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Improvement of Orthodontic Examination Methods for Patients with Distal Occlusion

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Relevance. Distal occlusion (DO) refers to the pathology of the maxillofacial region in the sagittal plane and occupies a leading place among dental anomalies. The maxillary anomaly is distal occlusion, which accounts for 37.3-65.0% in children. The authors themselves identified this pathology in 49.31%. Biryukova A.S. (2005) notes that distal occlusion of all the anomalies of the maxillofacial region is 54.4%. Distal occlusion in adolescents is characterized by a variety, as a result of which various methods of treatment with removable and non-removable orthodontic devices are proposed. In the orthodontic treatment of adolescents with distal occlusion in identical situations, including the presence of the same sagittal gap in the anterior dentition, as well as using the same treatment methods, the results were different. In some patients, treatment ended in a short time, while in others, even prolonged treatment led to relapses. In modern conditions, the changes occurring in the temporomandibular joints (TMJ) Orthodontic treatment methods play an important role in the formation of a permanent bite in the dynamics of dental arches. There is no data on the magnitude of the forward displacement of the lower jaw, taking into account gnatic and dental types of the face.

The data obtained expand the existing understanding of the patterns of the structure of the maxillofacial region in adolescents with the dental alveolar form of distal occlusion. A working prognostic classification of the dental alveolar form of distal occlusion in adolescents has been created. The methods of treatment of patients with the dental alveolar form of distal occlusion have been optimized, taking into account the individual characteristics of the craniofacial complex, and their effectiveness has been evaluated. These studies can be used in the educational process at dental faculties of medical universities. Thus, based on the angular and linear parameters of the facial region of the skull, according to the study of telerentgenograms of the head in the lateral projection before treatment, patients with class II anomalies of 1 and 2 subclasses were diagnosed with retroposition of the lower jaw, as evidenced by a decrease in the angular parameters SNB, SNPg, NAB, NAPg. At the same time, in patients with class II, division 1 anomalies, this pathology was combined with an underdevelopment of the apical base of the lower jaw, in patients with class II, division 2 anomalies, with a retroposition of the upper jaw ($T = 118.0$, $p < 0.05$) without sagittal jaw size abnormalities. In the group of patients with class II, division 1 anomalies, the length of the apical base of the lower dentition was 2.5 mm less than the median value of the norm ($T = 63.5$, $p < 0.05$). During the study, patients in both groups also showed an increase in the Wits number and the angular parameter ANB, which indicates the skeletal shape of the distal bite. The results of the vertical plane study indicate a horizontal type of facial skeleton growth in patients of the studied groups. The analysis of the position of the incisors in the examined patients with class II anomalies of 1 and 2 subclasses revealed the disorders characteristic of both groups: vestibular tilt of the upper incisors in patients with class II anomalies of 1 subclass, retrosion of the upper incisors in the group of patients with class II anomalies of 2 subclass. At the same time, the anterior slope of the lower incisors turned out to be significantly higher than the average value of the norm in patients of both groups. The study also found that patients in both groups had supra-positioning of the articular heads relative to the base of the skull, and clockwise rotation of the mandibular plane relative to the plane of the base of the skull.

The use of a functional non-removable device was determined by random sampling. Thus, in 10 cases (19.61%), a Herbst device combined with a multibonding system was used, while 41 patients

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(80.39%) had SUS. To prevent excessive vestibular tilt of the lower incisors, 15 people (29.41%) had braces with a reduced torc; in all patients, the functional devices were fixed on rigid steel arches with a cross section of 0.019 × 0.025", bendback (bending of the arch behind the supporting lower molar), metal and ligature binding of the teeth of the lower dentition. To prevent palatine or vestibular deviation and rotation of the first permanent molars of the upper dentition, Goggarian arches were used in 12 patients (23.53%), and rings were attached to the second molars of the upper jaw in 39 (76.47%) patients. In 2 (3.92%) cases, the upper canines in anerubption were extracted in parallel using a Kilroy spring, in 3 (5.88%) cases, a Quadhelix transpalatinal arch was used to unilaterally expand the upper dentition. After treatment, 33 (86.84%) patients had contacts in the area of the first permanent molars according to Engl class I, 3 (7.89%) people had contacts in class I with hypercorrection, and in 2 (5.26%) cases, due to the adentation of the second premolars, a ratio of molars according to Engl class III was formed within the lower dentition [1.3.5.7.9.11].

The total duration of treatment with a multibonding system in combination with non-removable functional devices averaged 24.2 ± 0.94 months. The average age of patients after completion of orthodontic treatment was 20.0 (17.0–24.0) years. Based on the study of diagnostic models of the dentition of 16 patients with class II, division 1 anomalies who completed orthodontic treatment, it was revealed that when treated with non-removable functional devices, there was a statistically significant decrease in the size of segments S3 (p 0.01) and S4 (p 0.01) due to the elimination of upper incisor protrusion. The total length of the upper dentition significantly decreased (T = 20.0, p 0.05). At the same time, an increase in the total size of the segments S1–S6 of the lower dental arch was noted (T = 27.5, p 0.05). During treatment, there was also a reduction in the length of the anterior segment of the upper dentition by 1.6 mm (T = 0.0, p 0.001), an elongation of the anterior segment of the lower dentition by 0.5 mm (T = 13.0, p 0.01), and an expansion of the upper dental arch in the area of the first premolars by 3.8 mm (T = 0.0, p 0.001), between the first permanent 11 molars – by 3 mm (T = 7.0, p 0.01). The width of the lower dentition in the patients of the study group in the area of the first permanent premolars increased by 2.3 mm (T = 7.5, p 0.01), between the first permanent molars – by 0.9 mm (T = 13.5, p 0.01). The results of the study revealed a decrease in the anterior lower segment, an increase in the right and left lower segments.

When analyzing the obtained data from the study of diagnostic models of the dentition of 22 patients with class II anomalies of the 2nd subclass who completed orthodontic treatment, it was found that the use of non-removable functional devices contributes to an increase in the total length of the upper and lower dentition. The total size of the S1–S6 segments in this group significantly increased by 4.6 mm in the upper dentition (T = 12.0, p 0.001), and by 2.8 mm in the lower dentition (T = 15.0, p 0.001). The length of the anterior segment of the upper dentition increased by 2.8 mm (T = 0.0, p 0.001) and amounted to 17.0 (16.7–18.0) mm, the size of the anterior segment of the lower dentition increased by 2.3 mm (T = 0.0, p 0.001). The results also indicate that when using functionally functioning non-removable devices in the examined patients, the upper and lower dental arches expanded in the area of the first premolars (p 0.001) and the first permanent molars (p 0.001), and the ratio of the segments of the dental arches of the upper and lower dentitions normalized. When analyzing the obtained data from the study of diagnostic models of the dentition of 22 patients with class II anomalies of the 2nd subclass who completed orthodontic treatment, it was found that the use of non-removable functional devices contributes to an increase in the total length of the upper and lower dentition. The total size of the S1–S6 segments in this group significantly increased by 4.6 mm in the upper dentition (T = 12.0, p 0.001), and by 2.8 mm in the lower dentition (T = 15.0, p 0.001). The length of the anterior segment of the upper dentition increased by 2.8 mm (T = 0.0, p 0.001) and amounted to 17.0 (16.7–18.0) mm, the size of the anterior segment of the lower dentition increased by 2.3 mm (T = 0.0, p 0.001). The results also indicate that when using functionally functioning non-removable devices in the examined patients, the upper and lower dental arches expanded in the area of the first premolars (p 0.001) and the first permanent molars (p 0.001), and the ratio of the segments of the dental arches of the upper and lower dentitions normalized. Based on statistical processing of the study of lateral TRG in patients with class II anomalies of 1 and 2 subclasses, it was found that

the treatment of distal occlusion using functional non-removable devices is effective in patients of both groups, as evidenced by the normalization of occlusion due to skeletal and dental alveolar changes with optimization of facial aesthetics. Thus, during treatment in patients with class II anomalies of 1 and 2 subclasses, there was a significant increase in the angular parameter SNB, a decrease in the angular parameter ANB, and a linear Wits number.

At the same time, patients with class II and division 1 anomalies also show an increase in the linear parameter B'-J'. In the vertical plane, functionally functioning non-removable devices in both groups of patients contributed to an increase in the posterior total height of the facial skeleton. The results obtained at the dental alveolar level indicate that in patients with class II and division 1 anomalies, the position of the upper incisors was normalized during treatment by eliminating their protrusion. Thus, the magnitude of the angular parameters of 1-NS decreased by 11.92 ± 2.14°, 1-SpP – by 12.24 ± 2.02°, 1-NA – by 12.82 ± 1.73°. In patients with class II anomalies of the 2nd subclass, there was an increase in the angular parameters 1-NS, 1-SpP, 1-NA. It was also found that the use of non-removable functional devices contributed to the mesial displacement of the first permanent molars and the vestibular inclination of the incisors of the lower dentition in both groups of patients.

Conclusion. The improvement of facial aesthetics in patients with class II, division 1 anomalies occurred due to a decrease in the bulge of the soft–tissue profile (including and excluding the nose), upper lip retrosion; in patients with class II, division 2 anomalies, due to upper lip retrosion, flattening of the hard-tissue and soft-tissue profiles (including the nose). When studying lateral TRG in patients with residual jaw growth and with completed skeletal growth, it was found that in the group of patients with residual growth, changes occurred mainly at the skeletal level, as evidenced by an increase in the angular parameters SNB, SNPg, NAB, a decrease in the Wits number and the angular parameter ANB. It was also revealed that the following linear parameters increased significantly in the study group of patients: A'-B', B'-J', PNS-J', Ar-Go, S-Go, Co-Go, Co-Gn, Go-Me. The normalization of facial aesthetics in this group occurred due to the flattening of the hard- and soft-tissue profiles with the retrosion of both lips. In adolescents with residual jaw growth, bite normalization was carried out during treatment by shifting the lower jaw forward, due to optimization of its growth. At the same time, changes in the study group were also noted in the upper jaw. At the dental alveolar level, mesial displacement of the first permanent molars of the mandible and vestibular deviation of the lower incisors were revealed.

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