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## Restoration Of The Profile Of Bioregulators Of Blood Plasma In People Of Second Adulthood With Osteochondrosis Of The Spine Against The Background Of Daily Wearing Of Medical And Preventive Clothing.

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### ABSTRACT

Until now, osteochondrosis of the spine remains one of the most important problems of modern medicine. Special attention to this problem last years is caused by number increase of the given pathology cases among persons of the most efficient age. With osteochondrosis of the lumbar spine of the 2nd degree, pain syndrome is often noted. It is accompanied by muscular-tonic and vegetative-vascular syndromes, significantly worsening the patients' well-being. The development of osteochondrosis of the lumbar spine is also accompanied by a negative dynamics of the activity of lipid peroxidation and the content of substances in the plasma that affect the processes of microcirculation. Daily wearing of medicinal-prophylactic clothes (the author's variant) for half a year was applied for the elimination of osteochondrosis signs in the observed persons. The patients receiving given correction, were noted to have gradual positive dynamics of accountable indices. In the patients observed, a rapid elimination of clinical manifestations of osteochondrosis and a gradual recovery of plasma concentrations of thromboxane B<sub>2</sub>, 6-keto-prostaglandin F<sub>1</sub>α, P-selectin, RESAM-1, lipid peroxidation products and NO metabolites was found. The results obtained make it possible to consider medical and preventive clothing as a full component of mass prophylaxis of osteochondrosis progression and an important means of preserving the health of people with this pathology.

**Keywords:** the second mature age, osteochondrosis, pain syndrome, plasma, microcirculation, medicinal-prophylactic clothes.

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## INTRODUCTION

Continuous development of medical science ensures the development of increasingly effective approaches to the treatment of various pathologies. Despite this, osteochondrosis of the spine is still a very common and often difficult to treat disease worldwide [1]. This is exacerbated by an increase in recent years in patients with this pathology among the able-bodied population. The aggravation of osteochondrosis always sharply worsens the general state of health, often causes temporary disability, and at times disability [2,3]. The development of osteochondrosis affects the cardiovascular system and hematological parameters [4,5,6]. It is known that even with initial disturbances in the spine, microcirculation impairments can occur, leading to a rapid aggravation of hypoxia in the tissues [7]. The emerging situation progressively violates the anabolic processes in the patients' body and sharply worsens the long-term prognosis [8].

Traditionally, the currently prescribed treatment options for osteochondrosis are far from being able to achieve a satisfactory health effect in all cases [9,10]. In this connection, the continuation of the search for new effective approaches to its correction, which can necessarily affect not only the degree of its clinical manifestations, but also the hematological indices, including the level of plasma bioregulators, remains very in demand. In this respect, variants of non-medicamentous effects that have no side effects may be particularly promising [11].

In previous studies on humans [12] and animals [13, 14], the boundaries of the therapeutic effects of many therapeutic effects on the body were firmly established, including the attenuation of violations of the balance of bioregulators in the blood [15]. Previously, children with scoliosis had found out the possibility of long-term physical therapy training in the optimization of a number of hematological indicators [16]. At the same time, for a large part of the working population, there is a low commitment to regular exercise [17]. For this reason, it is necessary to continue searching for variants of non-drug correction that will be acceptable for the majority of patients [18,19] and will be able not only to stubbornly suppress the main external manifestations of the disease, but also positively influence the levels of biologically active substances important for microcirculation in plasma. An alternative to therapeutic physical training in osteochondrosis was the author's daily use of medicinal-prophylactic clothes (MPC). From one side, the attachment to MPC among patients is incommensurably higher than to medicinal physical training [20]. From the other side, in previous researches there was established the possibility of correction of clinical and hematological disturbances caused by pathology of spinal column [21,22], with the help of MPC. So, we put the following aim in our research: to estimate the dynamics of clinical syndromes and platelets' aggregation activity in persons of the second mature age with osteochondrosis of the 2<sup>nd</sup> degree who daily wore the author's MPC for half a year.

## MATERIALS AND METHODS

The conducted research was approved by the Local Ethic Committee of the Russian State Social University in May, 17<sup>th</sup>, 2016 (Record №5).

The research was conducted on people living in Central Russia (Moscow City and Moscow region). Into our research we took 37 healthy people of both sexes (18 men and 19 women) of the second mature age (mean age 43.5±2.5 years) who composed the control group. We also examined 43 people of both sexes (21 men and 22 women) of the same age (mean age 44.7±1.9 years) with osteochondrosis of the 2<sup>nd</sup> degree who composed the group of observation. The diagnosis of osteochondrosis was confirmed clinically and rontgenologically. Existing in some persons from the group of observation concomitant chronic diseases (chronic bronchitis, chronic tonsillitis, chronic cholecystitis) were in the state of lasting persistent remission. In 93.0% of patients, the duration of exacerbation of the disease exceeded 2 weeks, with 88.4% of patients receiving treatment (medication, physiotherapy, massage, reflexology) for osteochondrosis, which in all cases was not effective enough. This research is approved by the local Ethics Committee of the Russian State Social University on May, 14<sup>th</sup>, 2015 (Record №5). All the examined persons gave written informed consent on participation in conducted research.

In our research we determined the activity of the processes of lipids' peroxidation (LPO) in blood plasma which was registered according to the content of thiobarbituric acid (TBA)-active products in it with the

help of a set produced by the firm "Agat-Med" (Russia) and to the level of acylhydroperoxides (AHP) [23]. We also registered antioxidant activity of blood [24].

We determined molecules' concentrations of P-selectin and PECAM-1 (Bender MedSystems GmbH, Austria) by enzymeimmunoassay in plasma.

In blood plasma of examined children we determined the content of thromboxane A<sub>2</sub> metabolite – thromboxane B<sub>2</sub> and prostacyclin metabolite – 6-keto-prostaglandin F<sub>1α</sub> by enzymeimmunoassay with the help of sets produced by the firm "Enzo Life science" (USA). We also determined the summary content of nitric oxide metabolites [25] in children's plasma.

All the persons from the group of observation were recommended to wear designed by the authors medicinal-prophylactic clothes [26] every day to correct osteochondrosis manifestations. The applied MPC consisted of belt-cast with warming effect which was composed of two details – backplate and breast-plate. There were elements of their mutual connection. The belt-cast was also provided with vertical pockets of different width. Stiffening ribs of elastic material were inserted into one of them, warming elements – into the others. Both plates were made of two layers of fabric. Vertical stitches forming pockets, were made along whole their surface. Both layers of fabric were sewed between each other along the lower cut and sides. The upper cut was left open and was provided with a zipper. A set of salt heaters was used as warming element.

The patients from the group of observation were examined at the beginning and in 3 months, 6 months of constant MPC wearing. The control group was examined once.

Received in our research results were processes by Student's (t) criterion.

## RESULTS OF INVESTIGATION

In the initial state, in persons with osteochondrosis, the increase in LPO processes in plasma was noted. This was indicated by high concentrations of AHP and TBA products in the plasma, exceeding the control by 19.5% and by 14.6%, respectively. Daily wearing of MPC was accompanied by weakening of LPO processes in plasma of persons with osteochondrosis. So, already in 3 months of observation the quantity of AHP and TBA products in plasma lowered from  $2.45 \pm 0.48$  D<sub>233</sub>/1 ml and  $4.48 \pm 0.52$  mkmol/l (control values –  $1.77 \pm 0.23$  D<sub>233</sub>/1 ml and  $3.26 \pm 0.29$  mkmol/l, respectively) till  $2.05 \pm 0.52$  D<sub>233</sub>/1 ml and  $3.91 \pm 0.42$  mkmol/l, respectively. By the 6<sup>th</sup> month of MPC application the content of AHP in plasma of persons with osteochondrosis reached  $1.80 \pm 0.29$  D<sub>233</sub>/1 ml at the decrease of TBA-active compounds in it till  $3.30 \pm 0.34$  mkmol/l against the background of plasma AOA strengthening from  $23.8 \pm 0.41\%$  at the beginning till  $32.2 \pm 0.32\%$  by the end of observation (control values –  $32.6 \pm 0.49\%$ ). The persons with osteochondrosis were noted to have gradual lowering of initially increased concentrations of accountable adhesion molecules in plasma in the result of MPC wearing (table). In half a year's MPC wearing the persons with osteochondrosis were found to have reliably lowered levels of P-selectin and PECAM-1 on 22.2% and 22.1%, respectively. These indices nearly approached the control ones.

In blood of the examined persons with osteochondrosis we noted imbalance of arachidonic acid metabolites: the level of thromboxane B<sub>2</sub> in their plasma turned out to be higher in comparison with the control level on 30.6%, whereas the level of its functional antagonist's derivative – 6-keto-prostaglandin F<sub>1α</sub> – lowered on 15.9% (Table 1). It was accompanied by content lowering of summary quantity of nitric oxide metabolites on 23.6% in comparison with the control values.

The plasma of persons with osteochondrosis who daily wore MPC, was noted to have gradual leveling of the existed imbalance of arachidonic acid metabolites. By 6 months of observation the level of thromboxane B<sub>2</sub> in their plasma lowered in comparison with the initial one by 30.2% and the derivative level of its functional antagonist – 6-keto-prostaglandin F<sub>1α</sub> rose by 15.6% and reached the control values in both cases (Table 1). In 6 months of observation it was accompanied in the observed persons by content rise of nitric oxide summary metabolites in their plasma by 23.3%.

**Table: The dynamics of morpho-functional and hematological characteristics of examined children with scoliosis against the background of medioprophyllactic clothes' wearing**

Parameters	A group of children with scoliosis against the background of medioprophyllactic clothes' wearing, n=39, M±m			Control, n=34, M±m
	initial state	3 months	6 months	
acylhydroperoxides of plasma, D <sub>233</sub> /l ml	2.45±0.48	2.05±0.52	1.80±0.29	1.77±0.23
	p< 0.01	p <sub>1</sub> < 0.05	p <sub>1</sub> <0.01	
thiobarbituric acid-products of plasma, mkmol/l	4.48±0.52	3.91±0.42	3.30±0.34	3.26±0.29
	p< 0.01	p <sub>1</sub> < 0.05	p <sub>1</sub> <0.01	
antioxidant activity of plasma, %	23.8±0.41	27.5±0.38	32.2±0.32	32.6±0.49
	p< 0.01	p <sub>1</sub> < 0.05	p <sub>1</sub> <0.01	
P-selectin, ng/ml	119.9±0.49	107.7±0.51	98.1±0.39	98.4±0.42
	p< 0.01	p <sub>1</sub> <0.05	p <sub>1</sub> <0.01	
PECAM-1, ng/ml	58.6±0.38	52.1±0.33	48.0±0.25	47.3±0.27
	p< 0.01	p <sub>1</sub> <0.05	p <sub>1</sub> <0.01	
thromboxan B <sub>2</sub> , pg / ml	220.3±0.67	187.3±0.54	169.2±0.45	168.7±0.75
	p< 0.01	p <sub>1</sub> <0.05	p <sub>1</sub> <0.01	
6-keto-prostaglandin F <sub>1α</sub> , pg / ml	82.8±0.32	89.4±0.30	95.7±0.29	96.0±0.42
	p< 0.01	p <sub>1</sub> <0.05	p <sub>1</sub> <0.01	
nitric oxide's metabolites, umol/l	29.2±0.24	32.5±0.35	36.0±0.28	36.1±0.29
	p< 0.01	p <sub>1</sub> <0.05	p <sub>1</sub> <0.01	

Conventional signs: p – signification of parameters' differences of children with scoliosis and control group. p<sub>1</sub> – dynamics' signification of accountable indices of children with scoliosis in the course of correction in comparison with the beginning.

### DISCUSSION

The ontogeny of any organism is realized in the course of constant interaction of the organism with the environment provided the homeostasis is clearly preserved [27,28]. Disturbances in different internals, including spinal column, can often develop against this background. Degenerative-dystrophic changes develop in it most often (till 70% of all the patients with spinal column pathology, high primary disablement – till 41.1%) [9]. It has long been noted that the presence of osteochondrosis negatively affects the work of internal organs and metabolism [29]. Developing with osteochondrosis, an aseptic inflammatory process in the spine has a pronounced negative effect on blood vessels and blood [6].

The formation of these disorders in osteochondrosis worsens the circulatory processes, thereby weakening the work of internal organs [30]. An important role in development of these dysfunctions at osteochondrosis belongs to disturbances' development of regular blood elements' (including platelets) microrheological features [31]. Weakening of antioxidant protection of a body with the increase of LPO intensity in plasma and its cells is very significant in it. Products of plasma lipid peroxidation cause changes in the membranes of blood and vascular cells and worsen their function. This greatly contributes to the formation of membranopathy [32]. Its consequence in the body is deterioration of microcirculation and inhibition of metabolism [33,34].

Very sensitive indicators of the violation of cellular interactions in the blood are the concentrations of the cell adhesion molecule P-selectin and RESAM-1. Their concentrations indicate the level of their expression and thus the potential of the interaction of blood cells and the endothelium. In addition, it is recognized that fluctuations in the levels of P-selectin and RESAM-1 concentrations are associated with changes in the activity of the metabolism of blood and vascular cells. In this connection, an increase in the plasma level of these molecules makes it possible to consider one important marker of cell malnutrition in the blood [35].

In the modern world, the search for new forms of recovery and social integration of various groups of patients and invalids is becoming more urgent [36,37]. One of new rehabilitation variants is application of MPC

[38,39]. Its design is being conducted in accordance with the last achievements of science [40]. Working out of MPC for individuals with osteochondrosis becomes very significant because of wide prevalence of this pathology [41,42]. At that, additional researches are necessary for final clarification of all the aspects of these clothes' positive impact on a child's body. It was just begun in the given research.

It was found out in the research that daily MPC wearing could lower LPO intensity in blood plasma and to eliminate the manifestations of osteochondrosis. It improved functioning of the internals, providing decrease of negative stimulating impacts on the surface of platelets which were typical for osteochondrosis. At that, weakening of LPO activity in organism provided activity optimization of platelets' enzymatic systems and receptors on their surface. Found lowering of plasmatic level of P-selectin and PECAM-1 in persons with osteochondrosis daily wearing MPC, greatly contributed to optimization of vital processes in blood cells. It also pointed at minimization of risk episodes of capillary course' blocking by and formation of optimal conditions for metabolism in tissues of persons with osteochondrosis [43].

As a result of the constant wearing of MPC in the vascular wall of persons with osteochondrosis, the synthesis of biologically active substances is balanced, normalizing the humoral processes of regulation of blood cells. It was detected in the research that proaggregants' levels were optimized in blood of patients against the background of daily MPC wearing. It was connected with the decrease of thromboxane A<sub>2</sub> formation what was judged by the level fall of its inactive form – thromboxane B<sub>2</sub> – in blood. In the result of MPC wearing the persons with osteochondrosis were also noted to have the level rise of its physiological antagonist – prostacyclin what restored the balance of arachidonic acid metabolites in blood. Given changes were strengthened in those persons who wore MPC, by the rise of NO production in vascular walls. Probably, it took place in the result of synthesis activation of endothelial NO-synthase in conditions of LPO suppression in plasma [44]. Minimized in these conditions, micro-rheological disorders are also capable of enhancing trophic, including in the walls of blood vessels, thereby further stimulating the production of disaggregants in them.

#### CONCLUSION

When osteochondrosis of the spine develops, changes in the concentration of many biologically active substances are often recorded in the blood. In many respects this is caused by the increase in the plasma processes of lipid peroxidation, which damages blood cells and vessel walls. Daily 6-month wearing of medicinal-prophylactic clothes weakens the processes of lipid peroxidation in plasma. In this case, the daily wear of people with osteochondrosis treatment and preventive clothing contributes to the onset of a balance between the levels of various bioregulators in blood plasma. After 6 months of observation in their blood, the concentration of adhesion molecules and substances affecting the rheology and hemostasis processes came to the control level. The obtained results allow treating preventive clothing as an important component of mass prophylaxis of dysfunctions in the body against the background of osteochondrosis and an important means of maintaining the health of internal organs in people with this disease.

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