

Results of orthodontic treatment of a child with asymmetrical micrognathia and the congenital mandibular condylar hyperplasia

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Abstract

Aim. To analyze the results of orthodontic treatment of a child with asymmetrical micrognathia and mandibular condylar hyperplasia.

Methods. The configuration of a face in the photos was evaluated and diagnostic models of the jaws were analyzed by using the Pont's and Korkhaus methods in treatment dynamics. The physiological status of bone tissue, temporomandibular joints and teeth was studied by using orthopantomography and computed tomography. Functional disorders were detected by using special tests, including Eschler–Bittner's test and Ilyina-Markosyan's test. Orthodontic treatment and stimulation of mandibular growth in the mixed dentition stage were undertaken with the single jaw removable appliances and the appliance improved by us for correction of the distal occlusion. The Damon Q bracket system with archwires was used in permanent dentition period.

Results. The child's convex facial profile was typical for distal occlusion and micrognathia. The facial asymmetry, increasing with mouth opening, and a decrease in mandibular range of motion indicated lesion of the right temporomandibular joint. The right condyle was enlarged on the orthopantomogram. The computed tomography showed that it was asymmetrically enlarged and had a cellular structure. There was detected asymmetric micrognathia. The comprehensive rehabilitation plan included orthodontic treatment, myotherapy, speech therapy, mechanotherapy. The use of removable orthodontic appliances led to the normal size of the dentition and their relation, significantly reduced functional disorders and improved facial aesthetics. Five years after completion of orthodontic treatment, the physiological occlusion and amplitude of the mandibular movements remained, but the right mandibular angle was flattened.

Conclusion. The comprehensive rehabilitation of a child with asymmetrical micrognathia and mandibular condylar hyperplasia started in mixed dentition stage provided conditions for the formation of normal permanent dentition and the improvement of functional disorders and facial aesthetics; our results allow us to suggest the positive effect of our tactics for treatment of the patient.

Keywords: asymmetrical micrognathia, mandibular condylar hyperplasia, rehabilitation, children.

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Background. Inferior retrognathia (24.4%), inferior micrognathia (17.6%), or inferior microretrognathia (21.8%) are registered in children with dentoalveolar abnormalities complicated with diseases of the temporomandibular joints. Diseases of the temporomandibular joints are detected in distal occlusion, which is a common dentoalveolar abnormality in children [1,2].

One of the causes of lower micrognathia is congenital pathology of the temporomandibular joints [3,4]. Asymmetric damage to the growth zones of the dento-maxillofacial region is believed to

lead to compensatory-adaptive functional [5] and morphological changes, including facial skeleton asymmetry.

The prevalence of asymmetric disorders of the facial skeleton can reach 38.33% [6]. In addition to the International Classification of Diseases, Edition 10, the authors distinguish two main variants of asymmetric disorders, namely, the position (anterior or posterior) and the size (increase or decrease) of the jaws.

Asymmetric inferior micrognathia is classified as a complex dental problem. Deformities of the

dentoalveolar arches, occlusion, and facial skeleton in the sagittal, vertical, and transversal planes lead to aesthetic dissatisfaction and decreased quality of life of patients. In this regard, such conditions are of interest to researchers [7–15].

Functional correction of occlusive disorders combined with lower micro- and/or retrognathia not associated with damage to the temporomandibular joints are prescribed to growing children [16–18].

When ankylosis of the temporomandibular joints is detected, the inclusion of surgical intervention in the comprehensive rehabilitation plan for children with dentoalveolar abnormalities is considered the only appropriate approach [19].

Morphofunctional disorders of the dento-maxillofacial region with abnormalities associated with the pathology of the temporomandibular joints are diverse [20–22]. This situation determines the relevance of studying the efficiency of therapeutic interventions and the technique of their use on the basis of the individual characteristics of patients. The analysis of individual clinical cases is of interest for practical orthodontics.

The study aimed to analyze the efficiency of orthodontic treatment of a pediatric patient with lower asymmetric micrognathia and hyperplasia of the articular head of the lower jaw (clinical case).

Materials and methods. We studied the efficiency of conservative orthodontic treatment in a patient aged 9 to 14 years with an asymmetric lower micrognathia and impaired formation of the articular head of the lower jaw. In the case follow-up, during the periods of transitional and permanent occlusion, the generally accepted basic (clinical) research methods were used, namely, survey, examination, and functional tests, to detect impairment of the functions of breathing, speech, chewing, swallowing, and movements of the lower jaw.

For differential diagnostics of dentoalveolar and skeletal forms of distal occlusion, the Eschler–Bittner test results were analyzed. Morphofunctional disorders in the transversal plane were studied using tests according to L.V. Ilyina-Markosian.

The results of clinical methods of research were clarified using additional (instrumental) methods. Symmetry and proportionality of facial segments, as well as the profile aesthetics were assessed by face photometry in frontal and lateral projections. With the use of diagnostic models of the jaws, deviations from the individual norm of the dentition width in the area of premolars and molars were studied by using the Pont method, and deviations in the length of the anterior parts of the dentition were studied by using the Korkhaus method. The state of the bone tissue, temporomandibular joints,

and teeth was examined by orthopantomography and computed tomography [22].

Control of the treatment efficiency was performed on photographs of the face in frontal and lateral views obtained during the case follow-up, and on orthopantomograms, computed tomography scans, and diagnostic models of the jaws.

Orthodontic treatment during the transitional dentition period was performed using removable orthodontic appliances [23], including ones that we improved [24]. Single-jaw removable orthodontic appliances during the transitional dentition period were used because of the limited opening of the mouth.

In the period of permanent occlusion (at the age of 13 to 14 years), the teeth position, the shape and size of dentition, and their ratio were corrected using the edgewise technique (Damon Q braces, orthodontic archwires, class 2 intermaxillary elastic retainer).

The patient performed physiotherapy exercises to achieve the correct posture and regularly performed myogymnastics to normalize the tongue position and lip seal; improve the functions of breathing, chewing, swallowing, and speech; and increase the amplitude of the lowering of the lower jaw with its displacement to the healthy side until the maximum possible myodynamic balance in the dentofacial area was achieved. Mechanotherapy was used to increase the range of motion of the lower jaw.

Results and discussion. Patient A visited an orthodontist at the age of 9 years with complaints of malocclusion and gradually (from the age of 5) increasing facial asymmetry, which intensified when they opened their mouth. During the survey, the patient's and the parents' complaints, life history, and medical case history were studied. At the age of 2 weeks, the child received inpatient treatment with a radiographically confirmed diagnosis of right shoulder osteomyelitis. Hyperplasia of the right articular head of the mandibular bone was not detected before the visit to the orthodontist.

During the examination of patient A, attention was drawn to the postural disorder. The child's facial profile, which was similar to that of the mother, was convex. The patient had facial asymmetry at rest, which increased when the mouth was opened due to the lower jaw displacement to the right, thereby indicating indirectly that the excursion of the elements of the right temporomandibular joint was limited.

Lower jaw movements and facial aesthetics in lateral and frontal projections were studied using functional Eschler–Bittner test and the Ilyina-Markosian test. Clinical functional tests were

Table 1. Dimensions of the dentition of patient A in the case follow-up

Age, years	Width of the dentition according to the Pont method at SI = 31.0						Length of the anterior segment of the dentition according to Korkhaus		
	premolar region			molar region			lo	lo	lu
	norm	upper dentition	lower dentition	norm	upper dentition	lower dentition	norm	upper dentition	lower dentition
9	39.0	35.0	37.2	48.4	46.5	48.4	18.0	23.0	14.0
11	39.0	36.0	37.5	48.4	48.0	48.4	18.0	20.0	15.0
13	39.0	38.0	38.0	48.4	48.0	48.4	18.0	19.0	15.0
14	39.0	39.0	39.0	48.4	48.4	48.4	18.0	18.0	16.0

**Fig. 1.** Diagnostic models of patient A's jaws before treatment: a – lateral view (right); b – frontal view; c – lateral view (left).

conducted to determine the type of breathing (nasal, oral, mixed) and swallowing (somatic, infantile). The child was referred to consultation with a speech therapist because of improper pronunciation of certain sounds.

The medical record of an orthodontic patient (registration form No.043-1/u), approved by order of the Ministry of Health of Russia dated December 15, 2014, No.834n, contains an informed consent to conduct orthodontic treatment and the use of anonymized photographs of his teeth and oral cavity ("I authorize the use of photographs of my teeth and oral cavity without specifying my name and surname.").

Examination of the oral cavity revealed hyperemia and edema of the hard palate mucous membrane due to trauma from the cutting edges of the lower incisors. As a result of preterm extraction of tooth 8.5 and migration of tooth 4.4 toward the included defect (Kennedy class III), asymmetry of the lower dentition occurred with shortening of its lateral segment. The sagittal overjet between the cutting edges of the incisors reached 7.0 mm. The ratio of the dentition in the sagittal direction in the area of the first permanent molar teeth corresponded to subclass 1 of class II according to Angle (Fig. 1).

On the basis of these clinical research methods, a provisional diagnosis was established, namely, distal occlusion (class II, subclass 1 according to Angle), deep incisal disocclusion, lower asymmetric micrognathia, asymmetry of the dentition, narrowed and elongated anterior part of the upper dentition, shortening of the anterior part of the

lower incisors, and abnormalities in the position of the teeth.

Deviations from the individual norm were studied on diagnostic models of patient A's jaws by using the Pont and Korkhaus methods (Table 1).

The Pont method revealed that, at the age of 9 years, the patient experienced a narrowing in the area of the first premolars of the upper jaw by 4.0 mm, in the lower jaw by 1.8 mm, in the area of the first molars of the upper jaw by 1.9 mm, and that of the lower jaw corresponded to the norm. The Korkhaus method detected a lengthening of the anterior part of the upper dentition by 5.0 mm and a shortening of the anterior part of the lower dentition by 2.0 mm.

The orthopantomogram revealed deformity of the right articular head (Fig. 2).

Computed tomography was performed to clarify the localization of structural disorders of the jaws and temporomandibular joints, and it revealed the asymmetry of the body (Fig. 3, a) and the mandibular ramus bones, as well as enlargement and cellular structure of the articular head on the right (Fig. 3, b, c).

In accordance with the treatment plan, the upper dentition was enlarged and its anterior part was shortened until the individual norm by Pont and Korkhaus was achieved. The right lateral segment of the lower dentition was lengthened using a removable plate with screws and clasp fixation, thus achieving symmetry of the inferior dental arch and creating conditions for eruption in the arch of premolars and permanent canines.

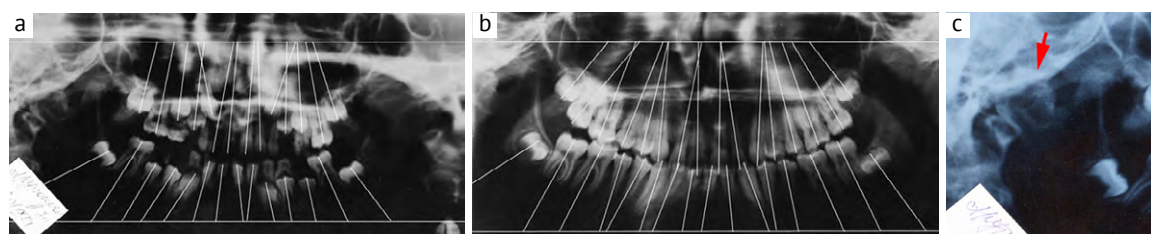


Fig. 2. Orthopantomograms of patient A.: a — before orthodontic treatment (9 years old); b — after completion of orthodontic treatment (14 years old); c — altered articular head on the right.



Fig. 3. Computed tomography scans of patient A, 9 years old: area of the mandibular body (a), articular heads (b, c) of the lower jaw.

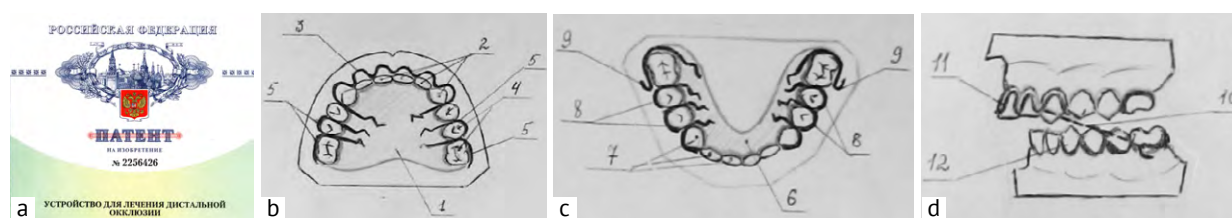


Fig. 4. Orthodontic appliance for elimination of distal occlusion: a — patent [24]; b — plate for the upper jaw; c — plate for the lower jaw; d — intermaxillary elastics.

The use of a biteplate enabled dentoalveolar growth in the lateral parts of the jaws and reduced the degree of incisal overlap to half the height of the crowns of the lower incisors.

After correcting the shape and size of the dentition to stimulate the growth of the lower jaw, for one year, we applied a device we created (Fig. 4, a) for the treatment of distal occlusion, which contained removable plate devices for the upper and lower jaws with the possibility of class 2 elastic traction [24]. In this case, the maxillary apparatus (Fig. 4, b) was created as a support that evenly distributes the force developed by the traction on the palate, alveolar process, and the maxillary teeth. The mandibular appliance (Fig. 4, c), which rested on the alveolar part of the lower jaw and the inner surface of the lower teeth, due to a small constant (within 100 g) elastic traction, contributed to the gradual extension and growth of the lower jaw (Fig. 4, d).

The appliance for distal occlusion elimination was used for one year. The patient and his parents were trained in elastic retainer replacement, myogymnastics, massage, and mechanotherapy to increase the degree of mouth opening and to move

the mandible forward and to the left. Constant mechanical and functional impact (intermaxillary elastics, regular myotherapy) promoted the growth of the lower jaw and improved face configuration.

By the age of 11 years, the shape and size of the dentition, and occlusion in patient A had significantly improved. The sagittal overjet decreased to 2.0 mm, and excessive incisal overbite remained within half of the height of the crowns of the lower incisors (Fig. 5, a, b, c). The dentition asymmetry (Fig. 5, d, e) and the shortening of the lower dentition on the right by 2.0 mm was reflected in the coincidence of the median lines of the dentition at the time of occlusion. The midline of the lower dentition was displaced by 2 mm to the right relative to the upper dentition.

After the eruption of the second permanent molars, the Damon Q braces were fixed (Fig. 6), and orthodontic archwires were successively applied. The growth of the mandible was stimulated and the occlusion was corrected using intermaxillary elastics in combination with myotherapy.

As a result of the complex treatment performed with the use of orthodontic devices and myothe-



Fig. 5. Diagnostic models of the jaws of patient A, 11 years old, after treatment with removable orthodontic appliances: a — right view; b — frontal view; c — left view; d — upper jaw; e — lower jaw.

rapy, the patient's facial configuration has improved significantly. A decrease in facial asymmetry when opening the mouth indirectly indicated an improvement in the functioning of the right temporomandibular joint.

The final elimination of dentoalveolar abnormalities was achieved with the use of the Damon Q braces with orthodontic archwires at the age of 13 to 14 years. Buccal tubes were fixed on the first and second molars. Intermaxillary elastics were used to correct the occlusion, and the patient performed myogymnastics regularly.

As a result of treatment, the width of the upper dentition increased by 4.0 mm in the premolar region and by 1.9 mm in the molar region, and it increased in the premolar region by 1.8 mm in the lower dentition. The length of the anterior part of the upper dentition decreased by 5.0 mm, and the length of the lower one increased by 2.0 mm. The sizes of the dentition and their ratio corresponded to the norm (Table 1).

Functional disorders have significantly decreased, and the aesthetics of the face have improved. After the completion of the active period of orthodontic treatment, the patient was recommended to perform myogymnastics regularly and follow-up with an orthodontist two times a year until the completion of facial skeleton growth.

Five years after the orthodontic treatment completion, the physiological occlusion and range of motion of the lower jaw were preserved, but the area of the mandibular angle on the right was flattened.

CONCLUSION

1. Inferior asymmetric micrognathia caused by impaired formation of the mandibular articular head is a complex pathology of the maxillofacial region, accompanied by abnormalities in the position of the teeth, deformities of the dentition, and occlusion in the transverse, sagittal, and vertical planes. Patients who have this condition need a comprehensive approach to the choice of therapeutic and diagnostic measures and long-term rehabilitation in accordance with the individual characteristics of the clinical manifestations of the pathology.

2. The elimination of dentoalveolar abnormalities and functional disorders in the transitional



Fig. 6. Patient A at 13 years old, Damon Q braces fixed.

dentition period is one of the main tasks of the comprehensive rehabilitation of such patients. Comprehensive rehabilitation of a child with lower micrognathia and congenital hyperplasia of the articular head of the lower jaw during the transitional dentition period led to a significant decrease in the severity of dento-maxillofacial abnormalities and improved movements of the lower jaw, chewing functions, speech, and facial aesthetics. The achievement of myodynamic balance created favorable conditions for the growth of facial skeleton, contributed to a decrease in the severity of morphofunctional and aesthetic disorders, and the formation of physiological occlusion during the permanent occlusion period.

3. In the period of permanent occlusion, physiological occlusion was achieved, which remained in the long term. From the results, we consider that the management of the patient has a positive effect.

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