid.org/0009-0005-6327-4492

ИНФОРМАЦИЯ ОБ АВТОРАХ

Макарова Мария Евгеньевна – к.м.н., ассистент, кафедра терапевтической стоматологии медицинского института, ФГАОУ ВО «Российский университет дружбы народов им. Патриса Лумумбы»; 117198, Российская Федерация, г. Москва, ул. Миклухо-Маклая, д. 6; https://orcid.org/0000-0002-1120-4055

Хабадзе Зураб Суликоевич – д.м.н., доцент, кафедра терапевтической стоматологии медицинского института, ФГАОУ ВО «Российский университет дружбы народов им. Патриса Лумумбы»; 117198, Российская Федерация, г. Москва, ул. Миклухо-Маклая, д. 6; https://orcid.org/0000-0002-7257-5503

Генералова Юлия Алексеевна – ассистент, кафедра терапевтической стоматологии медицинского института, ФГАОУ ВО «Российский университет дружбы народов им. Патриса Лумумбы»; 117198, Российская Федерация, г. Москва, ул. Миклухо-Маклая, д. 6; https://orcid.org/0000-0003-1926-7162

Куликова Алена Алексеевна – ассистент, кафедра терапевтической стоматологии медицинского института, ФГАОУ ВО «Российский университет дружбы народов им. Патриса Лумумбы»; 117198, Российская Федерация, г. Москва, ул. Миклухо-Маклая, д. 6; https://orcid.org/0000-0002-7227-9966

Бадалов Фикрет Витальевич – ассистент, ФГАОУ ВО «Российский университет дружбы народов им. Патриса Лумумбы»; 117198, Российская Федерация, г. Москва, ул. Миклухо-Маклая, д. 6; https://orcid.org/0009-0008-9517-4682

Даштиева Марина Юзбеговна – ассистент, ФГАОУ ВО «Российский университет дружбы народов им. Патриса Лумумбы»; 117198, Российская Федерация, г. Москва, ул. Миклухо-Маклая, д. 6; https://orcid.org/0000-0001-8903-2487

Умаров Адам Юнусович – ординатор, ФГАОУ ВО «Российский университет дружбы народов им. Патриса Лумумбы»; 117198, Российская Федерация, г. Москва, ул. Миклухо-Маклая, д. 6; https://orcid.org/0009-0005-6327-4492

AUTHOR'S CONTRIBUTION

Mariya E. Makarova – has made a substantial contribution to the concept or design of the article.

Zurab S. Khabadze – revised the article critically for important intellectual content; approved the version to be published.

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Marina Yu. Dashtieva – the acquisition, analysis, or interpretation of data for the article; drafted the article.

Adam Yu. Umarov – the acquisition, analysis, or interpretation of data for the article.

ВКЛАД АВТОРОВ

М.Е. Макарова– существенный вклад в замысел и дизайн исследования.

З.С. Хабадзе – подготовка статьи или ее критический пересмотр в части значимого интеллектуального содержания, окончательное одобрение варианта статьи для опубликования.

Ю.А. Генералова – сбор данных, анализ и интерпретация данных, подготовка статьи.

А.А. Куликова – существенный вклад в замысел и дизайн исследования.

Ф.В.Бадалов– сбор данных, анализ и интерпретация данных, подготовка статьи.

М.Ю. Даштиева – сбор данных, анализ и интерпретация данных, подготовка статьи.

А.Ю. Умаров – сбор данных, анализ и интерпретация данных, подготовка статьи