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DIAGNOSIS OF MALOCCLUSIONS IN CHILDREN WITH NEUROLOGICAL DISORDERS

323.01 – STOMATOLOGY

Summary of the doctoral thesis in medical sciences

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The thesis was elaborated within the department of stomatological pro-paedeutics „Pavel Godoroja" Nicolae Testemitanu State University of Medicine and Pharmacy of the Republic of Moldova, founding Consortium of Doctoral School in Medical Sciences.

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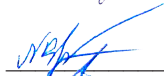Uncuța Diana, dr. hab. șt. med. conferențiar universitar

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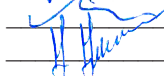State University of Medicine, Samara Russian Federation
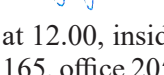
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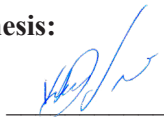Iliciuc Ion, dr. hab. șt. med., prof. univ.

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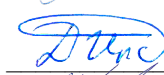
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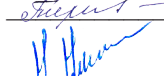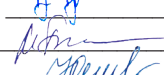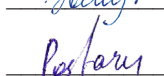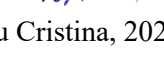Iliciuc Ion, dr. hab. șt. med., prof. univ.
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CONTENTS

CONCEPTUAL REFERENCES OF RESEARCH

Actuality and importance of the topic

Malocclusions in children rank second (with 50-80% of cases) among dental diseases and mark an incidence of persistent increase, especially in the Republic of Moldova [3, 7, 8, 10,15].

There is an insufficient and contradictory number of publications, the authors of which report, on the one hand, an increased incidence (up to 89.4% of cases), on the other hand, it is stated that the incidence in children with neurological pathology does not differ, finding some priority forms of healthy children [2, 17].

The problem of pediatric dentistry remains stress, especially associated with pain syndrome, mainly tension-type headache [12, 13, 21]. The disadvantages of the applied methods consist in their weak capacity to highlight the origin, the functional of the nervous system and the neuromuscular system, involved in pathology of malocclusions [14, 20]. For this reason, their etiopathogenic mechanisms are insufficiently studied, and the standard methods do not allow the possibility of planning the volume of orthodontic treatment [1, 4, 6].

In children with special needs and malocclusions, stereotypical movements of abnormal opening or closing of the mandible associated with the onset of pathological masticatory reflex of the central or peripheral origin [17, 18]. Thus, electromyography results, may experience central, peripheral or mixed impairment and varied treatment tactics.

Description of the research situation and identification of research problems:

Knowledge of the etiology and mechanisms of impairment in malocclusions are incompletely elucidated [10, 24]. From the literature review we have retained the idea that clinical manifestations reflect the result of complex interactions predominantly of the genetic and environmental factors during the development of the dental system [1, 6, 11].

The information from the medical files, from questionnaires, the

examination by computer tomography (CT) in profile and the electromyography (EMG) of the masticatory muscles proved to be a real use in selecting the topic [10]. These increased my interest, helping me to focus on the essential ideas of the pathological correlations between the systems of the researched field. [12, 13, 21, 23].

We realized that the facial skeleton, especially the teeth and the alveolar process is closely integrated with both the base of the skull, the naso-maxillary complex and the mandibular [11, 22]. So, any structural or functional changes in the region can generate pathologically significant disorders in the facial part [13, 23]. This highlights the fact that the successful orthodontic treatment of malocclusions depends largely on the knowledge of the anatomical features involved in the pathological process [7, 11, 14, 20, 22].

The selected topic may also have a wide applicability in the field of pathological anatomy, pediatrics, neurology, medical genetics, oromaxillofacial surgery, pediatric dentistry, medical recovery.

Thus, without studying quantitatively and qualitatively the polysystemic interactions and interrelationships, the diagnosis of malocclusions in children cannot argue the reason for the increase the effectiveness of routine treatment [[12, 13, 21, 23, 24]. The applicability and accessibility of neurophysiological examination in children with malocclusions may be a measure to counteract the inefficiency of existing orthodontic treatment [11, 22].

The motivation of the topic started from working hypotheses when we demonstrated through clinical case studies the cause-effect relationship between the oromaxillofacial region systems in malocclusions through the existence of facial asymmetry, associated with risk algic factor and pathological muscle weakness [5, 9, 11, 23, 24].

The essence of the study consists in making the diagnosis in children with malocclusions associated or not associated with neurological pathology by CT examination in facial profile and EMG [16, 18].

Synthesizing the formulated hypotheses, **the aim of the thesis** is

to evaluate the clinical and paraclinical manifestations of malocclusions in children with neurological disorders for the development of measures for early diagnosis of the underlying disease.

In this context we have established **the main objectives of the study**:

1. Determining the frequency of malocclusions in children with neurological disorders;

2. Morphological and functional evaluation of malocclusions in children with organic and functional neurological disorders;

3. Highlighting the specificity of growth and development of the body according to the stages of formation of canine and lower second premolars roots in children with malocclusions and neurological disorders;

4. Estimation of diagnostic behavior and differentiated diagnosis in children with malocclusions in neurological pathology.

The research hypothesis is that dysfunction of the anatomical structures of the orofacial region in children with malocclusions can be caused by both local, as well as by affecting the nervous system with common pathological connections, forming a bipolar complex. At one pole the local pathophysiological mechanisms of the orofacial region begin, and at another pole - the central neurological processes. Evaluation of the correlation between the poles, depending on the presence / absence of motor deficit and pain phenomenon, would highlight the poorly received and abnormally interpreted quality of the act of chewing by the nervous system in children.

The general methodology of the research is based on the study of the common laws of pathological processes of malocclusions in 46 children with neurological pathology at the age of 7 and 15 years. The study was performed based on national protocols based on the association with neurological pathology in children who met the criteria for inclusion in the research group. We compared the results obtained in another 46 children of the same age with malocclusions not associated with neurological pathology. The data of the investi-

gations were computerized by SPSS methods, variational, discriminatory with the help of the programs "Epi-info-2002" and "Excel" from the package "Microsoft Office" and presented through different types of tables, graphs and diagrams.

The scientific novelty of the study was:
- ✓ The evaluation of the impact of some risk factors on the evolution of the clinical manifestations of malocclusions in children aged 7-15 years highlights the altered lesional aspect direct or indirect;
- ✓ The pain phenomenon has a dual character in the stages of formation of the roots of permanent canines, of the lower second premolars and causes structural lesions with increasing disorders by the age of 15 in children with malocclusions associated with neurological disorders.;
- ✓ EMG monitoring on the masticatory muscles determines the character of affecting the motor phenomenon in the act of chewing in children with malocclusions;

The important scientific problem solved are:
- The obtained results deepen the specialist's knowledge on the character and nature of neuromuscular disorders in children with malocclusions.
- EMG examination highlights the mixed forms of malocclusions, which facilitates differentiated therapeutics.
- Morphofunctional investigations, associated with neurophysiological examination on children with malocclusions allow the development of atypical disorders.

The theoretical significance of the study lies in the multifactorial mastication in children with malocclusions by studying the neuro-reflective act and complements new methods of diagnosis.

The applicative value of the study:
- Contributions of the training of pediatric dentists in the problems of malocclusions;

- Development of a diagnostic algorithm for atypical forms of of malocclusions;
- Strengthening the prophylaxis of secondary complications and orthodontic diagnosis;
- Use of data obtained in the training of students and medical staff.

Main results submitted for thesis defense:

1. Risk factors in malocclusions have a heterogeneous action in the clinical manifestation, the parameters of the cranial and facial structure, the linear and angular parameters of the maxillary bones, the stages of formation of permanent canine roots, lower second premolars and in determining the capacity of the average duration of muscle contraction (sec.) in the chewing act in children;

2. CT examination in children with malocclusions reveals acquired craniofacial dysmorphism;

3. Neurophysiological records is an accessible, non-invasive method, it increases the diagnostic value of morphological and functional changes in the masticatory muscles in children with malocclusions;

4. Evaluation of mean amplitude (μV) parameters and mean muscle contraction duration (sec) of electromyographic records in children is of decisive importance in assessing the degree of compensation for pain syndrome and motor disorders;

5. Evaluation of neuro-physiological variants of the masticatory system malocclusions in children determines the location and nature of the pain phenomenon.

Implementation of scientific results:

The results of the study were implemented in the instructive-methodical and research process within the State University of Medicine and Pharmacy "Nicolae Testemitanu" especially:

1. Method of diagnosis of neuromuscular disorders in children with malocclusions (Positive Decision of the Patent no. 1293 of 30.05.2018).

2. Use of a questionnaire for the diagnosis of tension-type head-

ache in children with malocclusions (20.11.2018, IMSP IM and C, advisory department);

3. Using the method of diagnosis of neuromuscular disorders in children with oro-maxillo-facial abnormalities (30.05.2019, functional diagnosis department, IMSP IM and C);

4. Method for complex diagnostics of occlusion (Positive decision for Patent for invention N 2694175 din 09.07.2019);

5. Method of diagnosis of malocclusions in children with central sensory disorders (Positive Decision of the Patent no. A61B 5/0488 of 30.10.2019).

6. Using the diagnostic method in the clinical manifestations of syndromic and non-syndromic facial asymmetries in children (10.02.2020, State University of Medicine and Pharmacy "Nicolae Testemitanu", neuropediatric clinic);

Approval of results. The results of the research were presented in PDF format at various scientific forums and discussed at: Congresses of the European Orthodontic Society (Sweden - 2016, Montreaux - 2017, Edinburgh - 2018, Nice – 2019); UNAS International Congress, Bucharest (2017, 2018, 2019); Annual scientific conference: Days of the State University of Medicine and Pharmacy "Nicolae Testemiteanu" (2017,2019 Balkan Dental Society Congress (Bass, Thessaloniki - 2017); International Symposium on Orthodontics and Pediatric Dentistry, Samara (2017,2019); Congress of the Balkan Society of Orthodontists (Iasi -2018); VII International Congress of students and young doctors "MedEspera" (Chisinau, 2018).

Thesis publications. The study materials were reflected in 19 scientific publications, including 2 articles in international journals, 2 articles in reviewed international journals, 6 articles in national journals, 2 articles in international conference book, 6 abstract in international conference book, 1 single author publication, 3 patents.

The volume and structure of the thesis The thesis is presented on 156 pages of electronic text, 122 pages of basic text, written on a

computer and is divided into: introduction, actuality of study, materials and research methods, analysis of the results obtained, conclusions and practical recommendations. The bibliographic index cites 187 literary sources. The thesis is illustrated with 27 tables, 74 figures, 7 annexes.

Keywords: malocclusions, children, neuromuscular system, electromyography

The positive opinion of the Research Ethics Committee was obtained for the thesis (Protocol no. 42 from 14.12.2016).

THESIS CONTENT

1. CONTEMPORARY ASPECTS OF MALOCCLUSIONS IN CHILDREN WITH NEUROLOGICAL DISORDERS

The literature recognizes mastication as a complex neuro-physiological act that ensures a well-directed balance between the central nerous system, articular, ligament, bone and muscle system, with strict rhythmic and symmetrical activation, followed by the resting phase of the muscles [2, 6, 18, 19, 21]. The neuro-physiological mechanism is achieved by pyramidal and extrapyramidal pathways from the periphery to the motor cortical areas, followed by the reflective response with the rhythmicity of mandibular movements [5, 9, 10, 12]. The generator of automatism of mandibular motility and reflex response is coordinated and performed by the central nervous system with great complexity and precision [2, 4]. They dose the occlusal force and determine the opening reflex of the mouth by contraction and relaxation of the masticatory muscles. Both muscles have a strong mastication derivative that achieves static and dynamic balance of the mandible under the control of the nervous system [1, 6, 13, 19].

In malocclusions the impulses of the masticatory act, transmitted to the brain, are poorly received and abnormally interpreted by both the central and peripheral nervous system [10, 11, 13]. Dentomaxillofacial imaging has been developing continuously in recent years.

The basic criterion for diagnosis in dentistry is the radiological image. Starting from dental radiology, we went to the stage of exploring the panoramic technique with intraoral and extraoral focus, which became classic with the generic name of orthopantomography (OPG). This step increased until the use of OPG as a selective method of the dentomaxillofacial complex [3, 4, 8, 9, 15, 25]. The second stage of the evolution of imaging in dentistry concerns the possibilities of obtaining imaging by ultrasound and magnetic resonance, with the aim of increasing the quality of the medical act [5, 17, 18, 19].

The dento-maxillary system is one of the most complex systems of the human body, both morphologically and functionally. For this reason, it is highlighted that the act of mastication is performed cortically, the type and rhythm of movements are determined subcortically, and the coordination and modulation of the dynamics are directed by peripheral reflexes [1, 21].

Deviations from the physiological rule are due to malocclusions, which can damage the morphofunctional integrity and the harmonious and proportionate development of all components.

2. MATERIAL AND METHODS OF RESEARCH

We performed an analytical and comparative study of the characteristics of the action of risk factors, the X-ray aspect of the craniofacial and neuro-physiological parameters of the masticatory system in 46 children (mean age - 12, 4 ± 2.1 years) with malocclusions associated with neurological pathology (research group) and 46 other children (mean age - 12.1 ± 1.9 years) with malocclusions not associated with neurological pathology (control group), followed at 7 and 15 years of age.

As a method of epidemiological research, which provides a qualitative record of malocclusions (in the sagittal, vertical and transverse) was selected by Bjork (1945).

The design of the research consists in estimating the particulari-

ties of the action of some risk factors, highlighting the particularities of clinical and X-ray manifestations, evaluating the neurophysiological specificity depending on the presence / absence of the pain phenomenon and age of the child.

Criteria for patient inclusion:
- Children with malocclusions and neurological pathology (infantile cerebral palsy and tension-type headache);
- Children during mixed and permanent dentition;
- Children aged 7-15 years;
- Children not seek orthodontic treatment

Criteria for patient exclusion:
- Children with congenital malformations of the cranio-maxillo-facial skeleton;
- Children for whom no study consent has been obtained;
- Disorders of the endocrine system;
- Children with a history of cranio-maxillofacial trauma;
- Children with signs and symptoms of the temporomandibular joint disorders;
- Children with severe mental disorders;
- Children with other types of primary and secondary headaches.

The analysis of the study models was determined according to the Pont and Korhaus method (*figure 1 a and b*).

a   b
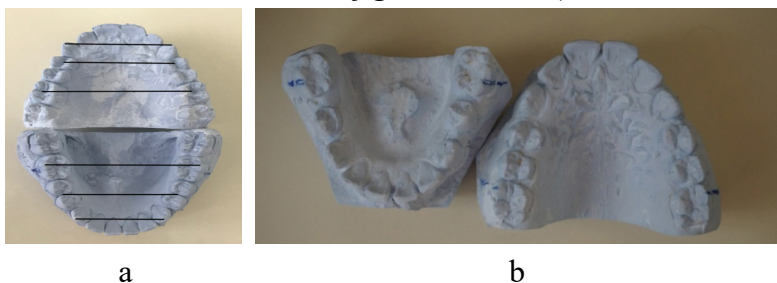
Figure 1. **Width of the upper and lower dental arch of the patient with malocclusions associated with cerebral palsy (a - method Pont; b - method Korhaus)**

The analysis of linear and angular parameters, length, height and base of the skull, anterior and posterior height of the face, upper and lower jaw parameters, linear and angular parameters we performed at computer tomography according to the method Anikienko and et. (*figure 2*) [18].
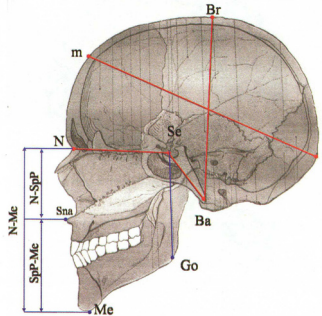
Figure 2. **Cranial and facial parameters measured in children aged 7-15 years with malocclusions and neurological disorders (according Anikienko and et al. 2014)**

By electromyography records with superficial electrodes it allowed us to obtain: the threshold of muscle contraction, its duration and amplitude (*figure 3 a and b*).

a   b
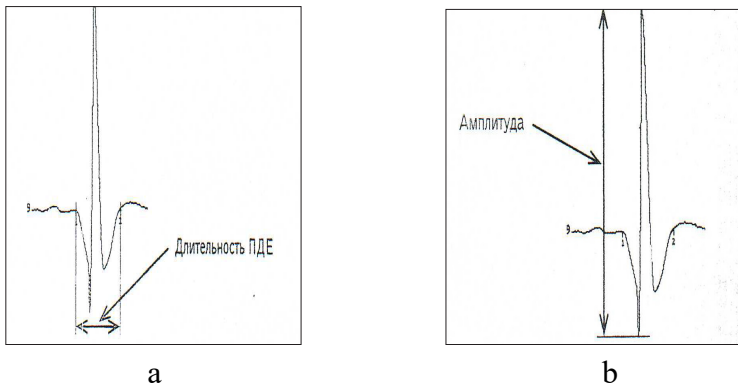
Figure 3. **Muscle motor unit potential parameters: a- form amplitude; b - duration of muscle contraction**

3. ASSESSMENT OF THE MORPHOLOGICAL CONDITION OF THE STOMATOGNATHIC SYSTEM AND DEVELOPMENT OF RISK FACTORS IN CHILDREN WITH NEUROLOGIC DISORDERS

Chief complain presented by children from both groups with malocclusions in 100% of cases had a morphological, aesthetic (48.9% - 60.9% of cases) and functional (51.1% - 39.1% of cases) aspect, appreciated clinically as insignificant, p> 0.05. More significant was the quality of the functional disorders of the act of mastication, which prevailed in the research group (38.6% - 11.1% cases, p <0.01 and 38.6% - 2.8 cases, p <0.001 respectively). Up to 97.8% of cases, children with malocclusions were born on time in the research group and up to 78.7% of cases, p <0.05 - in the control group, and prematurely we detected in 2.2% and 21 , 3%, p <0.01, respectively.

In the control group, natural feeding predominated (80.0% of cases) and only 17.8% of cases, p <0.001 - artificial feeding, compared to 40.4% of cases and 57.4% of cases, respectivly, p < 0.001, in the research group (*figure 4*).
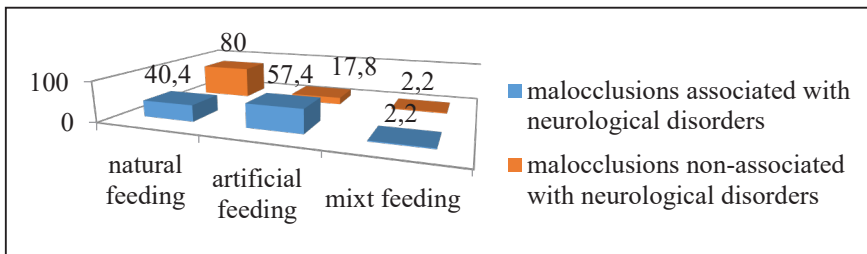
Figure 4. **Distribution of the feeding character in the first 6 months of life of children with malocclusions associated and non- associated with neurological disorders (in%)**

The normal eruption in the diagnosis of malocclusions in the research group shows in 17.1% cases (5 months) with a maximum of 39% of cases (6 months) and manifests itself until the age of 1 year and 2 months, and in the control group it manifests itself variably from 41.7% of cases (5 months) to 58.3% of cases, p <0.01 (6 months). Permanent tooth eruption takes place earlier in the research group (at 4 years - 4.9%, 5–6 years - in 22.0% and at the age of 7 years - up to 31.4% of cases) opposite to the control group where it is later and with undulating character (5 years - in 13.9%, 6 years - 44.4% and 7 years - 41.7% cases, p <0.001). Perinatal factors, with a frequency of 74.5% of cases in the research group compared to 6.6% of cases, p <0.001 in the control group, in both boys and girls were considered as a risk factors in malocclusions (*table 1*) .

Table 1. **Distribution of patients according to risk factors in children with malocclusions associated and non- associated with neurological disorders**

Risk factors	Research groups		p-value
	L_1 Research group	L_0 Control group	
Perinatal factors	35 (74,5%)	3 (6,6%)	p=0,000 (p<0,001)
Postnatal factors	28 (59,6%)	9 (20,0%)	p=0,000 (p<0,001)

Oral habits (up to 20.5% cases in the research group and 8.3% cases in the control group) were specific as a risk factor in malocclusions, especially finger sucking (18.2% cases), associated with the interposition and gnawing of objects (2.3% cases), p <0.001.

Intra-oral examination of children with malocclusions, we highlight two basic clinical phenomena: pain manifestations (tension-type headache) and motor disorders (*figure 5*).

Figure 5. **Intra-oral examination of the patient with malocclusions associated with motor disorder (infantile cerebral palsy)**

The analysis of the root formation stage in the diagnosis of malocclusions in the examined children highlights: stage F in canines and premolars in both groups at the age of 7-12 years, G-H stage in the lower permanent canines and F-G in the lower second premolars at the age of 12- 15 years in the research group; c) stage G at the level of development of the roots of the lower permanent canines and the lower second premolars at the age of 12-15 years in the control group (*table 2*).

Table 2. **Distribution of the stages of roots formation of permanent canines and lower second premolars in children according to age with malocclusions**

Stages of roots formation							
Permanent lower canines				Second lower premolars			
L_1 Research group		L_0 Control group		L_1 Research group		L_0 Control group	
7-12 years	12-15 years	7-12 years	12-15 years	7-12 years	12-15 years	7-12 years	12-15 years
F	G - H	F	G	E - F	F- G	F	G

Analyzing the cranial parameters at CT at the age between 7-12 years, we highlight: a) the decrease of the height (Ba-Br) and the length of the skull (m-i); b) decrease in the anterior length of the skull base (N-S), the angle formed between the anterior and posterior length (<NSBa) with statistically significant differences (p <0.001) in children with malocclusions associated with neurological

disorders, and in children in the control group only height (Ba-Br) and skull length (m-i) were determined to be statistically significantly reduced (p <0.001) compared to mean values in children with physiological occlusion (*table 3*).

Table 3 **Comparative analysis of cranial parameters in patients with maloclusions disorders at the age of 7-12 years with mean values in children with physiological occlusion**

Cranial parameters	L_1 M± m	L_0 M± m	Mean value in children with physiological occlusion
m-i	171,66±1,14*	166,36±1,86***	**182,72±2,44**
Ba-Br	134,14±1,05	131,57±1,39*	**141,2±1,79**
N-S	60,8±0,7***	64,54±0,8**	**66,3± 0,76**
∠NSBa	121,88±1,49	129,18±1,36	**130,14±1,14**
S-Ba	41,17±0,7	42,53±0,7	**41,4±0,93**

Note: L_1 – Research group, L_0- Control group, M- mediate, m- average error. Statistically significant differences versus norm: * – p<0,05; ** – p<0,01; *** – p<0,001.

The difference between the groups showed that in children in the research group the length of the skull (m-i) is statistically significantly higher in 3.1%, and the length of the skull base (N-S) and the sphenoid angle (<NSBa) significantly decreased in 5.8% and 5.7% respectively compared to children in the control group aged 7-12 years (*figure 6*).
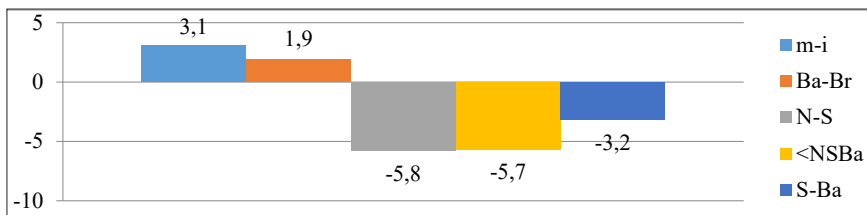
Figure 6. **Difference (in%) of cranial parameters in patients aged 7-12 years with malocclusions associated or non-associated with neurological disorders**

In children aged 12 to 15 years with malocclusions associated with neurological disorders (L1), statistically significant is maintained increase in skull length (m-i) and decrease anterior length of skull base (N-S), but in control group is determined that not just skull length and anterior length of skull base is decreased, but the height of the skull in 4,3% cases (p<0.005) compared to the average values in children with physiological occlusion.

The difference between the groups showed that in children in the age group 12-15 years with malocclusions associated with neurological disorders there was a significant difference in skull length (m-i) greater in 5.1% (p <0.001), while the length anterior base of the skull smaller in 5.3% (p <0.01) compared to children in the control group (*figure 7*).
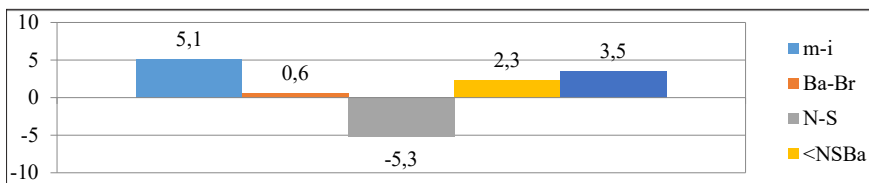
Figure 7. **The difference between groups of cranial parameters in patients with malocclusions at the age of 12-15 years (in%).**

All facial parameters are within the normal mean values, except for the lower face height (SpP-Me), which was determined with a higher value (p <0.05) in the children in the research group compared to those in the control group (p> 0.05) compared to the mean values in children with physiological occlusion.

The difference between the groups showed that the lower face height (SpP-Me) and the upper face height (N-SpP) in the research group compared to the control group turned out to be higher in 3.7% (p <0, 05) even more statistically significant cases (*figure 8*).

18
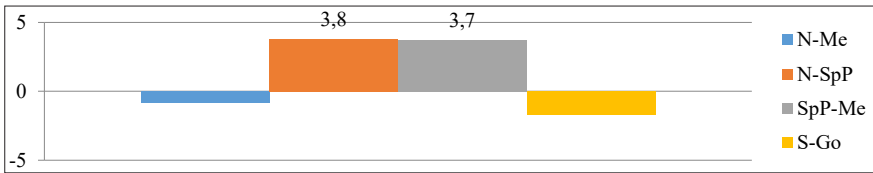
Figure 8**. Difference between groups of facial parameters in patients aged 7-12 years (in %)**

The analysis of facial parameters at the age of 12-15 years finds an increase in the lower face height - SpP-Me ($p < 0.01$) and the total face height - N-Me ($p < 0.05$) both in the research group and in the control group compared to the average values in children with physiological occlusion (*figure 9*).
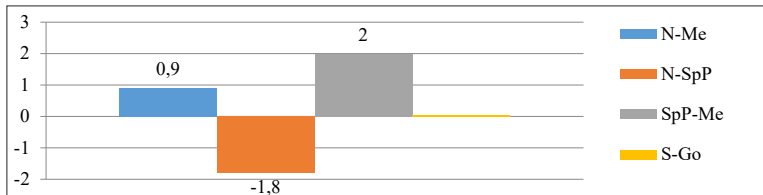
Figure 9**. The difference between the groups of facial parameters aged 12-15 years**

By the age of 12-15 years we highlight: a) in the research group - increasing the posterior height of the upper jaw (Pppo-SpP) ($p < 0.05$) and decreasing the angle between the long axis of the upper incisor and the maxillary plane which shows statistically significant protrusion of upper incisors ($p < 0.01$) (b) in the control group- protrusion of the upper incisors compared to the mean values in children with physiological occlusion.

At the age of 12-15 years we find overjet and open bite are increased in 97.2% and 79.9% ($p < 0.001$), respectively, in children with neurological disorders, while in those without neurological disorders - in 38, 4% ($p > 0.05$) and, correspondingly, 45.5% ($p < 0.001$) cases compared to the mean values in children with physiological occlusion.

4. THE FREQUENCY ANALYSIS OF MALOCCLUSIONS IN CHILDREN DEPENDING ON NEUROLOGICAL PATHOLOGY

After Bjork et al. we highlighted three subgroups of children with malocclusions, associated with neurological pathology: a) *in sagittal plan* – 25,3% with visual disorders, 20,8% - hearing disorders and 16,6% - motor disorders; b) *in vertical plan* - 59,0% with motor disorders, 57,1% - hearing disorders and 40,0% - visual disorders; c) *in transvers plan* - 34 ,7% with visual disorders, 24,4% - with motor disorders and 22,1% - hearing disorders (*table 3*). Thus, among children with motor disorders we highlight a frequency of malocclusions up to 76.1% of cases, followed by children with hearing disorders - 36.3% of cases and children with visual disorders- in 25.9% of cases. The most affected (up to 33.7% of cases) proved to be between 12–15 years of age and was characteristic for both study groups of children with malocclusions. Comorbidity in these children varies depending on the reference plans, especially in the sagittal plane are associated up to 37.8% of cases - with motor disorders, 36.3% - in auditory-impaired children and in 25.9% of cases - in visually impaired children.

Table 4. **Frequency of malocclusions in children with neurological disorders**

Malocclusions	Children with neurological disorders			x^2	p
	Visual impaired n=360 (25,9%)	Auditory impaired n=504 (36,3%)	Motor disorders n=524 (76,1%)		
In sagittal plan	91 (25,3%)	105 (20,8%)	*87 (16,6%)*	9,99	0,0068
In vertical plan	144 (40,0%)	288 (57,1%)	309 (59,0%)	35,34	0,0001
In transversal plan	125 (34,7%)	111 (22,1%)	*128 (24,4%)*	18,91	0,0001

The clinical peculiarities of malocclusions in the research group, compared to the control group, consist of:

A. *in sagittal plan*: a1. a higher frequency of overjet for children with motor disorders (89.7% cases), auditory impaired (75.2% cases) and visual (73.6% cases, p <0.3144) and a2. in auditory-impaired children, ovejet is more significant (75.2% compared to 24.8% of cases, p <0.0007) compared to reverse overjet.

B. *in vertical plan*: b1. prevalence of deep bite versus open bite (p <0.0001) and b2. deep bite in patients with motor and visual impairments is more significant (84.5% versus 15.5% cases and 84.0% versus 16.0% cases, respectively, p <0.0001).

C. *in transversal plan* prevalence of deep bite versus open bite (p <0.0001) and b2. deep bite in patients with motor and visual impairments is more significant (84.5% versus 15.5% cases and 84.0% versus 16.0% cases, respectively, p <0.0001).

5. ASSESSMENT OF THE FUNCTIONAL CONDITION OF THE NEUROREFLECTIVE SYSTEM BY ELECTROMIO-GRAPHICAL EXAMINATION IN CHILDREN WITH MAL-OCCLUSIONS AND NEUROLOGICAL DISORDERS

Dysfunctions of the neuro-reflective system of the masticatory muscles in malocclusions we studied by electromyographic parameters (amplitude and duration of muscle contractions) in a time interval at rest, at maximum clenching of the jaw and the ability to restore muscle.

In malocclusions we highlight an asymmetric decrease in amplitude compared to the mean values (p = 0.001) (*table 5*).

Towards the age of 12-15 years we highlight the decrease of electromyographic parameters in the children of the research group, manifested by decreased amplitude and average duration of muscle contraction, compared to the average values in physiological occlusion (*figure 10*).

Table 5. **General average amplitude of mm. masseter and temporal in children with malocclusions associated and non-associated with neurological disorders (µV)**

Average amplitude of muscle contractions	L_1 Research group $(n^1=46)$	L_0 Control group $(n^2=46)$	F	p
m. masseter, D	290,20±9,26	421,76±23,75	26,169	p=0,000 (**p<0,001**)
m.temporal, D	199,64±10,64	358,59±21,75	42,486	p=0,000 (**p<0,001**)
m. masseter, S	227,51±10,75	325,86±21,2	16,771	p=0,000 (**p<0,001**)
m.temporal, S	155,77±11,69	266,28±18,9	24,173	p=0,000 (**p<0,001**)

Thus, when applying the test to the children of the research group, it highlights the decrease of the average amplitude of mm. masseters R (p<0.01), masseter L (p<0.001), temporal L (p <0.001) and increasing the duration of the potential (p<0.001), compared to mean values in physiological occlusion.
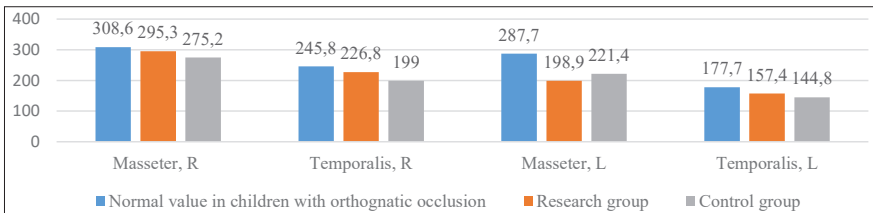
Figure 10. **Comparative characteristics of mean amplitude in patients with malocclusions**

In the maximum relaxation phase for 5 seconds, the average amplitude and duration of the potential in the research group return slower compared to the average values in the physiological occlusion, but more active than the control group.

GENERAL CONCLUSIONS

1. The frequency of malocclusions in children varies depending on the reference plans and the nature of the neurological pathology. In children with malocclusions associated and not associated with neurological disorders, malocclusions class II Angle predominated - in 74.5% of cases and deep bite - in 54.3% of cases with a statistically insignificant difference (p> 0.05). Malocclusions class I Angle and open bite increase in children with functional neurological disorders (21.3%) compared to non-associated neurological disorders. In organic neurological disorders (infantile cerebral palsy) more frequently (59.0% of cases) we highlight malocclusions in the vertical plane, and in the sagittal and transversal plane - only 34.7% and 25.3% corresponding cases;

2. Evaluation of cranio-maxillofacial morphometry in children with malocclusions associated with neurological disorders shows intensification of skull length growth (5.1%, p <0.001) and slowing of skull base length growth (5.3%, p <0.01), increased growth of the vertical facial mass at the age of 12-15 years (9.1%, p <0.001) of the lower height of the face and an increase in the posterior height of the upper jaw (pppo-SpP) and protrusion of the upper incisors (<Is-SpP) (7.7%, p <0.05) reflecting a state of advancing malocclusions associated with neurological disorders

3. The functional evaluation of the masticatory muscles, determined by the asymmetry coefficient of the amplitude and duration of muscle contractions in different phases of the masticatory process allows scientifically and practically the initiation of early diagnosis in children with malocclusions.

4. Stages of permanent canine and lower second premolar root formation in children with malocclusions associated with neurological disorders are influenced by the pain phenomenon, by accelerating the formation of lower canine roots (stage G) and slowing down the formation of lower second premolar roots (stage F) at age 12- 15 years, finding a development of the body in 65-85% compared to children with maloccluisons non-associated with neurological disorders where the growth and development of the body is up to 65% of cases.

SELECTIVE BIBLIOGRAPHY

1. *Adit Arora, Amit Prakash.* Orthodontic management in children with special needs. (International Journal of Medical Dentistry, Volume 3, Issue 3 July/September 2013, pp.207-211).

2. *American Academy of Pediatric Dentistry* - Guideline on Behavior Guidance for the Pediatric Dental Patient – Reference Manual, V 33, nr.6,2008, II: 161-183.

3. *Ana Cristina Oliveira, Saul Martins, Paiva Milene, Torres Martins, Cintia Silva Torres, Isabela Almeida Pordeus.* Prevalence and determinant factors of malocclusion in children with special need (*European Journal of Orthodontics*, Volume 33, Issue 4, 1, August 2011, pp. 413–418).

4. *Boj J.R., Catala M., Mendoza A.* – Odontopediatria – Masson, Barcelona, 2005.

5. *Cifrek M., Medved V., Tonkovic S., Ostojic S (2009).* Surface EMG based muscle fatigue evaluation in biomechanics. Clinical Biomechanics, 24 (4), 327-340.

6. *Dorobat V., Stanciu D.* Ortodonție și ortopedie dento-facială. Editura Medicală, 2011.

7. *Joana P. Cabrita BSDH Maria de Fatima Bizarra BSDH, MHC.Phd Sandra Ribeiro Graca BSDH,Med.,Phd.* Prevalence of malocclusion in indivuiduals with intellectual disability: A comparative study SPECIAL CARE DENTISTRY. Volume 37, Issue 4 July/August 2017, pp. 181-186.

8. *Lajnert V, Maricić BM, Jokić NI, Vrancić ZR, Grzić R, Prpić I.* The Comparison of Malocclusion Prevalence Between Children with Cerebral Palsy and Healthy Children. Coll Antropol. 2015 Sep;39(3):663-6.

9. *Nishi SE., Basri R.,Adam S.,Norma Ab Rahman.* Association between muscle activity and overjet in class II malocclusions with surface electromyography. J. Orthod. Sci., 2018, 7:3.

10. *Poştaru C., Melnic Sv., Postnikov M., Uncuţa D.* Incidenţa anomaliilor dento-maxilare la copiii cu necesităţi special: studio prospective, descriptive. *MJHS* 2019, 18(1):58-67. ISSN 2345-1467.

11. *Poştaru C., Uncuţa D.* Analysis of craniofacial morphology in children with malooclusions and cerebral palsy by 3-dimensional computer tomography. *Ма*те*рі*али науково-практичної конференції 3 м*і*жнародою участю*.* Тернор*і* *Dental Summit*, 23-24 mai, 2019, p.20-21. УДК 616.31(063).

12. *Poştaru C., Zabun T., Pankratova N., Postnikov M., Uncuţa D.* Caracteristica cefaleei de tip tensional la copiii cu anomalii dento-maxilare. Al XXII-lea Congres Interrnaţional al UNAS. *Revista Română de Medicină Dentară*. 2018, vol. XXI (3), 227-242. ISSN 1841-6942.

13. *Poştaru Cristina.* Analiza tomografiei computerizate pe secţiune sagitală la copii cu vârsta cuprinsă între 9-15 ani cu anomalii dento-maxilare şi paralizie cerebrală infantilă. *Medicina stomatologică*, 2019; 1-2: 56-65. ISSN 1857-1328.

14. *Sabuncuoglu, F.A.,* Özcan, E. Orthodontic management of a patient with cerebral palsy. Six years follow-up (2015). Journal of Contemporary Dental Practice, 15 (4), pp.491-495.

15. *Situaţia copiilor în R. Moldova în anul 2015. 27.05.2016.* Biroul Naţional de Statistică al Republicii Moldova;

16. *Van den Engel-Hoek L[1], de Groot IJ[2], Sie LT[3], van Bruggen HW[4], de Groot SA[2], Erasmus CE[5], van Alfen N[5]* Dystrophic changes in masticatory muscles related to chewing problems and malocclusions in Duchenne muscular dystrophy. Neuromuscul Disord. 2016 Jun; 26 (6): 354-360. doi: 10.1016/j.nmd.2016.03.008.

17. *Yogi, Helena; Alves, Levy Anderson César; Guedes, Renata; Ciamponi, Ana Lidia.* Determinant factors of malocclusion in children and adolescents with cerebral palsy American Journal of Orthodontics & Dentofacial Orthopedics, 09/2018, Volume 154, Issue 3.

18. Аникиенко А.А., Панкратова Н.В., Персин Л.С., Януше-

вич О.О. Системный подход в изучении взаимосвязей морфологических структур лица и черепа- путь к расширению понимания специальности ортодонтия. Фундаментальные основы ортодонтии. Москва, 2014.

19. Карпов А.Н, Постников М.А, Степанов Г.В. Ортодонтия: учебное пособие /ФГБОУ ВО СамГМУ Минздрава России – Самара: ООО "Издательско-полиграфический комплекс "Право", 2020 – 319с.

20. Максимова М.Ю., Т.Ю. Хохлова, М.А. Пирадов. Головная боль напряженного типа. Том 10. N3, 2016 www.annaly-nevrologii.ru.

21. Поштару К.Г., Панкратова Н.В., Постников М.А. Характер головной боли напряженного типа у детей с зубочелюстными аномалии. Вестник медицинского института "РЕАВИЗ", 2018: 4(34): 52-60. ISSN 2226-762X.

22. Поштару К.Г., Постников М.А., Панкратова Н.В., Репина Т.Б., Ункуца Д. Б. Изучение параметров мозгового и лицевого черепа у детей с зубочелюстными аномалии и детским церебральным параличом. В: Журнал Ортодонтия. 2019, 2(86): 71.

23. Поштару К.Г., Постников М.А., Панкратова Н.В., Ункуца Д. Б. Изучение характера головной боли напряженного типа у пациентов с аномалии окклюзии. В: Журнал Ортодонтия. 2019, 2(86): 67.

24. Поштару К.Г., Ункуца Д., Постников М.А., Панкратова Н.В. Зубочелюстные аномалии у детей со специальными потребностями в Республике Молдова. Стоматология детского возраста и профилактика. 2018. 3(66). 62-68. ISSN 1683-3031. Doi: I0.25636 (РИНЦ).

LIST OF PUBLICATIONS AND SCIENTIFIC EVENTS
at which the research results were presented
on the phd thesis in medical sciences
SCIENTIFIC PAPERS

• Articles in scientific journals abroad:
✓ **articles in journals reviewed abroad**

1. Поштару К., Постников М., Панкратова Н., Трунин Д., Степанов Г., Родионова А. Цефалометрические параметры у пациентов в возрасте 9-15 лет с зубочелюстными аномалиями и детским центральным параличом. In: Stomatology. 2019, 98(5), 73-81. ISSN 2309-5318. doi.org/10/17116/stomat20199805173 (SCOPUS)

2. Поштару К.Г., Ункуца Д., Постников М.А., Панкратова Н.В. Зубочелюстные аномалии у детей со специальными потребностями в Республике Молдова. Стоматология детского возраста и профилактика, 2018, 3(66), 62-68. ISSN 1683-3031. Doi: 10.25636 (РИНЦ).

3. Поштару К.Г., Панкратова Н.В., Постников М.А. Характер головной боли напряженного типа у детей с зубочелюстными аномалии. Вестник медицинского института "РЕАВИЗ", 2018; 4(34): 52-60. ISSN 2226-762X

4. Постников М.А., Трунин Д.А., Малкина В.Д., Панкратова Н.В., Клочков Ф.Г, Поштару К.Г. Остеопатическая коррекция в комплексном лечении пациентов с зубочелюстно-лицевыми аномалиями. Российский остеопатический журнал, 2018,1-2(40-41), с. 91-99. ISSN 2220-0975.

• Articles in accredited national scientific journal:
✓ **articles in category B journals**

5. Railean S., Lisa D., Railean Gh., Poștaru C., Clair S. Diagnostic algorithm of children with severe neurological disorders. *Curierul Medical*, 2016; 2 (59), 15-20. ISSN 1857-0666.

6. Poștaru C., Malkina V., Pankratova N., Postnikov M. Complex treatment of children with distal malocclusion and osteopathy problems. *Moldovan Medical Journal*, 2018, 61(3), 10-14. ISSN 2537-6381.

7. Poștaru C., Melnic Sv., Postnikov M., Uncuța D. Incidența anomaliilor dentomaxilare la copiii cu necesități speciale: studiu prospectiv, descriptiv. MJHS 2019, 18(1): 58-67. ISSN 2345-1467.

✓ **articles in category C journals**

8. Poștaru C**.**, Railean S., Railean Gh., Projanschi G., Factorii de risc în anomaliile dento-maxilare la copii cu dizabilități neurologice. *Medicina stomatologică*. 2014; 1(30): 16- 19. ISSN1857-1328.

9. Railean S., Poștaru C., Spinei A., Railean Gh. Malocluziile la copii cu dizabilități severe în Republica Moldova. *Medicina stomatologică*. 2014; 3(33): 20-24. ISSN 1857-1328.

10. Poștaru Cristina. Analiza tomografiei computerizate pe secțiune sagitală la copii cu vîrsta cuprinsă între 9-15 ani cu anomalii dento-maxilare și paralezia cerebrală infantilă. *Medicina stomatologică*. 2019; 1-2: 56-65. ISSN 1857-1328.

• **Articles in international scientific collections:**

11. Поштару К.Г., Постников М.А., Трунин Д.А., Панкратова Н.В., Габдрафиков Р.Р. Результаты изучения характера головной боли напряженного типа у пациентов с зубочелюстными аномалиями. В: Сборник материалов республиканской конференции стоматологов „Актуальные вопросы стоматологии". Уфа, БГМУ, 2018, 376-383.

• **Articles in scientific conference proceedings:**
International held abroad

12. Poștaru C., Zabun T., Pankratova N., Postnikov M., Uncuța D. Caracteristica cefaleei de tip tensional la copii cu anomalii dento-maxilare. *Al XXII-lea Congress Internațional al UNAS. Revista Română de Medicină Dentară,* 2018, vol.XXI (3), 227-242. ISSN 1841-6942.

13. Railean S., Lupan I., David Lisa, Claire Csanger, Spinei A., Railean Gh., Poștaru C. Incidența deformațiilor craniene la copii cu dizabilități neurologice severe și impactul lor asupra ocluziei. *Al XIX-lea Congress Internațional al UNAS. Revista Română de Medicină Dentară.* 2015; 1(18), 5-20. ISSN 1841-6942

• **Summary/abstracts/theses in scientific conference papers:**
✓ **international**

14. Poștaru C., Railean S., Melnic S**.** Malocclusion in mixed and permanent dentition in children from Republic of Moldova. *XV International Congress of Medical Sciences.* Sofia, Bulgaria; 2016, 301.

15. Малкина В.Д., Поштару К.Г., Постников М.А. Диагностика зубочелюстно-лицевых аномалии с применением программы Dolphin Imaging при планирование ортодонтического лечения. В*:* Материалы *XIII* научно-практической конференции молодых ученых и студентов с международным участием посвященной "Году развития туризма и народных ремесел" Душамбе, Республика Таджикистан, 2018, 81.

16. Poștaru C., Uncuta D. Analysis of craniofacial morphology in children with malocclusions and cerebral palsy by 3-dimensional computer tomography. Матеріали науково-практичної конференції з міжнародною участю, Ternopil Dental Summit, 23-24 mai, 2019, p 20-21. **УДК 616.31(063).**

✓ **national**

17. Postaru C., Melnic S., Cheptanaru O. Malocclusion patterns in physically, auditory and visually handicapped patients in Republic of Moldova. In: *Abstract book The 7th International Medical Congress for students and Young Doctors MedEspera,* Chișinău, Republic of Moldova, 3-5 May 2018, p.252. ISBN 978-9975-47-174-9.

18. Поштару К. Г, Постников М. А., Панкратова Н.В., Репина Т.В, Ункуца Д.Б. Изучение параметров мозгового и лицевого черепа у детей с зубочелюстными аномалиями и детским церебральным параличом. В: Журнал Ортодонтия, 2019, 2(86).

19. Поштару К.Г., Постников М.А., Панкратова Н.В., Ункуца Д.Б. Изучение характера головной боли напряженного типа у пациентов с аномалии окклюзии. В: Журнал Ортодонтия, 2019, 2(86).

• **Patents, certificates of registration of materials at invention salons:**

20. Poștaru Cr., Railean S., Railean Gh., Postnikov M., Rodionova A. Metodă de diagnostic al dereglărilor neuromusculare la copii cu anomalii oromaxilo-faciale. Brevet de invenţie MD 1293, nr.12/2018, 2018.12.31.

21. Poștaru Cr., Railean S., Railean Gh., Uncuța D. Metodă de diagnostic al anomaliilor dento-maxilare la copii cu tulburări senzoriale centrale. Brevet de invenţie s 2019 0052 din 2019.05.24.

22. Постников М.А., Чигарина С. Е., Испанова С.Н., Малкина В.Д., Поштару К.Г., Колесов М.А. Способ комплексной диагностики окклюзии. Патент Nr. 2694175 2019. 07.09.

• **Participation with communication at scientific forums:**
✓ **international**

23. Поштару К., Ункуца Д. Современный взгляд на проблемы зубочелюстных аномалии у детей с головными болями. В: XX Стоматлогический Международный Симпозиум по Ортодонтии и Детской Стоматологии, г. Самара Ноябрь 8-10 2017.

24. Персин Л.С., Панкратова Н.В., Репина Т.В., Родионова Ю.В., Поштару К. Оссобенности ортодонтического лечения пациентов с ретенцией клыков. В: Международная научно-практическая конференция "Междисциплинарный подход в диагностике, профилактике и лечении заболеваний челюстно-лицевой области". Минск 28 марта 2018.

25. Панкратова Н.В., Персин Л.С., Репина Т.В., Родионова Ю.В., Поштару К. Интенсивность возрастных изменений параметров черепа за период смены зубов у детей с физиологической окклюзией. Конференция по стоматологии с

международным участием "Актуальные вопросы практической стоматологии". Г. Тольятти. 18-20 мая 2018.

26. Postaru C., Pankratova N., Postnikov M., Uncuța D. Analiza creșterii și dezvoltării organismului la copii cu dereglări neurologice. *Al XXIII-lea Congress Internațional al UNAS*. București, România. Octombrie 2-5 octombrie 2019. ISSN 2344-2727.

27. Поштару К.Г., Ункуца Д.Б., Панкратова Н.В., Райлян С.К. Анализ морфофункционального состояния зубочелюстной системы у детей с головной болью напряженного типа в сочетание с аномалиями окклюзии. В: XXII Стоматлогический Международный Симпозиум по Ортодонтии и Детской Стоматологии, г. Самара Ноябрь 6-8 2019.

✓ **national**

28. Postaru C., Cheptanaru O., Melnic S., Uncuța D., Postnikov M. Rolul anomaliilor dento-maxilare la copii cu cefaleea de tip tensională. În: *Conferința consacrată Zilei Stomatologului Sfintei Apolonia și Comemorarea Academicianului, Profesor universitar, Doctor habilitat, Ion Lupan*. Chișinău, 9 februarie 2018.

• **Participation with posters at scientific forums:**

✓ **international**

29. Railean S., Poștaru C., Uncuța D., Railean Gh. The severity of malocclusion in children with special needs in the Republic of Moldova. Stockholm, Suedia, 16-20 iunie, 2016.

30. Railean S.; Railean G., Postaru C. Incidence of cranial deformities according to the type of the school. In: *The 22nd BaSS Congress.* Thessaloniki, Greece, 2017.

31. Răilean S., Poștaru C., Spinei A., Postnicov M., Uncuța D., Bălteanu O. Relația dintre malocluzii și caria dentară la copii cu dizabilități intelectuale. În: *Al 21-lea Congres Internațional UNAS.* București, România, Octombrie 3-6 2017. ISSN 2344-2727.

32. Postaru C., Railean S., Cheptanaru O., Postnikov M., Uncuța D. Functional electromyography of mastication muscle in children

with malocclusion and tension type headache. *2ⁿᵈ Congress of the Balkanic Association of Orthodontic Specialist, 9ᵗʰ Romanian Association for Excellence in Orthodontics Congress*, Iasi, Romania. 24-26 May 2018. ISBN 978-606-13-4404-8.

33. Postaru C., Railean S., Melnic S., Uncuța D., Postnikov M. Prevalence of malocclusion among 6-18 year old children with special needs in the Republic of Moldova. *94ᵗʰ Congress of the European Orthodontic Society* Edinburg, U.K., June 17-21 2018.

34. Postaru C., Railean S., Postnikov M., Uncuța D. Caracterul cefaleelor de tensiune la copii cu anomalii dento-maxilare. *Al XXII-lea Congress Internațional al UNAS*. București, România. Octombrie 3-6 2018. ISSN 2344-2727.

✓ **national**

35. Poștaru C., Railean S., Melnic S., Uncuța D. Particularitățile anomaliilor dento-maxilare la copii cu cefalee de tip tensională. În: *Conferința științifică anuală în cadrul Zilelor USMF ''Nicolae Testemițanu''.*, Chișinău, 16-20 octombrie 2017.

36. Poștaru C., Postnikov M., Uncuța D**.** Particularitățile de creștere a aparatului dento-maxilar la copii cu dereglări neurologice bazate pe dezvoltarea dinților. În: *Conferința științifică anuală în cadrul Zilelor USMF ''Nicolae Testemițanu''.*, Chișinău, 15-18 octombrie 2019.