

I.L. Skrypnyk, S.A. Shnaider¹, V.N. Gorokhivskiy¹, O.V. Suslova², A.E. Denga¹,
O.L. Kordonets³, S.V. Rachynskiy²
Bogomolets National Medical University, Kyiv, ¹State Establishment "The Institute of stomatology
and maxilla-facial surgery National academy of medical sciences of Ukraine", Odessa,
²Odessa National Medical University, Odessa

FEATURES OF THE STRUCTURE OF THE FACIAL SKULL IN PATIENTS WITH AGENESIS OF THE UPPER LATERAL INCISORS IN CASE OF MESIAL OCCLUSION WITH NORMAL MANDIBLE POSITION

e-mail: oksanadenga@gmail.com

The research is devoted to the study of the characteristics of the correspondence of the size of the teeth and dentition of the upper and lower jaw and the structure of the facial skull in patients with agenesia of the upper lateral incisors in the mesial bite. The study involved 55 patients who applied to the Department of Orthodontics of the Bogomolets National Medical University aged 9 to 23 years with agenesia of both lateral incisors of the upper jaw, the absence of transverse anomalies and mesial occlusion (class III according to Engle) with normal mandibular position. In patients with upper lateral incisor agenesia and mesial occlusion, significant narrowing and shortening of the maxillary dentition, especially in the area of premolars and molars, as well as narrowing of the apical base of the maxilla were observed. The average values of the ANB angle and the WITS index indicate the presence of a skeletal mesial occlusion accompanied by occlusion disorders and malposition of the central incisors, which requires an individual approach to diagnosis and treatment planning.

Key words: mesial bite, teeth, orthodontics, lower jaw, skull.

І.Л. Скрипник, С.А. Шнайдер, В.Н. Горохівський, О.В. Сусллова, А.Е. Дєньга,
О.Л. Кордонєць, С.В. Рачинський

ОСОБЛИВОСТІ БУДОВИ ЛИЦЕВОГО ВІДДІЛУ ЧЕРЕПА У ПАЦІЄНТІВ З АГЕНЕЗІЄЮ ВЕРХНІХ ЛАТЕРАЛЬНИХ РІЗЦІВ ПРИ МЕЗІАЛЬНОМУ ПРИКУСІ З НОРМАЛЬНИМ ПОЛОЖЕННЯМ НИЖНЬОЇ ЩЕЛЕПИ

Дослідження присвячене вивченню характеристики відповідності розмірів зубів і зубних рядів верхньої і нижньої щелепи та особливостей будови лицевого відділу черепа у пацієнтів з агенезією верхніх латеральних різців при мезіальному прикусі. В дослідженні брали участь 55 пацієнтів, які звернулися на кафедру ортодонції НМУ ім. О. О. Богомольця у віці від 9 до 23 років із агенезією обох латеральних різців верхньої щелепи, відсутністю транверсальних аномалій та мезіальним прикусом (III клас за Енлем) із нормальними положенням нижньої щелепи. У пацієнтів з агенезією верхніх латеральних різців та мезіальним прикусом спостерігалось суттєве звуження та вкорочення зубних рядів верхньої щелепи, особливо у ділянці премолярів і молярів, а також звуження апікального базису верхньої щелепи. Середні значення кута ANB та індексу WITS вказують на наявність скелетного мезіального прикусу, що супроводжується порушеннями оклюзії та неправильним положенням центральних різців, що потребує індивідуального підходу в діагностиці та плануванні лікування.

Ключові слова: мезіальний прикус, зуби, ортодонція, нижня щелепа, череп.

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The agenesia of the upper lateral incisors is a fairly common anomaly in the development of dentition, which affects the formation of correct occlusal and aesthetic relationships in patients. The presence of this pathology in patients with a mesial occlusion, characterized by a shift in the ratios of the dentition towards a violation of the harmony of the facial skeleton, significantly complicates both the diagnosis and the development of treatment approaches [5, 9]. However, despite a wide range of studies in the field of orthodontics and maxillofacial surgery, the specific features of the structure of the facial skull in such patients are still insufficiently studied. This is especially true when the agenesia of the lateral incisors is combined with a mesial occlusion and a normal position of the mandible [2, 6].

Most scientific works have focused on the treatment aspects of mesial occlusion or lateral incisor agenesia separately. However, the issue of the relationship between the absence of lateral incisors and the development of the facial skeleton in patients with mesial occlusion requires further research. Such a combined pathology can lead to serious changes in the development of the dentition and affect the overall proportions of the facial skull, which complicates the diagnosis and the development of effective approaches to its treatment [9].

In addition, there is a lack of data on the characteristics of the correspondence of the size of the teeth and dentition of the upper and lower jaw in patients with such anomalies, especially in the context of

a mesial occlusion with a normal mandible position [10, 11]. The study of these aspects is extremely important since the harmonious development of the maxillofacial skeleton and correct occlusal relations are the key not only to the aesthetic appearance but also to the functional health of the patient [8]. The lack of scientific data on the anthropometric parameters of the skull and the ratio of tooth sizes in such patients makes this study relevant and important for further developing diagnostic approaches and improving the efficacy of treatment [7].

Thus, further research aimed at studying these anthropometric and occlusal aspects can provide new data that will contribute to the development of more accurate methods of diagnosis and treatment of patients with upper lateral incisor agenesis in mesial occlusion, which is an important task of modern orthodontics and maxillofacial surgery [3, 4].

The purpose of the study was to establish the characteristics of the correspondence of the size of the teeth and dentition of the upper and lower jaw and the structural features of the facial skull in patients with agenesis of the upper lateral incisors in the mesial occlusion.

Materials and methods. The study involved 55 patients who applied to the Department of Orthodontics of the Bogomolets National Medical University aged 9 to 23 years with agenesis of both lateral incisors of the upper jaw, no transverse anomalies and a mesial occlusion (Engle class III) with normal mandibular position. Patients were divided into 3 groups:

- Group I – 17 patients with an overbite, aged 9 to 12 years;
- Group II – 23 patients with a permanent bite and incomplete growth, aged 13 to 18 years. Growth was determined in five patients by hand radiographs, in 18 patients – by the shape of the cervical vertebrae on lateral telerradiography (TRG);
- Group III – 15 patients with complete growth, aged 19–23 years. Lateral TRG confirmed complete growth.

The inclusion criteria were bilateral absence of lateral maxillary incisors, absence of transverse anomalies, and mesial occlusion with normal SNB angle. The selected patients were divided into the following groups:

Subsequently, for each patient, the values of the basic set of diagnostic data were determined, which included: gender, analysis of diagnostic models according to Bolton (1962) to exclude the mismatch of the sizes of the upper and lower teeth (in a permanent bite), the values of the angles SNA, SNB, ANB on the lateral TRG, the angle of inclination of the upper central incisors to the plane of the upper jaw on the lateral TRG, and the WITS score.

The results were processed using variational statistical methods of analysis using Microsoft Office Excel 2016 software. Statistical processing of the experimental study results was carried out by the methods of variation analysis using the Student's test. The difference was considered statistically significant at $p < 0.01$ [1].

Results of the study and their discussion. The analysis of the results of measuring the diagnostic models of the jaws before treatment in patients with a permanent bite (groups II and III), who had agenesis of the upper lateral incisors and mesial occlusion, shows significant deviations in the formation of the dentition and the position of individual teeth. All patients demonstrated abnormalities in the shape and size of the dentition, which was manifested in their narrowing and shortening. According to the Pon and Korkhaus methods, these patients were characterized by narrowing of the upper jaw dentition in the area of premolars and molars, as well as narrowing of the apical base of the jaws according to the Snagina method. In particular, the narrowing of the upper dentition in the area of premolars averages 3.8 ± 0.23 mm, which is a significant indicator, and in the area of molars – 1.4 ± 0.10 mm. This indicates an insufficient development of the upper jaw, which leads to a violation of the harmony of occlusal relations.

In addition, patients had a narrowing of the lower dentition. In the area of premolars, it averaged 2.2 ± 0.16 mm, and in the area of molars – 0.85 ± 0.44 mm. Such indicators indicate that the agenesis of the lateral incisors affects not only the upper jaw, but also the position and shape of the teeth of the lower jaw. The shortening of the anterior part of the upper dentition averaged 3.9 ± 0.15 mm, which is a sign of limited development of the anterior part of the jaw. There was also a narrowing of the apical base of the upper jaw, which averaged 2.2 ± 0.07 mm, confirming the presence of skeletal anomalies in this group of patients.

To evaluate the correspondence of the sizes of the anterior teeth (anterior ratio index) of the upper and lower jaws in patients with upper lateral incisor agenesis, 76 diagnostic models were measured using the Bolton method. The measurements were performed on 38 patients from groups II and III. In the first subgroup, the anterior ratio index was not calculated because this index is intended for patients with a permanent bite. The results of the analysis of the anterior ratio index in patients of the second and third

subgroups showed no significant discrepancies in the size of the anterior teeth of the upper and lower jaw, which indicates the preservation of proportions between the sizes of the teeth in the anterior group.

In calculating the indices, a special coefficient was used to determine the width of the lateral incisors based on the width of the central incisors using a coefficient of 0.7. This approach allows to obtain more accurate measurement results, especially in cases of absence of lateral incisors. The systematized diagnostic data by patient groups are presented in Table 1, which allows comparing the results of the study between different groups and getting an idea of the nature of changes in each group.

Table 1

Mean values of initial diagnostic data in patients with lateral incisor agenesis and mesial occlusion, M±m

Index	Group I	Group II	Group III
Gender: male	70.6 %	52.2 %	40.0 %
female	29.4 %	47.8 %	60.0 %
Narrowing in the area of upper molars, mm	–	0.8±0.09	2.0±0.12
Narrowing in the area of upper premolars, mm	–	3.2±0.10	4.4±0.13
Narrowing in the area of lower molars, mm	–	0.6±0.08	1.1±0.81
Narrowing in the area of lower premolars, mm	–	2.0±0.21	2.9±0.11
Shortening of the upper dentition, mm	–	3.2±0.16	4.7±0.14
Narrowing of the apical base of the upper jaw, mm	–	1.7±0.02	2.8±0.13
Anterior ratio index by Bolton	–	69.4±2.3 %	79.8±3.4 %
SNA, degrees	77.3±2.2	76.1±4.4	75.5±3.8
SNB, degrees	78.8±3.1	79.1±2.5	77.9±2.2
ANB, degrees	-1.6±0.3	-2.8±0.2	-3.7±0.4
Central incisor curvature, degrees	109.2±1.1	105.1±2.6	103.1±3.1
WITS, mm	0.2±0.07	-1.1±0.4	-2.3±0.2

The analysis of the initial diagnostic data in the patient subgroups showed that in the youngest first subgroup, which included patients with a variable occlusion, moderate pathological changes prevailed. In particular, the values of the central incisors were almost normal, indicating the absence of significant deformities in this age group. The WITS values used to assess the sagittal occlusal relationship in the first subgroup corresponded to direct contact of the cutting edges of the upper and lower incisors, which confirms the stability of the occlusal relationship in the anterior region. The mean value of the ANB angle in this group was $-1.6\pm 0.3^\circ$, indicating moderate disturbances in the jaw relationship characteristic of the mesial occlusion. These data indicate that patients in this subgroup are at the initial stage of skeletal pathology development, when the changes have not yet reached significant severity.

In patients of the second subgroup, which included individuals with a permanent bite and incomplete growth, the changes were more pronounced compared to the first subgroup. The average narrowing of the upper dentition in the premolar region was 3.2 ± 0.10 mm, which indicates a significant narrowing compared to normal anatomical parameters. In the area of molars, these indicators were slightly lower, but also significant – 0.8 ± 0.09 mm. This narrowing reflects not only a violation of the development of the dentition, but also affects the harmony of occlusal relationships. The shortening of the anterior section of the upper dentition is also important, with average values equal to 3.2 ± 0.16 mm, which indicates a lack of space for the correct placement of the anterior teeth. This shortening significantly affects the functional capabilities of the dentition, in particular, the efficiency of chewing and occlusal contacts. In addition, in this subgroup, there was a narrowing of the apical base of the maxilla, the average values of which were 1.7 ± 0.02 mm, which confirms the insufficient development of the jaw in these patients.

The ANB angle in the patients of the second subgroup had a mean value of $-1.8\pm 0.09^\circ$, which indicates a more pronounced mesial jaw relationship, characteristic of patients with a progressive mesial occlusion. Reverse overlap in the anterior region was also recorded, which is confirmed by the average values of the WITS index, which were -1.1 ± 0.4 mm. This indicates a displacement of occlusal contacts, which is a characteristic feature of the mesial occlusion in this subgroup of patients.

In the patients of the third subgroup, who had completed growth, the changes in the indicators were even more pronounced and corresponded to the classical picture of a skeletal mesial occlusion. The narrowing of the upper dentition in the premolar area was the largest and amounted to 4.4 ± 0.13 mm, which is an important indicator for the diagnosis of serious anomalies in the development of the jaw. In the area of molars, these indicators also remained at a high level – 2.0 ± 0.12 mm, which confirms the systematic disruption of dentition development in this group of patients. The shortening of the upper dentition was on average 4.7 ± 0.14 mm, which was significantly higher than in patients with incomplete growth. This shortening significantly affects the functionality of the dentition and increases the risk of developing additional occlusal disorders. Together with the narrowing of the apical base of the upper jaw, the average values of which were 2.8 ± 0.13 mm, these indicators indicate significant disorders in the formation of the skeletal structure of the jaws in patients of this subgroup.

The ANB angle in the patients of the third subgroup was $-2.8 \pm 0.2^\circ$, which confirms the presence of a pronounced mesial occlusion. In addition, the WITS values in this group were significantly lower, amounting to -2.3 ± 0.2 mm, indicating a significant displacement of occlusal contacts and emphasizing the severity of occlusal disorders in these patients. These data indicate that pathological changes in patients with completed growth are more pronounced and require special attention when planning treatment. The obtained results confirm the importance of analyzing structural changes in patients with mesial occlusion and agenesis of the upper lateral incisors, as these anomalies have a significant impact on the overall development of the dentition. In particular, our data indicate a narrowing and shortening of the upper dentition, which is consistent with the findings of previous studies on the impact of serious orthodontic disorders on the quality of life of patients [5, 9]. In our case, the narrowing of the upper dentition in the area of premolars and molars was observed in all patients with severe signs of mesial occlusion, which indicates the need for timely intervention to correct such anomalies. In addition, the detected changes in occlusal ratios in patients with mesial occlusion confirm the impact of malocclusion on the motor function of the jaws and chewing activity. This is in line with previous studies that have shown that severe malocclusion can significantly affect the functional capabilities of patients [2]. This is especially true for patients of the third group, who had more pronounced structural changes, which confirms the progression of the pathology with age. The narrowing of the apical base of the maxilla is also one of the key indicators of underdevelopment of the jawbone in patients with a mesial occlusion. The detected narrowing of the base in our sample correlates with previous studies that emphasize the importance of correcting these disorders at an early age to prevent further complications [10]. An important aspect is the fact that in patients with completed jaw growth, the changes were most pronounced, which confirms the need for early orthodontic intervention. This is also consistent with studies showing that late orthodontic treatment is less effective in correcting serious structural anomalies, such as mesial occlusion [6]. Thus, the results emphasize the need for early diagnosis and treatment planning for patients with mesial occlusion and upper lateral incisor agenesis to prevent further development of pathology and reduce patients' quality of life [11].

Conclusions

1. In patients of the second and third groups with agenesis of the upper lateral incisors and mesial occlusion, there is a significant narrowing and shortening of the upper jaw dentition, especially in the area of premolars and molars, as well as narrowing of the apical base of the upper jaw.
2. The mean values of the ANB angle and the WITS index in patients of the second and third groups indicate the presence of a skeletal mesial occlusion, accompanied by occlusion disorders and malposition of the central incisors, which requires an individual approach to diagnosis and treatment planning.
3. In patients of the third group with completed growth, more pronounced changes in the indicators are observed, which indicates the progression of skeletal anomalies with age and emphasizes the need for timely correction of dentoalveolar pathology.

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