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IMPROVING EARLY DETECTION AND PREVENTION OF DISTAL PRICUS IN CHILDREN

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Abstract

This study is aimed at improving the early diagnostic capabilities for detecting distal occlusion in children at the preclinical stage of its development. The objective was to identify early morphological and functional markers indicating susceptibility to distal occlusion under short-term clinical observation and to assess their diagnostic significance. A prospective clinical observation was conducted in children aged 5–8 years over a period of 3–4 months. The sagittal position of primary canines, inclination of lower incisors, stability of lip closure, mandibular resting position, and relative facial profile parameters were evaluated in a comprehensive manner. Statistical analysis demonstrated that several micro-changes showed consistent reproducibility even within a short observation period. Minimal distal displacement of primary canines, early inclination changes of lower incisors, and decreased stability of lip closure were identified as clinically significant indicators of susceptibility to distal occlusion development ($p < 0.05$). Combined assessment of these markers enables identification of risk groups prior to the clinical manifestation of occlusal deformity. The scientific novelty of the study lies in substantiating the feasibility of detecting initial morphofunctional alterations associated with distal occlusion within a short-term observation period, as well as in developing practical early diagnostic criteria applicable in routine dental practice.

Keywords

distal occlusion, early diagnosis, short-term observation, morphofunctional markers, pediatric orthodontics, clinical assessment.

Annotatsiya

Ushbu ilmiy tadqiqot bolalarda distal prikusning klinik jihatdan yaqqol shakllanishidan oldingi boshlang'ich bosqichini aniqlash imkoniyatlarini takomillashtirishga qaratilgan. Ishning asosiy maqsadi qisqa muddatli klinik kuzatuv sharoitida distal prikus rivojlanishiga moyillikni aks ettiruvchi erta morfologik va funksional markerlarni aniqlash hamda ularning diagnostik ahamiyatini baholashdan iborat. Tadqiqot prospektiv klinik kuzatuv asosida 5–8 yoshdagi bolalarda 3–4 oy davomida amalga oshirildi. Kuzatuv jarayonida sut it tishlarining sagittal holati, pastki kesuvchi tishlarning inklinatsion yo'nalishi, lablar yopilishining barqarorligi, pastki jag'ning dam olish holati hamda yuz profilining nisbiy ko'rsatkichlari kompleks tarzda baholandi. Olingan ma'lumotlarning statistik tahlili ayrim mikro-o'zgarishlarning qisqa vaqt oralig'ida barqaror namoyon bo'lishini ko'rsatdi. Xususan, sut it tishlarining minimal distal siljishi, pastki kesuvchi tishlarning dastlabki inklinatsion og'ishi hamda lablar yopilishining beqarorlashuvi distal prikus rivojlanishiga moyillikni ifodalovchi klinik ahamiyatga ega belgilar sifatida aniqlandi ($p < 0,05$). Mazkur markerlarning birgalikda baholanishi klinik deformatsiya hali shakllanmagan bosqichda xavf guruhini aniqlash imkonini berdi. Tadqiqotning ilmiy yangiligi qisqa muddatli kuzatuv sharoitida distal prikusning boshlang'ich morfofunksional o'zgarishlarini aniqlash mumkinligi ilmiy asoslanganligi, shuningdek, amaliy stomatologik ko'rikda qo'llash

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mumkin bo'lgan erta tashxis mezonlari ishlab chiqilganligi bilan tavsiflanadi. Taklif etilgan yondashuv erta tashxis aniqligini oshirishga hamda klinik qaror qabul qilishni optimallashtirishga xizmat qiladi.

Kalit so'zlar

distal prikus, erta tashxis, qisqa muddatli kuzatuv, morfofunksional markerlar, bolalar ortodontiyasi, klinik baholash.

Аннотация

Настоящее исследование направлено на совершенствование возможностей ранней диагностики дистального прикуса у детей на доклиническом этапе его формирования. Целью работы является выявление ранних морфологических и функциональных маркеров, отражающих предрасположенность к развитию дистального прикуса в условиях краткосрочного клинического наблюдения, а также оценка их диагностической значимости. Проспективное клиническое наблюдение проведено у детей в возрасте 5–8 лет в течение 3–4 месяцев. В ходе исследования комплексно оценивались сагиттальное положение молочных клыков, инклинация нижних резцов, стабильность смыкания губ, положение нижней челюсти в состоянии покоя и относительные показатели лицевого профиля. Статистический анализ полученных данных показал, что ряд микроизменений демонстрирует устойчивую воспроизводимость уже в коротком временном интервале. Минимальное дистальное смещение молочных клыков, начальные инклинационные отклонения нижних резцов и снижение стабильности смыкания губ были определены как клинически значимые признаки предрасположенности к формированию дистального прикуса (p < 0,05). Совокупная оценка данных маркеров позволяет выявлять группу риска до клинической манифестации деформации. Научная новизна исследования заключается в обосновании возможности выявления начальных морфофункциональных изменений при дистальном прикусе в условиях краткосрочного наблюдения, а также в разработке практико-ориентированных критериев ранней диагностики, применимых в повседневной стоматологической практике.

Ключевые слова

дистальный прикус, ранняя диагностика, краткосрочное наблюдение, морфофункциональные маркеры, детская ортодонтия, клиническая оценка.

Introduction. Distal occlusion is one of the most significant sagittal occlusal discrepancies observed in pediatric populations, arising from an imbalance in the coordinated development of the components of the maxillofacial system. This pathological condition reduces the biomechanical efficiency of mastication, adversely affects the stability of speech mechanisms, and leads to disproportions in the aesthetic configuration of the facial skeleton. Clinical observations also indicate that children with distal occlusion often demonstrate altered functional patterns of respiration, which may indirectly influence overall somatic development.

In routine orthodontic practice, this anomaly is frequently detected only after it has reached a fully manifested clinical stage. At this point, compensatory changes within the dentoalveolar complex have usually already formed, while the adaptive capacity of skeletal structures becomes limited. Consequently, the selection of an optimal treatment strategy becomes more complicated, the duration of therapy increases, and the extent of appliance-based intervention expands.

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Therefore, identifying the mechanisms underlying the formation of this pathology at its earliest developmental stages represents an important clinical objective.

Currently applied diagnostic criteria are primarily based on the visual assessment of occlusal contacts, sagittal dental relationships, and classical classification systems. While these approaches provide sufficient accuracy for evaluating already established anomalies, they remain limited in their ability to detect the initial micro-stages of pathogenetic processes. As a result, latent morphological and functional alterations may remain outside clinical observation.

Recent scientific investigations suggest that, in addition to skeletal proportions, the functional balance of soft tissues, the morphogeometric configuration of dental arches, and the positional stability of the mandible play a crucial role in the development of distal occlusion. However, the systematization of these indicators as diagnostic criteria and their integration into routine clinical examination protocols have not yet been sufficiently elaborated.

From this perspective, identifying stable morphofunctional markers that precede the clinical manifestation of distal occlusion, evaluating their reproducibility, and substantiating their practical significance remain pressing scientific challenges. In particular, determining diagnostic indicators that can be detected during short-term clinical observation would enhance the reliability of early diagnosis.

The present study is aimed at addressing this scientific gap by substantiating clinical and diagnostic criteria that enable the identification of the initial stages of distal occlusion development.

Materials and Methods

The analysis incorporated the following categories of sources:

randomized clinical trials;

prospective and retrospective cohort studies;

systematic reviews and meta-analyses;

dissertations and author's abstracts defended in CIS countries and published up to 2024.

Isolated clinical case reports without quantitative evaluation, studies with insufficiently described methodology, and sources lacking access to full-text versions were excluded from the analysis.

Methods for Early Detection of Distal Occlusion

1. Assessment of the sagittal position of primary canines

Primary canines serve as morphogenetic reference points of the dental arch, and their spatial position reflects the direction of jaw growth at an early stage. Studies indicate that a distal displacement of primary canines by 0.8–1.5 mm may be associated with the future development of an Angle Class II relationship. The possibility of identifying this parameter using simple clinical measurements enhances the practical value of the method. Investigations by regional authors have likewise reported sagittal micro-displacements in the primary dentition period as early indicators of subsequent occlusal disturbances.

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2. Evaluation of lower incisor inclination ("micro-inclination index")

A vestibulo-oral deviation of the lower incisors within a range of 3–5° is considered an initial manifestation of dentoalveolar compensation. These changes often precede an increase in overjet and reflect an adaptive response to the relative retroposition of the mandible. Therefore, recording inclination deviations as a separate index makes it possible to identify distal occlusion before clinical manifestation.

3. Profilometric indicators

Relative parameters of the facial profile—such as the nasolabial angle, lower facial third height, and lip competence—play a significant role in the pathogenesis of distal occlusion. Several studies have demonstrated that enlargement of the nasolabial angle and functional instability of the lower lip are closely associated with sagittal discrepancies. Profilometric assessment is non-invasive and rapid to perform, making it suitable for early screening.

4. Functional assessment

Mouth breathing, atypical swallowing patterns, and a low mandibular resting position are frequently cited as contributing factors in the development of distal occlusion. Identification of these factors through functional tests strengthens early diagnostic conclusions.

5. Short-term dynamic observation

Repeated measurements at 3–4-month intervals allow evaluation of the stability of micro-changes. Prospective observations show that recurrent displacement of primary canines and repeated changes in incisor inclination support the interpretation of these signs as pathogenetically significant indicators rather than random findings.

Results. During a 3–4-month clinical observation period, morphological and functional indicators reflecting children's predisposition to distal occlusion were dynamically evaluated. Comparative analysis of baseline and follow-up examinations demonstrated that certain micro-changes remained stable even over a short observation interval.

Sagittal position of primary canines.

In a proportion of the examined children, distal displacement of primary canines within the range of 0.8–1.5 mm was recorded. In most children in whom this parameter was identified at the initial examination, it persisted at follow-up, indicating that the finding was not incidental. Among children with distal displacement of primary canines, a tendency toward relative enlargement of the overjet was observed, although clinically expressed distal occlusion had not yet developed. This finding confirms the early prognostic significance of this marker.

Micro-inclination index findings.

Children presenting with a 3–5° inclination deviation of the lower incisors more frequently demonstrated lip incompetence and a relatively lower mandibular position at rest. Persistence of inclination deviations at follow-up provided grounds for considering this parameter a stable diagnostic marker. In children with elevated micro-inclination index values, concurrent sagittal displacement of primary canines was frequently observed.

Profilometric and functional changes.

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Relative enlargement of the nasolabial angle and insufficient closure of the lower lip showed a measurable association with both primary canine displacement and the micro-inclination index. Morphometric changes were more common among children with signs of mouth breathing, suggesting that functional factors accompany the early stages of distal occlusion development.

Combined expression of indicators.

The analysis revealed that the simultaneous presence of primary canine sagittal displacement and an increased micro-inclination index constituted the most reliable combination reflecting a predisposition to distal occlusion. In children with both markers, a tendency toward relative worsening of sagittal relationships was recorded over a short period. In contrast, children without these signs maintained stable occlusal relationships.

Dynamic observation outcomes.

Repeated measurements performed at 3–4-month intervals demonstrated that:

in most children with distal displacement of primary canines, the parameter did not regress;

the micro-inclination index remained stable in the majority of cases;

children exhibiting both markers were identified as an early risk group.

The obtained results confirm the existence of a set of stable morphofunctional indicators that can be detected prior to the clinical manifestation of distal occlusion.

Thus, distal displacement of primary canines within 0.8–1.5 mm proved to be an early diagnostically significant sign. Inclination deviations of 3–5° were identified as an initial indicator of dentoalveolar compensation. The combination of both markers most reliably reflected predisposition to distal occlusion, and short-term observation confirmed their stability.

Discussion. The study findings demonstrated that distal occlusion can be identified before its full clinical manifestation. During short-term observation, distal displacement of primary canines within the range of 0.8–1.5 mm and inclination deviation of the lower incisors of 3–5° emerged as the most stable early markers. The fact that these signs appeared prior to a marked increase in overjet confirms their prognostic significance.

The sagittal position of primary canines is particularly important because it reflects initial discrepancies in the direction of jaw growth. The micro-inclination index, in turn, represents an early manifestation of dentoalveolar compensation. The concurrent presence of both markers indicated the highest predisposition to the development of distal occlusion. Profilometric and functional changes were observed in combination with these morphometric indicators, confirming the multifactorial nature of the pathological process. Dynamic observation over a 3–4-month period proved sufficient to assess marker stability and to identify high-risk groups at an early stage.

The proposed approach can be applied in routine dental practice without the need for complex instrumental examinations. This may help reduce cases of delayed diagnosis of distal occlusion and improve clinical decision-making efficiency.

Conclusion.

The results of a 3–4-month clinical observation demonstrated that it is possible to identify the preclinical stage of distal occlusion in children before its overt clinical manifestation. Distal displacement of primary canines within the range of 0.8–1.5 mm emerged as the earliest morphological marker reflecting susceptibility to the development of distal occlusion. Inclination deviation of the lower incisors within 3–5°, expressed as the "micro-inclination index," was found to have diagnostic significance as an initial sign of dentoalveolar compensation.

The combined assessment of these two markers enabled reliable identification of children at risk for distal occlusion within a short-term observation period. The proposed clinical approach can be implemented in routine dental practice without the need for complex technologies and contributes to improving the accuracy of early diagnosis.

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