
THE INCIDENCE OF CHANGES IN THE AXIAL SKELETON OF YOUNG ATHLETES

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Key words:

- Posture,
- SpinalMouse[®],
- axial organ,
- athletes.

Abstract:

In this work, authors aimed to assess changes of the axial system in young athletes. In the examined group of athletes (n = 18) were 10 swimmers (6 boys and 4 girls, average age 15.5 ± 1.58 years) and 8 gymnasts (average age 15 years). By using SpinalMouse[®] there was realized assessment of the curvature of the spine in the basic position: thoracic kyphosis, lumbar lordosis, pelvic inclination in the sagittal plane and mobility of the spine in flexion and extension in different sectors. The research results show the greatest changes in the basic position in the sagittal plane of the thoracic spine in both investigated groups of athletes. In assessing the mobility of the spine in flexion and extension, the largest deviations were observed in the pelvic inclination and mobility of the hip joints. The gymnasts were observed a significantly increased mobility in the extension of thoracic ($p < 0.05$) and lumbar spine ($p < 0.05$) compared with a group of swimmers. The results point to the many changes in the quality of the axial system of young athletes.

INTRODUCTION

Issues related to postural health is still current. In the field of prevention and health promotion is important to address the youth at the time of taking the children to school. Precision diagnostics axial system development particularly in the period of accelerated growth of the child is a basic pillar of diagnosis. The specificity of the construction of the spine, which has anterior-posterior spinal curvatures, is connected with its function, as well as with the fact that humans adopted an upright position. Physiological curvatures of the spine are shaped gradually at successive stages of posturogenesis. Curvatures of the spine are the physiologically structural - a functional unity. The level of the anterior-posterior curvatures depends on numerous factors, inter alia somatic type, gender, lifestyle and physical activity [8]. A good deal of studies emphasizes the positive influence of physical activity among children and adolescents in all aspects of health. But it also creation of functional disorders of the musculoskeletal system may cause its inadequate, unilateral, or excessive load. Asymmetrical load, especially during rapid growth may result to pathological curvature of the spine. Selected studies prove maladaptation of the musculoskeletal system to inadequate physical activity [5, 11, 8, 9]

When evaluating posture is important to use diagnostic methods that satisfy the criteria of reliability, validity and general-use tool and the applicable in clinical practice. Such criteria satisfies the new electrical measuring equipment SpinalMouse[®] [10, 12]. SpinalMouse[®] passes through the skin from top to bottom and followed shapes and angles of the spine, offers us the possibility of assessing diseases of the spine, posture and mobility. It was evolved to specify positions and mobility of axial skeleton in the sagittal and frontal planes. The biggest and most important advantage of this equipment is non-invasive treatment without using

chemicals or radiation and patients comfort is thus secure. It is non-invasive examinations without side effects on the patient's body. In combination with the computer program it evaluates the curvature of the spine without using harmful radiation. It follows the settlement of the spine, segmental and global measurement of angles in the sagittal and frontal plane, the mobility of the spine [6]. The results are reflected in the graphical report with clear and understandable information about the patient. The report contains a graphic representation of the spine with a 3D display and a table with angular values of the vertebral pairs, in the segmental and global level. Software visualizes graphically problem areas and their are designated as "red flags" that hypomobile and hypermobility parts of the spine, as well as any deviations from the reference value [7]. The results show an excellent effect in comparison to X-ray documentation. The measuring head follows automatically records the shape and clinically relevant data [1]. Measurement results can be assessed and printed immediately after the measurement. One of the main advantages of the SpinalMouse® over other appraisal tool is definitely its immediacy [2]. The aim of this work was to evaluate changes in axial system of young athletes with SpinalMouse®.

MATERIAL AND METHODS

Monitoring was realized in December 2010 and in January 2011 at the Department of Physiotherapy Faculty of Health branches in Presov. Study group was consisted of swimmers of the Sports Club in Presov. Monitoring was participated 10 swimmers (6 boys and 4 girls, average age 15.5 ± 1.58 years) and 8 gymnasts aged 15. Using SpinalMouse® assessment was realized curvature of the spine in the basic position: thoracic kyphosis, lumbar lordosis, pelvic inclination in the sagittal plane and the spinal mobility in flexion and extension in individual sectors. Monitored parameters between groups of athletes were compared through t-test for independent samples. All calculations for statistical significance $p < 0.05$ was considered significant with 95% confidence interval. Calculation of frequency data and analysis of variance was performed using the statistical software STATGRAPICS Centurion XV. Descriptive statistics was calculated using MS Excel XP parts of SPSS 15 for Windows.

RESULTS

In the basic position the largest problems in the examined group were observed in the sagittal plane of the thoracic spine. As many as 50.0% swimmers and 25.0% gymnasts have had flat back, 10.0% of swimmers and 25.0% of gymnasts have had hyperkyphotic position of the thoracic spine. In the lumbar spine sector hyperlordotic curvature have had 30.0% of swimmers and 25.0% of gymnasts. Reduced curve in this sector spine was diagnosed in 10.0% of swimmers. Position of the pelvis was examined in 40.0% in anteflexion for f swimmers and gymnasts for 12.5% (Table 1).

Table 1. The percentage of changes in the basic shape of the spine in the basic position examined in the sagittal plane (SpinalMouse®)

individual sectors	group	reduced curvature	correct curvature	increased curvature
Pelvic tilt	PL	0	60,0	40,0
	G	0	87,5	12,5
Thoracic spine	PL	50,0	40,0	10,0
	G	25,0	50,0	25,0
Lumbar spine	PL	10,0	60,0	30,0
	G	0	75,0	25,0

A legend: PL - swimmers, G – gymnast

In the trunk flexion examined in the sagittal plane most of swimmers (60.0%) and 37.5% of gymnasts showed reduced mobility of hip joints. In the thoracic sector of the spine 30.0% of swimmers and 50.0% of gymnasts has increased mobility and reduced 10.0% . In assessing mobility of the spine most of examined had physiologically mobility in the lumbar sector. Signs of hypermobility examined in lumbar spine showed 40.0% of gymnasts 25.0% of gymnasts (Table 2).

Table 2. The percentage of changes of mobility of the spine in the basic position in flexion examined in the sagittal plane measured by SpinalMouse ®

individual sectors	group	reduced mobility	correct mobility	increased mobility
Pelvic tilt	PL	60,0	40,0	0,0
	G	37,5	62,5	0,0
Thoracic spine	PL	10,0	60,0	30,0
	G	25,0	62,5	12,5
Lumbar spine	PL	0,0	60,0	40,0
	G	12,5	62,5	25,0

A legend: PL - swimmers, G - gymnast

In assessing the mobility of the spine in extension the largest deviations were diagnosed in the pelvis inclination and mobility in the hip joints. As many as 90.0% of swimmers and 50.0% of gymnasts trunk extension done mainly through the movement in the pelvis, which suggests increased movement in hip joints. In the thoracic sector of the spine 20.0% of swimmers and 50.0% of gymnasts had increased mobility. The mobility in the lumbar of the spine sector 40.0% of swimmers had and reduced motility (Table 3).

Table 3. The percentage of changes of mobility of the spine in extension in the sagittal plane measured by SpinalMouse ®

individual sectors	group	reduced mobility	correct mobility	increased mobility
Pelvic tilt	PL	10,0	0,0	90,0
	G	0,0	50,0	50,0
Thoracic spine	PL	0,0	80,0	20,0
	G	0,0	50,0	50,0
Lumbar spine	PL	40,0	60,0	0,0
	G	0,0	100,0	0,0

A legend: PL - swimmers, G - gymnast

The angle of thoracic kyphosis and lumbar lordosis in the basic position for swimmers (35.2 ± 6.87 and -34.9 ± 7.48) and gymnasts (37.1 ± 9.11 and -37.5 ± 5.80) showed significantly important difference. Similarly, the parameters of mobility of the spine in flexion in various sectors between the groups was not statistically significant. The mobility of the spine in extension shows statistically significant ($p < 0.05$) increased mobility in the pelvis in of swimmers (-24.9 ± 6.62) compared with a group of gymnasts ($-11.1 \pm 5,89$). The gymnasts were observed a significantly increased mobility in the thoracic extension ($p < 0.05$) and extension in the lumbar spine ($p < 0.05$) compared with a group of swimmers.

Table 4. Mean (\pm SD) postural parameters in the sagittal plane of swimmers and gymnasts, statistical significance was assessed using t-test

	swimmers	gymnast	T	P
SR U Pelvic tilt	22,2 \pm 6,87	24,7 \pm 5,11	-,871	,396
SR U Thoracic spine	35,2 \pm 6,87	37,1 \pm 9,11	-,509	,618
SR U Lumbar spine	-34,9 \pm 7,48	-37,5 \pm 5,80	,805	,432
SR U-F Pelvic tilt	32,9 \pm 12,1	41,1 \pm 16,77	-1,209	,244
SR U-F Thoracic spine	21,3 \pm 9,47	13,6 \pm 15,08	1,321	,205
SR U-F Lumbar spine	72,4 \pm 8,19	62,2 \pm 9,85	1,918	,073
SR U-E Pelvic tilt	-24,9 \pm 6,62	-11,1 \pm 5,89	-4,600	,000
SR U-E Thoracic spine	0,40 \pm 10,18	-11,0 \pm 11,21	2,257	,038
SR U-E Lumbar spine	-12,80 \pm 10,39	-23,5 \pm 7,13	2,476	,025

Legend: SR - sagittal plane, U - basic position, UF - mobility in flexion, UE - mobility to extension

DISCUSSION

The results of our research indicate that thoracic kyphosis is reduced by 50% of swimmers. Several studies point to change the curvature of the thoracic kyphosis of young athletes. Most authors shows both to an increase curvature of the spine in this part eventually differences were noted in the evaluation of the spine of mobility in different sectors in extension. In the training process it is necessary think about the compensatory exercise and general regeneration. Unilaterally applied sporting activity can cause serious defects in posture adolescents, as demonstrated by the results of our research. Wojtys et al reported that a high exposure of intensive athletic might increase the risk of developing adolescent hyperkyphosis in certain sports [15]. Increased thoracic kyphosis in volleyball and handball players, sprinters and taekwondo fighters reported Lichota et al [8]. López-Minarro et al [9] evaluated the curvature of the spine in the sagittal plane and the inclination of the pelvis of young kayakers. Indicate an increased incidence hyperkyphotic curvature in the basic position, lumbar lordosis ranged in neutral terms. In another study have been observed: much greater asymmetries in pelvic placement in the transverse plane, significantly greater asymmetries of shoulder blades in relation to the transverse plane, as well as significantly smaller thoracic kyphosis angle in female basketball players in comparison with the placement of the above parameters in their non-training peers [4]. It is demonstrated that defects in holding of the spine in the thoracic region affects the change of status of the lumbar spine and the pelvis inclination [14]. Increased the pelvis inclination of was recorded in 40% of swimmers. Lichota et al [8] reported an increased tendency the pelvis inclination in taekwondo fighters in middle level varied among sprinters and volleyball players, also increased tendency of pelvis tilt was characterized for handball players. Total physiological curvature of the spine is moved at a similar level in taekwondo fighters, athletes, volleyball players and only significantly lower gain handball players.

CONCLUSION

SpinalMouse® is a device that allows software to monitor changes in the of axial skeleton at the segment level, individual sectors and general curvature. It records the deviations from the reference value. With its unique ability it records data related to posture. Using SpinalMouse® gives objective data to evaluate changes of the spine among athletes. It provides relevant comparative data that allows comparison of inter and intra groups. The angle of curvature of the spine in the basic position was not significantly significant. Similarly, the parameters of mobility of the spine in flexion in various sectors between the groups was not statistically significant. Significant differences were observed in the evaluation of the spine mobility in different sectors in extension. In the training process it is necessary think about the compensatory exercise and general regeneration. Unilaterally applied sporting activity can cause serious defects in posture adolescents, as demonstrated by the results of our research.

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