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## Clinical efficacy of the complex method of treatment of patients with narrowing of the upper jaw and ENT pathology

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### Abstract

At present time the abnormalities of the tooth-jaw system in children and adolescents occupy one of the first places among the diseases of the maxillofacial area. In the concomitant diseases of other systems of the body, in particular, ENT organs, the violation of the dentofacial system is detected in 60% to 90% of cases. One of the most important etiological factors in the development of narrowing of the dentition is the violation of respiration function and, as a consequence, the appearance of oral respiration. This is led by the diseases of the ENT - organs: deviation of the nasal septum, hypertrophy of the nasal conchae, pharyngeal and palatine tonsils, rhinosinusitis, adenoid growths. We have examined 239 patients with dentofacial anomalies, aged 6-18 years, in order to identify their combination with the pathology of ENT-organs. Out of them there were selected 25 children for the operative treatment on the nasal septum and orthodontic treatment. For the objective clinical evaluation of the performed complex operative and orthodontic treatment of patients with narrowing of the upper jaw and ENT pathology, the parameters of the width of the upper jaw in the area 4|4, 6|6 teeth, width and depth of the arches of the palate should be used. According to the results of the analysis of the treatment performed in patients of three age groups, 6-9, 10-14 and 15-18 years old with narrowing of the upper jaw and ENT-pathology, it was determined that the use of the offered complex method of operative and orthodontic treatment contributes to the effective and reliable ( $p < 0.05$ ) expansion of the upper jaw and arches of the palate and reduction of the depth of the arch of the palate compared with the indicators before the treatment.

**Keywords:** Narrowing of the upper jaw, dental maxillary deformation, ENT pathology, orthodontic treatment

### Introduction

Anomalies of bite in children and adolescents are commonly found in diseases of the maxillofacial area. Over the past decade, the frequency of detection of bite anomalies has increased, and the necessity for the treatment-prophylactic measures is 36.9% in a variable bite, and in the period of constant bite more than 40%, and constantly increases with age [1, 2]. In the concomitant diseases of other systems of the body, in particular, ENT pathology, violations of the tooth-jaw system are detected in 60% to 90% of cases [3, 6]. Among the anomalies of the form of the dentitions in the transversal plane, the narrowing of the dentition is most common.

One of the most important etiological factors in the development of narrowing of the dentition is the violation of nasal breathing and, as a result, the occurrence of oral respiration [2, 6]. The peculiarity of the development of the upper respiratory tract – is a causative factor, which leads to mouth-like respiration in children and adolescents. Prior to the occurrence of abnormalities of the tooth-jaw system are caused by the deflection of the nasal septum most often. Some authors believe that the difficulty of nasal breathing is the reason for the narrowing of the jaws and other tooth-jaw anomalies, while other authors, on the contrary, believe that the narrowed upper jaw causes respiratory failure [5, 7, 8]. There are 4 theories of the origin of the nasal septum deflections: compensatory, rickets, traumatic and physiological. According to the compensatory theory, the deflection of the nasal septum arises as a result of the pressure of the nasal conchae on the septum. The rickets theory has very few supporters, while the traumatic one is recognized by everyone. Traumatic deflection of the nasal septum occurs quite often. According to some authors, physiological deflections on the basis of the anomalies of the growth of the skeletal system are most often [4, 6]. Physiological theory believes that in the rapid growth of the nasal septum in the vertical direction, it, being between the massive bones, begins to lean into one or the other direction, which is believed to lead to anomalies of bite [1, 3, 6].

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Therefore, at present, it is relevant to determine the most effective orthodontic and surgical treatment of patients with narrowing of the upper jaw and deflection of the nasal septum.

### The aim of the study

Is to increase the effectiveness of treatment of patients with narrowing of the upper jaw, deflection of the nasal septum and ENT diseases by the use of the offered complex of operative and orthodontic methods.

### Materials and methods of the study

We have examined 239 patients with dentofacial anomalies, aged 6-18 years, in order to identify their combination with the pathology of ENT organs, 25 children were selected out of these children, and surgical treatment on the nasal septum was performed and orthodontic treatment.

Clinical, anthropometric research has been carried out for the purpose of the work.

Clinical examination of patients with narrowing of the upper jaw involves questioning: patient complaints, medical history, and mother's condition during pregnancy, delivery, birth status, method and timing of breastfeeding, general child's health, and related illnesses, periods of eruption of the milk teeth, beginning of change and eruption of the permanent teeth. Then the data on the anamnesis of the disease, which include information about when the pathological signs were first observed and what was the dynamics of their development, or whether the patient applied to the specialists earlier or any treatment was performed. Separately, the attention is focused in identifying of factors that contributed to the development of orthodontic pathology, that is, diseases of ENT organs. The next stage of the clinical examination is an objective study, which begins with an external review of the patient. Also, they examine the oral cavity, the shape of the dentitions and the position of individual teeth, teeth, bite, evaluate the attachment of the upper and lower lip and tongue frenulum, the position and size of the tongue, the study of the configuration of the palate. The orthodontic diagnosis was determined in accordance with the classifications of Kalvelis, Engel and Khoroshilkina [4].

Using anthropometric methods of study, they performed head and face examinations, examination of jaw diagnostic models using 3D-scanning of plaster jaw models, followed by diagnosis using graphic methods and biometrics, photometry – by photos, study of functional respiratory disorders and respiratory systems of the body. X-ray methods of study were also widely used: Orthopantomography and teleroentgenography of the head in lateral and direct projections.

Additionally, ENT pathology was diagnosed, namely, anterior and posterior rhinoscopy, endoscopic examination of the nasal cavity and nasopharynx, and functional respiratory tests, which were to identify the mouth type of respiration. For this purpose, it is recommended to collect water into the mouth and keep it at its maximum. With a sharp difficulty in nasal breathing, the patient is forced to swallow water to breathe through the mouth. Regarding the operative method of interference on the nasal septum, it was performed using the method we have offered. The closest method of performance to our method is the classic version of the Kilian method [6]. The entire operation is carried out inside the nasal cavity, that is, there are no cuts on the skin of the face and, as a consequence, the possibility of postoperative scar formation

on the open areas of the face is excluded. The essence of this operation is that within the nasal passages under the endoscopic control, cuts of the mucous membrane of the nasal septum and perichondrium from the two sides in turn are made. In this case, a small sharp scalpel with a rounded non-sharpened apex is used, since the sharp end of the scalpel can easily cut the entire thickness of the cartilage, as well as perichondrium and the mucous membrane of the opposite nasal passage. They cut the mucous membrane and perichondrium to the cartilage, through the made cut, the mucosal membrane is removed, together with the perichondrium and periosteum to the required level.

We have performed the analysis of the parameters of the width of the upper jaw in the area of  $4|4$ ,  $6|6$  teeth, width and depth of the arch of the palate.

### Results of the research and their discussion

This study is based on a clinical examination of patients with narrowing of the upper jaw as a result of deflection of the nasal septum, the treatment of which was performed with removable and non-removable devices and patients who had previously been surgically performed the operative intervention on the nasal septum offered by us and on the study of the therapeutic effect on the basis of the data obtained by anthropometric and X-ray measurements. During the study it was determined that the age of patients varied from 6 to 18 years and they were divided into 3 subgroups: A – patients from 6 to 9 years, B – from 10 to 14 years, C – from 15 to 18 years.

As it can be seen from the chart below, most of the examined patients had a late variable bite – 140 patients (group 2 – 58.5%), 80 patients had a constant bite that was formed (group 3 – 33.4%), 19 patients had an early changeable bite and were under the age of 3 (group 1 – 7.9%) (Fig. 1).

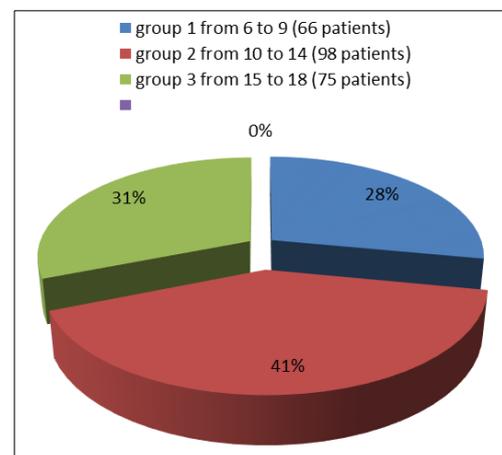


Fig. 1: Division of the examined patients by age.

Totally there were examined 85 people, who depending on age, sex, presence of ENT pathology, but with narrowing of the upper jaw, were divided into three groups:

Group 1 - patients with constriction of the upper jaw without ENT pathology, 30 persons.

Group 2 - patients with narrowing of the upper jaw and ENT pathology, 30 people.

Group 3 - patients with narrowing of the upper jaw and ENT pathology, who were treated by the offered by us method, 25 people.

The third group of patients consisted of 25 patients: 16 girls and 9 boys who had narrowed upper jaw and were identified the pathology of ENT organs, who had a previous surgical intervention on the nasal septum (Table 1).

**Table 1:** Division of patients with narrowing of the upper jaw in the group III relative to age distribution.

	IIIA - from 6 to 9 years	IIIB - from 10 to 14 years	IIIB - from 15 to 18 years
group III (n=25) patients	6	11	8

The mean values of the changes that occurred during the expansion of the upper jaw in patients of the three groups were registered prior to the use of the orthodontic apparatus (T1), 2 months after fixation of the orthodontic apparatus (T2), after removal of the apparatus (T3), and 6 months after the removal of the apparatus (T4).

In the examination and treatment of patients of the group III, we have analyzed the index of width of the upper jaw in the area of 4|4, 6|6 teeth, the width of the arch of the palate and the depth of the palatal arches. We have determined that the width of the upper jaw in the area of 4|4 before the treatment was 30.3±1.04 mm, 2 months after the fixation of the orthodontic device, the width increased up to 32.9±1.04 mm, after the removal of the apparatus, the figure was 37.1±1.24 mm. Six months after the removal of the apparatus, the index of the width of the upper jaw in the area of 4|4 was 36.1±1.42 mm and was significantly higher ( $p<0.05$ ) from the indicator before the treatment.

The index of the width of the upper jaw in the area of 6|6 before orthodontic treatment was 39.9±0.97 mm and significantly increased ( $p<0.05$ ) after 2 months of the orthodontic device up to 42.4±0.94 mm. After removing of the apparatus, this index reached the maximum value and was

46.6±1.09 mm, and six months after the removal of the orthodontic device was higher ( $p<0.05$ ) from the indicator before the treatment and was 45.6±1.02 mm.

The width of the arch of the palate in patients with narrowing of the upper jaw without combining with ENT pathology was 35±1.08 mm before treatment. Two months after the operation of the orthodontic apparatus, this index has significantly increased to 37.6±1.05mm, and after the removal of the device it reached a maximum of 41.8mm. Six months after the orthodontic treatment the width of the arches of the palate was 40.6±1.02 mm and it was better ( $p<0.05$ ) than the index before the treatment.

Depth of the arch of the palate in IIIA group patients before orthodontic treatment was 16.8±0.27 mm. During the orthodontic treatment, this figure improved up to 16.4±0.27 mm and reached the best value ( $p<0.05$ ) after the removal of the orthodontic device – 15.4±0.15 mm. The depth of the arch of the palate was maintained at the achieved level and 6 months after the completion of the treatment of patients in group 1, aged from 6 to 9 years, and this rate was significantly better ( $p<0.05$ ) from the basic level and was 15.6±0.18 mm (Table 2).

**Table 2:** Average values in the expansion of the upper jaw in the IIIA group of patients

Age	IIIA group – from 6 to 9 years (n=6)			
Term	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>
Width in the area 4 4	30.3±1.04	32.9±1.04	37.1±1.24*	36.1±1.42*
Width in the area 6 6	39.9±0.97	42.4±0.94*	46.6±1.09*	45.6±1.02*
Width of the palatine arch	35.0±1.08	37.6±1.05*	41.8±1.02*	40.6±1.35*
Depth of of the palatine arch	16.8±0.27	16.4±0.27	15.4±0.15*	15.6±0.18*

\*  $p<0.05$  – a significant difference between the indicators before the treatment and during different terms after the treatment;

Regarding the IIIB group of patients, the results of model analysis in different time periods looked like this. The parameters of the width of the upper jaw in the area of 4|4 before the treatment was 31.2±1.6 mm, after 2 months of the use of the orthodontic device the width in this area increased to 33.8±1.67 mm, after removal of the apparatus, the result of

expansion was up to 38.5±1.56 mm. During the further observation, 6 months after the removal of the apparatus, the width in the area of 4|4 was 37.3±1.81 mm, and was significantly higher ( $p<0.05$ ) than the indicators before the treatment (Table 3).

**Table 3:** Average values for the expanded maxilla in the IIIB group of patients

Age	IIIB group – from 10 to 14 years (n=11)			
Term	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>
Width in the area 4 4	31.2±1.6	33.8±1.67	38.5±1.56*	37.3±1.81*
Width in the area 6 6	43.0±1.87	45.8±1.95	50.3±1.86*	48.8±2.3*
Width of the palatine arch	35.5±1.74	38.4±1.78	41.8±1.60*	40.3±1.74*
Depth of of the palatine arch	18.2±0.99	17.7±1.0	16.9±0.98*	17.1±1.01*

\*  $p<0.05$  – a significant difference between the indicators before the treatment and during different terms after the treatment;

The index of the width of the upper jaw in the area of 6|6 in patients of the IIIB group before orthodontic treatment was 43.0±1.87 mm, after 2 months the width has increased to 45.8±1.95 mm. After removing of the orthodontic apparatus, the width of the upper jaw in the area of 6|6 was 50.3±1.86 mm. Six months after the use of orthodontic devices, the result was significantly higher 48.8±2.3 mm ( $p<0.05$ ) than the pre-treatment indicator.

The width of the palatine arch in patients of the IIIB group before orthodontic treatment was 35.5±1.74 mm, and after two months the orthodontic device increased up to 38.4±1.78

mm. After removing of the orthodontic apparatus, the maximum value was 41.8±1.60 mm, and six months after the removal of the orthodontic apparatus, the width of the arch of the palate was 40.3±1.74 mm and was significantly higher ( $p<0.05$ ) from the indicator to the beginning of treatment.

Depth of the arch of the palate in patients of the same group before the orthodontic treatment was 18.2±0.99mm. During the orthodontic treatment in 2 months, the indicators significantly improved to 17.7±1.0 mm, and after the removal of the orthodontic device was 16.9±0.98 mm. And 6 months after the end of treatment, this indicator was significantly

better ( $p<0.05$ ) from the beginning of treatment and was  $17.1\pm 1.01$  mm.

Indicators in the patients of the IIC group with narrowing of the upper jaw and ENT pathology, which were treated using the offered by us method, were as follows: the width of the upper jaw in the area of  $4|4$  was  $33.2\pm 1.23$  mm before the

treatment, after 2 months of the performed treatment, the width in this area has increased up to  $35.6\pm 1.22$  mm, after the removal of the apparatus, the index was  $40.2\pm 1.34$  mm, and six months after the orthodontic treatment, the width of the maxilla in the area of  $4|4$  was  $39.1\pm 1.53$  mm (Table 4).

**Table 4:** Average values in the extended maxilla in the IIC group of patients

Age Term	IIC group – from 15 to 18 years (n=8)			
	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>
Width in the area $4 4$	$33.2\pm 1.23$	$35.6\pm 1.22$	$40.2\pm 1.34^*$	$39.1\pm 1.53^*$
Width in the area $6 6$	$43.1\pm 1.54$	$45.5\pm 1.55^*$	$50.1\pm 1.62^*$	$48.5\pm 2.21^*$
Width of the palatine arch	$38.4\pm 1.08$	$40.6\pm 1.29$	$45.0\pm 1.68^*$	$43.3\pm 2.01^*$
Depth of the palatine arch	$18.8\pm 0.94$	$18.3\pm 0.91$	$17.3\pm 0.91^*$	$17.5\pm 0.94^*$

\*  $p<0.05$  – a significant difference between the indicators before the treatment and during different terms after the treatment;

The data of the width of the upper jaw in the area of  $6|6$  in patients before the orthodontic treatment were  $43.1\pm 1.54$  mm, after 2 months of the action of orthodontic device, significantly increased to  $45.5\pm 1.62$  mm, and after removing the orthodontic apparatus was  $50.1\pm 1.62$  mm. Six months after the performed treatment using the orthodontic apparatus of the upper jaw in the area of  $6|6$  they were  $48.5\pm 2.21$  mm and were significantly higher ( $p<0.05$ ) than the indexes before the treatment.

The width of the arch of the palate in patients of the IIC group before the treatment was  $38.4\pm 1.08$  mm and significantly increased and in 2 months it was  $40.6\pm 1.68$  mm, and after the removal of the device it has reached  $45.0\pm 1.68$  mm. Six months after the end of treatment with orthodontic devices, the width of the arches of the palate was  $43.3\pm 2.01$  mm and was significantly higher ( $p<0.05$ ) than the indicator before the treatment.

The depth of the arch of the palate in patients of the IIC group before the orthodontic treatment was  $18.8\pm 0.94$  mm. During the orthodontic treatment, this figure improved up to  $18.3\pm 0.91$  mm and reached the best value ( $p<0.05$ ) after the removal of the orthodontic device –  $17.3\pm 0.91$  mm. The depth of the arch of the palate decreased somewhat after 6 months after the completion of treatment of patients in the IIC group and this index was significantly better ( $p<0.05$ ) from the basic level and was  $17.5\pm 0.94$  mm (Table 4).

## Conclusions

For the objective clinical evaluation of the complex operative and orthodontic treatment of patients with narrowing of the upper jaw and ENT pathology, the parameters of the width of the upper jaw in the area of  $4|4$ ,  $6|6$  teeth, width and depth of the arches of the palate should be used.

According to the results of the analysis of the performed treatment in patients of three age groups, 6-9, 10-14 and 15-18 years with narrowing of the upper jaw and ENT pathology, it was determined that the use of the offered by us complex method of operative and orthodontic treatment contributes to an effective and reliable ( $p<0.05$ ) expansion of the upper jaw and arches of the palate and the decrease of the depth of the arch of the palate compared with the indicators before the treatment.

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