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# Diagnosis and Treatment of Jaws and Oral Organs in Patients with Splastic Cerebral Palsy

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***Abstract:*** Early diagnosis of jaw pathologies in patients with CP and evaluation of the effectiveness of timely treatment. Comprehensive anthropometric, dental, laboratory, and sociological studies were conducted on 299 children and adolescents aged 6 to 18 years, including 143 with CP (main group - MG) and 156 somatically healthy (control group - CG) who required dental care. Treatment and prevention of dental system pathologies, malocclusion defects and preliminary prediction of existing pathology risks, along with the developed treatment regimen, lead to high effectiveness of prevention of dental system abnormalities. This research is very relevant in the field of dentistry, maxillofacial surgery, and prosthetics. And, in speech therapy and psychology, since by treating dentition, we give children a beautiful smile, even teeth, which directly affects diction. Novelty/originality of this study: for the first time in Uzbekistan, we studied the prevalence of dental morbidity, malocclusion and periodontal diseases among children aged 6-18 years. We also assessed the biochemical status of the oral cavity for the first time by studying the microbiome of saliva during prosthetics made of different materials.

***Keywords:*** *Cerebral palsy, dental pathology, jaws*

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## I. INTRODUCTION

Despite the large-scale study of the problems of free radical processes (FRP) in recent years, the problem of effectively blocking their negative effects on the cell has not been solved. It is proved that the studied contingent of children with cerebral palsy (CP) has a very high risk

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of developing deformities of teeth and dentition. However, despite a significant number of domestic and foreign publications on this issue, this has not led to any real positive results in improving the effectiveness of dental care (DC) for children with neuropsychiatric disorders (NPD) [1]. According to most authors [2]; [3] the DP for such children remains insufficiently optimized, turns out to be untimely and incomplete. In addition, it is known that numerous accumulated scientific materials confirm that the state of the ESR is considered an indicator of the state of the body as a whole. It is also known that, to date, it has been established that in children with congenital and hereditary pathology, hypoxic syndrome is almost constantly present, manifested by a violation of redox reactions (VRR) in mitochondria. Mitochondrial dysfunction is characterized by an increase in the activity of glycolysis, which in hypoxia is always accompanied by an increase in the content of lactic and pyruvic acids, peroxide compounds, and calcium metabolism disorders [4]; [5]. Literature data suggest that an increase in lactic acid production accompanies hypoxic conditions (HC) of any etiology, including cerebral palsy. The above factors contribute to the formation of a high risk of pathological changes in the tissues of a growing organism, especially in the tissues of the rudiments of teeth, which, as a rule, occurs in chronic pathology (ChP) in children, accompanied by hypoxic conditions (HC).

### A. *Objectives of the Study*

Early diagnosis of jaw narrowing and oral cavity pathologies in patients with CP and evaluation of the effectiveness of timely treatment.

### B. *Research Problem/Novel Contribution*

Novelty/originality of this study: for the first time in Uzbekistan, we studied the prevalence of dental morbidity, malocclusion and periodontal diseases among children and adolescents aged 6-18 years. We also assessed the biochemical status of the oral cavity for the first time by studying the microbiome of saliva and the hygienic condition of the oral cavity during prosthetics made of different materials.

## II. LITERATURE REVIEW

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) [6]; [7]; [1]. In cerebral palsy (CP), isolated and combined forms of pathology are often encountered [7]; [1]; [8]. 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 [9];[10];[4]; [11]. Systemic changes accompanying nasal obstruction include pulmonary heart disease [2] ; [12]; [13]. 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 [10]; [5]. 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 [8]. 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 [12]; [10]. 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 [6]; [1], 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.

## III. METHODOLOGY

A comprehensive anthropometric, dental, and clinical-laboratory study was conducted on 299 children and adolescents. Among them, 143 with CP and concomitant intellectual disability (ID) - main group (MG); 156 somatically healthy children and adolescents requiring dental care were selected as the control group (CG). Anthropometric, cephalometric parameters of jaws, and clinical-dental conditions of both genders aged 6 to 18 years were evaluated, including 44 (30.76%) aged 6–9 years (MG-1); 39 (27.27%) aged 10-13 years (MG-2) and 60 (41.9%) aged 14-18 years (MG-3); with CG - 58 (37.17%, CG-1); 61 (39.1%, CG-2) and 37 (23.7%, CG-3), also by gender, considering age-related anatomical-physiological features of the examined stomatognathic system.

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.

## IV. RESULTS

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.

TABLE 1
TELE ROENTGENOGRAPHY OF CHILDREN AND ADOLSCENTS AMONG THE EXAMINED PATIENTS

| Measurement factors | Normal | MG -1 | MG -2 | MG -3 | CG -1 | CG -2 | CG -3 |
|---|---|---|---|---|---|---|---|
| In mm and degrees | | | | | | | |
| Na-Perp to point A | 0-1±0 | -5,62 | -8,97 | -10,45 | -3,31 | -4,64 | -5,89 |
| Mand.length (Go-Gn) | 97-100±0 | 87,9 | 88,8 | 90,2 | 92,7 | 94,1 | 96,5 |
| Max/length (Go-PointA) | 80±0 | 71,2 | 73,5 | 75,9 | 75,4 | 77,6 | 79,1 |
| Ant.fac.Ht (ANS-Menton) | 57-58±0 | 49,8 | 51,3 | 53,5 | 53,7 | 55,2 | 56,8 |
| Mand.to Cranial Base (Pog-Na Perp) | Small(-8-6±0) | -10,3 | -11,5 | -12,6 | -8,4 | -9,1 | -9,7 |
| Upper I to Point A | 4-6±0 | 9,6 | 11,9 | 14,1 | 5,4 | 7,5 | 8,9 |
| Lower I to Point A | 1-3± | 6,8 | 8,2 | 10,5 | 3,1 | 4,6 | 5,9 |
| Upper pharynx | 15-20±0 | 10,4 | 9,3 | 8,5 | 14,1 | 12,8 | 11,3 |
| Lower pharynx | 11-14±0 | 6,1 | 4,7 | 3,8 | 10,7 | 9,1 | 7,6 |
| FMA (deg) | 22-28±0 | 25 | 26 | 27 | 28 | 29 | 25 |
| FMIA (deg) | 67±0 | 56 | 52 | 48 | 63 | 60 | 58 |
| IMPA (deg) | 88±0 | 99 | 102 | 105 | 89 | 91 | 97 |
| Z angle (deg) | 75±0 | 70 | 67 | 65 | 74 | 71 | 69 |
| Facial angle (deg) | 87,8±3,57 | 82 | 79 | 75 | 88 | 87 | 85 |
| Angle of convexity | 0±5,09 | 2,5 | 2,5 | 2 | 3,5 | 3 | 3 |
| A-B plane to facial plane | 1,6±3,67 | -1,5 | -2 | -2,5 | -1,6 | -2 | -2 |
| Mandibular plane to F.H plane(deg) | 21,9±3,24 | 22,5 | 23 | 24 | 20,5 | 22 | 23 |
| Y axis angle (deg) | 59,4±3,82 | 56 | 57,5 | 59 | 55 | 56,5 | 57 |
| Occlusal plane to F.H plane | 9,3 ±3,83 | 9 | 10,5 | 12 | 7 | 8,5 | 10 |
| I to I (deg) | 135,4±5,7 | 125,5 | 121,5 | 118 | 130,5 | 125 | 123 |
| I to occlusal plane | 14,5±3,48 | 10,5 | 8 | 6,5 | 11,5 | 10 | 9,5 |
| I to Mandibular plane | 2,7±1,80 | 8,5 | 11 | 13,5 | 5 | 7 | 10 |

TABLE 2
INDEX ASSESSMENT OF PERIODONTAL STATUS, NSRJ, SYSTEMIC AND LOCAL IMMUNITY INDICATORS IN CHILDREN AND ADOLESCENTS OF THE EXAMINED GROUPS

| User | Clinical group (M ±σ) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Average OG | MG-1 | MG-2 | MG-3 | Average CG | CG -1 | CG -2 | CG -3 |
| USOC, ml/min | 0,27±0,03* | 0,24±0,04 | 0,22±0,08 | 0,33±0,02 | 0,40±0,07 | 0,36±0,1 | 0,40±0,04 | 0,43±0,09 |
| OHI-S, units | 2,8±0,3* | 2,6±0,5 | 3,0±0,1 | 2,8±0,5 | 1,4±0,40 | 1,5±0,22 | 1,02±0,01 | 1,3±0,33 |
| OHI-S | | | | | | | | |
| PMA, % | 44,4±8,4* | 41,3±5,1 | 48,4±8,3 | 45,2±3,4 | 32,4±5,42 | 28,2±5,8 | 26,0±6,2 | 39,5±6,08 |
| PBI, points | 4,6±1,2* | 3,4±1,9 | 5,0±1,4 | 4,02±1, | 1,14±0,1 | 1,08±1 | 1,5±1,1 | 1,2±1 |
| Caries prevalence, % | 98,9±2,04* | 94,2±1,6 | 100±0,2 | 99,2±2,0 | 89,8±2,1 | 86,2±1,2 | 93,5±2 | 87,4±2, |
| Caries intensity (DMF), units | 8,8±0,1* | 4,9±0,8 | 9,9±0,1 | 8,9±0,1 | 4,5±0,6 | 3,4±0,8 | 6,04±0,4 | 4,01±0,3 |
| IgA, g/l | 0,54±0,22* | 0,45±0,12 | 0,49±0,06 | 0,78±0,04 | 1,9±0,7 | 1,08±0,4 | 1,4±0,23 | 2,5±0,5 |
| IgG, g/l | 15,9±2,08* | 12,6±1 | 17,5±1 | 15,02±0,5 | 10,21±0,24 | 10,5±0,34 | 9,3±0,64 | 10,9±0,12 |
| IgE, g/l | 3,5±0,5* | 2,5±3,1 | 5,04±4,8 | 4,3±2,34 | 0,44±0,03 | 0,5±0,01 | 0,34±0,08 | 0,4±0,09 |
| IgM, g/l | 0,7±0,08* | 0,44±0,9 | 0,62±1,0 | 0,8±0,9 | 1,7±0,44 | 1,9±0,49 | 1,7±0,9 | 1,4±0,9 |
| Lysozyme, μg/l | 0,34±0,08* | 0,4±0,06* | 0,24±0,01* | 0,71±0,9* | 4,4±0,45 | 4,6±0,85 | 4,04±0,7 | 4,54±0,9 |
| Lacto-ferrin, μg/ml | 0,63±0,02* | 0,75±0,08* | 0,42±0,04* | 0,65±0,06* | 1,9±0,44 | 2,5±0,8 | 1,24±0,7 | 2,08±0,1 |
| sIgA, mg/l | 86,3±6,8* | 99,8±6,02* | 77,4±4,3* | 84,5±5,3* | 27,03±7,5 | 244,08±9,7 | 226,03±9,5 | 300,03±4,4 |

*Note: CG — Control Group, MG — Main Group; * – p <0.05 compared to the mean values of the CG group; USOC — unstimulated saliva of the oral cavity.*

## V. DISCUSSION/ANALYSIS

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 IgA 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 (Table 2)

## VI. 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.

## VII. LIMITATIONS AND STUDY FORWARD

In our research, we studied only the deformation of the dentition, the biochemical composition of saliva, and also evaluated the hygienic index when using metallic and cermet prostheses. The topic is very big, in the next studies we plan to study new methods for early diagnosis, new prostheses for effective prosthetics.

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