

# Research Journal of Pharmaceutical, Biological and Chemical Sciences

## Features of the Psycho-Functional State and the Fine Motors Skills of Fingers of Young Patients With Connective Tissue Dysplasia.

G. G. Yafarova<sup>1\*</sup>, T. V. Baltina, and L. M. Bikchentaeva.

Kazan Federal University, 420008, 18 Kremlevskaia Street, Kazan, Russia.

### ABSTRACT

The paper describes the features of the psycho-functional state and the fine motors skills of young people with signs of connective tissue dysplasia. It was revealed that connective tissue dysplasia is accompanied by vagotonia and hyposthenic type of constitution. People with signs of connective tissue dysplasia have decreased activity and mood indicators as per “Health, activity, and mood” (HAM) questionnaire, and their aggressiveness index is elevated. In the presence of connective tissue dysplasia, disorders of motors skills of hands were observed, such as low differentiation of finger movements, their rigidity, and clear decrease of the involvement of the thumbs of both hands in the overall motility of hands.

**Keywords:** connective tissue dysplasia, finger motility, psycho-emotional state.

\*Corresponding author

## INTRODUCTION

In the general structure of diseases of the musculoskeletal system, non-inflammatory diseases of the joints, which include connective tissue dysplasia (CTD), occupy a leading place. However, if a huge amount of work is devoted to the study of the pathogenesis and treatment of osteoarthritis, as the most common non-inflammatory diseases of the joints of older people, non-inflammatory diseases of the joints of young people are much less studied [1]. By the early 21<sup>st</sup> century, CTD is interpreted as an important social phenomenon. It is believed that in the modern population, the prevalence of connective tissue dysplasia reached the level of up to 70% [2].

The Beighton scale, based on the detection of hypermobile syndrome, is one of the generally accepted methods for detecting CTD [3]. Hypermobility of joints is diagnosed when the motility of small and large joints increases in relation to standard motility after the exclusion of systemic diseases, such as Ehlers-Danlos, Marfan, and Stickler syndromes, imperfect osteogenesis, etc. Extra-joints signs (including phenotypic ones) of connective tissue damage are so typical for the people with hypermobility that the definition of hypermobility syndrome has been adopted in international practice. According to the modern classification, it belongs to the group of diffuse non-inflammatory diseases of connective tissue (cipher m 35.7. according to ICD-10). Manifestations of CTD are not limited to the problems of the musculoskeletal system, but they are naturally associated with extra-articular signs of "insolvency" of connective tissue structures: heart valve prolapse, hyperextensibility of skin, traumatism, hernias, venous pathology, etc. [4].

## PROBLEM STATEMENT

CTD and the associated hypermobility of joints is a risk factor for the development of diseases of the musculoskeletal system in adulthood. For people with joint hypermobility, the frequency of complaints and objective changes in the skeleton (scoliosis and flat feet), depending on gender and age, is evidently higher (36-90%) than for people without joint hypermobility (18-60%) [5]. Most people with joint hypermobility often have worse quality of life. Most of them at a certain stage of life receive signs of pathology of the musculoskeletal system. This is, perhaps, the result of a violation of the existing balance between the load and the initial decrease of the threshold of "mechanical strength" of the musculoskeletal system.

## PURPOSE OF THE STUDY

This study was aimed at assessing the psycho-functional state and features of the fine motor skills of hands of people with signs of connective tissue dysplasia.

## RESEARCH METHODS

36 people from 20 to 23 years old (19 men and 17 women) took voluntary and informed participation in the study. The presence of CTD was assessed by the severity of generalized joint hypermobility on the Beighton scale [3]. The first group consisted of individuals without signs of CTD (n=18, control), the group II formed individuals with the symptoms of CTD (n=18), of them 12 patients revealed moderate hypermobility of joints (4-6 points on the Beighton scale), and 6 people - severe signs (7 to 9 points).

Psycho-physiological state was assessed using a computer system for complex monitoring of the state of the body LUM [6], which included methods for detecting simple auditory motor reaction; simple visual motor reaction; correction test (determination of the accuracy and productivity of arbitrary attention), indicators of mechanical and semantic memory; and psycho-emotional state according to the "Health, activity, and mood" test. The subjects' vegetative status was determined according to the Kerdo index, and their type of constitution - according to the Pignet index. Diagnosis of the level of development of the fine motor activity of hands was carried out using a ten-finger chaotic tapping, in which the subject was invited to press the keys in an arbitrary ("random") order in the conditions of a predetermined one-to-one correspondence finger-key [7]. In this test, the level of fingers involvement in the overall motor activity of the hand, the severity of synkinesias and rigidity of the hand, as well as the rigidity of each finger of both hands were determined.

Statistical processing of the results was performed using the software "BIOSTAT" with the utilization of the Student's test (t-test), and nonparametric Mann-Whitney U test.

## FINDINGS

The coefficient of logical memory in the test "Semantic memory" in the group I averaged  $0.8 \pm 0.5$ , and in the group II -  $0.6 \pm 0.5$ : people with signs of connective tissue dysplasia demonstrated significantly lower ( $p < 0.05$ ) ability to memorize logically than people in the control group by an average of 25%. In the proof-reading test, which allows assessing the stability and concentration of arbitrary attention, the differences between the groups were unreliable. The volume of mechanical memory and the parameters of sensorimotor reactions also did not differ.

When rapid assessment of health, activity and mood according to the "Health, activity, and mood" test (Figure 1) was carried out, in both groups the health of the subjects was within normal limits (5-5.5 points and above). The activity index in the control group was within the normal range (average  $5.2 \pm 0.4$ ), and in the group with CTD, the points were below the standard values (average  $4.02 \pm 0.2$ ), but between the groups this indicator did not differ significantly. Mood index in both groups was within normal limits, however, in the group II the points were significantly lower ( $p < 0.05$ ) than in the group I. Anxiety levels in both groups were within normal limits and did not differ significantly; however, the aggressiveness index in the group I was significantly lower ( $p < 0.05$ ) than in the group II.

The research has shown that in the control group the rate of neuroticism, according to G. Eysenck scale, was lower than in the group with CTD. In determining the proportion of people with different severity of neuroticism in the group I, in this group, there was majority of people with an average value of neuroticism (67%), and the share of people with a high level of neuroticism was at the level of 33%. In the group II, people with a high level of neuroticism (56%) dominated, and there were 33% of people with an average level of neuroticism; low level of neuroticism demonstrated 11%.

In the evaluation of vegetative status by the Kerdo index in the group I, 44% of the subjects demonstrated normotony, 45% - sympatheticotonia and in 11% - vagotonia. In the group of people with signs of connective tissue dysplasia, there were less normotonics (33%), and there was a significant increase in the proportion of people with vagotonia (33%) that is 3 times higher than in the control group.

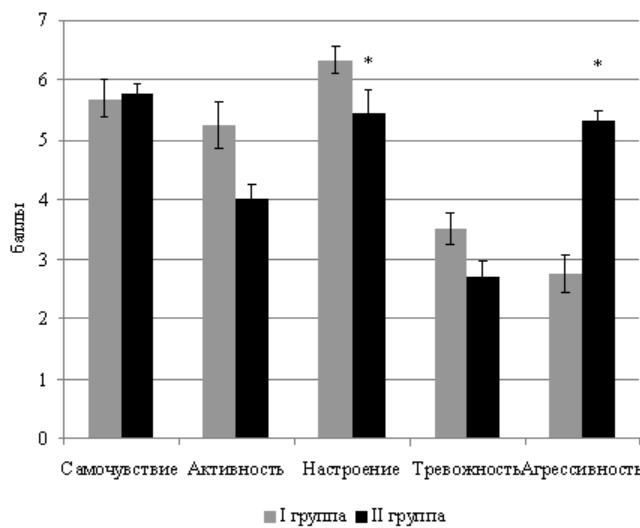
To determine the type of physique of the subjects, we used the Pignet index. In the group I, the average value of the index was higher than in the group II. Hypostenics (56%) dominated among subjects with connective tissue dysplasia; in the group I their share was 33%. The number of hyperstenics in the group with CTD was 2 times less than in the control group (11% and 22%, respectively). In the group I, there were 45% of individuals of the normostenic type and in the group of subjects with connective tissue dysplasia the number of such people was less by 12%.

Involvement of fingers is a parameter characterizing participation of each finger of the hand in motor activity. The majority of subjects (90%), both in the groups I and II, demonstrated a high level of finger involvement in the overall motor activity of the hand. For this parameter significant differences for the thumbs of both hands were found (Figure 2): among the patients with signs of connective tissue dysplasia, the involvement of thumbs in general motor activity was reliably lower than in the control group, both right and left hands ( $p < 0.05$ ).

Rigidity assesses the state of muscle tone and resistance when trying to make any passive movement: muscle rigidity does not allow complete relaxation of the muscle that is caused by disorders in the nervous system. All subjects had a high level of the hand rigidity. The number of rigid clamps per finger in the CTD group as a whole was greater than in the control group (Figure 3). It can be noted that the most "rigid" were thumbs in the group II: the number of rigid clamps in this group was higher than in the control one ( $p < 0.05$ ), both right and left hands.

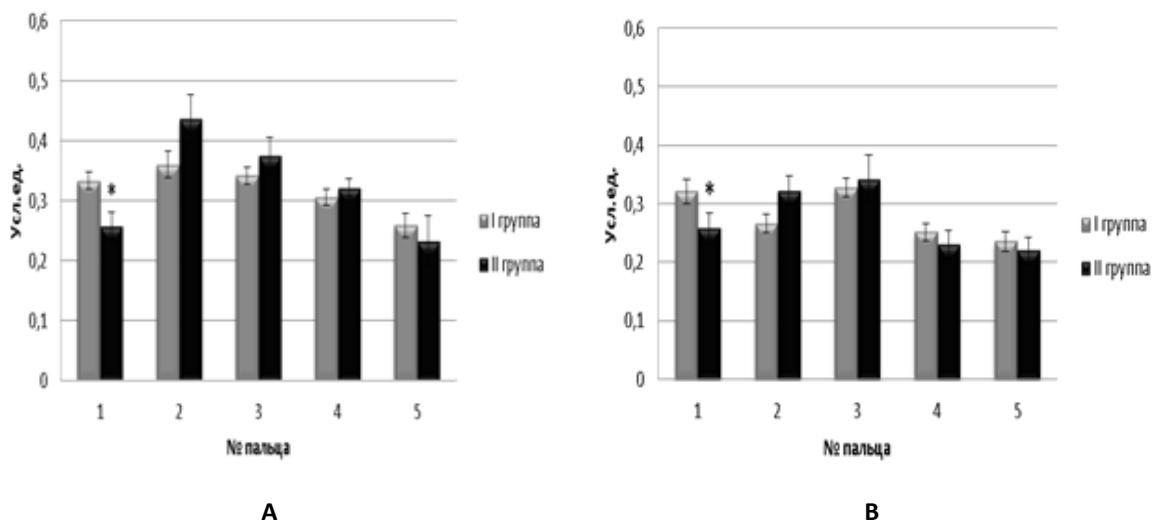
Synkinesia is a sign of an insufficient differentiation of movements: unnecessary muscles are included when performing a certain task. Synkinesia is a congenital disorder that is associated with the formation of certain areas in the brain. Age norms are the following: for children up to 5 years old, the number of synkinesias should be less than 30, up to 6 years old -  $S < 20$ , up to 7 years old -  $S < 15$ , up to 8 years old -  $S < 10$ , up to 9 years old -  $S < 4$ , and for children over 9 years old and adults, this figure should normally be equal to zero [7]. All subjects had a low level of finger differentiation, that is, synkinesia was registered. In the group I, the number

of synkinesias of the right hand averaged  $20.86 \pm 7.64$ , left - to  $18.57 \pm 7.99$ . The number of synkinesias in the group II was greater than in the first group (for the right hand, an average of  $228.20 \pm 99.21$ , for the left - an average of  $144.00 \pm 60.33$ ). The differences between the groups are reliable (for the left hand  $p=0.033$ ; for the right hand  $p=0.031$ ) that indicates a lower differentiation of finger movements for the people with signs of CTD as compared with the control group.



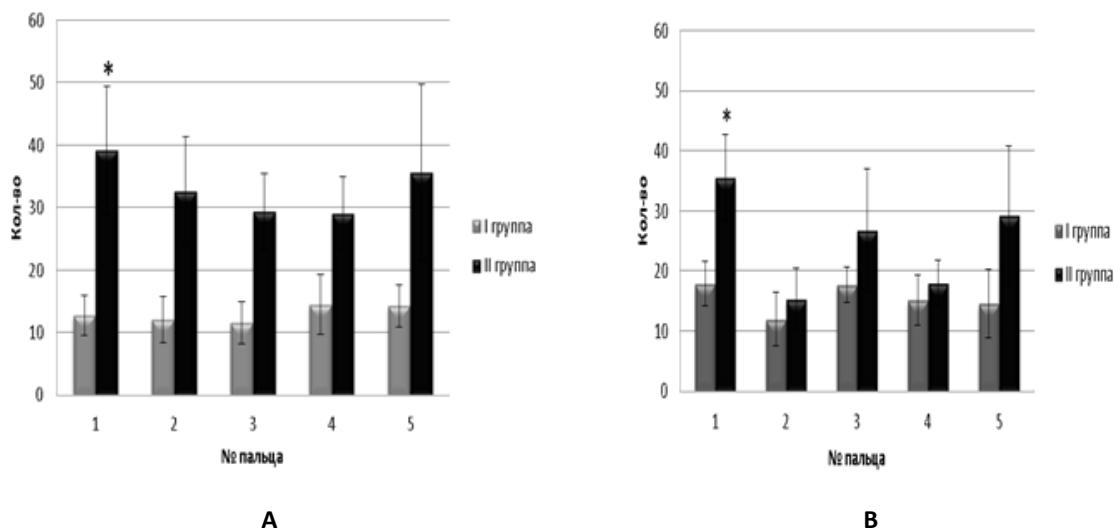
**Fig. 1:** Results of diagnostics of health, activity and mood (HAM test), where: the group I is a control group, the group II are people with signs of connective tissue dysplasia,

\* - Reliable differences between the groups,  $p<0.05$ .



**Fig. 2:** Fractional activity of the fingers of the right (A) and left (B) hand, where: the group I is a control group, the group II are people with signs of connective tissue dysplasia,

\* - Reliable differences between the groups,  $p<0.05$ .



**Fig. 3: Number of rigid finger clamps of the right (A) and left (B) hand, where: the group I is a control group, the group II are people with signs of connective tissue dysplasia,**

\* - Reliable differences between the groups,  $p<0.05$ .

#### CONCLUSION

Thus, people with signs of CTD demonstrated lower indicators of semantic memory than those of the control group. In the group with CTD, the activity and mood indicators of the HAM questionnaire were lower, and the aggressiveness index was higher than in the control group. The level of neuroticism in the group with connective tissue dysplasia was higher than in the control group, and there was on average two times more people with a high level of neuroticism than in the control group that indicates increased lability of the nervous system that have people with CTD. In the group with signs of CTD, there was an increase in the proportion of people with vagotonia, and the hyposthenic type of constitution prevailed. People with signs of CTD had obvious violations of the functional state of the fine motor skills of hands. The fact that people with CTD have a reduced involvement of the thumbs of both hands in the total motor activity of hands is particularly noteworthy, and a greater number of rigid clips of the thumb of both hands were also registered. Our results are consistent with the data of foreign authors, who showed the connection between hypermobility syndrome and osteoarthritis at the level of cervical spine and metacarpophalangeal and knee joints [8].

To date, there is no consensus on whether CTD is a disease. A number of authors believe that CTD is a pathological state that can be considered a disease when there are clinically significant lesions of organs and systems. Other authors consider CTD as a disease characterized not only by morphological changes and organogenesis disorders, but also by vegetative disorders. For most CTD patients, autonomic dysfunction syndrome is formed at an early age. It is suggested that CTD is associated with neuro-circulatory asthenia, which may be connected with simultaneous formation of the hypothalamic-pituitary-adrenal system and connective tissue in embryogenesis [9]. Asthenic syndrome leads to reduced labor efficiency, increased fatigue, and poor tolerability of physical and psycho-emotional stress. According to the results of our studies, for the people with CTD, weakness of constitution and vagotonia prevailed, and a violation of psycho-physiological and emotional state was revealed. People with CTD demonstrated clear changes in the indicators of fine motor skills of fingers, characterizing the labor performance. For people with signs of CTD, the revealed violations of the psycho-functional state and features of the fine motor skills of hands can be regarded as an indicator of resource depletion when adapting to stress and their severity has a certain parallelism with the manifestations of somatic markers of connective tissue dysplasia.

#### ACKNOWLEDGMENTS

This work was funded by the subsidy allocated to Kazan Federal University for the state assignment in the sphere of scientific activities №17.9783.2017/8.9.

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