SPINE MOBILITY IN ADOLESCENTS AND THE LEVEL OF PHYSICAL ACTIVITY

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- dynamic posture,
- spine flexibility,
- range of motion of the spine in athletes,
- the system Zebris APGMS Pointer

Abstract:

The aim: The aim of the study was to analyze the impact of increased physical activity on the mobility of the spine in adolescents aged 14-16 years.

Material and methods: The study group consisted of 60 people aged 14-16 years, including 30 teenagers with increased physical activity, and 30 young people who claimed none extra physical activity apart from obligatory physical education classes. The tests were conducted with the use of a computer system Zebris APGMS Pointer to analyze body postures. The ranges of motion of the spine have been analyzed in the sagittal plane: flexion and extension and in the frontal plane: lateral flexion.

Results: Statistical analysis showed that teenagers with increased physical activity have mobility within the ranges standards or have increased mobility, and adolescents who do not do sport tend to have the reduced ranges of spine mobility.

Conclusion: Increased physical activity should be promoted among children and adolescents in order to maintain normal range of mobility.

INTRODUCTION

Proper posture is one of the conditions for the proper functioning of the body, ensures the harmonious development, especially in the period of growth and maturation of children and adolescents. Speaking about prevention, testing and treatment of posture, however, only the static aspect is often taken into account. Curvature of the spine is estimated in the sagittal plane, asymmetries in the frontal plane and rotations and torsion in the transverse plane, but the whole of this evaluation is done in a stationary standing position [4]. The dynamic aspect of posture, that is, the range and quality of the mobility of the spine, is often not taken into consideration. You can not separate these two aspects from each other. The configuration of the spine will affect the dynamics of the spine, and mobility will shape the static posture [12].

Therefore, the authors decided to investigate the dynamic posture and to compare the extent of movement of the spine in people practicing sports with people who do not do any extra physical activity.

PURPOSE OF RESEARCH

The aim of the study was to examine whether and how increased physical activity influences on the mobility of the spine in the sagittal and frontal planes in adolescents aged 14-16 years.

MATERIAL AND METHODS

The study was conducted on a group of 60 people aged 14-16 years. The young people attended to one of Krakow's middle schools. The tests were carried out in 2013/2014. The study consisted of 30 people who formed the group with increased physical activity and 30 people who formed a control group: young people not doing any extra physical activity apart from compulsory physical education classes in schools. The criterion for admission to the group of people with increased activity were: attending an extra sports classes or participating in additional sports activities in their free time at least twice a week and at least for a year. In order to exclude from the control group children who are physically active in their free time, there was a questionnaire prepared for the children's parents.

To perform testing there was used the system Zebris APGMS Pointer, which allowed to assess the mobility of the spine. The first step in the study was to select the type of measurement: analysis of mobility. The measurement was made in two planes: sagittal and coronal. The examined person was standing motionless in the calibrated area and at the behest of the examiner he/she was performing the movements within the body: bending, straightening and lateral bending. In the position of standing neutral and 4 positions of the spine (forward bending, extension to the back and in the extreme positions of both lateral bending) there were points on the patient's body marked and there was the outline of the shape of the spine made with the use of ultrasonic points indicator. Then, the computer system analyzed and plotted points and drafts, thus the data were obtained in the form of degrees of movement and a graphical representation of the spine during the movement [15].

RESULTS

There have been collected statistical data and analysis of statistical parameters of the range of motion of the spine in the sagittal and frontal plane in teenagers with increased physical activity.

Table 1. The statistical results of the mobility of the spine in the sagittal plane in the leading group with increased physical activity at age 14-16 years. (source: own material)

	Arithmetic average	*Median*	*Standard deviation*	*Coefficient of variation*
Thoracic bending	33,11	33,15	11,00	34%
Thoracic spine extension	3,69	2,35	16,35	443%
Lumbar flexion	62,45	63,15	15,49	25%
Lumbar extension	10,03	9,60	13,96	139%
Bending in the part C7-S3	88,44	92,55	17,8	20%
Extension in the part C7-S3	22,62	20,80	10,63	47%
Left thoracic lateral flexion	43,53	45,05	19,15	44%
Right thoracic lateral flexion	24,33	23,05	18,40	76%

Left lumbar lateral flexion	13,44	12,50	10,63	79%
Right lumbar lateral flexion	20,19	20,25	8,49	42%
Left lateral flexion in the part C7-S3	30,46	30,30	8,24	26%
Right lateral flexion in the part C7-S3	32,03	31,70	7,89	26%

Table 2. The statistical results of the mobility of the spine in the sagittal and frontal planes in the control group (with reduced physical activity) aged 14-16 years. (source: own material)

	Arithmetical average	*Median*	*Standard deviation*	*Coefficient of variation*
Thoracic bending	28,65	29,20	15,00	51%
Thoracic spine extension	8,08	7,30	17,99	223%
Lumbar flexion	57,10	57,90	16,68	29%
Lumbar extension	9,45	11,15	13,52	143%
Bending in the part C7-S3	83,57	85,6	17,22	21%
Extension in the part C7-S3	16,66	16,60	10,93	66%
Left thoracic lateral flexion	33,06	37,50	19,79	60%
Right thoracic lateral flexion	29,83	28,35	23,71	79%
Left lumbar lateral flexion	13,22	11,90	11,48	87%
Right lumbar lateral flexion	14,97	12,70	12,09	81%
Left lateral flexion in the part C7-S3	29,98	27,30	8,90	30%
Right lateral flexion in the part C7-S3	30,50	29,60	9,74	33%

Table 3. Statistical significance (according to the T- Student's test) of the differences in the range of motion in the group with increased and decreased physical activity among young people. (source: own material)

	T-Student's test
Thoracic flexion	**2,63**
Thoracic extension	-1,95
Lumbar flexion	**2,53**
Lumbar extension	0,32
Flexion in the part C7-S3	**2,12**
Extension in the part C7-S3	**4,21**
Left thoracic lateral flexion	**4,09**
Right thoracic lateral flexion	-1,98
Left lateral lumbar flexion	0,15
Right lateral lumbar flexion	**3,81**
Left lateral flexion in the part C7-S3	1,76
Right lateral flexion in the part C7-S3	0,42

The standards for the mobility of the thoracic spine are: flexion - 30-40 °, extension - 20-25 ° lateral flexion - 25 °. The standards for the motion of the lumbar spine are: flexion -60 °, extension - 25 °, lateral flexion - 25 °[8].

The group with increased physical activity is mostly characterized by normal ranges of flexion in the thoracic and lumbar spine. The group with the reduced physical activity is characterized by the heterogeneity (high dispersion of data), but the arithmetic mean of flexion both in the thoracic and lumbar spine indicates a lowered movable ranges.

The global flexion and extension of the trunk (C7- S3) is significantly higher in patients with increased physical activity compared with the group with decreased physical activity.

Left thoracic lateral flexion in any of the groups is not within normal limits. Both in patients with increased, and in the group with decreased physical activity there was observed the increased range of mobility. The group physically more active have higher mobility in terms of left thoracic lateral flexion.

Right lumbar lateral flexion for both groups is less than indicated by the standards, but the results of the group with increased physical activity are closer to them. All the results discussed above are statistically significant (based on T-Student's test).

DISCUSSION

The mobility of the spine is essential for all vital functions. We could not walk, sit or perform any simplest motor tasks without the mobility of the spine, so it is really important to

care for the maintenance of normal ranges of motion of all sections of the spine. Blocking or restricting mobility on any segment will trigger the compensation mechanisms in other sections of the spine, which over some time will cause congestion and pain. Motion abnormalities of the spine are bound to impact on other structures of the body as well. Limited mobility of the thoracic spine can cause restricted mobility of the chest, shoulder blades and shoulders. Abnormal ranges of motion in the lumbar region can cause dysfunction within the sacroiliac joints and hip joints, knee and ankle [8]. The increased range of mobility in the spine also belongs to irregularities. A large range of motion in the spine in flaccid body (poor muscle tone) is a risk factor for spondylolisthesis and spinal fractures [6,9]. It may contribute to creating posture defects, especially scoliosis [3]. Sachse also distinguishes pathological local secondary hypermobility, which often occurs as a token compensation neighboring blocked segment of the spine [1,5].The studies in athletes, however, do not confirm the negative impact of the increased mobility of the spine [2,7,10,11,13,14]. This is probably because the active people have the correct tension and muscle strength and good proprioception [6,7].

Analyzing the study discussed above, we can conclude that taking care of the correct range of mobility in the spine is very important. In fact, it may protect children and youth against the formation of posture, and in the later adult life - the pain and rapid degeneration of the spine. To improve the mobility of the spine an additional physical activity. The study of the authors led to the conclusion that people with increased physical activity are mostly similar to the standards and they do not tend to a reduced (or lack of a) range of motion. People who are engaged in extra physical activity often have an increased range of movement in the spine, but it is not the cause of the formation of pathological changes, because there is a proper muscle stabilization. In conclusion, physical activity has a positive effect on the mobility of the spine.

CONCLUSIONS

The results led to the following conclusions:

1) The group with increased physical activity has the results of spinal mobility more often similar to the standards than those in the control group.
2) People with increased physical activity tend to have physiological or increased range of mobility of the spine.
3) People with reduced physical activity tend to have reduced ranges of motion of the spine.

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