Gender features of functional condition of backbone of teenagers with scoliotic posture

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Purpose: to study mobility of backbone, endurance of muscles of a trunk and to define gender features of functional condition of backbone at children of the middle school age with scoliotic posture depending on the direction of the top of arch of curvature of spine.

Material & Methods: 40 girls and 40 boys, including 18 girls and 18 boys with the right-side deformation of backbone in the thoracic department, the left-side – 22 girls and 22 boys are examined.

Results: features of changes of indicators, depending on sex of children and frontage of the top of arch of curvature of spine column, are revealed when studying the level of flexibility of backbone and endurance of muscles of a trunk at children of the middle school age with scoliotic posture.

Conclusions: it is established that the level of decrease in flexibility of backbone is higher at boys, than at girls, whereas indicators of contractile ability and tone of muscles of "muscular corset" are higher at boys.

Keywords: teenagers, scoliotic posture, functional condition of backbone, gender distinctions.

Introduction

Violations of posture remain the most widespread functional frustration of the musculoskeletal system at pupils on statistics that make from 33,4% to 80% of the children's population [1; 5; 10].

Scoliotic deformation of backbone is the center of pathological proprioceptive impulsation, is reflected negatively in the whole organism of children, including on motor, regulatory functions and so forth [6; 12]. Violations of posture at children influence processes of growth and level of physical development, with the reduction of physiologic reserves of almost all systems of organism [3; 4; 6; 8].

Insufficient attention to this problem and untimely correction of functional violations of backbone at the children's age promote the formation of diseases not only the musculoskeletal system, but also other bodies and systems which are the reason of decrease or loss of working capacity at the mature age [6; 8; 12; 13].

According to many researchers, the first reliable gain of frequency of violations of posture is the share of the younger school age, the second, – of the middle school age [1; 2; 8]. Features of flexions of backbone are substantially caused by such factors as age, sexual differences [1; 3; 7]. However, gender features of the musculoskeletal system of children at the choice of means of physical rehabilitation are not always considered that results in insufficient efficiency of their application.

Difference of the middle school age is that sexual ripening begins at a child that coincides with the period of completion of biological ripening of organism, the hormonal background considerably changes. At the same time the bone system grows enough in high gear, to 9–10 sm a year whereas muscular tissue is not in time behind it. It results in fast fatigue even from insignificant exercise stresses, violations of coordination and constraint of movements [3; 7].

Gender features of this period of the development of organism are that it begins in 11–12 years old at girls, and at boys – in 12–13 years old. At the same time the increase in length of backbone is more expressed in group of boys [1].

The condition of backbone and the development of muscles of trunk play the major role in the formation of a correct posture [4; 7; 11]. Therefore the assessment of their functional condition, first of all, is necessary for the determination of the basic level which is the subsoil for the personified approach to the creation of programs of physical rehabilitation of pupils with violations of posture. It is known that the top of arch of curvature of spine column can be the address to the left or to the right at scoliotic posture, it has to be considered near the assessment of features of mobile ability of backbone and endurance of muscles of trunk, however such data are still absent in available to us literature.

Communication of the research with scientific programs, plans, subjects

The research is executed according to the Built plan of the RW of Dnipropetrovsk state institute of physical culture and sport of MES of Ukraine and is fragment of the research work: "Prevention of primary disability as a result of injuries and diseases of the musculoskeletal system of means of physical rehabilitation" (No. of the state registration is 0116U003014).

The purpose of the research:

to learn the level of mobile ability of backbone and endurance of muscles of trunk and to define gender features of their functional condition at children of the middle school age with

scoliotic posture depending on curvature of the top of arch of curvature of spine column.

Material and Methods of the research

The researches are carried out on the basis of CI "Anniversary comprehensive high school No. 1" of Dnipropetrovsk during the preventive review of 189 pupils of 11–14 years old. Scoliotic posture is found at 121 children (64,0%), and at girls is almost twice more often – 79 (65,3%), than at boys – 42 (34,7%), (χ^2=21,4; p=3,69E-06). The left-side deformation of backbone (LSD) among girls was observed 3,1 times more often – at 60 children (75,9%), than right-side (RSD) – at 19 (24,1%), (χ^2=40,5; p=1,96E-10). It often turned out among boys almost equally as LSD – at 24 (57,1%), and RSD – at 18 (42,9%), (χ^2=1,19; p=0,28).

40 girls and 40 boys, including with the right-side deformation of spine column in the chest department – 18 girls and 18 boys, left-side – 22 girls and 22 boys in whom scoliotic disease is not established at application of tool diagnostic methods, are selected by the informed consent with parents of children for the research of mobility of backbone and endurance of muscles of trunk.

Functional state was defined by the testing of mobility of spine column forward in starting position, standing on distance which remains from the ends of fingers to the floor [9]. Mobility of spine column was defined also in starting position back, standing, on distance from the seventh cervical vertebra by the beginning of inter-buttock fold at the maximum bending back [9]. Side mobility of spine column was defined on distance from the nail phalanx of the third finger of hand to the floor in the provision of the maximum bending [9] to the right and to the left.

Power endurance of muscles of prelum abdominale was defined by the maximum time of maintenance of straight legs, lifted feet from support 45 sm by 10 sm high up (at an angle 45°) in situation, lying on back [9].

Power endurance of muscles of side zones of trunk was estimated in starting position of a child on one side at the maintenance of body muscle tension of right and left parties [9].

Static power endurance of muscles of back was defined for fitball test at the maintenance of body in situation, lying in emphasis on hips on fitball (the top part of trunk was on weight at an angle 5–10°, feet are fixed on a gymnastic balance beam,

hands on the nape) [9].

Dynamic power endurance of muscles of prelum abdominale investigated in the test bending-trunk extension from situation, lying on back in situation, sitting [9].

The tone of muscles of forward abdominal wall was determined by condition of straight line of stomach upon transition from situation, lying on back in situation, standing: if the line remained straight line, the tone was estimated as excellent (5 points), when sagging straight line less than 2 sm estimated tone of muscles as good (4 points), when sagging more than 2 sm considered satisfactory tone of muscles (3 points), considered tone unsatisfactory at fortnightly sagging, that is at the drooped stomach (2 points).

Contractile ability of muscles of forward abdominal wall was defined in static and dynamic tests behind abdominometry at the level of navel. This indicator was defined at rest, lying on back and standing in the static test, at the dynamic test – at stomach suction. Contractile ability was considered stomach circle, excellent in the absence of changes, at different measurements (5 points), contractile ability was estimated as good (4 points) at its increase up to 2 sm, over 2 sm (3 points) considered satisfactory indicators of increase in circle, and contractile ability estimated as bad at reduction of circle of stomach (2 points) [9].

Statistical processing of results of the researches was carried out by methods of variation statistics with use of standard package of the application programs SPSS 13.0 for Windows.

Results of the research and their discussion

The deviation from milestone in the chest department of backbone was more essential (5,7±0,2) sm at girls at the anthropometrical research of children with LSD, than at boys (3,8±0,4) sm (p<0,001). This indicator did not differ significantly among children with the right-side deformation: girls had (4,1±0,6) sm and (3,2±0,4) sm – at boys (p>0,05).

When determining mobility of spine column forward its limitation at boys did not depend on the part of deformation of backbone (tab. 1).

Girls with left-side deformation of backbone have its flexibility forward and was less back, than at RSD (p<0,05 та p<0,001 respectively). However in comparison with boys who had

Table 1

Gender features of mobility of backbone of the examined children

Indicator, unit	Boys (n=40)		Girls (n=40)	
	RSD of spine column (n=18)	LSD of spine column (n=22)	RSD of spine column (n=18)	LSD of spine column (n=22)
Mobility of spine column forward, sm	3,7±0,5	3,3±0,2	2,1±0,4	3,2±0,3[1]
Mobility of spine column back, sm	7,4±0,7	6,5±0,5	4,2±0,4[**]	6,1±0,2[3]
Right-side mobility of spine column, sm	2,7±0,6	7,4±1,2[1]	2,4±0,3	4,9±0,4[3/*]
Left-side mobility of spine column, sm	7,7±1,0	4,3±0,6[2]	6,2±0,4	2,9±0,2[3/*]

Notes: 1. [1]– p<0,05; [2]– p<0,01; [3]– p<0,001 – the level of reliability of changes between indicators of children with left-side and right-side deformation of backbone; 2. [*]– p<0,05; [**]– p<0,01 – the level of reliability of changes between indicators of boys and girls.

right-side asymmetry of spine column its mobility back at girls was the best what reduction of distance from the 7th cervical vertebra by the beginning of inter-buttock fold at the maximum bending testifies back by 1,4 times (p<0,01). He pays attention the fact that the level of flexibility both forward, and back did not depend significantly on the part of deformation of backbone at boys.

Dependence of changes of side mobility of spine column on its right-or left-side deformation was rather expected. RSD was followed by minor changes of mobility in right side both at boys, and girls. Essential reduction of flexibility as at boys, and girls in 1,8 (p<0,01) and by 1,5 times (p<0,05) respectively, in comparison with children with RSD was watched existence of LSD. At the same time limitation of mobility also was more expressive at boys (p<0,05).

Therefore, mobility of backbone has not only gender differences, but also depends on bend of the top of arch of its curvature. Especially it concerns boys in whom the expressed asymmetry of restriction of side mobility in side, opposite to deformation of backbone, is found.

Essential differences in static power endurance of muscles of back for fitball test at RSD or LSD are not revealed both at boys, and at girls, however, this indicator was 1,4 times lower at girls in comparison with boys (p<0,001) (tab. 2).

Static power endurance of muscles of side zones of trunk was more lowered at LSD both at boys (p<0,01), and girls (p<0,001), but contractile ability of muscles of side zones was 1,3 times higher at boys, than at girls (p<0,001).

Dynamic power endurance of muscles of forward abdominal wall less at LSD, than at RSD by 1,5 times (p<0,01) at boys and by 1,3 times, – at girls (p<0,05).

This indicator was smaller in 1,4 (p<0,01) and by 1,3 times (p<0,05) respectively in comparison with boys girls both with RSD, and LSD. Dependences of tone of muscles of prelum

abdominale on the type of deformation are not found.

It was satisfactory in comparison with boys, its decrease as was observed at RSD by 1,3 times (p<0,001), and LSD – by 1,5 times (p<0,01) at girls. Contractile ability of muscles of forward abdominal wall did not depend on type of deformation of spine column in the static test at boys and was estimated as good. This indicator was satisfactory at girls as by the existence of LSD (p<0,01), and RSD (p<0,01).

Contractile ability of muscles of forward abdominal wall was good at RSD, at LSD – satisfactory in the dynamic test boys. Girls had this indicator considerably smaller and answered satisfactory condition at RSD and more insufficient – at LSD (p<0,01).

Thus, mobility of backbone and endurance of muscles of trunk at children of the middle school age with violation of posture have excellent gender features that needs to be considered when developing the program of physical rehabilitation.

Conclusions

1. It is necessary to consider flexion of the top of arch of curvature of spine column at the assessment of features of mobile ability of backbone and endurance of muscles of trunk at children of the middle school age with scoliotic posture.

2. Scoliotic posture with left-side flexion of the top of arch of rachiocampsis at girls of the middle school age is followed by the reduction of flexibility both forward, and back in comparison with right-side asymmetry of backbone by 1,5 times (p<0,05 and p<0,001 respectively).

3. Level of flexibility both forward, and back at boys did not depend significantly on the part of deformation of backbone, however, mobility was smaller by 1,4 times back in comparison with girls at its right-side asymmetry (p<0,01).

4. It is necessary to refer more expressed asymmetry of re-

Gender features of endurance of muscles of trunk of the examined children

Indicator, unit	Boys (n=40)		Girls (n=40)	
	RSD of spine column (n=18)	LSD of spine column (n=22)	RSD of spine column (n=18)	LSD of spine column (n=22)
Static power endurance of muscles of back (fitball-test), s	58,1±1,4	55,3±0,7	41,6±1,1***	39,2±1,0***
Static power endurance of muscles of side zones of trunk, s	52,4±0,7	50,1±0,4[2]	40,2±0,3***	38,3±0,3[3]/***
Static power endurance of muscles of prelum abdominale, s	76,9±2,1	74,2±1,8	68,8±0,5***	65,2±0,7[3]/***
Dynamic power endurance of muscles of prelum abdominale, times	11,9±1,0	8,2±0,6[2]	8,4±0,8**	6,5±0,4[1]/*
Tone of muscles of prelum abdominale, points	3,7±0,1	3,4±0,3	2,9±0,2***	2,3±0,2***
Contractile ability of muscles of forward abdominal wall (static test), points	4,2±0,3	3,9±0,4	3,2±0,2**	2,6±0,1[1]/**
Contractile ability of muscles of forward abdominal wall (dynamic test), points	4,4±0,2	3,3±0,4[1]	3,4±0,4*	2,4±0,2[2]/*

Notes: 1. [1] – p<0,05; [2] – p<0,01; [3] – p<0,001 – the level of reliability of changes between indicators of children with left-side and right-side deformation of backbone; 2. * – p<0,05; ** – p<0,01; *** – p<0,001 – the level of reliability of changes between indicators of boys and girls.

striction of side mobility in side, opposite to the deformation of backbone to gender features of mobility of backbone at scoliotic posture at boys of the middle school age in comparison with girls (p<0,05).

5. Gender features of power endurance of muscles were expressed in reduction of static power endurance of muscles of back of girls by 1,4 times (p<0,001), in comparison with boys, and also contractile ability of muscles of side zones – by 1,3 times (p<0,001), dynamic power endurance of muscles of forward abdominal wall, tone of muscles of prelum abdominale, – by 1,3 times at right-side asymmetry of backbone (p<0,001) and by 1,5 times – at left-side.

Prospects of the subsequent researches. The received results are planned to be considered when developing of the personified complexes of physical rehabilitation of teenagers with scoliotic posture with the subsequent prospect of studying of their efficiency.

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