European Journal of Molecular & Clinical Medicine
ISSN 2515-8260 Volume 07, Issue 03, 2020

Clinical Characteristics Of The Dentition In Young Men, The Role Of Metalloproteinases And Connective Tissue Markers In The Development Of Temporomandibular Joint Pathology And Their Correction

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Abstract – The most controversial issue in the study of the pathology of the temporomandibular system (TMJ) in childhood and adolescence is caused by etiopathogenetic aspects. Some researchers attribute the occurrence of this group of diseases to malocclusion [10,12, 20], while other authors focus more on age-related features of the growing organism, more precisely on a number of morphological and psychomotor processes that occur and end in the puberty and cause physiological abnormalities in a growing organism [7.19]. The third group of scientists approaches this issue with more modern views, that is, they put forward the role of metalloproteinases and markers of connective tissue for the formation of organs and tissues of the maxillofacial region (MFR).

Key words: pathology of the temporomandibular system, malocclusion, features of the growing organism, morphological and psychomotor processes.

1. INTRODUCTION

We know that matrix metalloproteinases (MMPs) consist of more than 20 zinc-dependent endopeptidases secreted or linked to the cell surface, the substrates of which, in addition to the extracellular matrix components, can also be other proteases, chemotactic molecules, latent forms of growth factors, soluble proteins, membrane-associated proteins that bind growth factor [23].

MMP activity in the intercellular space is specifically suppressed by tissue inhibitors (TIMP), structurally related proteins, three of which (TIMP-1, 2, and 4) are secreted in soluble form, and one (TIMP-3) is associated with the extracellular matrix [22]. It should be noted that TIMP2 includes the properties and functions of all other types of TIMP; MMP2, MMP3 play an important role in the development of the sky. And an immunohistochemical increase in MMP-2 was detected by Brownetal. (2002) during palatogenesis in mice [24]. MMP-2 play a specific role in epithelial migration [24]. Selective isolation of MMP-9 into the ossification zones was found by Baliveretal. 2001, in the midline of the developing upper jaw. Expression of MMP-9 during healing on the skin leads to scarring [17]. Scar tissue formed after surgery in newborns consists of type I collagen fibers [18].

2. LITERATURE REVIEW

In premature infants in tracheal aspirate and in blood serum, an increase in the content of MMP 1.2.9 and TIMP2 is observed during the course of bronchopulmonary dysplasia. This indicates a prolonged destruction of the extracellular matrix and processes of pulmonary fibrosis [1].

Increased expression of MMP1, MMP2, MMP9 leads to degradation of the collagen of the extracellular matrix of the alveolar tissue, and is also a trigger for unregulated production of matrix components and leads to the development of fibrosis in children with bronchopulmonary dysplasia [25].

Matrix metalloproteinases belong to a large family of Zn^{2+} and Ca^{2+} -containing endopeptidases secreted by various types of cells, which destroy all protein and proteoglycan components of the extracellular matrix, including fibrillar and non-fibrillar collagens, fibronectin, laminin and glycoprotein [8].

3. ANALYSIS

To date, the human genome contains more than 200 MMP-like genes, including MMPs themselves (more than 20 genes), membrane-bound MMPs, ADAM proteinases (disintegrin-metalloproteinase domains), ADAMTS proteinases (disintegrin-metalloproteinase domains with thrombospondin motif) others. MMP gene expression is induced by a large number of substances, including growth factors, cytokines, chemical agents, and mechanical stress [4].

Sources of the formation of MMPs are fibroblasts, macrophages, neutrophils, monocytes, osteoclasts, chondrocytes, keratinocytes, endothelial and epithelial cells [9, 11, 15]. Based on the primary structure, substrate specificity, and cell localization, MMPs are divided into 3 types. In addition, the advantages of MMPs and TIMPs, as possible markers of congenital connective tissue dysplasia and its progression, can be attributed to; nosological specificity; profitability and the determination of MMP in combination with TIMP provides the basis for a correct interpretation of the state of the matrixin system.

Thus, despite the fact that impaired collagen metabolism is an essential component of organ and systemic dysplastic changes, the role of collagen metabolism regulators for the formation of physiological organs and tissues of the DVJ has not been studied to date.

The questions regarding the features of MMPs are not specified, depending on the nature and severity of the clinical manifestations of the pathological process of TMJ. Moreover, one of the syndromes of TMJ dysfunction is one of the most common pathological conditions encountered in dental practice; the prevalence of functional disorders of TMJ non-inflammatory in nature is up to 80% of articular pathology [10,13, 25].

The purpose of this study is to give a clinical characterization of the dentoalveolar system in young men, to determine the clinical diagnostic value and prognostic capabilities of matrix metalloproteinases 1, 8, 9 TNF-alpha and IL-10 in patients with connective tissue pathologies in the maxillofacial region.

Materials and research methods: In order to assess the clinical state of DVJ and determine the role of metalloproteinases and markers in the development and formation of pathology in the temporomandibular joint among children and youths, 300 patients were examined, including 145 patients with anomalies and deformities of DVJ, as well as pain syndromes of TMJ students secondary schools and college of children who came to a specialist dentist for treatment at the Department of Orthopedic Dentistry of BukhMI and the regional pediatric and adult dental clinic in Bukhara in compliance with all ethical principles of medical research by the Helsinki Declaration of the World Medical Association.

For clinical and anthropometric assessments of the parameters of the head - determination of the shape of the skull; head circumference (HCcf), head length (longitudinal head diameter (LHD)), head width (transverse head size (THS)), vertical or vertical head diameter (VHD), transverse forehead size (TFS), head base size and face parameters measured by the method of Shomirzaev N.Kh 1998.

For the study and evaluation of the dental oral condition (OC) and DVJ, as well as for the collection of medical and sociological data, a total of 300 examined both sexes aged 6 to 18 years living in the city of Bukhara was taken; 130 of them are boys (43.33%) and 170 girls (56.66). Of these, 145 examined with TMJ pathologies (the main group - MG) and 155 examined with absolutely no TMJ pathologies (control group - CG).

Table №1.

By gender and age group of children examined, n = 300

Age / quantity		Total		Girls		Boys	
		quantity	**in %**	**quantity**	**in %**	**quantity**	**in %**
6-9 years old 67/22,33%	**MG**	25	8,33%	13	4,33%	12	4,06%
	CG	42	14%	22	7,33%	20	6,66%
10-13 years old 100/33,3%	**MG**	52	17,33%	30	10%	22	7,33%
	CG	48	16%	24	8%	24	8%
14-18 years old 133/44,3%	**MG**	68	22,66%	41	13,66%	27	9,0%
	CG	65	21,66%	40	13,33%	25	8,33%
Total 300/100%	**MG**	**145**	**48,33%**	**84**	**28%**	**61**	**20,33%**
	CG	**155**	**51,66%**	**86**	**28,66%**	**69**	**23%**

For clinical and anthropometric studies of DVJ during a dental examination, the onset and nature of the onset of symptoms were clarified, as well as what the patient attributes to their onset. The nature of pain, localization, and irradiation to other areas of the MFR were established: the neck, the area of the clavicle, chest, and muscles of the upper limb belt. The presence of sound phenomena in the joint and the moment of their occurrence revealed complaints about the general state of health. The height of the lower part of the face in the position of central occlusion (CO) was determined and compared with the height of the physiological rest of the lower jaw (l / j). Particular attention was paid to the height of the lower part of the face when patients have various designs of dentures, since they create new occlusal relationships in the OC and change the spatial position of the l / j. The trajectory of the movement of l / j, its smoothness and symmetry were determined. The closure of the dentition in the sagittal, vertical and transverse directions was evaluated. When the functional part of the diagnosis was made, dynamic tests were performed. According to the testimony, clinical functional tests were performed by Ashler-Bitner, Ilyina-Markosyan and orthodontic diagnoses were made in accordance with the classifications of Engle, L.S. Persina.

X-ray examination methods: An important part of the functional analysis of teeth, jaws and TMJ is radiography. Since the joint is paired, an X-ray examination of the TMJ was performed on both sides of the patients, regardless of discomfort in one or both joints.

To determine the level of matrix metalloproteinases-1, 9 and a tissue inhibitor of metalloproteinases-1 (TIMP-1) in blood serum, venous blood samples were subjected to

primary separation in laboratory centrifuges for 20 minutes and the concentration of all studied factors - MMP-1, MMP-9, TIMP-1 - was measured simultaneously in one blood sample.

The contents of MMP-1, MMP-9 and TIMP-1 were determined using a standard test kit (Cloud-CloneCorp., China) in accordance with the instructions for 45 young men with TMJ pathologies and 15 absolutely healthy young men:

- The minimum detectable concentration of MMP-1 was 0.059 ng / ml. In 15 healthy volunteers, the serum content of MMP-1 was 1.34 (1.18; 1.38) ng / ml;
- The minimum detectable concentration of MMP-9 was 0.059 ng / ml. In 15 healthy volunteers, the serum content of MMP-9 was 385.87 ± 43.34 ng / ml;
- The minimum detectable concentration of TIMP-1 was 0.063 ng / ml. In 15 healthy volunteers, the serum content of TIMP-1 was 710.80 ± 199.24 ng / ml.

Statistical analysis of the data was performed using the SPSS Statistics 21.0 software. The selection of the main characteristics and statistical criteria when comparing them was carried out after studying the distribution of the characteristic and comparing it with the Gauss distribution according to the Kolmogorov – Smirnov criterion.

For signs with a normal distribution, the mean ± standard deviation (M ± SD) was calculated and parametric methods were used to compare unrelated signs - one-way analysis of variance with Bonferroni correction for the number of compared groups of more than two, Student's t-test - for two groups.

The results of anthropometric studies in the field of DVJ in children and adolescents showed that the morphological and physiognomic height with TMJ pathologies in different directions increases (especially at 14-18 years old) than in healthy children.

The growth rate of the anthropometric parameters of the face in healthy children is almost the same at regular intervals, and in children with TMJ pathologies they change spasmodically. Also, in children of both sexes with TMJ pathologies, there is an acceleration in the time of eruption of permanent teeth, early loss of primary teeth. Crowding of incisors, improper eruption of fangs and uneven growth of the jaw bones are observed.

The morphological and physiognomic height of the face in children with TMJ pathologies at different return stages grows at different speeds (they accelerate at 14-18 years old) than in children and youths of the CG.

The growth rate of the anthropometric parameters of the face in healthy children with CG is almost the same at regular intervals, and in children with TMJ pathologies they change spasmodically. In children of both sexes with TMJ pathologies, acceleration of teething of permanent teeth, early loss of primary teeth are noted. Crowding of incisors and incorrect cutting of fangs are observed. It has been established that the ratio of the upper, middle and lower parts of the face in girls of all groups is closer to the "principle of the golden ratio", as compared to boys. In children with TMJ pathologies, especially in boys, the ratio of parts of the face does not correspond to the Fibonacci number (table №2).

Table № 2

Morphometric parameters in children and youths with pathologies of the temporomandibular joint and healthy groups

Age and gender / Face parameters (cm)		6-9 years old; n= 67		10-13 years old; n= 100		14-18 years old; n= 133	
		Boys n= 30	Girls n= 37	Boys n= 48	Girls n= 52	Boys n= 52	Girls n= 81
Physio face height	**CG**	16,9±0,11	17,1±0,14*	17,4±0,09	17,4±0,12*	19,0±0,20	19,0±0,04*

Morpho face height	**MG**	16,4±0,09	17,4±0,03*	16,8±0,10	17,5±0,08*	19,1±0,02	18,8±0,02*
Height ver. parts of the face Medium Height parts of the face	**CG**	11,8±0,60	11,4±0,42	12,2±0,03	11,8±0,62	13,0±0,02	13,0±0,40
	MG	11,0±0,04	11,6±0,08*	11,8±0,01	11,9±0,12*	12,2±0,42	12,0±0,60*
Height lower parts of the face	**CG**	5,9±0,06	5,8±0,25	6,2±0,34	6,0±0,45	6,9±0,28	6,6±0,38
	MG	5,6±0,06	5,9±0,04	5,7±0,06	6,0±0,01	6,4±0,09	6,8±0,48
Physio face height	**CG**	5,9±0,05	5,9±0,02*	6,2±0,05	6,4±0,08*	6,4±0,12	6,9±0,02*
Morpho face height	**MG**	5,5±0,02	5,9±0,02*	5,9±0,08	6,4±0,06*	6,0±0,02	6,9±0,01*
Height ver. parts of the face Medium Height parts of the face	**CG**	5,8±0,08	5,9±0,02*	5,9±0,01	6,4±0,08*	6,2±0,01	6,9±0,07*
	MG	5,7±0,08	5,6±0,02	6,4±0,06	5,6±0,02	6,5±0,06	5,8±0,07
Height lower parts of the face	**CG**	1:1,622	1:1,55	1:1,624	1:1,90	1:1,980	1:1,90
	MG	1:1,534	1:1,668	1:1,581	1:1,60	1:1,60	1:1,45

Note: * - confidence indicator (P <0.05) compared with the previous age. HPSD is a chronic pathology of the respiratory system.

According to the results of examinations among children and adolescents with TMJ pathologies, a medial bite was detected in 17 patients (25.0 ± 0.10) aged 14–18 years, in 16 children and adolescents - 30.7 ± 0.03 at the age of 10– 13 years in MG. Children with TMJ pathology often had crowded teeth. Crowding of teeth n / h was found in 8.0 ± 0.12 cases in children aged 6–9 years, in children in MG 10–13 years old - 11.5 ± 0.03; and in 11.8 ± 0.13 cases in children aged 14–18 years. It was found that the crowding of teeth per hour was relatively high in 12.0 ± 0.10 cases in MG of 6–9 years, 15.4 ± 0.03 in MG of 10–13 years and in 13.2 ± 0.12 cases in groups of 14–18 years old (table №3).

Table №3.

Occurred bite forms in examined children and youths from 6 to 18 years

Age / **Bite**	**CG = 155 healthy children and youths Only 24 fiziol. occlusion -15.5%**						**MG = 145 children and adolescents with TMJ pathologies. Only 145 patol. bite - 100%**					
	6-9 years old; n= 42		**10-13 years old n= 48**		**14-18 years old n= 65**		**6-9 years old n= 25**		**10-13 years old n= 52**		**14-18 years old n= 68**	
	number	%	number	%	number	%	number	%	number	%	number	%
Distal	-	0	-	0	-	0	3	12,0	3	5,7	1	1,4
Back	-	0	1	0,2	1	0,15	3	12,0	4	7,7	6	8,8
Open	-	0	-	0	-	0	3	12,0	3	5,7	8	11,8
Deep	-	0	2	0,42	3	0,46	2	8,0	4	7,7	6	8,8

Biprognatic	1	0,24	3	0,62	-	-	1	4,0	1	1,9	3	4,4
Protrusion	-	0	-	0	-	0	2	8,0	5	9,6	5	7,3
Crowding l / j	1	0,24	2	0,42	3	0,46	2	8,0	6	11,5	8	11,8
Crowding u / j	-	0	2	0,42	2	0,3	3	12,0	8	15,4	9	13,2
Cross	-	0	-	0	2	0,3	1	4,0	2	3,8	5	7,3
Medial	-	0	-	0	1	0,15	5	20,0	16	30,7	17	25,0
Total	2	0,48	10	2,08	12	1,84	25	100	52	100	68	100

Defects in the dentition with a TMJ pathology were observed in 81.37 ± 0.13 children, and in 118 children with exhaustive hypertension. Of these, the majority of infraocclusions were detected in the group of children aged 14-18 years old 82.3 ± 0.06. In the CG, 3.2 ± 0.11 diastema of the jaw was observed and 10.3 ± 0.05 in the CG with a TMJ pathology. In MG, the highest diastema defect rate was observed in the group of children aged 10–13 years. Supraocclusion was also observed in 15.5 ± 0.05 children in the EX 10-13 years old. Dystopia of the teeth was not found in children in the CG, a total of 4.8 ± 0.05 was observed in the MG, of which 5.8 ± 0.11 was observed in the group of children aged 10-13 years (table № 4).

Table №4.

Occurred defects of the dentition in the examined children and youths from 6 to 18 years.

Age / Bite	155 healthy children and youths							145 children and youths with TMJ pathologies					
	155 children	**6-9 years old; n= 42**		**10-13 years old n= 48**		**14-18 years old n= 65**		145 children	**6-9 years old n= 25**		**10-13 years old n= 52**		**14-18 years old; n= 68**	
		count.	%		%		%			%		%		%
Dystopia	-	-	0	-	0	-	0	7/4,8	4	16,0	3	5,8	-	0
Infraocclusion	4/2,6	1	2,4	1	2,1	2	3,1	88/60,7	12	4,8	20	38,5	56	82,3
Diastema	5/3,2	1	2,4	2	4,2	2	3,1	15/10,3	1	4,0	8	15,4	6	8,8
Supraocclusion	6/3,9	-	0	4	8,33	2	3,1	8/5,5	1	4,0	7	15,5	-	0
Total	**15/9,7 %**	**2**	**4,8**	**7**	**14,6**	**6**	**9,23**	**118/81,37 %**	**18**	**72,0**	**38**	**73,1**	**62**	**91,2**

In 45 examined children with TMJ, serum MMP-1 and MMP-9, which play a central role in the metabolism of connective tissue proteins and are specific markers of collagen breakdown, were studied [6]. Biochemical parameters of blood serum in young men with TMJ are presented in table No. 5. Attention was drawn to a significant increase in the content of MMP-1 in children with TMJ as the main enzyme that denatured fibrillar collagen of the extracellular matrix. Similar changes were revealed in the study of the content of MMP-9, the

concentration of which was 1.6 times higher among young men in the main group than in the young men in the comparison group, which, according to N.I. Solovieva and O.S. Ryzhakova [14], may indicate the activation of hydrolysis of type IV collagen. The concentration of TIMP-1 in cases of TMJ has decreased when compared with young men. The increased coefficients MMP-1 / T1MP-1 and MMP-9 / TIMP-1 confirm the possibility of exceeding the rate of collagen degradation by matrix proteinases at the rate of its synthesis.

Table №5

Comparative characteristics of the content of matrix metalloproteinases in blood serum in young men with TMJ, M ± m

Survey	Group Indicator	
	Young men with TMJ, n = 48 (MG)	**Healthy young men (CG) n = 15**
MMP-9, ng / ml	118,17±8,63*	73,97±5,19
MMP-1, ng / ml	11,11±1,08*	4,37±0,53
MMP-3, ng / ml	38,04±3,14*	7,72±0,61
TIMP-1, ng / ml	598,62±18,91	728,32±19,13
MMP-1 / T1MP-1, conv. units	0,003	0,002
MMP-9 / T1MR-1, conv. units	1,33*	0,54

Note: * - significance of differences P <0.05 with respect to control data

Representatives of the MMP groups are also interstitial collagenase MMP-3, which break down the fibrillar collagen of the corresponding types, as well as naproteoglycans, laminin, fibronectin and amorphous collagen.

The revealed imbalance of type I and type III collagens due to the high activity of metalloproteases with PG indicates a predominance of synthesis of type III collagen, which is an embryonic protein with low strength, which correlates with a systemic decrease in the level of collagen, which determines the integrity of connective tissue in DVJ.

Decreased synthesis of total collagen and the predominance of its immature fraction with a deficiency of components of the intracellular matrix, which determine the weakening and overstretching of connective tissue. The established differences in the number, nature of the distribution and localization of collagen and elastic fibers along with impaired expression of protein-coding genes, in particular, the MMP and TIMP families, determine the multilevel changes in the microarchitectonics of the dentofacial system in children with TMJ.

4. DISCUSSION

It has been established that adolescents with TMJ pathology show a depletion of the reserve potential of antioxidant, antimicrobial protection against the background of increased lipoperoxidation and contamination of the mouth with pathogenic and conditionally pathogenic microflora, as well as a decrease in pH saliva stability and a decrease in the level of cellular metabolism [1]. Based on the foregoing, the purpose of this study was to study the biochemical parameters of pancreatic cancer in adolescents with TMJ disease.

The debut of the work was a wide clinical study of a large group of adolescents with hypertension, which allowed us to identify the following significant patterns. When assessing

the genealogical history in adolescents of this group, there was a burdened heredity not only for diseases of the gastrointestinal tract (80.8%), but also for diseases formed against the background of undifferentiated connective tissue dysplasia (UCTD), namely varicose veins of the lower extremities (57.7%), myopia (40.4%), which is consistent with the research data of V.V. Chemodanov (2010) on the important role of UCTD in the development of chronic pathology in children. Almost a fifth of children with TMJ disease (23.1%) were born by caesarean section. A large mass at birth (more than 4000 gr.) Was noted in every fifth child (19.2%) of the main group of the survey, which was significantly more than in the CG ($p < 0.05$).

The duration of breastfeeding in children with MG turned out to be significantly shorter than in the CG comparison and CG, in addition, only 9.6% of children. Consequently, the clinical and anamnestic markers identified in stage I make it possible to speak with high probability of the presence of genetically determined UCTD in children with TMJ pathology.

An important mechanism of homeostasis in OC is equilibrium in the prooxidant-antioxidant system. In the process, the activity of catalase, MDA, elastase, lysozyme and urease was studied, which are presented in table No. 6. The data in the table demonstrate that the activity of catalase in MG during the initial clinical laboratory study was on average 2 times lower than in MG.

This indicates the depletion of the reserve capabilities of the antioxidant system in adolescent exhaust gas. Given that in the genesis of the development of TMJ pathology in adolescents, membrane-pathological processes at the level of cellular factors are of great importance, and the process of lipid peroxidation (LP) was studied as an important mechanism leading to the destabilization of cell membranes in the course of work.

Table №6.

Dynamics of changes in the biochemical parameters of the oral fluid in healthy children and with a TMJ disease (mkat / l, mkat / l and u / ml,, mkat / l)

Indicators	Children with TMJ disease n = 48	Healthy children (control) n = 15
Catalase activity	0,122±0,021*	0,324±0,024
Malondialdehyde	0,305±0,032*	0,129±0,016
Elastase activity	2,97±0,16*	1,72±0,14
Lysozyme activity	0,025±0,004*	0,093±0,008
Urease activity	0,417±0,034*	0,096±0,011

Note: * - significance of differences $P < 0.05$ when compared with control

The obtained research results showed that in adolescent exhaust gas, the content of MDA was significantly higher than in CG children. This indicated a local “in the oral cavity” intensification of lipid peroxidation processes in adolescent exhaust gas. The results of the study of the degree of inflammatory processes in OC, the intensity of which characterizes the activity of the leukocyte proteolytic enzyme elastase in the oral fluid, are presented in table №6. Biochemical analysis of pancreatic cancer in adolescent exhaust gas showed an increase in elastase activity in pancreatic cancer.

During the study, the level of antimicrobial protection by the content of lysozyme in the OF was studied, the results are summarized in table No. 6. In adolescent exhaust gas, the activity of lysozyme in the OF was 2.4-3 times less than in adolescents without somatic diseases. The state of antimicrobial protection in OC was also evaluated by the activity of urease in the OF, which is produced by pathogenic and conditionally pathogenic microflora. The results of a study of the activity of urease in pancreatic cancer in adolescents MG and CG are presented in the table. Urease activity in the OF in adolescent MG was on average 2 times higher than that in the CG ($P < 0.05$).

Thus, a decrease in catalase activity and a high content of MDA in OF in adolescent exhaust gas testified to a violation of the reserve capabilities of the antioxidant system and the intensification of lipid peroxidation in OC. In adolescent exhaust gas, a significant decrease in the content of lysozyme in the OF and a simultaneous increase in the activity of urease relative to the data of practically healthy children were recorded. This indicates that the exhaust gas had a decrease in the level of antibacterial protection of the pancreas, as a result of which the degree of contamination of the OC with pathogenic and conditionally pathogenic microflora increased.

The results of the study dictate the need to develop rational preventive measures that will accompany the treatment of children with TMJ.

As you know, the systemic metabolism of connective tissue in patients with DVA is characterized by the release of glycoproteins, a decrease in sulfated GAG. In addition, they determine the rheological properties of blood, which serves as an explanation for the occurrence of typical hemostasis disorders in DVA, affecting thrombophilia caused by a systemic inflammatory response, which explains the predominance of GAG destruction over their synthesis. Table №7 shows the dynamics of inflammatory markers in children with TMJ disease.

Table №7

Dynamics of GAG, C-RB and ESR in adolescents with TMJ disease

Groups	Level of serum GAG, μmol / L	Erythrocyte sedimentation rate mm / hr	C-RB highly sensitive, ng / ml
With a TMJ disease n = 48 (MG)	24,65±21,5*	16,34 ±3,51*	35,39±4,42*
Healthy n = 15 (CG)	41,15±1,79	7,08±0,53	9,73±0,18

Note: * - significance of differences P <0.05 when compared with control.

We see that adolescent exhaust gas showed a significant increase in the level of glycosoaminglycan (GAG) in the blood serum by an average of 2.2 times when compared with CG. The obtained research results indicate that degenerative processes in the substance of the connective tissue are associated with a violation of the structure or function of the GAG and their involvement in the pathological process. In addition, the dynamics of GAPH in the blood serum of the examined children indicates its high specificity, which indicates cartilage damage and indicates the development of connective tissue dysplasia.

All examined adolescents studied the main indicators of inflammation by determining C-RB and ESR using a standard technique. Table №7 shows that the ESR in the exhaust gas was increased relative to the CG. When determining serum concentrations of C-RB using the highly sensitive ELISA analysis, a consistent increase in the results from CG to MG was noted. High concentrations of C-RB in the examined children with OG indicate the role of inflammation in damage to the connective tissue of the DVJ.

As a rule, GAG are degradation products of collagen and intercellular substance, which represent an extensive heterogeneous group of substances that form the intercellular matrix of connective tissue.

The role of serum concentrations of GAG as a biochemical marker in patients with DVA was studied mainly by domestic scientists. In adolescents, MG compared with CG there is an increased level of GAG in the blood. Therefore, in our opinion, a study of the concentration of GAG and its fractional spectrum can be used as additional tests in the diagnosis of the activity of the pathological process, its severity, nature of the course, and the effectiveness of treatment of TMJ.

As mentioned above, the pathology of TMJ causes changes at the level of a number of enzymes belonging to the MMP family.

This is expressed in the detection in saliva and serum of patients with TMJ diseases an increase in the concentration of MMP. The choice in our study of MMP-1, which is interstitial collagenase and MMP-9, acting on the collagen of the basement membranes, was carried out taking into account the fact that the extracellular matrix and basal membrane have a different structure and composition, and TIMP-1 is able to inhibit both indicated proteinases. In addition, MMP-1 and MMP-9 play a central role in the metabolism of connective tissue proteins and are specific markers of collagen breakdown.

5. CONCLUSION

In adolescents with TMJ, there is a change in the activity of MMT-1, type 9 in the blood serum, indicating remodeling of connective tissue, indicating metabolic disturbances. At the same time, adolescents with TMJ disease have an imbalance in the prooxidant-antioxidant system; a decrease in catalase activity and an increase in the level of malondialdehyde, a decrease in antimicrobial protection and an increase in the degree of contamination of pathogenic and conditionally pathogenic microflora.

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