

STUDY OF MUSCULAR SKELETAL APPARATUS'S FUNCTIONAL STATE OF JUNIOR SPORTSMEN- POWER LIFTERS, WHO HAVE BACKBONE VERTEBRAL ABNORMALITIES

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Abstract. *Purpose:* determination of abnormalities and disorders of muscular skeletal apparatuses' status of power lifters, who have vertebral abnormalities of backbone. *Material:* 58 junior sportsmen participated in the research. 36 sportsmen were the main group of the research and had vertebral disorders in backbone. For posture testing visual examination was used. Backbone mobility was tested with goniometry method. Flat feet were registered with plantography method. *Results:* we determined posture abnormalities in sagittal and frontal planes; feet flat, limited maximal movements in thoracic and lumbar spines. It was determined that the most limited were rotational movements and backbone unbending. The next were side bents. These limitations were accompanied by pain syndrome. These observations indirectly confirmed theory of direct interaction of backbone structures with nervous structures. It is also a confirmation of vertebral abnormalities' presence in junior sportsmen. *Conclusions:* it was found that in junior sportsmen – power lifters with backbone pathologies in 100% of cases symptoms are determined by local limitations of backbone mobility with pain syndrome. In 35% of cases they are accompanied by posture's disorders and feet flat. Orientation and methodic of rehabilitation of such sportsmen have been determined.

Keywords: rehabilitation, muscular, skeletal, posture, backbone, abnormalities.

Introduction

As on to day percentage of sportsmen with backbone traumas, caused by incorrect lifting of great weights, has been still remaining rather high. As a result changes of tissues' structural functional parameters appear. It can result from not only mechanical disorders but be direct reason of them. Mechanical factor is considered the main reason of backbone abnormalities [5, 6, 13]. Insufficient load on backbone is dangerous due to atrophy of its components and possible disorders in metabolism. Overloading of backbone also influences negatively on its functional state. With it (as a rule) one or another backbone structure suffers that, in the future, results in trauma. Sometimes, trauma appears due to disproportions in muscles' development and changes of natural backbone's profile [6, 7]. Recent time among all diseases of peripheral nervous system specific weight of backbone osteochondrosis has constantly been rising. In 5.3 – 21% of cases these pathology affects persons of young age. This pathology substantially restricts physical and functional potentials, which are especially important for sportsmen in conditions of constantly increased loads [4, 5]. Up to the present time there have existed a lot of questions of this disease's pathogenesis, especially in young people. In particular the question of backbone pathology's influence on sportsmen's motor potentials has not been solved, as well as the problems of objective diagnostic of early (pre-clinical) reflex symptoms of sportsmen's backbone osteochondrosis [8, 10, 11, 15].

Young, growing organism of sportsman has significant processes in bone tissues with uneven ossification and final formation of bones and joints in 20-25 years' age. Zones of growth also remain not closed. Bones are pliant to changes and are easily deformed with physical overloading (especially static). The processes of bone tissue's growth and development can be accelerated or decelerated. It is a result of hormones oscillations, which determine character of bone tissue's development [18, 19]. In growth and formation of bones substantial role is played by physical exercises. Static loads cause changes of ions content and cells' polarization in these tissues. They are compulsory condition for mineralization of bones at the account of absorbing of ionized forms of required micro-elements [15, 16]. Significant loads, excessive muscular efforts in this age are reflected in development of bones and joints. They change their shape and structure to larger extent than in case of adult person [7]. That is why during training it is necessary to consider existing age specificities. Multilateral character of trainings, observation of "step-by-step" principle, exercises' adequacy, exercises' alternation by different movements are compulsory as well as application of backbone, pelvis and lower limbs' relaxing exercises. It is directed on prevention from possible unfavorable deviations in adolescent's growth; on stimulation of growth and normal development of bone-ligament tissue. Thus, junior sportsmen shall be paid special attention to, who already have abnormalities in muscular skeletal apparatuses; in particular – posture's abnormalities and early backbone osteochondrosis.

Purpose, tasks of the work, material and methods

The purpose of the work is to determine abnormalities and limitations in muscular skeletal apparatuses of junior sportsmen – power lifters, who have vertebral abnormalities of backbone.

The methods and organization of the research: we tested 58 junior power lifters of 12-13 years' age, who were divided in main and control groups. Postures were examined visually. Backbone mobility was tested with method of goniometry. Pantograph method was used for detection of feet flat.

Results of the research

Among 12-13 years' age adolescents there is observed great number of backbone and feet pathologies. It is manifested as feet flat and posture's abnormalities. As per opinion of different authors they are from 57.0% to 65.4% of cases, depending on age [8, 12]. Considering high level of such pathologies' manifestation we conducted deepened examination of junior 12-13 years' age power lifters' muscular skeletal apparatuses. The examination included detail study of main parameters, characterizing posture, backbone mobility, symmetry of indicators as well as foot arc.

Analysis of visual examination data showed high percentage of posture abnormalities (see table 1). By the results of our researches it was found that most of sportsmen (in our research – 34 persons) have asymmetric location of shoulder girdle and blades. Location of blades and shoulder girdle is influenced by localization and direction of backbone warp.

Table 1

Analysis of junior power lifters' visual examination data

Age	Quantity of sportsmen	Posture		
		Asymmetric	Round-concave back	Flat back
12	15	7	-	8
13	19	9	6	4
Total	34	16	6	12

Our researches permitted to find, in most cases, dislocations of shoulder girdle and blades from the right of torso in upward direction. Backbone warps in upper and middle thoracic spines is accompanied by pulling of blade and shoulder girdle upward at the side of bulge. It depends on warp, points of fixing of rhomboid and trapezius muscles of certain side. So, dislocation of shoulder girdle and blades happen in compliance with general bio-mechanical principle [21-25]. This principle is rather clearly expressed with scoliosis, when blade and shoulder girdle are lower on concave side of thoracic warp and higher on convex side.

Blades' inclination forward was characteristic for all sportsmen with round concave back. Blades' lower angles were at certain distance from ribs. It was obvious strengthening of thoracic kyphosis. Position of shoulder girdle and blades of sportsmen with flat backs was not always of the same type. For example for the most of sportsmen blades' keeping up with chest was characteristic. With asymmetric posture (girdle's warp to the left) shoulder girdle and blade were higher to the right. In case of scoliosis they are lower at the left side. In case of backbone deformation in lumbar spine shoulder girdle and blades are located symmetrically.

In most of sportsmen with asymmetric postures we observed asymmetry of waist triangles. Smoothing of waist triangle takes place from the side of raised shoulder girdle. Asymmetry of waist triangles of sportsmen with round-concave back was expressed in less quantity of sportsmen and not so clearly. Torso dislocation in respect to pelvis was detected in 4 sportsmen. With it in 3 sportsmen it was to the left side and in 1 – to the right. Pelvis location in frontal plane was symmetric in most of sportsmen. But in sagittal plane we registered increase of angle of forward pelvis inclination. In sportsmen with flat back we found waist triangles' asymmetry in 7 children, torso dislocation to warp side – in 6 persons, asymmetry of pelvis position in frontal plane – in 4. Angle of forward inclination of pelvis was less and was 30-40°.

Asymmetric position of pelvis in frontal plane was detected in 28 sportsmen (mainly to left side). Pelvis side inclination was conditioned in most cases by weakness of abdomen oblique muscles.

Head forward inclination was detected in 13 tested sportsmen with asymmetric posture head inclination forward and to the left was registered in 7 sportsmen; forward and to the right – in 4 sportsmen. Straight head position was found in 2 sportsmen. Head position influences greatly on all complex bio-mechanical chain, including backbone and posture as it is. Forward head inclination is usually connected with increasing of thoracic kyphosis. Vertical head position is observed in sportsmen with flattened backbone profile in sagittal plane.

In sportsmen with round-concave back head forward inclination was registered in 5 boys.

Rather often in sportsmen with posture's abnormalities relative shortening of lower limb was detected. It should be noted that rather often it characterizes status of lower limbs' muscular skeletal apparatus. This feature witnesses about asymmetric tension of lower limbs' muscles and is accompanied by pelvis warp in frontal plane. From total quantity of the tested (34 persons) relative shortening of one of limbs was found in 13 boys.

Thus, with the help of visual examination we conducted analysis of junior power lifters' postures with registration of certain symptoms of posture abnormalities and made up individual posture profile of every tested sportsman.

Discussion

In testing of foot arc we found hypotonic type of foot (feet flat) in 26% of the tested sportsmen. In 38% of sportsmen we observed hypertonic type (tensed feet). 45% of sportsmen had dystonic type of foot (clubfoot). Normal type of foot belonged only to 4% of sportsmen. The received results confirm the data of other authors, who note that there is high percentage of foot arc's disorders, which differ by level: from 52.9 to 73.7% - in boys and from 44 to 58.8% - in girls [9, 12].

Thus we confirmed the data of authors [11, 12, 15], that as on the present time most of children and adolescents have abnormalities in muscular skeletal apparatus and are carriers of many markers of ligament tissue's dysplasia. In this connection such children are the group of risk, meaning appearing and stabilization of functional and in the future organic deformations of backbone. With it significant asymmetry of lower limbs' length in junior representatives of different sport specializations exceeds the same in children, who do not practice sports. Sport practicing in children and adolescent age does not depend on specific features of muscular functioning and to certain extent remove postural muscular imbalance and deviations in pelvis position. The latter appears at the account of functional blocking in sacrum – pelvis area. Owing to frequency of appearing of high functional fixings in cervical spine they result in hyper-mobility in cervical spine. It can be accompanied by a number of clinical symptoms.

Results of our researches confirm the mentioned facts. For example, maximal backbone movements were limited in thoracic and lumbar spines (see table 2 and table 3).

Table 2

Angles of maximal movements in thoracic spine of junior sportsmen

Backbone movement	Angle of movement (degrees)		Probability of changes	
	Forward / to the left	Backward/to the right	t	P
Bending in sagittal plane	27.0±1.4	17.2±1.6	-	-
Bending in frontal plane	12.4±3.7	14.0±2.9	0.34	> 0.5

Table 3

Angles of maximal movements in thoracic and lumbar spines of junior sportsmen

Backbone movement	Angle of movement (degrees)		Probability of changes	
	Forward / to the left	Backward/to the right	t	P
Bending in sagittal plane	78.4±5.4	61.5±5.3	-	-
Bending in frontal plane	47.8±5.7	52.4±6.0	0.56	>0.1
Rotation	32.2±5.3	34.1±6.9	0.22	>0.5

The most restricted were maximal and snatch rotational movements of all backbone. It was: to the side of prevailing symptoms of vertebra segment's osteochondrosis in average $32.2 \pm 2.3^\circ$ and 41.9 ± 2.0 ; in opposite side – $34.1 \pm 1.9^\circ$ and $44.5 \pm 2.1^\circ$. These indicators confidently differed from normal ($p < 0.001$). Analogous regularities were observed also for side mobility of backbone (in average, accordingly $50.1 \pm 4.8^\circ$ and 21.3 ± 4.4 , $p < 0.01$). Distinctions between side bents were not confident ($P > 0.05$).

We also found substantial variability of angle of "snatch" movements in three successive attempts. In junior sportsmen with backbone pathologies (mainly in second and third movements) the angle did not exceed the value of the first movement. With expressed pain syndromes dispersion of values was 20-30%. It can be explained as "saving" of backbone, resulted from pain syndromes. The most limited were rotational movements and unbending. The next were bents to sides. Bending of thoracic spine in combination with lumbar spine practically was not limited ($P > 0.05$).

This fact indirectly confirmed theory of direct interaction of backbone anatomic structures with nervous structures: with forward bents inter-vertebral space expands and "free" nervous structures. On the other hand it confirms

the opinion of a number of authors [5, 9, 17], that bending movements are risk factor, which shall be considered when working out complexes of therapeutic gymnastic for persons with backbone pathologies.

Thus, profound testing of junior sportsmen power lifters' muscular skeletal apparatuses helped to find out great percentage of sportsmen with functional disorders. Among them the most frequent were posture's abnormalities and feet flat. We marked out characteristic features of certain posture's abnormalities and made up individual profile of posture for every tested sportsman. The received data confirm authors' opinion about presence of such abnormalities in 12-13 years' age children. They are from 57.0% to 65.4% cases [8, 12]. We have supplemented the data of K. Bukup [3], I.U.L. Pshetakovski [14], Yu.V. Bobrik. [1], I.I. Bonchuk [2], that pain in back and limitations of backbone mobility are direct sign of degenerative-dystrophic changes in backbone.

Our observations showed that not all sportsmen with posture abnormalities felt pain and had limitations of backbone mobility. That is why initial signs of backbone osteochondrosis can not always be connected with posture's disorders and feet flat. But in confirmation of authors [11, 12, 15] we can affirm that such abnormalities of muscular skeletal apparatus can be carriers of significant quantity of markers of ligament tissue's dysplasia. They are additional reasons of early backbone osteochondrosis. In this connection such children are in risk group, meaning risk of appearing and stabilization of functional and, in the future, organic, backbone's deformations.

Conclusions:

We have registered rather high percentage of junior sportsmen-power lifters with morphological functional disorders of muscular skeletal apparatus. Such abnormalities are: disorders of postures, feet flat and possible pathologies of backbone. On the base of conducted researches it was proved that junior sportsmen- power lifters with pathologies of some motor segments of backbone clinical symptoms of early osteochondrosis is manifested in local limitations of backbone mobility. They are accompanied by pain syndromes and vegetative disorders in affected segment of backbone. On the base of the received data we determined physical rehabilitation methodic for junior sportsmen-power lifters with vertebral disorders of backbone.

The prospects of further researches imply working out of program of junior sportsmen-power lifters' physical rehabilitation from vertebral backbone abnormalities.

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Conflict of interests

The author declares that there is no conflict of interests.

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