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DENTAL STATUS OF ADOLESCENTS WITH HYPOTHALAMIC SYNDROME OF PUBERTY

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СТОМАТОЛОГИЧЕСКИЙ СТАТУС ПОДРОСТКОВ С ГИПОТАЛАМИЧЕСКИМ СИНДРОМОМ ПУБЕРТАТНОГО ПЕРИОДА

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The study examined the dental status of adolescents with hypothalamic syndrome of puberty (HSP). Clinical dental examinations of 98 adolescents with HSP and 94 healthy children were conducted. During the examination, the status of the hard dental tissues was determined according to the CFET, CFRS indices, and oral hygiene according to the K. Stallard and Silness Loe indices. The status of tissues in the periodontal area was assessed using indices of PMA %, bleeding, tartar, CPITN, and the Schiller – Pisarev test. A decrease in the level of dental health in adolescents with HSP compared with healthy peers was found. This is evidenced by dental caries' high prevalence and intensity and increased dental plaque indices.

Keywords: oral health, hypothalamic syndrome, adolescents

Исследован стоматологическоий статус подростков с гипоталамическим синдромом пубертатного периода (ГСПП). Осуществили клиническое обследование 98 подростков с ГСПП и 94 здоровых сверстников. При обследовании определяли состояние твердых тканей зубов по индексам КПУз, КПУп, гигиены рта по индексам K. Stallard, Silness Loe. Пародонтальный статус оценивали с помощью индексов PMA %, кровоточивости, зубного камня, CPITN, пробы Шиллера – Писарева. Установлено снижение уровня стоматологического здоровья у подростков с ГСПП по сравнению со здоровыми сверстниками, которое реализуется через высокую распространенность и интенсивность кариеса зубов, а также увеличение показателей пародонтальных индексов.

Ключевые слова: стоматологическое здоровье, гипоталамический синдром, подростки

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CFET – caries, filling, extracted teeth
CFRS – caries, filling, removed surfaces
CPITN – index of need for the treatment of periodontal diseases
DA – dental anomalies
HSP – hypothalamic syndrome of puberty
PMA – papillary-marginal-alveolar index
SiC-index – index of highest caries intensity

Domestic and foreign literature sources indicate a high level of dental diseases in children and adolescents with endocrinopathies [1–6]. Among endocrine diseases of adolescence, a significant proportion (82.4 patients per 1000 people) is occupied by the hypothalamic syndrome of puberty (HSP), while there is a tendency for the incidence to almost double over the last twenty years [7].

HSP is a pathological symptom complex of adolescence, which is characterized by dysfunction of the endocrine glands and metabolic, trophic, immune, and autonomic disorders.

This disease increases the risk of further development of obesity, metabolic syndrome, type 2 diabetes mellitus, hypertension, and atherosclerosis [8, 9]. Systemic abnormalities associated with this endocrinopathy may adversely affect children's dental health. However, researchers have not paid sufficient attention to the dental problems of children and adolescents with HSP.

This work aims to study the dental status of adolescents with HSP.

Material and Methods. A clinical examination of the dental area of 98 adolescents with HSP was performed; an endocrinologist established this diagnosis. The research design is analytical, cohort, sample, and dynamic. In the designated contingent, girls comprised 64.3 % (63 people), and boys – 35.7 % (35 people).

Criteria for inclusion in the study group: adolescents aged 13–18 years; mild, moderate, and severe GSPP; informed consent signed by parents and guardians.

The criteria for exclusion from the group were the patient's or his parents' refusal to sign an informed consent and to participate in the study, a complication of the syndrome by other endocrine diseases (diabetes mellitus, thyroid diseases, and others), concomitant somatic diseases during an exacerbation, infectious diseases.

The group of subjects was selected taking into account the age classification, which determines the range of adolescence [10], corresponding to the formation stage of permanent teeth occlusion – functional design or «pre-forming» permanent dentition in the terminology of Professor Yu. M. Malygin. (from 12–13 to 18 years old) and the most common manifestation of endocrine disease – from 13 years old.

The comparison group was formed from 94 healthy adolescents aged 13–18 years (girls accounted for 61.7 %, 58 people, boys – 38.3 %, 36 people).

The study was carried out in the endocrinology department of the Simferopol City Children's Clinical Hospital, as well as the children's department of the Crimean Republican Dental Center.

According to medical histories of diseases, HSP of primary origin with manifestation in the juvenile period was established in 48.9 % of adolescents, and the secondary form of the disease (background – obesity) was diagnosed in 45.9 % of people. In 5.1 % of adolescents, the form of the disease was not determined. The duration of the disease ranged from one year to 4 years. Adolescents with HSP in the study group had obesity of varying severity in 93.9 % of cases (92 children). At the same time, those examined with the third degree of severity dominated (38.8 %).

When determining the level of dental health in the compared groups, we were guided by the methodological approaches recommended by the World Health Organization [11].

During the examination, the condition of the hard tissues of the teeth was determined, and caries intensity indices were calculated – CFET and CFRS. Oral hygiene was assessed using quantitative and qualitative indices (Silness – Loe and K. Stallard). Periodontal status was established using the PMA % index, Schiller – Pisarev test, bleeding, dental calculus indices, and CPITN [12].

Statistical methods of processing the results. Statistical characteristics of random variables were determined for the samples; graphs were constructed to visualize the relationships between numerical data in the samples; distribution was checked for normality; equality of sample variations was assessed; reliability of the difference between samples of arithmetic mean (using parametric hypothesis testing criteria) or reliability of the difference of the measured attribute (using nonparametric goodness-of-fit tests). The type of distribution of values in the compared samples was determined using the nonparametric Kolmogorov – Smirnov test; the Levene test was also used to assess the homogeneity of variation in the samples.

If there were statistically proven prerequisites for parametric criteria, the Student t-test was used to assess differences between samples. At the same time, the statistical values of the nonparametric Mann – Whitney U-test were calculated. In cases where quantitative characteristics did not have a normal distribution with a given error level, the nonparametric Mann – Whitney U-test made the decision. Pearson linear correlation coefficient values were also calculated.

Results and Discussion. Analysis of the clinical examination results indicated a low level of dental health in adolescents with HSP compared to healthy individuals. This was reflected by caries indicators and objective indices characterizing periodontal status (Table 1).

Table 1

Values of Mann – Whitney U-test statistics, comparison of samples of adolescents with HSP/healthy ones according to various indicators

Index	Mann – Whitney U, Z value	Observed significance level (asymptotic, two-sided) $P_{asymp.sig}$ M-W U
K. Stallard	–5.032	0.000*
Silness – Loe	–5.078	0.000*
Schiller – Pisarev test	–4.845	0.000*
PMA, %	–5.228	0.000*
Bleeding index	–2.953	0.003*
CFRS	–6.451	0.000*
CFET	–6.211	0.000*

* $p<0.05$ there is a statistically significant difference.

The data in the table indicate that, given the observed level of significance of the nonparametric Mann – Whitney test when testing the hypothesis H0/H1, for all pairs of samples sick/healthy, the hypothesis H0 should be rejected in favor of the alternative H1 – a statistically significant difference between the studied parameter of the samples is present with the given level of significance.

In adolescents suffering from HSP, the prevalence of dental caries was 100 %, and in healthy peers – 86.4 %. The intensity of dental caries in adolescents with HSP was according to the CFET index – 5.32±1.69, according to the CFRS index – 5.94±1.75, according to the SiC-index – 9.78±1.98, significantly exceeding the indicators in the group comparison ($p<0.05$). According to the WHO assessment criteria, the incidence of caries in permanent teeth in those examined with HSP in this age group is interpreted as high.

Analysis of the components that make up the CFET index in adolescents with HSP showed that the value of element K – caries (3.25±1.7) was 2.4 times higher than element P – filling (1.37±1.5). In healthy adolescents, this ratio was in favor of the P component. The number of teeth removed due to complicated caries in adolescents with HSP was 0.5 as part of the CFRS index. In practically healthy peers, no permanent teeth were removed. This indicates a high need for oral sanitation and preventive measures for adolescents with HSP.

The level of oral hygiene in adolescents with GSPP met the criterion of «unsatisfactory» in 34.69 % of cases (34 people), «satisfactory» – in 53.06 % (52 people), and «good» – in 12.25 % (12 children). The Silness – Loe oral hygiene index averaged 1.49±0.19 points ($p<0.05$), and Stallard – 1.73±0.22 points ($p<0.05$); they were significantly higher than those of healthy peers.

When studying periodontal status in adolescents with HSP, clinical signs of gingivitis were diagnosed on average two times more often than in practically healthy individuals. At the same time, chronic catarrhal gingivitis of mild severity was recorded in 39.98 % of cases of moderate severity – in 56.1 %. Only four examined patients had no inflammatory changes (4.1 %).

An index assessment of the condition of periodontal tissues showed that the intensity and prevalence of inflammation were significantly higher ($p < 0.05$) in the cohort of adolescents with endocrine disease. The RMA gingivitis index averaged 25.69±3.3 %, the Schiller – Pisarev test value was 1.78±0.25 points, the bleeding index was 0.17±0.01 points, and the dental calculus index was 0.39±0.04 points. Adolescents suffering from HSP showed a high need for periodontal treatment (CPITN index was 0.83±0.02 points).

During the implementation of the study, the correlation between indicators characterizing periodontal status (PMA index, Schiller – Pisarev test) and the duration of endocrinopathy in adolescents was analyzed. Statistical analysis established a high correlation strength between the studied indicators (Table 2).

Table 2

Pearson linear correlation coefficient values

Study stage	Pearson correlation value	Observed significance level (asymptotic, two-sided)
Duration of the disease / PMA	0.883	0.01
Duration of the disease / Schiller – Pisarev test	0.776	0.01

Statistical analysis was performed to assess the severity of the influence of endocrine pathology and anomalies of the dentoalveolar system on the periodontal status of adolescents with HSP. A comparison was made between the subjects with HSP who had dentoalveolar anomalies and those with HSP. No tooth position, bite, or occlusion anomalies were observed (Table 3).

The table data indicates that, based on the readings of the observed significance level of the nonparametric Mann – Whitney test, with a significance level of P=0.95 for the PMA indices, the values of the Schiller – Pisarev test, the hypothesis H0 should be accepted – there is no statistically significant difference between the average values of the studied samples. For the bleeding index with a significance level, hypothesis H0 should be rejected in favor of the alternative H1 – a statistically significant difference between the means of the studied samples is present with a given significance level. This suggests that inflammatory changes in the tissues of the periodontal complex in adolescents with HSP are determined mainly by the presence of the underlying endocrine disease rather than by local factors.

Table 3

Analysis of samples according to PMA % indicators, bleeding index, and Schiller – Pisarev test in adolescents with hypothalamic syndrome with dentofacial anomalies and without dentofacial anomalies

Index	Group	n	AM	Stand. deviation	Absolut difference of AM	Observed level of significance (asymptotic, two-sided) M-W U
PMA, %	With DA	81	28.960	10.818	2.515	0.003
	Without DA	17	22.429	8.303		
Bleeding	With DA	81	0.176	0.191	0.015	0.764
	Without DA	17	0.161	0.085		
Schiller – Pisarev test	With DA	81	1.949	0.565	0.319	0.003
	Without DA	17	1,630	0,333		

Conclusion. Clinical examination revealed a lower level of dental health in adolescents with HSP compared to healthy peers. This is evidenced by dental caries' high prevalence and intensity and an increase in periodontal indices. This necessitates the development of active treatment and preventive measures in this population.

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USING DEEP CONVOLUTIONAL NEURAL NETWORKS FOR THREE-DIMENSIONAL CEPHALOMETRIC ANALYSIS

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ИСПОЛЬЗОВАНИЕ СВЕРТОЧНЫХ НЕЙРОННЫХ СЕТЕЙ ДЛЯ ПРОВЕДЕНИЯ ТРЕХМЕРНОГО ЦЕФАЛОМЕТРИЧЕСКОГО АНАЛИЗА

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The study included the development of a new convolutional neural network (CNN) model for recognizing and fitting cephalometric points on cone-beam computed tomography (CBCT) slices for further 3D cephalometric analysis and evaluation of its accuracy. We used DICOM files for 192 cone beam tomograms in the study. Each set of files was imported into ViSurgery software (Skolkovo, Russia). Next, three-dimensional models of the patient's soft tissues, bones, and teeth were generated, and 26 points were placed on the facial surface (soft tissue points), 38 on the skull surface (bone points), and ten dental cephalometric points per model. At the same time, the position of the points was corrected on CT plane slices in 3 planes. This study demonstrated the high efficiency of the image segmentation approach for training CNN to identify cephalometric points on CBCT. The proposed method, integrated into specialized software, has a high potential for reducing the labor intensity of the workflow.

Keywords: cone-beam computed tomography, cephalometric point landmarking, three-dimensional cephalometrics, convolutional neural networks, automatic identification, computer-assisted diagnostics

Разработана новая модель сверточной нейронной сети (СНС) для распознавания и установки цефалометрических точек на срезах конусно-лучевой компьютерной томограммы (КЛКТ) для дальнейшего проведения 3D-цефалометрического анализа и оценки его точности. В исследовании были использованы файлы DICOM для 192 конусно-лучевых томограмм. Каждый набор файлов был импортирован в программное обеспечение ViSurgery (Сколково, Россия). Далее были сформированы трехмерные модели мягких тканей, костей и зубов пациентов и установлены 26 точек на поверхности лица (мягкотканые точки), 38 – на поверхности черепа (костные точки) и 10 зубных