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INDICES AND DIAGNOSTIC GUIDELINES FOR PATIENTS WITH TRANSVERSE MALOCCLUSION

323.01 – STOMATOLOGY

Summary of Doctor of Medical Sciences Thesis

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The thesis was developed within the Orthodontics Department of the State University of Medicine and Pharmacy "Nicolae Testemițanu" and at the dental clinic "Orto-Dental" S.R.L.

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Public discussion of PhD dissertation will take place on 30.11.2023, at 14:00 at the State University of Medicine and Pharmacy "Nicolae Testemițanu," 165 Ştefan cel Mare şi Sfânt Blvd., office 204 during the public discussion session of the doctoral thesis, approved by the decision of the Scientific Council of the Consortium on 5.10.2023 *(minutes no.22)*.

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Relevance and Importance of the Topic Addressed

Dento-maxillary anomalies (DMAs) represent conditions that manifest as disruptions in the growth and development of the dental system or jaw bones. These disruptions can be congenital in nature or may occur later, significantly impacting the balance of dental arches and occlusion. The causes of DMAs are diverse and cover a wide range of factors that act during the pre- and postnatal morphogenesis process [1]. According to data from the World Health Organization (WHO), DMAs rank third in frequency after dental caries. Epidemiological investigations conducted by various researchers in different countries indicate that the prevalence of these anomalies is on the rise and can be identified at various stages of life [2].

The increasing frequency of DMAs, determined by the frequent visits of patients to orthodontists, has led to the need for epidemiological studies of these pathologies. The incidence of DMAs in the Republic of Moldova is increasing, and previous studies suggest the need for more in-depth research to detect this pathology and determine the predisposing factors for DMAs [3]. From global literature sources, it has been observed that the prevalence index of the population affected by DMAs varies depending on dentition. In the deciduous dentition, it varies as follows: Denmark - 14.6%, Germany - 50.2%, Canada - 66.1%, Russia - 24%, Romania - 40%. The prevalence index of DMAs in mixed dentition also exhibits significant variations: England - 37.5%, India - 38.9%, Russia - 49%, Romania - 75% [1, 4, 5]. In permanent dentition, it has been found that the prevalence of DMAs in 14-year-old children in Romania is 73.6%, while in Russia, the prevalence index is 35%. In the Republic of Moldova, a prevalence of approximately 25.2% of DMAs was determined in adolescents aged 16-17 in 2001.

Epidemiological studies conducted in Romania (2003) by various authors have highlighted a wide prevalence of DMAs in different regions, providing the following data: 41.9% (Schapira); 46.7% (Câmpeanu M.); 40% (Boboc Gh.); 50-60% (Cocârla E.); 75% (Firu P., Rusu M.). Valentina Dorobăți and her colleagues (2007) identified a frequency of 71.6% for DMAs [6]. According to global statistics, the frequency of DMAs in adolescents and adults aged 15 to 21 varies between 41.1% and 95.3%, with transverse malocclusions having an incidence ranging from 2.7% to 23.3% [3, 7].

Transverse malocclusions (TM) are characterized by narrowing of the superior jawbone and are one of the most common skeletal conditions in the maxillofacial region and the most frequent deformity of the upper jaw [1, 4]. They are caused by incongruent development of the jaw bones, midline deviations of dental arches in asymmetrical lateral areas, isolated dental misalignments, conduct slopes, lateral shifts, and nasal respiratory disorders. Children in the active phase of growth and development rely on physiological habits as stimuli for maxillary development. Maladaptive habits (such as thumb-sucking, lip-biting, nail-biting, bruxism, mouth breathing) can interfere with dental structure and may be part of the aetiology of transverse malocclusions, which can disrupt muscular force balance and affect the normal functional aesthetics of the entire stomatognathic system [8].

According to epidemiological research conducted by multiple teams of authors from various countries, there is an increasing trend in the prevalence of acquired DMAs as a consequence of respiratory disorders, which can be identified at different stages of life [5].

Numerous studies have shown that people with TM are at increased risk of worsening quality of life. They are more likely to experience impairment in all three aspects of functional status:

social, psychological and physical. In particular, these patients also have upper airway disorders in their medical history [7].

Increasingly, more studies indicate that environmental factors can play a significant role in facial and dental development and can modify the phenotype. According to epidemiological studies, the prevalence of mouth breathing in children and adolescents can be as high as 55% (Cavassani V.G.S., 2003; De Menezes V.A. et al., 2006; Felcar J.M. et al., 2010). Depending on its duration, mouth breathing can lead to numerous functional, structural, postural, and behavioural changes, including in the maxillary system, which is closely structurally and functionally related to the upper airways (Abreu R.R. et al., 2008; Nunes W.R., Di Francesco R.C., 2010). Children with nasal breathing difficulties have a 2-2.5 times higher risk of developing DMAs (Mannanova F.F., 1981; Emmerich A. et al., 2004; De Menezes V.A. et al., 2006). The distance between the lateral walls of the nasal cavity and the nasal septum is often reduced in transverse malocclusions. This reduction increases the resistance of nasal airflow and leads to nasal breathing difficulties [8, 9].

Therefore, children with long-term nasal respiratory insufficiency may develop long and narrow faces, narrow arches, high palatal vaults, dental malocclusions, gummy smiles, and other unattractive facial features. Most of these children are misdiagnosed with Attention Deficit Disorder (ADD) and hyperactivity [10]. Specialized literature has shown a correlation between mixed breathing and the type of facial growth in humans. McNamara, for instance, found a relationship between upper airway obstruction and deviant facial growth.

Nasal breathing is essential for the production of nitric oxide. Nitric oxide inhaled through nasal breathing participates in efficient oxygen exchange and increases blood oxygen by 18%, also improving lung capacity for oxygen absorption. Nitric oxide is a potent vasodilator and neurotransmitter that enhances oxygen transport throughout the body and is vital for all organs. Nitric oxide is extremely important for overall health and the efficiency of smooth muscles, such as blood vessels and the heart. Mouth breathing has a lower oxygen concentration in the blood compared to those who breathe through their nose. Low blood oxygen concentration has been associated with high blood pressure and heart failure [7].

Depending on its duration, mouth breathing can cause numerous functional, structural, postural, and behavioural changes, directly affecting the development of the dento-maxillary system. Many DMAs associated with nasal breathing disorders have a higher risk of relapse after orthodontic treatment (Akopyan V.L., 2008; Oltramari P.V.P. et al., 2007). The influence of nasal obstruction, which leads to changes in the oral and maxillofacial region (Gvozdeva Yu.V., 2010), remains insufficiently elucidated. Specialized literature lacks comprehensive works on this subject. Therefore, addressing these questions will allow for a deeper understanding of the aetiology and pathogenesis of DMAs, the influence of nasal breathing disorders, and the determination of optimal terms for orthodontic treatment, its types, as well as the possibility of preventing relapses.

Goal: To determine additional diagnostic criteria in patients with transverse malocclusion through the assessing of the impact of nasal breathing disorders.

Objectives:

1. Determine predisposing factors and study the prevalence of nasal respiratory disorders in patients with transverse malocclusion.
2. Study clinical and anthropometric changes in the stomatognathic apparatus in patients with transverse malocclusions by evaluating the trans nasal airway passage.

3. Conduct a comparative evaluation of the patterns of transverse malocclusion manifestation based on clinical, biometric, cephalometric parameters, and nasal breathing volume.
4. Developing the algorithm for the diagnosis and multidisciplinary treatment approach of transverse malocclusion.

Research Hypothesis: The research hypothesis arises directly from the study's purpose and consists of determining additional diagnostic criteria in patients with transverse malocclusion by assessing the impact of nasal breathing disorders.

Theoretical Significance of the Research: The methods of cephalometric analysis of facial aesthetic changes have been optimized through the use of postero-anterior teleradiography, yielding novel data regarding the characteristics of the stomatognathic system in patients with transverse malocclusion with/without nasal respiratory disorders. The scientific novelty with significant elements of originality consists of the comparative analysis of orthodontic indices and nasal breathing volume in patients with transverse malocclusion, highlighting predisposing factors. A groundbreaking predictive method has been developed, highlighting the dependent value of cephalometric, biometric indices, and the summary respiratory volume in relation to the age and gender of the respondents for the first time. We have highlighted the characteristics of transverse malocclusion, a joint manifestation pattern, by determining the preferred chewing side based on mandibular kinematics recording. We have devised the diagnostic algorithm for children with transverse malocclusion, with nasal respiratory disorders, by combining paraclinical examination and anterior rhinomanometry, which will contribute to the planning of multidisciplinary management.

Practical Value of the Study: The importance of a comprehensive assessment of the morpho-functional state of the stomatognathic apparatus in patients with transverse malocclusions with and without nasal respiratory conditions was highlighted. Additional diagnostic criteria for transverse malocclusions in orthodontic patients were determined, which will contribute to optimizing treatment methods and improving the quality of life for children. The necessity of developing a diagnostic algorithm for transverse malocclusions was argued, along with practical recommendations.

Approval of Thesis Results. The results obtained in the thesis have been approved and presented at various scientific conferences and congresses, both nationally and internationally. These scientific events included:

The National Scientific and Practical Conference with International Participation dedicated to the 90th anniversary of the eminent scientist Nicolae Testemițanu. This event took place in Chișinău, Republic of Moldova, on September 29, 2017. The Congress organized on the occasion of the 75th anniversary of the founding of Nicolae Testemițanu State University of Medicine and Pharmacy. This congress was held in Chișinău, Republic of Moldova, from October 21 to 23, 2020. The Medespera Congress, which took place from May 12 to 14, 2022, provided a valuable platform for presenting and discussing the thesis results. During the Annual Scientific Conference of the Nicolae Testemițanu Institute of Medicine and Pharmacy (IP USMF), held in Chișinău, Republic of Moldova, on October 19-20, 2016, the opportunity was provided to present and discuss the research results. The Conference dedicated to the days of Nicolae Testemițanu State University of Medicine and Pharmacy, which took place from October 15 to 19, 2018, in Chișinău, Republic of Moldova. The International Medical Congress for Students and Young Doctors, MedEspera, held from September 24 to 26, 2020, in Chișinău, Republic of Moldova. The Conference dedicated to the days of Nicolae Testemițanu State University of Medicine and Pharmacy in 2021. The event took place from October 20 to 22 and provided an ideal platform for presenting advances in my specialized field. The approval of the thesis topic occurred during the meeting of the Scientific Council of Profile 323.01 Dentistry on February 1, 2017 (Minutes No. 8). A favourable opinion was received on December 13, 2016, under No. 37, and the research protocol for the thesis topic was approved by the Research Ethics Committee of USMF "Nicolae Testemițanu". The results were approved at the Department of Orthodontics meeting of the "Nicolae Testemițanu" State University of Medicine and Pharmacy on August 25, 2023 (minutes No. 1).

The volume and structure of the thesis: The work consists of 109 pages of printed text and includes an introduction, 3 chapters, general conclusions, practical recommendations and as well as a bibliography with 93 references. The illustrative material comprises 45 figures, 14 tables, and 1 scheme.

Keywords: transverse malocclusion, paraclinical examination, comparative analysis, clinical protocol.

1. THE CONCEPT OF DIAGNOSIS FOR TRANSVERSE MALOCCLUSIONS

Another important role in the onset and development of transverse anomalies is attributed to respiratory conditions. According to literary sources, a correlation has been established between the development of transverse malocclusion (MT) and recurrent and chronic inflammatory pathology of the paranasal sinuses. The anatomical and physiological features of the nose and paranasal sinuses in children, frequent viral respiratory infections, adenoid hypertrophy, chronic rhinosinusitis, and hypertrophic nasal rhinitis are contributing factors to the increased incidence of MT development [6, 11].

The necessity for an objective assessment of nasal breathing in the diagnosis, treatment, and its effectiveness in patients with MT is currently supported by both practicing physicians and scientific researchers. This can be biologically explained by the fact that nasal airway obstruction leads to changes in head posture, maxillary development, and tongue position. During predominantly mouth breathing, the head is tilted backward, while the mandible and tongue are lowered. This can alter muscular balance, thus affecting pressure on the entire dento-maxillary apparatus [12, 13].

Therefore, it has been determined that respiratory airway-related conditions (ACRS) are risk factors for the development of malocclusion and/or craniofacial morphology alterations, based on longitudinal studies in growing patients.

2. MATERIALS AND RESEARCH METHODS

2.1. General Description of the Research

The study was conducted within the Orthodontics Department of Nicolae Testemițanu State University of Medicine and Pharmacy (USMF) and the "Orto-Dental" dental clinic from 2015 to 2022. The study included 201 patients aged 7-18 years, consisting of 120 females (59.7%) and 81 males (40.3%) with transverse malocclusions. The patients were divided into 2 study groups based on the type of malocclusion they presented.

As a result, they were assigned to T0 and T1. Group T0 comprised 92 patients (45.8%) with non-ENT (Ear, Nose, and Throat) related transverse malocclusions, and Group T1 consisted of 109 patients (54.2%) with transverse malocclusions associated with nasal respiratory conditions (table 1). Patients in the T1 group underwent additional investigations at the Department of Otorhinolaryngology within the Republican Clinical Hospital for Children "Emilian Coţaga," State University of Medicine and Pharmacy "Nicolae Testemiţanu," where they were examined by an otorhinolaryngologist, and nasal patency was assessed using the ATMOS PC 2000 Rhinomanometry apparatus (Germany).

Table 1. **Distribution of Investigated Patients by Study Groups and Gender**

Variable	**N = 201**[1]	**95% CI**[2]
Gender		
F	120 (59.7%)	53%, 66%
M	81 (40.3%)	34%, 47%
Age	12.2 (3.5)	12, 13
Residence		
Rural	105 (52.2%)	45%, 59%
Urban	96 (47.8%)	41%, 55%
Study Groups		
T0	92 (45.8%)	39%, 53%
T1	109 (54.2%)	47%, 61%
Nasal Hypertrophic Rhinitis (NHR)	10 (5.0%)	2.5%, 9.2%
Deviated Nasal Septum (DNS)	57 (28.4%)	22%, 35%
Chronic Rhinosinusitis (RSN)	22 (10.9%)	7.1%, 16%
Hypertrophy of adenoid vegetation (HVA)	20 (10.0%)	6.3%, 15%

Patients were included in the study based on a set of inclusion and exclusion criteria, which helped to better define the study and focus it on a specific representative group.

Inclusion Criteria:

1. Patients with transverse malocclusions during the mixed and permanent dentition period.
2. Patients with chronic and recurrent respiratory conditions of the nose and paranasal sinuses.
3. Subjects included in the study were of both sexes, from both rural and urban environments.
4. Patients residing in the territory of the Republic of Moldova.
5. Patients aged between 7-18 years.
6. Informed consent from parents to participate in the study.

Exclusion Criteria:

1. Congenital craniofacial malformations.
2. Skeletal facial asymmetries.
3. Severe temporomandibular joint dysfunction.
4. Acute neuromuscular conditions.
5. Adult patients.
6. Refusal of participation by parents and/or children.

2.2. Research Methods

The following methods were used to determine the indices and diagnostic procedures for transverse malocclusion:

1. Clinical Examination: Both extra-oral and intra-oral examinations were conducted.
2. Paraclinical Examination:

- Photometric examination
- Digital biometric study using Maestro 3D Ortho Studio software
- Radiological examination: Orthopantomography and lateral and posteroanterior cephalometry using Downs, Tweed-Merifeld, and Ricketts methods
- Cone-beam computed tomography (CBCT)

3. MODJAW™ 4D Technology
4. Anterior Rhinomanometry

These methods were employed to determine and assess the indices and diagnostic procedures for transverse malocclusion.

Paraclinical Examination

During the clinical examination of the respondents from groups T0 and T1, an internationally standardized form (FDI) was used for their assessment. The examination included the following steps: collection of data from the patient's history, evaluation of the type of occlusion, determination of joint conditions, and palpation of masticatory muscles; facial examination, which assessed the growth pattern, degree of labial competence, and facial symmetry in relation to the specific malocclusion; photometric examination, utilizing the Izard method for analysis.

For patients in group T1, additional medical history was collected, revealing complaints related to the location of the pathological process. Information about the duration of the disease, causes of onset, treatments received, personal and family history, and nasal patency assessment were all recorded. Nasal patency assessment was conducted using the ATMOS PC 2000 rhino manometer (Germany), guided by the standard simple menu, printer, and integrated display. The results of functional rhinomanometry differed statistically between the study groups, indicating the significant diagnostic value of this examination.

Paraclinical investigations also included computerized tomography. The patient was positioned supine in hyperextension. The device was angled to ensure that the section plane was perpendicular to the line connecting the external auditory canal and the external angle of the eye. The density scale ranged from -1000 (air) to +1000 (bone) Hounsfield units (HU). Sections of 3 mm were made in the osteomeatal complex area. Computerized tomography provided information about the involvement of paranasal sinuses, the extent of sinus inflammatory processes, and the interrelationships of structures within the osteomeatal complex, which is crucial for interdisciplinary diagnosis.

Radiological Examination

Radiological examination was performed for each patient, including orthopantomography, lateral teleradiography and posteroanterior teleradiography. The acquisition process was standardized following the protocol of the CARESTREAM CS 9000C 3D PANOREX + CEPH X-ray machine (64 kV at 10 mA, exposure time of 17.9 seconds), while adhering to the ALADA principles (As Low as Diagnostically Achievable) and the protocol of the International Commission on Radiological Protection. During exposure, the patient's head was in an orthostatic position (Natural Head Position/NHP), stabilized with supports. Subsequently, each radiological examination was exported in DICOM format.

In the postero-anterior teleradiography (a), several parameters were analysed, including the interzygomatico-frontal suture plane, interzygomatic arch plane, interjugal plane, occlusal plane, interantegonial plane, mentonian plane, midline analysis, and mandibular triangle. On the other hand, in the lateral teleradiography analysis, the maxillo-mandibular relationship was evaluated using the following angles: SNA (normal A-P position of the maxilla), SNB (normal A-P position of the mandible), ANB, IMPA (lower incisor inclination), FMA (facial pattern).

The postero-anterior teleradiography included the study of the following landmarks: jugale (J) at the level of the jugal process, the intersection between the contour of the maxillary tuberosity and the zygomatic bone; antegonion (AG) at the level of the antegonial region, the lower lateral edge of the antegonial protuberance (figure 1). The differences (AG. AG/J. J) between maxillary and mandibular widths were calculated.

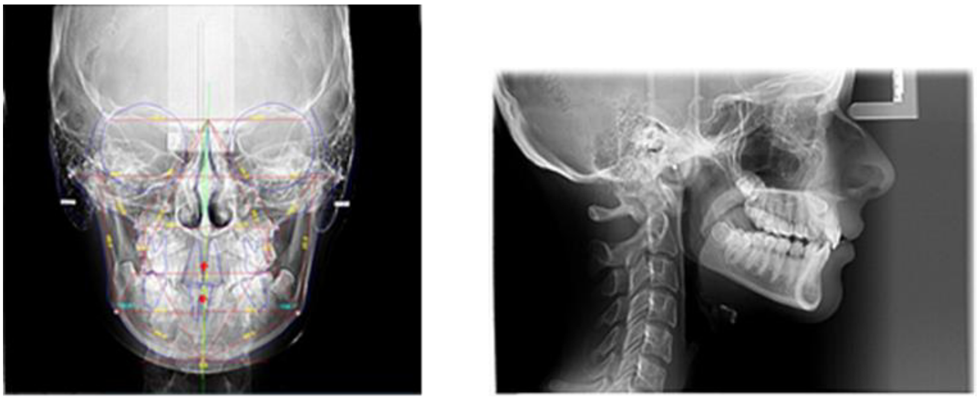


Figure 1. **Postero-anterior and Lateral Teleradiography**

Direct scanning of dental arches

Direct scanning (figure 2) was performed using the intraoral scanner MEDIT i700, with an accuracy of 11μm per arch, after which they can be exported in STL format.

a  b 

Figure 2. **MEDIT i700 intraoral scanner (a) and dental arches in occlusion (b)**

The processing of these digital images is carried out through specialized software, which converts the data into a three-dimensional model of the dental arches. This digital model provides an accurate representation of the teeth and their relationships within the dental arch.

2.3. Mathematical-Statistical Processing

The collected data were processed using the Rstudio program, where mean values with standard deviation, median with interquartile range, minimum, and maximum values were estimated. Correlational analysis was performed by applying Fisher's exact test, Wilcoxon rank, Kruskal test. G*Power 3 output supplemented by the estimation of 95% confidence intervals, with visualization performed through the correlation diagram displaying the data distribution and correlation coefficient values. Statistical analysis was conducted in several stages, according to the research design. In all types of statistical analysis, data were considered significant for $p < 0.05$.

3. COMPARATIVE EVALUATION OF DIAGNOSTIC CRITERIA FOR TRANSVERSE MALOCCLUSIONS

3.1. General Results of Study Groups

The study included 201 patients aged between 7 and 18 years. Patients were divided into 2 study groups based on transverse malocclusion and nasal airway conditions detected during the initiated study (figure 3).

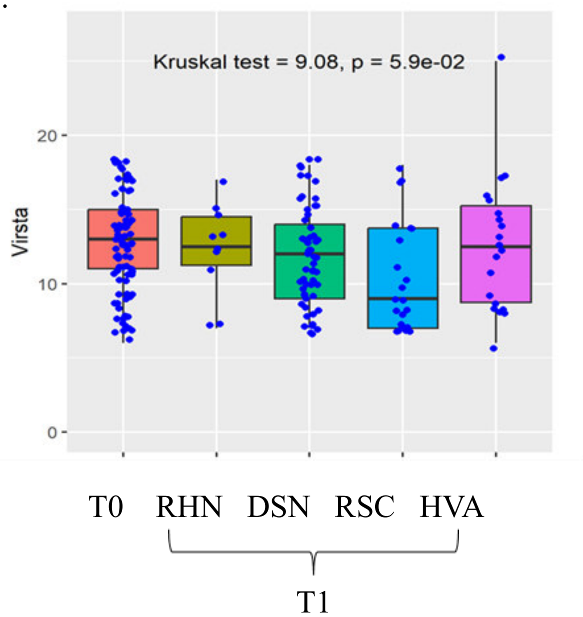


Figure 3. **Graphical visualization using a bar plot of study groups based on patients' age and upper respiratory tract conditions**

This correlation indicates that in group T1, patients with transverse malocclusion associated with upper respiratory tract conditions. This phenomenon determined that the female gender prevails in patients with nasal hypertrophic rhinitis (83%) and chronic rhinosinusitis (64%), while in the male gender, there was a higher incidence in patients with deviated nasal septum (57%) and hypertrophic of adenoid vegetation (61%).

Furthermore, the female gender had a higher rate of seeking medical attention compared to the male gender Based on the research, the incidence of upper respiratory tract conditions was studied according to the residence permit. This correlation did not identify statistically significant differences between the study groups (figure 4).

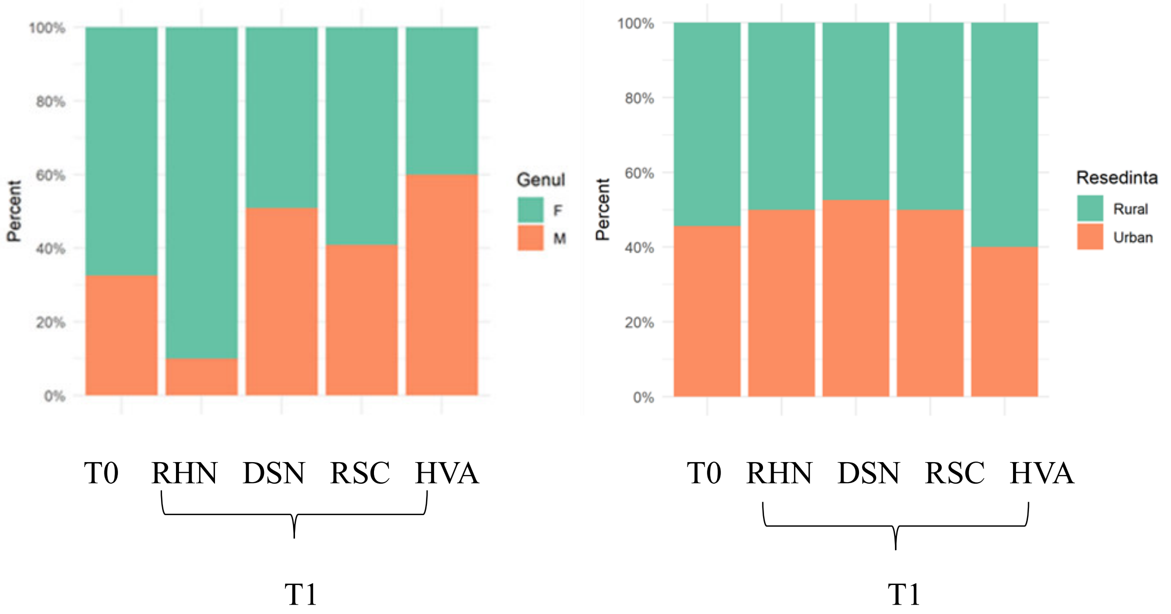


Figure 4. **Distribution by gender and by residence of patients with and without nasal respiratory conditions**

The height and width of the face were also determined and evaluated for each respondent based on the three patterns of transverse malocclusion. The correlative analysis of facial width and height, where the IZARD zy-zy values (p=0.053) did not identify statistically significant differences in the dentoalveolar manifestation pattern, but the IZARD N-ME value was statistically significant (p=0.001) (figure 5).

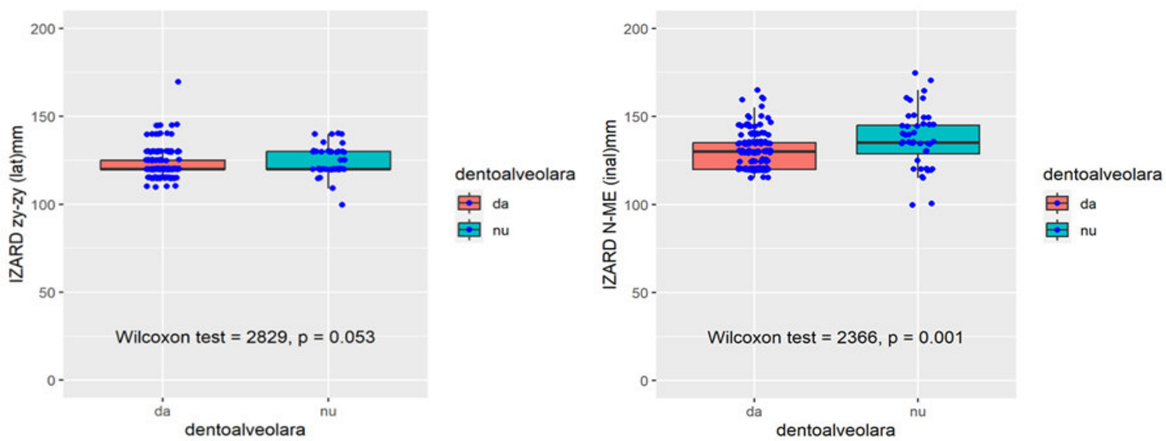


Figure 5. **Correlative analysis of facial width (a) and height (b) according to IZARD, by dentoalveolar manifestation pattern**

According to the Wilcoxon test, a comparative evaluation was made between the research groups, which did not reveal a statistically significant difference in facial width (p=0.197) and facial height (p=0.595) in the groups with the joint manifestation pattern (figure 6).

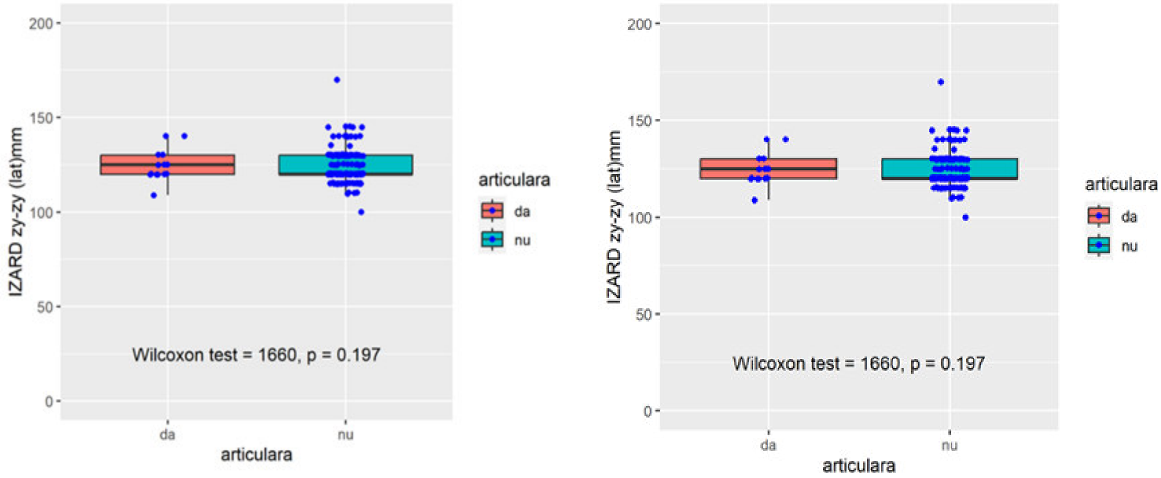


Figure 6. **Determination of facial width (a) and facial height (b) according to IZARD, by the joint manifestation pattern**

Comparative evaluation between the research groups for the gnathic manifestation pattern showed that facial width (p = 0.213) and height (p = 0) in this group did not exhibit statistically significant differences (figure 7).

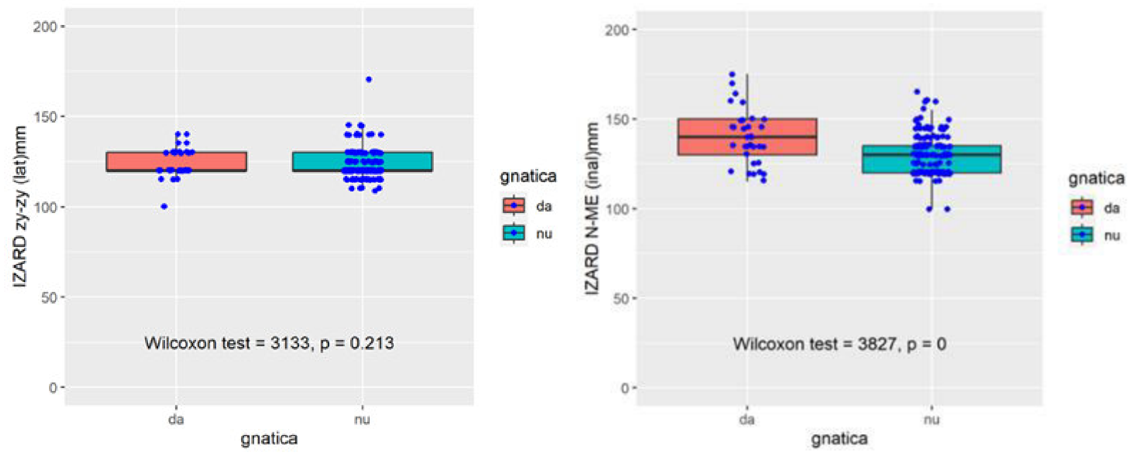


Figure 7. **Determination of facial width and facial height according to IZARD, by the gnathic manifestation pattern**

In the research, a comparative evaluation was conducted between facial symmetry and craniofacial growth patterns, revealing a prevalence of dolichocephalic shape (45%), which results from the impact of upper respiratory tract conditions. Brachycephalic shape was observed in 16% of cases, and mesocephalic shape in 20% of cases.

After assessing the growth pattern, the correlation between facial symmetry, in patients with transverse malocclusions was evaluated, taking into account all three craniofacial growth forms. It was found that the value was not significant in evaluating the dentoalveolar manifestation pattern (figure 8).

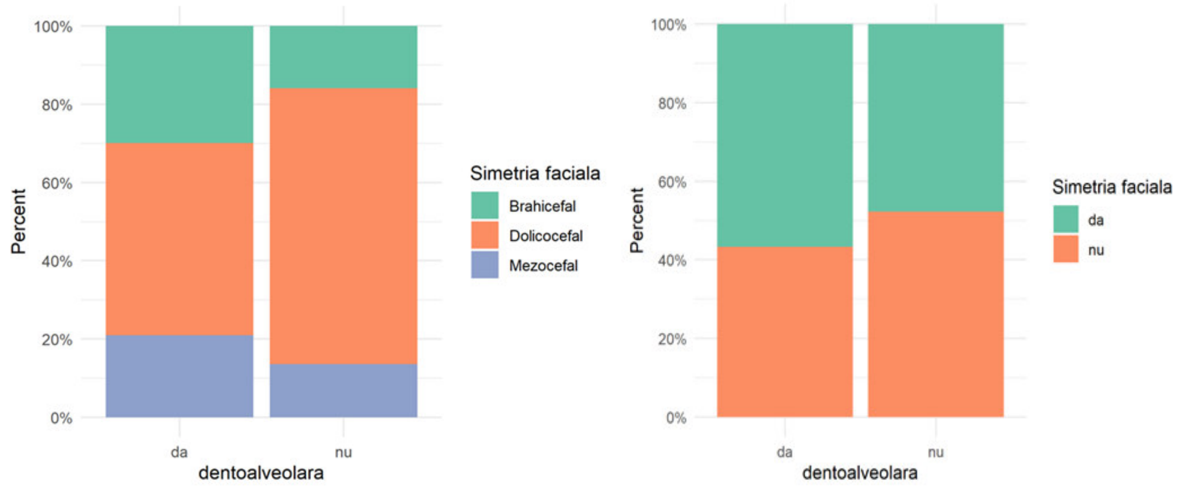


Figure 8. **Assessment of facial symmetry in all three types of craniofacial growth for the dentoalveolar manifestation pattern**

In patients with the joint manifestation pattern, a comparative evaluation was conducted between facial symmetry and craniofacial growth in both study groups, where facial symmetry was observed in 63% of dolichocephalic patients with the joint manifestation pattern. The brachycephalic form was found in 17% of cases, and the mesocephalic form in 20% of cases.

Facial symmetry in this manifestation pattern was reported in 60% of cases among the total respondents included in the study, while facial asymmetry was present in 40% of patients (figure 9).

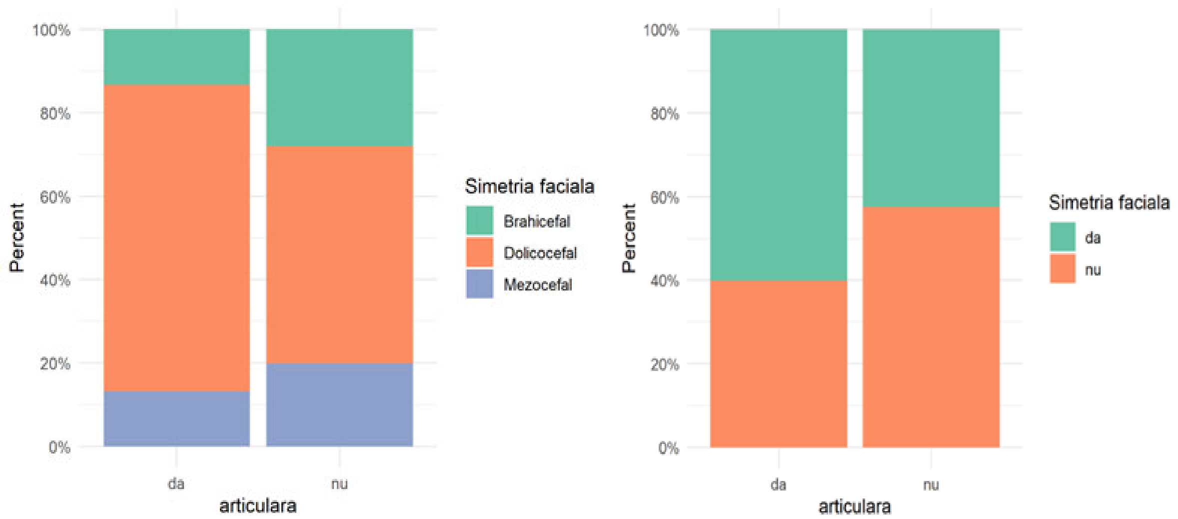


Figure 9. **Assessment of facial symmetry for all three types of craniofacial growth for the joint manifestation pattern**

The study was complemented by assessing the correlation between facial symmetry and the craniofacial growth type in patients with transverse malocclusions, gnathic manifestation pattern, where a prevalence of dolichocephalic growth was determined - 75% of cases, followed by brachycephalic growth - 15% of cases, while mesocephalic growth was present in only 10% of cases. After evaluating the growth type, facial symmetry and asymmetry were assessed in this manifestation pattern, where facial asymmetry was observed in approximately 80% of cases from the total respondents, and only 20% of cases exhibited facial symmetry in this manifestation pattern (figure 10).

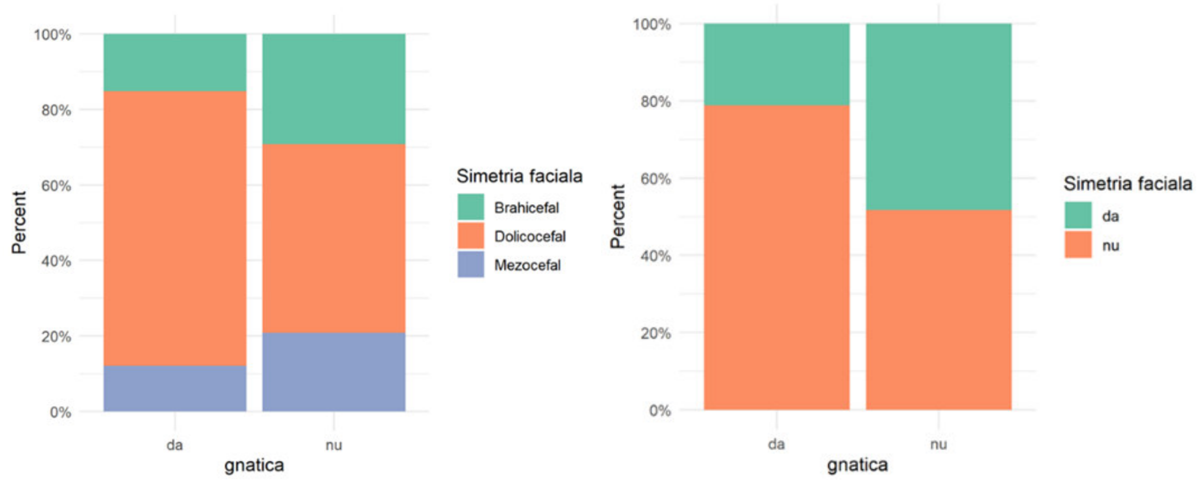


Figure 10. **Assessment of facial symmetry for all three types of craniofacial growth for the gnathic manifestation pattern**

In the study, biometric indices were analysed based on the authors Pont, Nance, Schwarz, and Korkhaus. Statistical analysis determined significant differences in certain groups of transverse malocclusions. Biometric indices were determined for all three patterns of transverse malocclusion: dentoalveolar, articular, and gnathic. A p-value <0.05 was considered statistically significant.

The biometric indices in the study were applied to all patients with transverse malocclusions, with or without upper airway conditions. Thus, inter-premolar and inter-molar widths were assessed for both maxillae (Pont), as well as the size and shape of dental arches, possible discrepancies between maxillae (Nance's perimeter), dental arch length (Korkhaus), and analysis of the length of lateral segments (Schwarz).

The results indicate that the study participants exhibited various patterns of transverse malocclusion. According to the evaluation, the dentoalveolar pattern was identified in 155 patients (78.1%), characterized by the influence of risk factors on maxillary transverse development.

The articular pattern was observed in 15 patients (7.5%) among the respondents, characterized by the absence of temporomandibular joint dysfunction during the growth period. The gnathic pattern was estimated in 31 patients (16.4%) based on general factors.

A significant finding is that approximately 91 (45.3%) of the total study participants exhibited facial asymmetry, while labial incompetence was identified in 113 (56.2%) patients.

Craniofacial growth was estimated with the following values: dolichocephalic - 108 cases (53.7%), brachycephalic - 54 cases (26.9%), mesocephalic - 39 cases (19.4%) (table 2).

Table 2. **Comparative Analysis of Manifestation Patterns and Craniofacial Growth**

Variable	**N = 201**[1]	**95% CI**[2]
Dentoalveolar		
Yes	155 (78.1%)	72%, 83%
no	46 (21.9%)	17%, 28%
articular		
yes	15 (7.5%)	4.4%, 12%
no	186 (92.5%)	88%, 96%

gnathic		
yes	31 (16.4%)	12%, 22%
no	170 (83.6%)	78%, 88%
Facial symmetry		
yes	110 (54.7%)	48%, 62%
no	91 (45.3%)	38%, 52%
Menton Deviation		
none	121 (60.2%)	53%, 67%
to the right	35 (17.4%)	13%, 24%
to the left	45 (22.4%)	17%, 29%
Lip seal		
yes	88 (43.8%)	37%, 51%
no	113 (56.2%)	49%, 63%
Facial shape		
Brachycephalic	54 (26.9%)	21%, 34%
Dolichocephalic	108 (53.7%)	47%, 61%
Mesocephalic	39 (19.4%)	14%, 26%

Furthermore, we performed a comparative analysis of respiratory conditions and biometric parameters indicating superior maxillary development deficiency. Specifically, for the dentoalveolar manifestation pattern, the following values were assessed as indicated in Table 2.

Patients with TCA without nasal respiratory conditions were identified in a percentage of 40.8%. The analysis reflects that patient with the dentoalveolar manifestation pattern presented nasal hypertrophic rhinitis - 7 cases (4.5%), nasal septum deviation - 49 cases (31.2%), chronic rhinosinusitis - 19 cases (12.1%), hypertrophy of adenoid vegetation - 18 cases (11.5%).

The analysis of posteroanterior cephalometry is an essential imaging investigation method, providing a detailed view of the position and relationships of maxillofacial structures. This radiologic diagnostic technology allows us to examine the bony architecture of the face and jaws in a frontal plane, providing valuable information about dental alignment, occlusal level, and relationships between the maxilla and mandible.

Through the analysis of posteroanterior cephalometry, we can investigate facial symmetry, facial structure proportions, and the alignment of the maxilla and mandible in detail. This approach enables us to identify any skeletal and dental discrepancies that can be corrected through appropriate and personalized orthodontic interventions.

A particularly important aspect of the analysis of posteroanterior cephalometry is evaluating the relationship between the upper and lower jaws, as this can offer valuable insights for orthodontic treatment planning. By carefully interpreting these radiographic images, we can accurately determine existing discrepancies and correction possibilities, considering the unique characteristics of each patient.

To obtain reliable results, it is vital that the interpretation of posteroanterior cephalometry analysis is carried out by a specialist with expertise in orthodontics or dental radiology. This ensures an accurate diagnosis and the development of an individualized treatment plan tailored to the needs and characteristics of each patient.

In conclusion, the analysis of posteroanterior cephalometry is an indispensable investigation method in orthodontic practice, providing detailed and valuable information about facial and maxillofacial structures.

The difference in the development of maxillary and mandibular width between the study groups was statistically significant.

In the T0 study group without ORL (Otorhinolaryngology) conditions, the width of the upper maxilla (J-J) was 40.0 mm (9.0), whereas in the T1 study group with nasal hypertrophic rhinitis, it was 39.0 mm (4.2), with nasal septum deviation - 39.2 mm (4.8), with chronic rhinosinusitis - 39.0 mm (3.5), and with hypertrophy of adenoid vegetation - 41.0 mm (4.2) (figure 11).

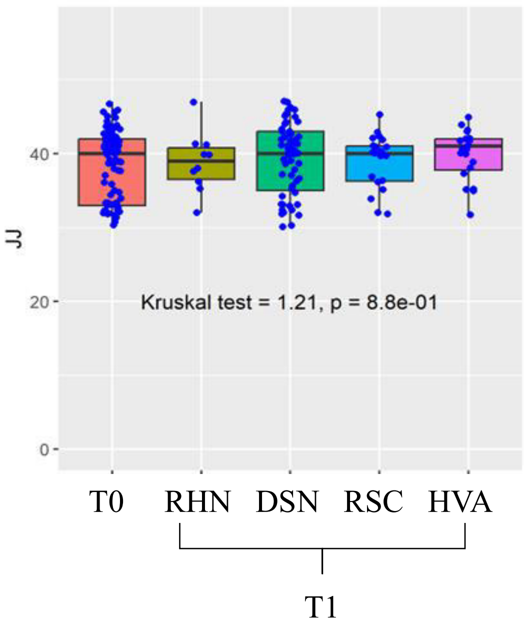


Figure 11. **Analysis of the development of the upper maxillary width (J-J) between groups**

The relationship between the skeletal widths of the maxillae is one of the most important pieces of information for evaluating transverse malocclusion. The development of the width of the lower maxilla (AG-AG) was recorded in both study groups.

In the T0 group (without nasal respiratory conditions), it measured 52.0 mm (10.0), whereas in patients from the T1 study group with nasal hypertrophic rhinitis, it was 54.5 mm (5.0), with nasal septum deviation - 53.0 mm (9.0), with chronic rhinosinusitis - 52.0 mm (6.8), and with hypertrophy of adenoid vegetation - 52.0 mm (7.2) (figure 12).

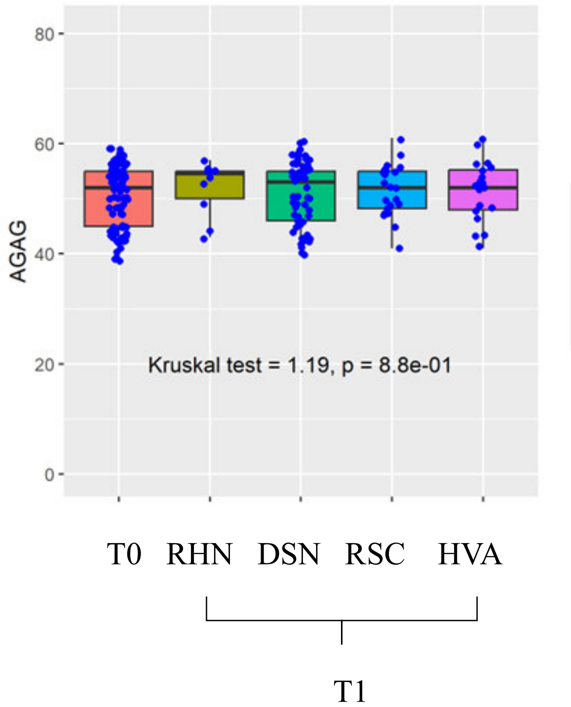


Figure 12. **Analysis of the development of the lower maxillary width (AG-AG) between groups**

From the total number of patients included in the study, anterior facial height (RMM) was analysed in relation to the development of upper and lower maxillary widths in girls (120) and boys (81). The data obtained are presented in Table 3.

Table 3. **Development of Jawbones Width in Relation to Transnasal Airway Passage**

Variable	**F**, N = 120[1]	**95% CI**[2]	**M**, N = 81[1]	**95% CI**[2]	**p-value**[3]
Total Volume	488.1 (154.8) 564.0 (284.0) 132.0 696.0	460, 516	489.5 (153.5) 569.0 (289.0) 212.0 696.0	456, 523	0.8
Total Resistance	0.3 (0.2) 0.3 (0.2) 0.1 0.8	0.31, 0.37	0.3 (0.2) 0.3 (0.2) 0.1 0.7	0.30, 0.38	0.7
J-J	38.8 (4.5) 40.0 (7.2) 30.0 47.0	38, 40	39.4 (4.3) 40.0 (8.0) 30.0 47.0	38, 40	0.3
AG-AG	50.6 (5.7) 52.0 (10.0) 39.0 61.0	50, 52	51.1 (5.4) 53.0 (8.0) 39.0 60.0	50, 52	0.7

The examination of nasal permeability was conducted using the ATMOS PC 2000 rhinomanometer (Germany), guided by a simple standard menu, with an integrated printer and display. The examination results are displayed on the rhinomanometer's screen in the form of a rhinogram or a Y/t graph. The pressure difference between the choanae (openings at the back of the nasal cavity) and inside the mask is measured by the device, and these values are converted into electrical signals using a differential pressure converter. The electrical signals are processed through microprocessors. By simultaneously measuring differential pressure and flow, a flow-pressure curve representing nasal resistance is obtained. The results of the determination of rhinomanometric parameters of the nasal cavity, including total volume and total resistance at 150 Pa for different types of nasal breathing, are presented in Table 4.

Table 4. **Data of rhinomanometric parameters of the nasal cavity, depending on the type of breathing**

Variables	**mixed**, N = 42[1]	**95% CI**[2]	**nasal**, N = 93[1]	**95% CI**[2]	**oral**, N = 66[1]	**95% CI**[2]	**p-value**[3]
Total volume	397.9 (176.4)	343, 453	547.2 (95.7)	528, 567	463.8 (171.4)	422, 506	<0.001
Total resistance	0.4 (0.2)	0.37, 0.51	0.3 (0.1)	0.27, 0.31	0.4 (0.2)	0.31, 0.40	0.019

Note: statistics=kruskal.test; p <- ggplot(df, aes(x=Lotul1, y=Volum, fill=Lotul1)) + geom_boxplot() +

We observe a significant statistical change in the nasal cavity volume indices for all types of breathing with a p-value <0.001. The rhinomanometric indices between groups T0 and T1 showed a statistically significant difference, indicating a conclusive statistical difference in the rhinometric data between the T0 and T1 study groups (table 5).

Table 5. **Rhinomanometric parameters data for nasal cavity between study groups T0 and T1**

Variables	**T0** N = 92	**95% CI2**	**RHN**, N = 10[1]	**95% CI**[2]	**DSN**, N = 57[1]	**95% CI**[2]	**RSN** N = 22[1]	**95% CI**[2]	**HVA**, N = 20[1]
Total volume	581.0 (40.2)	573, 586	268.5 (373.5)	216, 531	313.0 (338.0)	360, 450	359.0 (299.2)	358, 516	474.0 (271.0)
Total resistance	0.3 (0.1)	0.25, 0.27	0.4 (0.4)	0.29, 0.59	0.4 (0.4)	0.36, 0.47	0.4 (0.3)	0.3, 0.48	0.5 (0.3)

Note: annotate label = paste ("Kruskal test = ", round (statistics$statistic, 2), ", p = ", format (statistics p.value, scientific = TRUE, digits = 2), sep = ""))

Therefore, the statistical analyses accumulated regarding rhinomanometric indices confirm the influence of nasal respiratory conditions and the necessity for a more in-depth diagnosis of this pathology in Transverse Malocclusion (TM).

In conclusion, rhinomanometry is an objective method for studying nasal permeability and can be applied to evaluate the volume and total rhinosinusal resistance in patients with nasal respiratory conditions.

3.2. Development and Validation of the Predictive Model

In this research, a groundbreaking correlational analysis was conducted in the Republic of Moldova, examining the correlation between the assessment of total volume and total resistance in patients with/without nasal respiratory conditions and the transverse development of the upper jaw depending on the gender and age of the respondents.

The predictive model is an algorithm that takes into account the five most significant parameters arranged in order of increasing severity of transverse malocclusion. The following parameters were used for this purpose: total volume, total resistance, inter-premolar index, intermolar index according to Pont, width of the upper jaw J-J in posteroanterior cephalometric analysis, patient age, and gender (figure 13).

The current data indicate that transverse growth occurs at ages that coincide, on average, with the period of accelerated growth during adolescence, specifically around 11-12 years for girls and 13-14 years for boys.

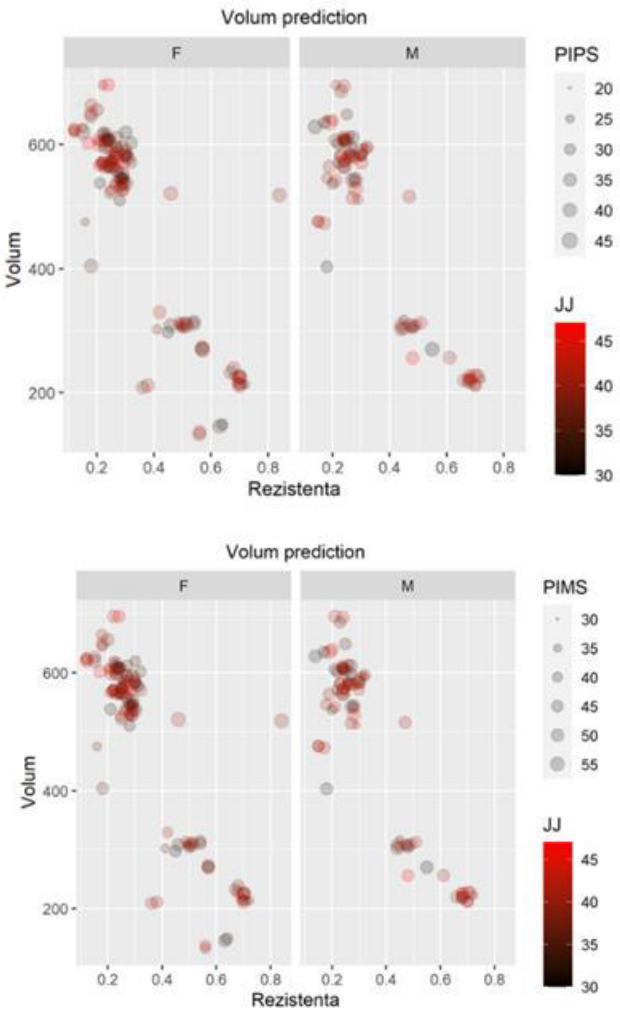


Figure 13. **Predictive model for evaluating transnasal airway passage impact on upper maxillary development**

However, the data should be analysed in relation to skeletal age to confirm this observation. Facial width development, especially the development of lower maxillary width in boys, continues beyond growth spurts, similar to developments in facial length and height.

Maxillary width growth decreases at a slower rate than sagittal and vertical growth, except in the posterior regions, where maxillae widen as they lengthen backward. Based on this method, the interference and influence of breathing type on upper maxillary development have been demonstrated.

Thus, this interrelationship suggests the need for a more in-depth diagnosis in growing patients with nasal respiratory conditions (figure 14).

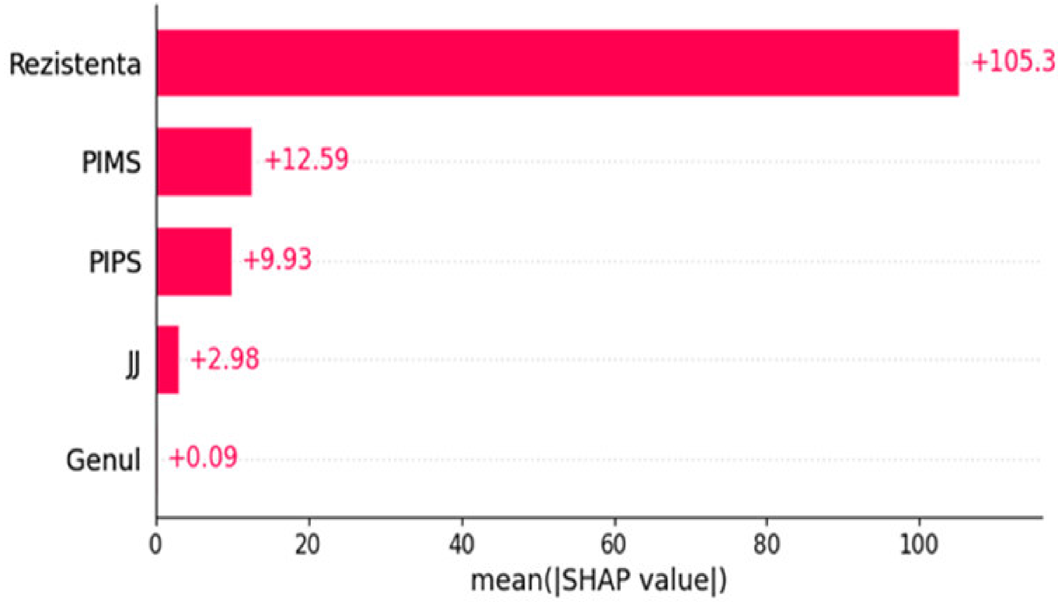


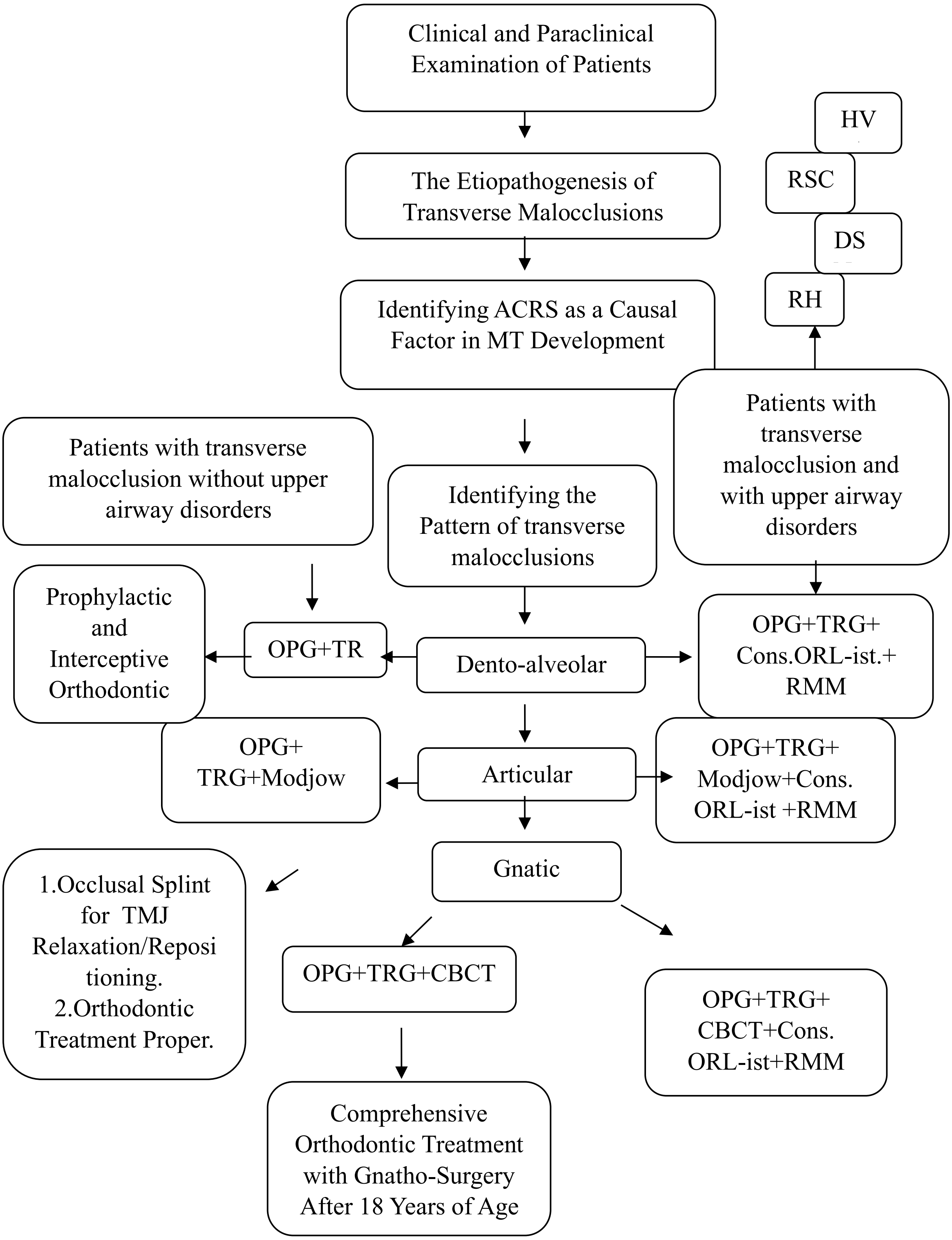
Figure 14. **Assessment of risk factors in the development and appearance of transverse maxillary deficiency (DMAs)**

It is important to note that some values, such as gender (+0.09), have a low effect within the predictive model, while total resistance has significant importance and a major value (+105.3) in upper maxillary development. In conclusion, it can be stated that the predictive model is stable and well-calibrated, capable of predicting the probability of nasal permeability's influence on the dento-maxillary apparatus.

The potential effects of parameters such as total resistance, total volume, upper maxillary width, inter-premolar and inter-molar distances have been jointly analysed in this predictive model, with the aim of predicting the influence of nasal respiratory conditions on age and gender-adjusted transverse malocclusions.

We propose an interdisciplinary approach to transverse malocclusions in patients with nasal respiratory conditions involving orthodontists and otorhinolaryngologists, combining specialized diagnostic methods. This algorithm offers a new perspective on diagnosis and valuable insights into subsequent treatment decisions.

The results obtained guide us to address nasal respiratory conditions in patients with frequently encountered transverse malocclusions, often neglected or considered isolated cases, from a different perspective. Until now, transverse malocclusions were primarily focused on pure orthodontic diagnosis. However, as a result of this study, new horizons and practical arguments for the necessity of a complex interdisciplinary diagnosis have opened up.



The scheme 1. **Diagnostic Algorithm and Treatment Guidelines**

3.3. Analysis of the imaging parameters of the transverse development of the upper and lower jaw

In the current research, a pilot study was conducted on patients with transverse malocclusions, specifically focusing on the joint and gnathic manifestation patterns. A total of 40 patients with the gnathic manifestation pattern were included in the study, and CBCT scans were performed to assess the developmental discrepancies between the maxillae (table 6). Analysing the growth and development of the maxillae is crucial, especially in growing children, to assess transverse anomalies, which are often underexplored. This information is essential for planning personalized orthodontic treatments.

The study assessed the developmental discrepancies between the maxillae in the transverse plane, with an average difference of 3.3 mm. This indicates that the patients included in the study require orthodontic treatment involving camouflage techniques.

Table 6. **Assessment of Jawbones Development Discrepancy Based on CBCT**

Variable	**N-40**	**95 %CI[2]**
Upper jaw	53.1 (1.6) 52.7 (1.4) 51.2 57.8	53,54
Lower jaw	56.1 (1.5) 55.9 (1.7) 53.5 61.4	56,57
Developmental discrepancy	3.0 (1.6) 3.3 (1.8) -1.8 6.2	2.5,3.5

The analysis of maxillary and mandibular development through the application of the Paired t-test-11.7 showed a statistically insignificant difference, with a p-value of 2.48 (figure 15). This suggests that conventional orthodontic treatment is indicated.

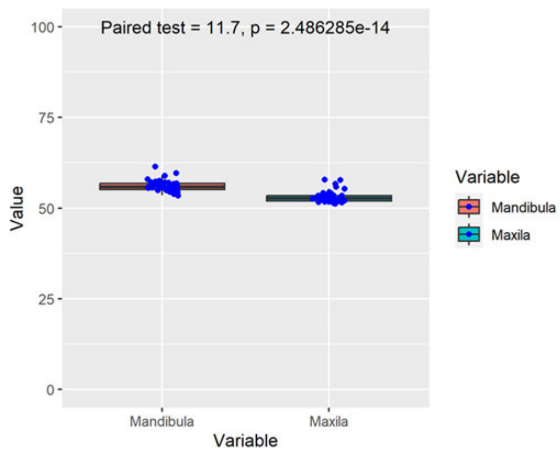


Figure 15. **Visual representation through basic box plots of maxillary and mandibular development**

In the research involving 27 patients with transverse malocclusion and an articular manifestation pattern, the preferred chewing side was assessed. It was observed that the right side predominated among the patients (figure 16).

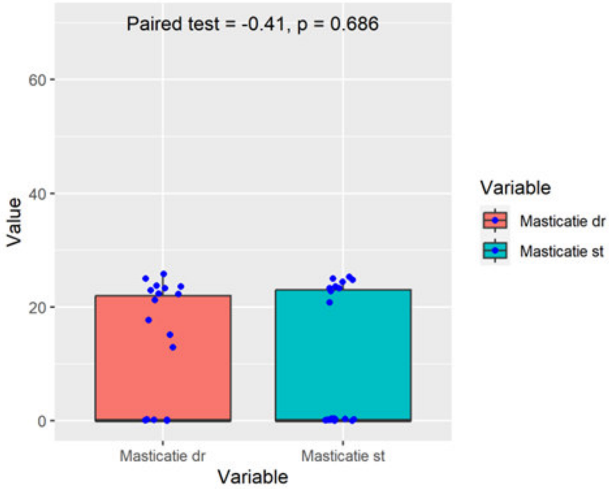


Figure 16. **Determination of the preferred chewing side in the study groups**

Using the Modjow appliance, lateral jaw movements to the right and left were recorded. The analysis of these movements revealed that during the right lateral movement, there was a complete absence of canine guidance, with contacts present only at the molar level.

In contrast, during the left lateral movement, with the absence of canine guidance, a completely flat trajectory was recorded (figure 17).

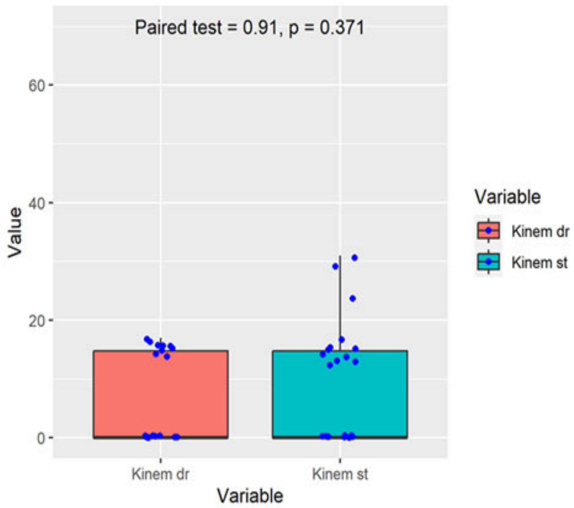


Figure 17. **Visual representation of right/left mandibular kinematics**

It should be emphasized that the analysis of functional recordings of mandibular dynamics serves not only as a diagnostic tool but also as a valuable method for monitoring progression and evaluating treatment effectiveness. By periodically recording mandibular movements during therapy, improvements and necessary adjustments for achieving optimal functionality of the upper maxilla in the transverse plane can be observed. This investigation allows us to analyse the quantitative and qualitative characteristics of inferior jaw trajectories, the movement of the articular condyles in the articular fossa, and detect various forms of temporomandibular joint dysfunction in the early stages of development.

In conclusion, a detailed analysis of functional recordings of mandibular dynamics is a crucial aspect in the evaluation and treatment of patients with transverse malocclusions. By carefully recording and interpreting mandibular movements, we obtain a detailed picture and can make informed therapeutic decisions to restore optimal functionality of the superior jaw.

4. SYNTHESIS OF THE OBTAINED RESULTS

The compartment reflects scientific data obtained based on research conducted in the field of orthodontics and otorhinolaryngology within the doctoral thesis in medical sciences on the topic "Indices and Guidelines in the Diagnosis of Transverse Malocclusion."

Within this study, the diagnosis of TM was evaluated based on ACRS. This research allowed for the determination of additional indices and the estimation of guidelines in the diagnosis of MT, represented in three patterns of manifestation: dentoalveolar, articular, and gnathic.

The incidence of transverse malocclusion TM is continuously increasing, and as a result, the conducted research has led to the implementation of new and updated studies in the early detection and diagnosis of this condition, with a focus on determining predisposing factors to the development of dental occlusion disorders. Epidemiological studies have suggested a correlation between transverse malocclusions and nasal respiratory conditions. Therefore, we conducted a more extensive and detailed study to investigate the correlation between ACRS and TM in children of different age groups.

TM is a dento-maxillary anomaly in the transverse plane characterized by the palatal cusps of the upper teeth in the canine, premolar, and molar regions closing orally relative to the corresponding lower tooth cusps. This results from insufficient width of the maxillary arch compared to the width of the mandibular arch [1, 14].

Harmful habits, such as finger-sucking, lip-biting, nail-biting, bruxism, and mouth-breathing, can have a negative impact on the harmonious development of the stomatognathic system and can contribute to the development of TMJ disorders. These habits can lead to an imbalance in muscle forces and can affect the appearance and function of the entire stomatognathic system [8].

According to epidemiological studies conducted by various scientific researchers from multiple countries, there is an increase in the frequency of acquired dento-maxillary conditions due to breathing problems, which can be identified at different stages of life [5, 15].

Patients with transverse malocclusion are at an increased risk of deteriorating quality of life. They face a higher likelihood of affecting all three aspects of functional status: social, psychological, and physical. In particular, these patients also have a medical history of upper respiratory tract conditions [16].

According to epidemiological investigations, it is observed that the prevalence of mouth breathing in children and adolescents can reach up to 55%, as shown in studies conducted by Cavassani V.G.S. in 2003, De Menezes V.A. and his colleagues in 2006, as well as Felcar J.M. and his colleagues in 2010. The duration of mouth breathing can lead to multiple changes in terms of function, structure, posture, and behaviour, including in the maxillary system, which is closely linked, both structurally and functionally, to the upper respiratory tract, as indicated by research conducted by Abreu R.R. and his colleagues in 2008, as well as by Nunes W.R. and Di Francesco R.C. in 2010. It is important to note that children experiencing difficulties in nasal breathing have a 2-2.5 times greater risk of developing DTM disorders, according to the work of Mannanova F.F. in 1981, Emmerich A. and his colleagues in 2004, and De Menezes V.A. and his colleagues in 2006.

The distance between the lateral walls of the nasal cavity and the nasal septum is often reduced in TMJ disorders. This reduction increases the resistance of nasal airflow and causes difficulties in nasal breathing [8, 14].

In orthodontic practice, in addition to the detailed analysis of the study model in all three planes, a set of indices is used to contribute to a comprehensive diagnosis. In clinical cases where a deficiency in the development of the upper jaw is detected, and there is a need for transverse expansion, biometric study through the Pont dentoalveolar index helps determine the existing deficit of space in the dental arch. Calculating the Pont index involves measuring the intermolar and interpremolar distances (both in the upper and lower areas) on the patient's dental model using a calliper (traditional method) and with the Maestro 3D Ortho Studio software (digital method). The obtained values are then compared to a reference value determined through a standardized formula.

Differences observed between calculated and measured values reflect deviations from normal values, providing crucial information for guiding future therapeutic approaches in orthodontic treatment. These identified discrepancies help us choose and plan an optimal treatment. Therefore, by rigorously applying the Pont index, relevant data regarding transverse discrepancies are obtained, supporting the selection of necessary orthodontic treatment approaches and solidifying the complete diagnosis and determination of an efficient therapeutic strategy. The paraclinical method used in diagnosing MT is employed to determine the pattern of manifestation, such as dentoalveolar, articular, and gnathic. The standardized radiography method in orthodontics has had a significant impact on the scientific basis of orthodontic diagnosis and has contributed to making informed therapeutic decisions, considering the specific craniofacial morphology of each patient. Linear and angular analysis of cephalometric radiographs has proven to be highly valuable in establishing a differentiated diagnosis for transverse malocclusion and has guided the process of orthodontic treatment planning for patients in the active craniofacial development phase. Indications for postero-anterior cephalometric radiography include assessing craniofacial asymmetry, evaluating maxillary skeletal relationships, monitoring treatment progress and outcomes, and planning orthognathic surgical treatment.

The analysis of postero-anterior cephalometric radiography in TM contributes to identifying the necessary parameters for detecting the patterns of manifestation of this condition. These include evaluating the area from the left external auditory meatus to the right external auditory meatus, identifying intracranial calcifications, identifying mastoid air cells, and the right and left petrous ridge [17].

Conducting a comparative assessment of cephalometric parameters helps detect the patterns of TM manifestation, assess facial asymmetry, and evaluate the upper and middle thirds of the face, which is essential in determining the pattern of TM manifestation.

To enable a correct diagnosis of AnDM, knowledge of both static and dynamic parameters, occlusal guidance, unilateral occlusal contact, tooth wear, the type of malocclusion, or temporomandibular joint (TMJ) conditions is necessary. In the study, software that scans jaw motion in real-time without using X-rays was used. The system is applicable in diagnosing orthodontic issues. The unique MODJAW™ 4D platform can aggregate all patient data, including 3D models, 4D movements, and facial CBCT scans. Through the analysis of jaw motion, certain functional changes were identified. In most cases of the studied patients, we observed a normal range of mouth opening in terms of amplitude. However, there were some slight deviations, both to the right and left, which were not always present during opening. By analysing the dynamic movements of the jaw, we managed to identify specific signs and symptoms associated with TM. These include canine guidance limitations and difficulties in achieving proper occlusion. This information is essential for establishing a correct diagnosis and carrying out appropriate orthodontic treatment for the clinical situation.

In the conducted research, 201 respondents were included and divided into 2 study groups. Group T0 consisted of 92 (45.8%) patients with a pattern of transverse malocclusion manifestation, including dentoalveolar, articular, and gnathic types. Group T1 was comprised of 109 (54.2%) patients with transverse malocclusion and nasal respiratory conditions. Among these 109 patients, there were cases of hypertrophic nasal rhinitis - 10 patients (5.0%), with the predominant incidence observed in patients with deviated nasal septum - 57 (28.4%), followed by chronic rhinosinusitis - 22 patients (10.9%), and hypertrophy of adenoid vegetations - 20 patients (10.0%). During the clinical examination of respondents in groups T0 and T1, the standardized international form (FDI) was used for their examination, following these steps: collecting data from their medical history, evaluating the type of dental occlusion, determining joint conditions, and palpating the masticatory muscles.

During the facial examination, the growth pattern, labial incompetence, and facial symmetry were determined in relation to the pattern of transverse malocclusion manifestation. The width and height of the face were also assessed according to the type of transverse malocclusion manifestation (dentoalveolar, articular, gnathic) using Izard's criteria.

For patients in group T1, their medical history was supplemented with information regarding complaints related to the location of the pathological process. The duration of the disease, causes of occurrence, applied treatments, personal and family history were specified. In this group of patients, nasal patency was also assessed using the ATMOS PC 2000 rhinomanometer (Germany), guided by the standard simple menu, complemented with a printer and integrated display [18].

This technique can be used in medical practice to guide the diagnostic process and the necessity of complex treatment in patients with TM and ACRS. One of the benefits of this technique is identifying the mechanism underlying nasal obstruction, which can also influence the development of the upper jaw. It's important to note that anterior rhinomanometry is just one of the available techniques for assessing nasal function, and a specialist physician will decide whether to use this technique based on the clinical situation. To assess the diagnostic value in the gnathic and articular patterns of transverse malocclusion, the study was complemented with imaging investigations such as computed tomography (CT). CT scans provided data on the involvement of paranasal sinuses, the extent of sinus inflammation, and the interrelationships of structures within the osteomeatal complex, which is crucial in multidisciplinary diagnosis. By demonstrating the interference of respiratory conditions with the onset and development of TM, the percentage of this pathology was evaluated for all patterns of transverse malocclusion manifestation [19, 20].

In the research, a correlation analysis was conducted to investigate the relationship between the assessment of total volume and total resistance in patients with or without nasal respiratory conditions. Additionally, the development of the upper jaw in the transverse plane was analysed based on the gender and age of the subjects in the study. My personal contribution was the development and validation of a predictive model, achieved by estimating the dependent value between cephalometric, biometric indices, and the total volume of breathing type relative to the age and gender of the respondents. The value of the predictive model lies in exploring new perspectives in the early detection of TM and the establishment of individualized orthodontic treatment approaches.

In the respective research, we conducted a pilot study by assessing the gnathic and articular patterns of manifestation in patients with TM. We performed cone-beam computed tomography (CBCT) imaging to evaluate developmental discrepancies between the upper and lower jaws. The analysis of maxillary growth and development is particularly important, especially in children in various growth stages, as the identification of transverse dentoalveolar anomalies is often incorrectly detected. This study is valuable in planning personalized orthodontic treatments. Thus, we observed an average discrepancy of 3.3 mm in the transverse development of the jaws in the patients included in the study, which indicates the need for orthodontic treatment. In patients with transverse malocclusion, the articular pattern of manifestation showed a preference for chewing. Based on this study, it was demonstrated that in the majority of patients in the study, the right side was the preferred chewing side.

The obtained results provide significant insight into the influence of ACRS on the development of TM in the research participants. It was determined that the female gender predominated among patients with hypertrophic nasal rhinitis, accounting for 83% of cases, as well as in cases of chronic rhinosinusitis, where it represented 64% of the total cases. In contrast, the male gender had a higher incidence in cases of deviated nasal septum, affecting 57% of patients in this group, and in cases of hypertrophy of adenoid vegetations, affecting 61% of patients in this group. Additionally, we found that, overall, the female gender had a higher prevalence compared to the male gender in the context of this study. Based on clinical and anthropometric parameters and transnasal airway passage, a comparison was made between the study groups T1 and T0, with statistically significant values. The results revealed the following significant findings: facial symmetry was identified in 67.9% of cases in group T1, labial incompetence was found in 60.6% of cases in group T1, and gingival smile was present in 73.4% of cases in group T1, indicating an analysis of the parameters of rhinomanometry and clinical-anthropometric indices of the respondents. We developed a complex algorithm of subjective and objective methods for diagnosis, allowing the evaluation of five analysed parameters that had the most significant influence on the development of transverse maxillary deficiency, ranked in order of increasing severity of transverse malocclusion. These parameters are: total volume, total resistance, inter-premolar index, inter-molar index according to Pont, upper jaw width J-J based on postero-anterior cephalometric analysis, patient age, and gender. Through this algorithm, we were able to demonstrate that breathing disorders and respiratory interference significantly impact the transverse development of the upper jaw. Thus, this algorithm enables a more detailed diagnosis for growing children with nasal respiratory conditions and the implementation of early, interceptive, and definitive treatment plans through interdisciplinary management of transverse malocclusion, resulting in achieving an optimal morpho-functional balance of the stomatognathic system. The proposed algorithm respects the sequence of diagnostic stages and predicts patterns of transverse malocclusion manifestation.

In conclusion, it should be noted that a multidisciplinary approach is mandatory in the medical care of patients with upper respiratory tract conditions and upper maxillary deficiency in transverse malocclusion in children.

5. GENERAL CONCLUSIONS

1. In accordance with our own results, the prevalence of upper respiratory tract conditions was observed in 54.2% of cases in both study groups: nasal septum deviation - 28.4%, chronic rhinosinusitis - 10.9%, hypertrophy of adenoid vegetation in 10.0% of cases, and nasal hypertrophic rhinitis in 5.0% of cases.

2. In patients with transverse malocclusion without upper respiratory tract conditions, facial symmetry was determined in 39.1% of cases, labial incompetence in 41.3%, and a gummy smile in 60.9% of cases. Meanwhile, in patients with transverse malocclusion and upper respiratory tract conditions, facial symmetry was observed in 67.9% of cases, labial incompetence in 68.8%, and a gummy smile was noted in 73.4% of cases among all respondents, confirming the impact of upper respiratory tract conditions on the transverse development of the upper jaw.

3. The predictive model was developed by estimating the dependent relationship between cephalometric, facial, biometric indices, and the overall volume of breathing type, relative to the age and gender of the respondents. The significance of the predictive model leads to the elucidation and exploration of new perspectives in the early detection of transverse malocclusion and the comparative analysis of manifestation patterns, where there is a statistically significant value between the dento-alveolar, articular, and gnathic manifestation patterns ($p<0.001$).

4. Estimating the diagnostic algorithm in patients with transverse malocclusion associated with or without nasal respiratory conditions will contribute to the early detection of predisposing factors in the respective pathology and to the planning of orthodontic treatment by adopting a multidisciplinary approach to transverse malocclusion. This approach will lead to achieving an optimal morpho-functional balance of the stomatognathic system.

PRACTICAL RECOMMENDATIONS

1. The early identification of predisposing factors in the onset of transverse malocclusion is recommended to be performed during the child's mixed dentition period. Consultation with an otolaryngologist and the use of anterior rhinomanometry is an expedient method in determining the influence of nasal breathing disorders on the development of the transverse dimension of the upper jaw.
2. Multidisciplinary approach is recommended for patients with transverse malocclusion with a dento-alveolar and gnathic manifestation pattern during the mixed dentition period.
3. Anterior rhinomanometry is necessary to assess nasal respiratory insufficiency and determine the appropriate treatment approach in children with facial asymmetry, lip incompetence, and gummy smile.
4. Scheduling educational sessions within primary educational institutions to explain the influence of respiratory conditions in children on the harmonious development of the stomatognathic system.

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INFORMATION REGARDING THE VALORIZATION OF RESEARCH RESULTS

at which the results of the researches for the doctoral thesis in medical sciences with the topic:
"Indices and Diagnostic Approaches in Patients with Transverse Malocclusion"
were presented

- **Articles in recognized foreign journals**

1.Trifan V., **Trifan D**. Objectives of diagnosis and orthodontic treatment of Angle Class III malocclusion depending on the dentition. In: Revista Română de Medicină Dentară. Volumul XVII-Nr.3/2014, pp. 182-192. ISSN 1841-6942.

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