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Features and challenges in the diagnosis of patients with maxillary hypodontia

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Abstract
INTRODUCTION. In the management of patients with agenesis of maxillary lateral incisors, a number of important issues arise related to the amount of free space, the age of the patient, types of occlusions and the condition of adjacent teeth. There are three treatment options for patients diagnosed with agenesis of maxillary lateral incisors. These options include canine mesialization, restoration based on adjacent teeth, and implantation. There are also special criteria that need to be considered when choosing an appropriate treatment option.
When planning all types of treatment, first, attention should be paid to the preservation of teeth. As a rule, the chosen treatment method should be the least invasive and meet the expected aesthetic and functional goals. The orthodontist plays a key role in achieving specific space requirements by placing the teeth in the ideal position for restoration. For example, canine mesialization may be one of the acceptable aesthetic treatments for patients with agenesis of maxillary lateral incisors. However, if it is used in the wrong patient, the result may be far from ideal. Ultimately, an interdisciplinary approach is the most predictable way to achieve optimal end aesthetics.
AIM. To study the literature to compile a review on the diagnosis and evaluation criteria of patients with agenesis of maxillary lateral incisors.
MATERIALS AND METHODS. Analysis of foreign literature data, scientific publications, electronic resources.
RESULTS. The treatment plan for patients with the absence of lateral incisors of the upper jaw should be drawn up taking into account the dental, functional and aesthetic aspects identified during the initial clinical examination.
CONCLUSIONS. The absence of lateral incisors in the upper jaw, with any accompanying malocclusion, should be treated as part of the overall treatment plan. Factors such as the individual characteristics of the patient, the size, shape, position, and color of teeth, their effect on the bite, as well as overall facial aesthetics, should all be taken into consideration when deciding whether to create an implant space or close one.

Keywords: hypodentia, agenesis of lateral incisors, mesialization of teeth, orthodontics

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Особенности и сложности в диагностике пациентов с адентией на верхней челюсти

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Резюме
ВВЕДЕНИЕ. При ведении пациентов с врожденным отсутствием боковых резцов верхней челюсти возникает ряд важных вопросов, связанных с количеством свободного пространства, возрастом пациента, видов окклюзии и состоянием соседних зубов. Существует три варианта лечения пациентов с диагнозом адентия боковых резцов верхней челюсти. Эти варианты включают мезиализацию клыков, реставрацию с опорой на соседние зубы и имплантацию. Существуют также особые критерии, которые необходимо учитывать при выборе подходящего варианта лечения.
При планировании всех видов лечения в первую очередь следует обращать внимание на сохранение зубов. Как правило, выбранный метод лечения должен быть наименее инвазивным и соответствовать ожидаемым эстетическим и функциональным целям. Ортодонт играет ключевую роль в достижении конкретных требований к пространству, устанавливая зубы в идеальном положении для восстановления. Например, мезиализация клыков, может быть, одним из приемлемых эстетических методов лечения пациентов с адентией боковых резцов на верхней челюсти. Однако, если оно применяется не у того пациента, конечный результат может быть далек от идеального. В конечном счете междисциплинарный подход является наиболее предсказуемым способом достижения оптимальной конечной эстетики.

ЦЕЛЬ. Изучение литературы для составления обзора по диагностике и критериям оценки пациентов с отсутствующими боковыми резцами верхней челюсти.
МАТЕРИАЛЫ И МЕТОДЫ. Анализ данных зарубежной литературы, научных публикаций, электронных ресурсов.
РЕЗУЛЬТАТЫ. План лечения пациентов, с отсутствием боковых резцов верхней челюсти, должен быть составлен с учетом стоматологических, функциональных и эстетических аспектов, выявленных в ходе первичного клинического обследования.
ВЫВОДЫ. Отсутствие боковых резцов верхней челюсти при любом сопутствующем неправильном прикусе необходимо лечить в рамках общего плана лечения. При принятии решения о том, следует ли создавать пространство для имплантации или его закрытие, следует учитывать такие факторы, как индивидуальные особенности пациента, размер, форма, положение и цвет зубов, влияние на прикус, а также общую эстетику лица и зубов.

Ключевые слова: гиподентия, адентия латеральных резцов, мезиализация зубов, ортодонтия

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INTRODUCTION

Should spaces be maintained for implant placement in cases of congenitally missing maxillary lateral incisors, or should these gaps be closed through mesial movement of the canines? The demand for orthodontic treatment in such patients is increased, as this condition significantly impacts smile and facial aesthetics. Given that a substantial proportion of these patients are adolescents, they often experience anxiety and insecurity. Both patients and their parents frequently seek a quick and simple solution, which may not always be feasible. These individuals are often more concerned with the aesthetics of their smile than with achieving optimal occlusion [1–3].

The absence of maxillary lateral incisors is associated with an unbalanced smile, dental asymmetry, and facial disharmony, presenting complex challenges that require thorough diagnosis and lack straightforward solutions [4]. Inadequate treatment planning and poor communication among the specialists involved in the correction of such issues can lead to heightened frustration among patients and their families. It is the orthodontist's responsibility to ensure functional and healthy occlusion while simultaneously improving aesthetics within the constraints of each individual case. Therefore, a diagnostic protocol that provides a systematic and comprehensive approach to evaluating patients with missing maxillary lateral incisors can facilitate treatment planning and enhance communication among specialists, patients, and their families.

The decision to open or close spaces is fundamentally a diagnostic one, and any approach involves a degree of compromise. The key question to address is: which compromise offers the best cost-benefit ratio for the patient, both functionally and aesthetically? To answer this, a diagnostic protocol must be considered, outlining the variables that should be analyzed before determining whether to maintain spaces for prosthetic replacement or to close them through repositioning and reshaping of the canines and central incisors [5–7].

MATERIALS AND METHODS

Search Strategy

To define and examine the diagnostic protocol for treating patients with maxillary lateral incisor agenesis, both international and domestic publications from 2011 to 2024 were analyzed. These publications included diagnostic criteria essential for the assessment and treatment planning of patients with missing maxillary lateral incisors.

The data analysis involved a review of international literature, scientific publications, and electronic resources from databases such as PubMed, Google, and reference lists of relevant studies and reviews.

Search Criteria

Publications, articles, and clinical cases meeting the following selection criteria were included:

1. Studies published between 2011 and 2024.
2. Research focusing on the diagnostic criteria required for evaluating and treating patients with maxillary lateral incisor agenesis.

RESULTS

A significant increase in the nasolabial angle and a shorter upper lip due to the repositioning of maxillary central incisors were observed in cases where bilateral spaces were closed. A convex profile is typically associated with Class II skeletal malocclusions. In such cases, space closure is often indicated, particularly when growth potential is limited, and sagittal gap closure through retraction of the maxillary anterior teeth is utilized to camouflage the skeletal discrepancy. In instances of severe protrusion of both maxillary and mandibular incisors, extraction of mandibular teeth may be indicated [3; 8–11].

Conversely, space closure in patients with a concave facial profile may exacerbate maxillary deficiency and further deepen the concavity of the profile. Therefore, opening the spaces for future prosthetic rehabili-

tation is often recommended, as this enhances upper lip support, thereby masking the appearance of a Class III skeletal pattern. Alternatively, a combined treatment approach involving orthognathic surgery may be considered; however, in such cases, the question of space closure must also be addressed [9; 12–14].

When assessing facial aesthetics, additional factors such as the nasolabial angle, nasal position, size and shape, and other critical aspects must be taken into account. While orthodontists cannot alter nasal morphology directly, certain orthodontic procedures that affect lip positioning may indirectly influence nasal appearance. Excessive lip retraction can increase the nasolabial angle, resulting in a "pseudo-enlargement" of the nose [9; 15].

Intraoral examination and clinical considerations

During the intraoral examination, attention is given to the occlusal relationship in both the anterior and posterior regions, tooth color, and smile aesthetics. In cases of maxillary lateral incisor agenesis, various types of dentofacial deformities have been observed, including vertical displacement of antagonist teeth into the edentulous space, tooth rotation, inclination toward the defect area, and combinations of these conditions [16].

Uncontrolled retraction of anterior teeth may lead to excessive vertical positioning of maxillary incisors, resulting in malocclusion and deep overbite. In patients with a gummy smile, the need for canine reshaping and color matching becomes more pronounced. Differences between the lip and gingival contours of canines adjacent to the central incisors become more apparent, and clinicians must be aware of these aesthetic implications [17; 18].

In addition to assessing the width of the canine at the cemento-enamel junction, clinical examination should also consider the gingival margin relationship between the canines and central incisors. The optimal gingival margin alignment is defined as one where the gingival margin of the canine is equal to or positioned 1.0–1.5 mm higher than the corresponding point on the gingival margin of the central incisor, with the lateral incisor's gingival margin located 0.5–1.0 mm below this reference line. A gingival margin level where the lateral incisor aligns with the central incisor is considered acceptable, but a scenario in which the lateral incisor's gingival margin is higher than that of the central incisor is highly undesirable [16].

A clinical study reported that none of the examined patients had a canine gingival margin positioned lower than that of the central incisors. Among the evaluated patients, 44.3% exhibited a canine gingival margin more than 0.5–1.0 mm higher than the central incisors, while 27.8% had a gingival margin at the same level as the central incisors, which permitted space closure as a viable treatment option. However, in 27.9% of patients, the canine gingival margin was significantly higher (1.0–1.5 mm above the central incisor margin), requiring substantial surgical and prosthodontic interventions to restore the gingival architecture when space closure was chosen as the treatment approach [16].

The ideal gingival architecture of the anterior dentition assumes that the gingival margins of the central incisors and canines are at the same level, while the lateral incisor's margin is approximately 1 mm lower. Therefore, space closure may lead to an unaesthetic gingival contour in the anterior region, particularly in patients with a gummy smile. Clinicians should be aware of such potential complications when deciding on the most appropriate treatment strategy. Canine extrusion and first premolar intrusion may be employed to achieve optimal gingival aesthetics when space closure is performed. Additionally, the canine's cusp must be reshaped to simulate the morphology of lateral incisors. If a first premolar is introduced into the canine position, composite buildup may be required to ensure proper canine guidance, as these teeth will assume the functional role of canines [16].

The presence of an adequate color balance among the maxillary anterior teeth plays a crucial role in a patient's aesthetic perception. Since canines are typically darker than lateral and central incisors, orthodontists must carefully evaluate the extent of this color mismatch when deciding whether to open or close spaces in the maxillary arch. A lack of color harmony between canines and adjacent teeth has been identified as a primary cause of patient dissatisfaction among those who underwent orthodontic treatment involving space closure for missing lateral incisors. Consequently, in cases of significant color disparity, maintaining the canines in their natural position may be the preferred treatment approach. When other factors hold greater importance in the decision-making process and space closure is selected, tooth whitening procedures can be performed to enhance the appearance of canines relative to the central incisors [19; 20].

Evaluation of Tooth Color and Morphology in Treatment Planning

In a clinical study, the color match between central incisors and canines was assessed using the "Vita" shade guide, as this parameter is a critical criterion for evaluating the potential aesthetic outcome of orthodontic treatment. It was observed that in 66.0% of examined patients, the color difference was within 0.5 shade units, which was considered optimal for achieving an aesthetically pleasing result. However, when the difference exceeded 0.5 shade units, it presented a significant challenge, making it difficult to guarantee a satisfactory aesthetic outcome [16].

Some canines exhibit such unique anatomical characteristics that even an experienced prosthodontist may struggle to reshape them into an acceptable lateral incisor morphology. Their forms range from conical to trapezoidal, and contour modifications can only be performed within certain limits. When the natural shape of the canine imposes significant restrictions on morphological alterations, the aesthetic result may be unsatisfactory for the patient, leading the clinician to consider space opening as a more viable option for improving aesthetics [21].

Complexity of Cases with Additional Dental Anomalies

The combination of maxillary lateral incisor agenesis with other congenital dental anomalies increases case complexity and is relatively common in clinical practice. Orthodontic wax-up simulations for evaluating different treatment options provide valuable information for treatment planning. A multidisciplinary approach is often required, and patient expectations should be carefully considered when selecting the appropriate treatment method [22].

Anthropometric Measurements in Patients with Maxillary Lateral Incisor Agenesis

An analysis of anthropometric parameters of the dentoalveolar system in different patient groups with maxillary lateral incisor agenesis revealed that patients with Angle Class III molar relationships exhibited the most significant discrepancies in transverse width and anterior arch length according to Korkhaus. In contrast, patients with Angle Class I molar relationships showed the smallest discrepancies [16].

Anthropometric measurements of dental models included an evaluation of the maxillary and mandibular apical bases using the method described by Rees [23]. In patients with Angle Class I molar relationships, 43.8% exhibited normal apical base relationships, with an average value of 8.01 ± 0.7 mm. However, in 56.2% of these patients, the apical base dimensions were smaller than normal, averaging 2.52 ± 0.31 mm. In patients with Angle Class II molar relationships, the apical base relationship was generally within the normal range, often close to the upper limit or exceeding it. Conversely, in patients with Angle Class III molar relationships, 61.5% had a reduced apical base relationship (1.12 ± 0.27 mm), while 38.5% were within the normal range but close to the lower threshold (3.17 ± 0.58 mm).

This parameter is crucial in determining the appropriate treatment method for patients with a skeletal Class I relationship. Based on the ratio of the maxillary and mandibular apical bases, both space opening and space closure may be viable options, provided that other important factors are taken into consideration. These include the proportional width of the canine relative to the anticipated width of the missing lateral incisors, the gingival margin alignment between canines and central incisors in different patient groups, tooth color harmony, and the relationship between the dental and apical arches [16].

Treatment Considerations for Arch Proportions and Space Management

If the ratio of the basal arches is below the normal range, expansion of the maxillary arch is required by creating space for the replacement of missing lateral incisors. Conversely, if this ratio exceeds the normal values, reduction of the maxillary arch dimensions is necessary by closing the space and mesializing the posterior dentition [16].

Achieving an adequate aesthetic outcome with space closure in patients with unilateral maxillary lateral incisor agenesis is a complex clinical challenge. A thorough comparison of the shape, color, and size of the canine on the side of the missing lateral incisor with the contralateral lateral incisor is crucial in determining whether space closure will result in a significant aesthetic compromise, which may contraindicate this approach. In cases of unilateral agenesis, the most aesthetically favorable outcomes are observed either when space is maintained for prosthetic replacement or when the existing lateral incisor is extracted to achieve symmetry [24].

Another important consideration is that canines typically have wide and long roots, whereas the lateral incisor region often consists of a narrow alveolar ridge, reflecting the usual morphology of the lateral incisor root. The combination of a broad canine root and a narrow alveolar ridge in the lateral incisor region may indicate insufficient bone volume to facilitate adequate canine movement [11; 25; 26].

DISCUSSION

When assessing the patient's profile, a comprehensive evaluation must be conducted to gather all necessary information for developing the most suitable treatment plan for each individual. The orthodontic approach selected for managing lateral incisor agenesis can influence the patient's facial profile.

Appropriate orthodontic mechanics can yield favorable outcomes in patients with a straight profile, whether by opening or closing the spaces resulting from congenitally missing lateral incisors. Consequently, other variables hold greater diagnostic significance in such cases. Patients with a concave profile present a more significant challenge when determining whether to open space for prosthetic replacement of missing maxillary lateral incisors. These patients often exhibit either an edge-to-edge or reverse incisor relationship. Skeletally, they frequently present with midface deficiency and/or mandibular prognathism.

A well-informed and appropriate decision should be supported by additional crucial factors; dental and functional aspects observed during the initial clinical examination are just as important as aesthetic considerations.

The position of the canine and the inclination of its root can be complicating factors when deciding to open space for prosthetic replacement. In patients with congenital absence of maxillary lateral incisors, canines frequently tend to erupt mesially, assuming a final position adjacent and parallel to the central incisors. This condition often favors utilizing the canine as a lateral incisor substitute. Space opening would be facilitated in cases where the canine is mesially inclined, with its crown positioned near the central incisor and its root in close proximity to the premolar root.

Achieving an aesthetically pleasing smile line with space closure in patients with maxillary lateral incisor agenesis, particularly those with an excessive gingival display, can be significantly more challenging than maintaining space for prosthetic replacement.

CONCLUSION

When planning the treatment of patients with congenital absence of maxillary lateral incisors, several critical factors must be considered to ensure effective and appropriate care. These factors include the available space within the dental arch, the patient's age, the maxillomandibular relationship, any existing malocclusions, and the condition of the teeth adjacent to the missing lateral incisor. This is not an exhaustive list, and additional investigations are required when planning treatment involving orthodontic and surgical approaches.

Based on clinical data, as well as anthropometric and radiographic analyses, the effectiveness of orthodontic treatment enables the development of a diagnostic and therapeutic algorithm for orthodontic management within a comprehensive rehabilitation program for patients with congenital absence of maxillary lateral incisors.

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