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OPTIMIZATION OF ORTHODONTIC TREATMENT IN CHILDREN WITH MESIAL OCCLUSION USING AN APPLIANCE FOR DENTAL ARCH LENGTHENING

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Abstract

Background. Mesial occlusion is one of the most complex sagittal malocclusions in children. Its clinical manifestations may result from a combination of dentoalveolar and skeletal abnormalities. Early orthodontic treatment during the growth period provides an opportunity to influence dental arch development and sagittal jaw relationships. Development of appliances that allow controlled correction of dental arch length may improve the possibilities of comprehensive treatment.

Objective. To optimize orthodontic treatment of children with mesial occlusion using an appliance designed to increase dental arch length and to preliminarily evaluate its clinical effectiveness when combined with a facemask.

Materials and methods. The study included 102 children with mesial occlusion: 56 girls and 46 boys. The main group consisted of 58 children (25 boys and 33 girls) treated with the developed orthodontic appliance combined with a facemask. The comparison group included 44 children treated with a conventional removable plate combined with a facemask. A control group consisted of 22 children (9 boys and 13 girls) without clinically significant malocclusion. Clinical examination, dental arch measurements and cephalometric assessment were performed before and after treatment.

Results. The preliminary model of the expected results demonstrated a greater increase in dental arch length in the main group than in the comparison group. The estimated increase in dental arch length was 3.1±0.6 mm in the main group and 1.9±0.5 mm in the comparison group. The sagittal discrepancy decreased by approximately 2.7±0.7 mm in the main group and 1.8±0.6 mm in the comparison group. Positive changes in ANB were also expected in both treatment groups.

Conclusion. The developed appliance combined with a facemask represents a promising approach to the comprehensive orthodontic treatment of children with mesial occlusion. Final assessment of effectiveness requires statistical analysis of the actual clinical and cephalometric measurements.

Keywords: children; mesial occlusion; orthodontic appliance; dental arch lengthening; facemask; sagittal malocclusion; orthodontic treatment.

Introduction

Mesial occlusion is a sagittal malocclusion characterized by an abnormal anteroposterior relationship between the upper and lower dental arches. Depending on its etiology and stage of development, the clinical condition may be associated with abnormal tooth position, maxillary deficiency, excessive mandibular growth, or a combination of these factors.

Early diagnosis and treatment are particularly important in children because active growth provides an opportunity to influence dentoalveolar development and, in selected patients, the skeletal component of the malocclusion.

Correction of dental arch length and shape is an important component of treatment. Insufficient dental arch length may contribute to crowding, abnormal position of the anterior teeth and deterioration of sagittal relationships. Conventional removable plates are widely used in pediatric orthodontics; however, their possibilities may be limited when controlled multidirectional effects on the dental arch are required.

Facemask therapy is commonly used in early treatment of patients with mesial occlusion, particularly when maxillary deficiency is present. Therefore, development of an individualized appliance capable of influencing dental arch length while being used with a facemask is of clinical interest.

Aim of the Study

To optimize orthodontic treatment of children with mesial occlusion by using an appliance for dental arch lengthening and to preliminarily evaluate its clinical and cephalometric effectiveness in combination with a facemask.

Materials and Methods

A total of 102 children with mesial occlusion were included in the clinical treatment groups. The study population comprised 56 girls and 46 boys.

The main group consisted of 58 children, including 25 boys and 33 girls. These patients were treated with the developed orthodontic appliance combined with a facemask.

The comparison group consisted of 44 children who received conventional removable plate therapy combined with a facemask.

A control group of 22 children, including 9 boys and 13 girls, was used to characterize reference values for the studied parameters. Thus, the total number of children assessed, including the control group, was 124.

Design of the Developed Orthodontic Appliance. The developed appliance was designed to correct the length and configuration of the dental arch in children with mesial occlusion. The principal concept of the appliance is to provide controlled orthodontic forces directed toward increasing dental arch length and improving the sagittal relationship of the dental arches.The appliance is individualized according to the patient's dental arch anatomy and clinical requirements. Its use in combination with a facemask is intended to integrate dentoalveolar correction with orthopedic management of the sagittal jaw relationship.

Clinical and Cephalometric Assessment

Clinical examination was performed before treatment and after the active treatment period. The following parameters were assessed: dental arch length and width, dental arch form, sagittal relationship, sagittal discrepancy, reverse overjet, incisor position, molar and canine relationships, and facial profile.

Cephalometric analysis included the SNA, SNB and ANB angles and other relevant skeletal parameters. The preliminary statistical model assumes presentation of quantitative data as mean ± standard deviation (M±SD). Statistical significance should be determined after analysis of the actual patient-level data, with $p<0.05$ considered statistically significant.

Preliminary Results

Initial clinical examination demonstrated sagittal dental arch abnormalities characteristic of mesial occlusion in both treatment groups. The preliminary model suggests positive changes after treatment, with more pronounced changes expected in the main group.

Parameter	Main group before	Main group after	Comparison before	Comparison after
Dental arch length, mm	27.4±1.2	30.5±1.1	27.6±1.3	29.5±1.2
Dental arch width, mm	31.8±1.4	32.7±1.3	31.7±1.5	32.3±1.4
Sagittal discrepancy, mm	-3.2±0.8	-0.5±0.6	-3.1±0.7	-1.3±0.6
Reverse overjet, mm	2.9±0.7	0.8±0.5	2.8±0.7	1.2±0.5

According to the preliminary model, dental arch length increased from 27.4±1.2 mm to 30.5±1.1 mm in the main group, corresponding to an estimated increase of 3.1 mm. In the comparison group, dental arch length increased from 27.6±1.3 mm to 29.5±1.2 mm, corresponding to an estimated increase of 1.9 mm.

The estimated reduction in sagittal discrepancy was approximately 2.7 mm in the main group and 1.8 mm in the comparison group. Reverse overjet also demonstrated a favorable trend in both groups.

Cephalometric Findings

Parameter	Main before	Main after	Comparison before	Comparison after
SNA, °	79.1±2.1	81.7±2.0	79.3±2.2	80.8±2.1
SNB, °	81.8±2.3	80.4±2.1	81.6±2.2	80.9±2.1
ANB, °	-2.7±1.0	1.3±0.9	-2.3±1.0	0.1±0.9
SN-GoGn, °	32.4±2.4	32.1±2.3	32.2±2.5	32.0±2.4

In the preliminary model, ANB increased from -2.7° to 1.3° in the main group and from -2.3° to 0.1° in the comparison group. The observed direction of change is consistent with improvement in the sagittal relationship of the jaws. These numerical values are preliminary model values and must be replaced by actual measurements before scientific publication.

Discussion

The preliminary findings support further clinical evaluation of the developed appliance as a component of comprehensive treatment of mesial occlusion in children. A key feature of the proposed approach is the controlled influence on dental arch length and configuration.Increasing dental arch length may create additional conditions for correction of tooth position and occlusal relationships. When combined

with facemask therapy, the appliance may allow simultaneous management of dentoalveolar changes and sagittal jaw relationships.The preliminary model suggests a greater increase in dental arch length in the main group than in the group treated with a conventional removable plate. However, these observations should be interpreted as preliminary until verified using the actual patient-level dataset and appropriate statistical testing.

Practical Significance. The developed individualized orthodontic appliance may expand the options for early treatment of children with mesial occlusion. Its individualized design allows the clinician to consider the patient's dental arch morphology and treatment objectives. Combined use with a facemask provides an integrated approach to dentoalveolar and sagittal correction.

Conclusion

The treatment cohort included 102 children with mesial occlusion: 56 girls and 46 boys. The main group consisted of 58 children (25 boys and 33 girls) treated with the developed appliance combined with a facemask. The comparison group consisted of 44 children treated with a conventional removable plate combined with a facemask. The control group included 22 children (9 boys and 13 girls), giving a total study population of 124 children when the control group is included. The preliminary model indicates a greater increase in dental arch length with the developed appliance than with conventional plate therapy. Positive trends were also observed in sagittal dental relationships and cephalometric parameters. The developed appliance is a promising component of comprehensive orthodontic treatment for children with mesial occlusion; confirmation requires analysis of the actual clinical dataset.

Study Limitations

The numerical clinical and cephalometric results presented in this draft are preliminary modeled values used to structure the manuscript. They are not a substitute for actual patient measurements. Before submission to a scientific journal, all numerical values, statistical tests, p-values, confidence intervals, and effect sizes must be recalculated from the original dataset.

References

1. Nigmatov R.N., Shomuxamedova F.A., Nigmatova I.M. Orthodontics. Volume 2: Textbook for students of medical higher educational institutions, Faculty of Dentistry. Tashkent; 2021.
3. Nigmatov R.N., Nigmatova I.M. Using the posterior distalization in patients with secondary deformation of dentition. World Health Care Providers Multidisciplinary Medical Journal. 2017;8(1):45–48.
4. Nigmatov R.N., Kadyrov Zh.M., Nigmatova I.M., Atamuratova N.B. The use of orthodontic appliances to expand the upper jaw in mixed dentition children. Stomatologiya. 2023.
5. Nigmatov R.N., Akbarov K.S., Nigmatova I.M. Etiology, diagnosis, prevalence and orthodontic treatment of children with crossbite in mixed dentition. Stomatologiya (Uzbekistan). 2023;1(2–3):66–74.

6. Nigmatova I.M., Yusupalieva K.B. A comprehensive assessment of the morphofunctional state of the temporomandibular joint in patients with dentofacial anomalies undergoing orthodontic treatment. Stomatologiya. 2026;1(1):47–53.
7. Nigmatov R.N., Murtazaev S.S., Nigmatova I.M., et al. Improving the diagnosis and orthodontic treatment of children with crossbite. Stomatologiya. 2024;1(94):85–91.