UDK:- 616.831-009.11- 616.31.07

DIAGNOSIS AND TREATMENT OF JAWS AND ORAL ORGANS IN PATIENTS WITH SPASTIC CEREBRAL PALSY

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Abstract

It is known that chronic diseases (CD), including pathologies of the respiratory system (RS) and central nervous system (CNS), significantly increase the number of growth disorders of the maxillofacial system (MFS) [2, 4, 13]. In cerebral palsy (CP), isolated and combined forms of pathology are often encountered [4, 13, 20]. Authors assert that dysfunction of the orbicularis oris muscle, which closes the oral cavity (OC), and the presence of airway obstruction in the form of adenoid growths, hypertrophy of the palatine and pharyngeal tonsils, and the harmful habit of mouth breathing often lead to systemic changes in the body as a whole [1, 3, 5, 9]. Systemic changes accompanying nasal obstruction include pulmonary heart disease [7, 10, 16]. According to several authors, mouth breathing (MB) disrupts the act of swallowing, during which muscles attached to the lower jaw (LJ) and hyoid bone pull the LJ backward, leading to the development of a prognathic (distal) bite. In normal swallowing, this does not occur as dental rows are tightly closed and held in the correct position due to tight interocclusal contacts of antagonizing teeth [3, 8]. Additionally, the balance of external and internal forces acting on the upper jaw (UJ) is disrupted, hindering its growth, and additional pressure from the buccal muscles exacerbates the constriction of dental rows (DR) in the lateral sections. As a result, narrowing of the UJ DR occurs, the lateral group of teeth is set transversely, and the absence of lip closure reinforces the MB habit, closing the "vicious circle" of MFS pathology pathogenesis [18, 20]. It is also established that motor defect in CP is disabling not only due to the insufficiency or absence of certain skills but also due to impaired functions of movement, speech, and psyche [11, 15, 17]. Children with CP differ from healthy peers; their teeth wear down, the anterior group is easily traumatized, many teeth are removed, leading to bite anomalies, bruxism, periodontal tissue pathologies [2, 13], and others. Considering the above, studying the structure, frequency, and mechanisms of MFS pathology formation in children and adolescents with CP is relevant for developing methods of early diagnosis and effective treatment.

Keywords. Cerebral palsy (CP); maxillofacial system (MFS), occlusion anomalies, respiratory system (RS) pathologies, central nervous system (CNS) disorders, distal bite, upper jaw constriction, early diagnosis, dental pathology, cephalometric analysis, oral cavity (OC).

Аннотация

Известно, что хронические заболевания (ХЗ), включая патологии дыхательной системы (ДС) и центральной нервной системы (ЦНС), значительно повышают частоту нарушений роста челюстно-лицевой системы (ЧЛС) [2, 4, 13]. У детей с детским церебральным параличом (ДЦП) часто встречаются изолированные и сочетанные формы патологий [4, 13, 20]. Авторы

отмечают, что дисфункция круговой мышцы рта, замыкающей полость рта (ПР), а также наличие обструкции дыхательных путей в виде аденоидных разрастаний, гипертрофии небных и глоточных миндалин и вредная привычка ротового дыхания нередко приводят к системным изменениям организма в целом [1, 3, 5, 9]. К системным изменениям, сопровождающим носовую обструкцию, относят лёгочно-сердечную недостаточность [7, 10, 16]. Согласно данным ряда авторов, ротовое дыхание нарушает акт глотания, при котором мышцы, прикрепляющиеся к нижней челюсти (НЧ) и подъязычной кости, тянут НЧ кзади, что способствует формированию прогнатического (дистального) прикуса. При нормальном глотании этого не происходит, поскольку зубные ряды плотно смыкаются и удерживаются в правильном положении благодаря межокклюзионным контактам антагонистов [3, 8]. Кроме того, нарушается баланс внешних и внутренних сил, действующих на верхнюю челюсть (ВЧ), что препятствует её росту, а дополнительное давление со стороны щёчных мышц усиливает сужение зубных рядов (ЗР) в боковых отделах. В результате происходит сужение ЗР ВЧ, боковая группа зубов располагается поперечно, а несмыкание губ закрепляет привычку ротового дыхания, замыкая «порочный круг» патогенеза патологий ЧЛС [18, 20]. Также установлено, что двигательный дефект при ДЦП приводит к инвалидизации не только вследствие недостаточности или отсутствия определённых навыков, но и из-за нарушения двигательных, речевых и психических функций [11, 15, 17]. Дети с ДЦП отличаются от здоровых сверстников: у них наблюдается повышенное стирание зубов, травматизация передней группы зубов, множественные удаления, что приводит к аномалиям прикуса, бруксизму, патологиям тканей пародонта [2, 13] и другим нарушениям. Учитывая изложенное, изучение структуры, частоты и механизмов формирования патологий ЧЛС у детей и подростков с ДЦП является актуальным для разработки методов ранней диагностики и эффективного лечения.

Ключевые слова. Детский церебральный паралич (ДЦП), челюстно-лицевая система (ЧЛС), аномалии прикуса, патологии дыхательной системы (ДС), расстройства центральной нервной системы (ЦНС), дистальный прикус, сужение верхней челюсти, ранняя диагностика, стоматологическая патология, цефалометрический анализ, полость рта (ПР).

Annotatsiya

Ma’lumki, surunkali kasalliklar (SK), shu jumladan nafas olish tizimi (NT) va markaziy asab tizimi (MAT) patologiyalari yuz-jag‘ tizimi (YUJT) o‘sishining buzilish chastotasini sezilarli darajada oshiradi [2, 4, 13]. Bolalar serebral falaji (BSF) bilan og‘rigan bolalarda ko‘pincha patologiyaning alohida va qo‘shma shakllari uchraydi [4, 13, 20]. Mualliflarning ta’kidlashicha, og‘iz bo‘shlig‘ini yopuvchi aylana mushak disfunksiyasi, shuningdek, adenoid o‘simtalar ko‘rinishidagi nafas yo‘llari obstruksiyasi, tanglay va halqum bodomsimon bezlari gipertrofiyasi va og‘izdan nafas olishning zararli odati ko‘pincha butun organizmda tizimli o‘zgarishlarga olib keladi [1, 3, 5, 9]. Burun obstruksiyasi bilan birga keladigan tizimli o‘zgarishlarga o‘pka-yurak yetishmovchiligi kiradi [7, 10, 16]. Bir qator mualliflarning ma’lumotlariga ko‘ra, og‘iz orqali nafas olish yutinish jarayonini buzadi. Bunda pastki jag‘ (PJ) va til osti suyagiga birikadigan mushaklar PJ ni orqaga tortadi, bu esa prognatik (distal) tishlovning shakllanishiga olib keladi. Normal yutinishda bu hodisa kuzatilmaydi, chunki antagonist tishlarning o‘zaro aloqasi tufayli tish qatorlari zich yopiladi va to‘g‘ri holatda saqlanadi [3, 8]. Bundan tashqari, yuqori jag‘ga (YuJ) ta’sir etuvchi tashqi va ichki kuchlar muvozanati buziladi, bu esa uning o‘sishiga to‘sqinlik qiladi. Yonoq mushaklari tomonidan qo‘shimcha bosim esa yon qismlarda tish qatorlarining (TQ) torayishini kuchaytiradi. Natijada, YuJ TQ torayadi, tishlarning yon guruhi ko‘ndalang joylashadi, lablarning yopilmasligi esa og‘iz orqali nafas olish odatini mustahkamlaydi va yuz-jag‘ tizimi patologiyasi patogenezining "yopiq aylanma"sini hosil

qiladi [18, 20]. Shuningdek, BSFda harakat nuqsoni nafaqat ma'lum ko'nikmalarning yetishmasligi yoki yo'qligi tufayli, balki harakat, nutq va ruhiy funksiyalarning buzilishi tufayli ham nogironlikka olib kelishi aniqlangan [11, 15, 17]. BSF bilan og'rigan bolalar sog'lom tengdoshlaridan farq qiladi: ularda tishlarning tez-tez ishqalanishi, old guruh tishlarining shikastlanishi, ko'plab tish olishlar kuzatiladi, bu esa tishlov anomaliyalari, bruksizm, parodont to'qimalari patologiyalari [2, 13] va boshqa buzilishlarga olib keladi. Yuqoridagilarni inobatga olgan holda, BSF bilan og'rigan bolalar va o'smirlarda YUJS patologiyalarining tuzilishi, chastotasi va shakllanish mexanizmlarini o'rganish erta tashxislash va samarali davolash usullarini ishlab chiqish uchun dolzarbdir.

Kalit so'zlar. Bolalar serebral falaji, yuz-jag' tizimi, tishlov anomaliyalari, nafas olish tizimi patologiyalari, markaziy asab tizimi buzilishlari, distal tishlov, yuqori jag' torayishi, erta tashxislash, stomatologik patologiya, sefalometrik tahlil, og'iz bo'shlig'i.

C A R J I S

Entrance. Cerebral palsy (CP) is one of the most common neurological disorders in childhood, often leading to secondary complications in various systems of the body, including the maxillofacial system (MFS). Chronic diseases (CD) affecting the respiratory system (RS) and central nervous system (CNS) are known to significantly increase the risk of maxillofacial growth disorders. In children with CP, both isolated and combined forms of MFS pathology are frequently observed. Mouth breathing, dysfunction of the orbicularis oris muscle, and airway obstruction caused by adenoid hypertrophy or enlarged tonsils contribute to abnormal jaw development. These factors lead to impaired swallowing, distal bite formation, and narrowing of the upper jaw. Continuous imbalance between external and internal muscular forces further aggravates these changes, forming a "vicious circle" of MFS deformation. Moreover, due to motor, speech, and psychological dysfunctions, children with CP are more prone to dental injuries, abnormal tooth wear, and periodontal pathologies. Therefore, the study of structural and functional disorders of the jaws and oral organs in children with cerebral palsy is essential for the early diagnosis and development of effective treatment approaches.

For comprehensive dental treatment, caries treatment, filling of defects, gum inspection and cleaning of dental calculus, periodontal ligament treatments with solutions of metronidazole, tetracycline, and chlorhexidine, and oral cavity rinsing 2-3 times a day with furacilin solution 1:1000 were performed. Orthodontic appliances were used to expand the jaws, including fixed systems like the Haurex (Haas) appliance (for upper and lower jaw narrowing) and trainer devices for protrusion based on indications considering age and nosology. For a comprehensive approach, MG underwent rehabilitation with a multidisciplinary team of specialists. Patients received physical therapy, massage, kinesitherapy, physiotherapy, positioning, reflexology, botulinum therapy, orthotics, and worked with psychologists, educators, and speech therapists. The results were evaluated after 18 months. Data were processed using the parametric Student's t-test or the non-parametric U-test using Excel MS Office 2013 software.

Table №1.

By the age group of the examined children, n=299.

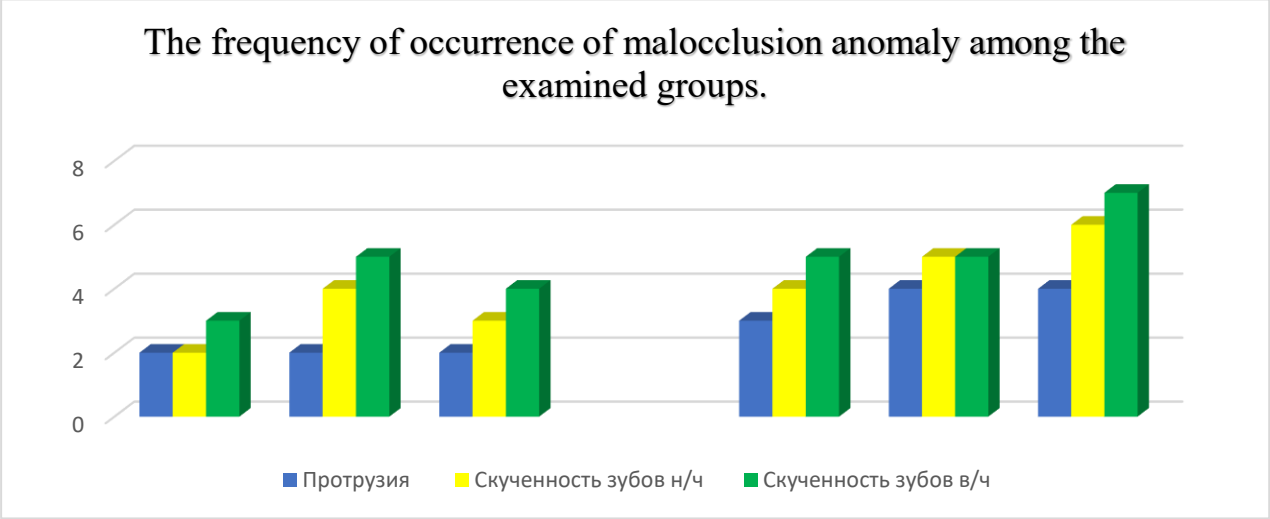
Age, yers	Boys		Girls		Total
	CG	MG	CP	MG	
6-9 yers	31/36,5%	28/33,8%	27/38%	16/26,7%	102/34,1%
10-13 yers	33/38,9%	25/30,1%	28/39,4%	14/23,3%	100/33,4%
14-18 yers	21/24,8%	30/36,1%	16/22,5%	30/50%	97/32,4%

Total	85/100%	83/100%	71/100%	60/100%	299/100%
From the overall study	85/28,4%	83/27,7%	71/23,8%	60/20%	299/100%

Note: MG - main group; CG - control group; CP - cerebral palsy.

Methods. Main examination methods included collection of anamneses, patient complaints, and a comprehensive examination of the maxillofacial area (MFA). Additional examination methods included index assessments - DMFT, DMFT + dmft, ICDAS II, Plaque Index PLI, OHI-S by Green-Vermillion (1964), PMA (Parma, 1960), PBI (Muhleman, 1975), TER, Saliva-Check Mutans express test (GC), caries risk assessment of dental plaque, transillumination method for carious defect diagnosis, and intraoral radiography. Cephalometric (ceph) methods were used to study the bone tissues of the head and MFA (Sella, Nasion, Orbital, subspinale, Pogonion, Gnation, Menton, Gonion, Articulare, Basion, Porion, PNS, ANS, S-N, Ba-N, orbitale, from ANS to PNS) in children and adolescents before and after treatment. Clinical and morphological study results in MG children showed: the detection of bite anomalies averaged 90.2%; in the CG - 53.6% of the total examined. Among children and adolescents, protrusion was found in 8.5±1.1*, lower jaw narrowing in 11.6±1.6*, upper jaw narrowing in 13.2±1.4, and other orthodontic pathologies in 66.7±1.3, significantly higher compared to CG; - 7.2±1.8; -10.8±1.5; -14.5±2.5; -67.5±1.4 respectively. Results indicated that crowding of the upper jaw, protrusion, and other pathological bites increased with age among the MG and compared to the CG.

Diagram №1.
The frequency of occurrence of malocclusion anomaly among the examined groups.



Note: OG - main group; CG - control group; * - P <0.05 when compared to healthy data; - P <0.05 when compared to CG children's data.

The obtained results regarding OHI-S, PLI indices, and caries indicators in primary and permanent teeth of the examined patients in the main group (MG) showed OHI-S values above 3.0±0.98; average PLI values were 3.0±0.84; in the control group (CG), these were 1.64±0.44 and 1.88±0.98, respectively. It was noted that the number of erupted teeth was lower among the MG compared to the CG. Additionally, the prevalence of caries in primary

teeth among children and adolescents in the MG averaged 98.88%, with 100% of children in the MG-2 group showing carious lesions in both permanent and primary teeth; in the CG, these figures were 89.85% and 93.54%, respectively.

RESULTS. Children and adolescents with cerebral palsy (CP) showed statistically significant differences in measurements such as Na-Perp to point, Mand.length, Max/length, Mand.to Cranial Base, Lower I to Point A, Lower pharynx, FMIA, Facial angle, Angle of convexity, Mandibular plane to F.H plane, Y-axis angle, Occlusal plane to F.H plane, I to I, and I to Mandibular plane compared to the CG (Table 2). As seen in the table, cephalometric (ceph) measurements of nearly all parameters determining the growth of the upper jaw, lower jaw, and palate showed significant underdevelopment of bone elements in the maxillofacial area (MFA) compared to CG 1, 2, and 3, with a noticeable significant difference observed with the age-related growth of children and adolescents with CP. Compared to morphological norms, the MG also showed statistically significant results in the measurement of the aforementioned bone element points. Cephalometric results indicated that the relationship of the apical bases of the jaws, especially among the incisors, compared to the cranial base, showed signs of outward displacement of the bones of the anterior part of the face. For example, signs such as forward displacement of the alveolar wall of the upper dental arch were observed in children with dental-jaw anomalies (DJA), along with changes in the hard and soft tissues of the upper jaw, lower jaw, lips, and hard palate in both MG and CG patients. Additionally, children and adolescents with CP and partially in the CG showed pathological changes in the normative formation.

CONSIDERATION. In 94.5% of cases (CG - 58.3%), children and adolescents in the main group (MG) exhibited signs of periodontal inflammation. Additionally, the results of comparing the levels of indices in the MG - OHI-S (2.8±0.3*), PMA (44.4±8.4*), and PBI (4.6±1.2*) - with the CG (1.4±0.40); (32.4±5.42); (1.14±0.1) respectively, reveal an association between the conditions of periodontal disease development in both groups. The level of salivary antioxidant defense (SOD) in MG patients of all ages was lower (0.27±0.03*) than in the CG by up to 1.6 times (0.40±0.07). The results demonstrate the dependency of the OHI-S and PMA indices on the level of SOD production: the higher the SOD indicator, the lower the OHI-S and PMA indices and the better the oral hygiene status.

The IgG level was on average 1.5 times higher (15.9±2.08*) and IgE 5 times higher (3.5±0.5*) compared to CG values. This observed change in class E antibody indicators suggests that pathological changes in the MG are not limited to the dentofacial system (DFS) or cerebral palsy (CP) but also affect the detoxification system.

Additionally, there was a noted decrease in the content of lysozyme in the saliva of the CP group by 10-11 times, lactoferrin by 3 times, and sIgA by 3.0-3.5 times compared to the CG, indicating that CP is associated with significant deviations from the norm in systemic immunity in the examined children.

Positive results in measurements after treatment were observed: in the upper part of the maxilla, the most posterior slope of the Pogonion point, the tubercle point of the mandible, the point in front of the chin of the mandible, the chin point of the mandible, the lowest point of the symphysis sphere, the angle of the mandible, the inner concave surface of the upper part of the greater wing of the sphenoid bone corresponding to the point of the posterior inferior aperture of the anterior wing, the upper part of the ear opening, the posterior point of the hard palate, the most anterior point of the maxilla in relation to the palate, and others.

Against the backdrop of comprehensive treatment, in the dynamics relative to sIgA, the

level of salivation after treatment doubled, indicating an enhancement of the immunity of the oral fluid. Analysis of changes through mathematical criteria shows that the immune protection system of the oral cavity is activated after the application of a comprehensive treatment method for children with dentofacial anomalies (DFA) along with cerebral palsy (CP). In the CP group, there are many uncontrollable factors provoking the occurrence of lip diseases, habitual neurotic actions manifesting in "biting," licking, and sucking of the lips.

Additionally, the positive dynamics in the functioning of the dentofacial system led to positive shifts in the overall condition of the patients and the effectiveness of CP rehabilitation. Children began to chew and swallow better, digestion improved, consequently enhancing the absorption of trace elements and nutrients. Children gained muscle mass, increased muscle strength, and consequently, their motor abilities improved. Mood became more stable, pronunciation improved, and vocabulary expanded.

CONCLUSION. Thus, children and adolescents with cerebral palsy (CP) represent a high-risk group for improper formation of craniofacial bones and head structures, pathologies of the oral cavity, carious and non-carious lesions of the hard tissues of the teeth, periodontal tissue pathologies, and oral mucosa diseases. The results of the studies indicate that oxidative stress in the oral cavity, along with genetically determined immune system dysfunction, especially in children and adolescents of groups MG-2 and MG-3, is one of the leading factors in the pathogenesis of dental pathology in CP. The interaction between CP and dental pathology has a threefold exacerbating nature.

The proposed treatment methods for CP can influence the destructive factors and causes of dentofacial anomalies (DFA), especially when considering the mechanisms of influence on clinical, anthropometric, immunological, and biochemical indicators in the etiopathogenesis of DFA in this group of children. Additionally, treatment and prevention of DFA, correction of bite defects, preliminary prediction of the existing risk of pathology, and simultaneous inclusion of specialized treatment methods for pathology and traditional treatment methods, in accordance with the developed algorithm, are the main factors for high effectiveness in the short and long term. These approaches prevent or significantly reduce the development of anomalies in the craniofacial system, confirming the reliability of the results of the scientific and practical study.

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