

QUALITY OF THE POSTURAL SYSTEM OF UNIVERSITY STUDENTS

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- Spinal Mouse®.
- curvature of the spine

Abstract:

The aim: The aim of this work was to evaluate the changes in the spinal curvature in the basal position of the sagittal and frontal plane of university students using the SpinalMouse®. **Material:** The studied group consisted of 120 university students from Prešov University in Prešov, of which 48 were men and 72 were aged between 21 and 34 years of age. **Methods:** Measurement was performed with the Spinal Mouse®. From the data obtained, the percentage of changes in the shape of the spine in the basic position in the sagittal and the frontal plane was calculated within the entire group. Postural parameters were evaluated in the basal position in the frontal and sagittal plane in the individual sections of the spine. **Results:** The biggest problems were diagnosed in the frontal plane of the spinal cord. More than 90% of the subjects were diagnosed with pathological curvature without emphasizing the degree of this curvature. **Conclusion:** Regular physical activity is an important factor in the formation of the postural system. However, it should be emphasized that unilaterally applied sport activity can lead to serious errors in holding the body of adolescents.

INTRODUCTION

Posture is one of the indicators of normal development, the static and dynamic physical fitness of an individual. It ensures the harmonious functioning of the body with the optimal utilization of all its capabilities. Optimized muscle activity requires balance and coordination between individual muscular groups managed through the CNS [Richter 2011]. Postural and locomotive motors ensure movement so that the articulated surfaces are burdened over the entire surface, avoiding overburdening and premature wear, while also ensuring the stability of the segment position when still as well as during movement and to the extent necessary. Both motor skills form a whole. An example here is a person holding their body [Véle 2006; Vojta, Peters 2010]. We consider the influence of holding the body as the main pillar of the healthy development of the body. Although the physiological curvature of the spine is gradually shaped in the subsequent stages of posturogenesis, the level of spine curvature in the sagittal plane depends on many factors, including somatic types, lifestyle and physical activity [Lichota et al. 2011]. The deficit of varied motion stimuli, a static unilateral burden in daily life and leisure time in disadvantageous ergonomic positions create conditions for the development of functional disorders of the locomotor system, the most frequent manifestation of which is the incorrect holding of the body. The prevalence of diseases of the supportive-

musculoskeletal system is increasing, which is due, among other causes, mainly the insufficient active burdening of the body. Globally however, it can be seen that a positive attitude toward movement in children and youth is decreasing and passive rest is increasing over physical activity itself. The natural consequence of insufficient physical activity is the unfavourable indicators of physical development and the decreasing level of physical fitness [Medeková, Doležalová 2010]. Spine curvature in the sagittal plane is perceived as an adaptation to a vertical position and is a factor determining its physiological structural-functional unity. Postural dysfunction arises because the verticalization of the human body is still young from a physiological point of view. Verticalization is managed by a young, species-specific program that is not as stable as phylogenetic older motor programs, e.g. flexural reactions. Insufficient stabilization of the body's vertical position is nowadays the most common cause of postural dysfunction [Rašev 2007]. Although the physiological curvature of the spine is gradually shaped in the subsequent stages of posturogenesis, the level of spine curvature in the sagittal plane depends on many factors, including somatic types, lifestyle and physical activity [Lichota et al. 2011]. Many studies highlight the positive impact of physical activity in children and adolescents in all aspects of health. However, an inadequate, unilateral, or excessive burden on the locomotion system may cause functional and structural disorders of the locomotor system. Asymmetric burdens, particularly during periods of intense growth, can lead to pathological spine curvatures. Selected studies confirm the maladaptation of the locomotor system to inappropriate physical activity [Kanasová 2006; Medeková, Bekö 2009; Lichota et al. 2011; López-Minarro et al. 2010]. Wilczyński [2005] emphasizes that a timely and accurate diagnosis sets the basis for proper therapeutic intervention. Currently many instruments are used to evaluate the quality of the postural system, which increase the objectivity of this type of examination.

MATERIAL AND METHOD

The monitoring was performed in 2016 at the Department of Physiotherapy of the Faculty of Health Care Departments of Prešov University in Prešov. The studied group consisted of 120 university students (students of the Faculty of Health Care and the Faculty of Sports, out of which were 48 men and 72 women, aged 21 to 34. Measurement was performed once with the SpinalMouse®. The measurement results are reflected in the graphical report with clear and comprehensible information about the patient. The result of the processing is the backbone display with 3D imaging and table with angular values of backbone pairs, and on the segmental and global level [Kociová, Mikuláková 2011]. From the data obtained, the percentage of changes in the shape of the spine in the basic position in the sagittal and the frontal plane was calculated within the entire group. The monitored parameter was evaluated with the software of the device according to a reference value characteristic for a specific proband. The given parameter is referred to as physiology (a standard for a single proband) or a pathology: reduced curvature, increased spine curvature in the sagittal plane, deviation from the vertical in the frontal plane. The postural parameters in the sagittal and frontal plane in each spinal section are reported as mean values and standard deviation, spine flexibility in flexion and extension in individual sections. The monitored parameters between groups of athletes were compared through a t-test for independent samples. For all calculations, the statistical significance $p < 0.05$ was considered significant with a 95% confidence interval. A frequency data calculation and scatter analysis were performed using the STATGRAPHICS Centurion XV statistical software. Descriptive statistics were calculated using MS EXCEL XP and SPSS 15 for Windows. The study was conducted within the project KEGA 044PU-4/2016 "Innovation of health-oriented educational tools for future teachers of physical and sports education and experts in sports and health".

RESULTS:

The percentage of changes in the shape of the spine in the sagittal plane evaluated by SpinalMouse® is demonstrated in Table 1.

Table 1 Percentage representation of changes in the shape of the spine in the sagittal plane evaluated using the SpinalMouse® with Faculty of Healthcare students

The shape of the spine in the basic position in the sagittal plane (SpinalMouse®)			
sac/hip	13.3	76.6	10.0
thoracic	26.6	56.6	16.6
lumbar	16.6	70.0	13.3

In the basic position, the biggest problems with FHC students were observed in the sagittal plane in the thoracic spine. Up to 16.6% of the subjects had a hyperkyfosis status and 26.6% a flat back. In the lumbar sector of the spine, 13.3% of the subjects had a hyperlordotic curvature. A reduced curve in this spinal section was diagnosed in 16.6% of the examined subjects (Table 1).

Table 2 Percentage representation of changes in the shape of the spine in the sagittal plane evaluated using the SpinalMouse® with Faculty of Sports students

The shape of the spine in the basic position in the sagittal plane (SpinalMouse®)			
individual sections of the spine	reduced curvature (%)	correct curvature (%)	increased curvature (%)
sac/hip	3.33	86.6	10.0
thoracic	16.6	66.6	16.6
lumbar	13.3	76.6	10.0

The biggest problems with FS students were diagnosed in the sagittal plane in the thoracic spine. Up to 16.6% of the subjects had a hyperkyfosis status and 16.6% a flat back. In the lumbar sector of the spine, 10% of the subjects had a hyperlordotic curvature. A reduced curve in this spinal section was diagnosed in 13.3% of the examined subjects. (Table 2)

The students from the Faculty of Sports demonstrate a better assessment of the position of spine in the cross and lumbar section at the sagittal plane compared to FHC students.

Table 3 Average values of the postural parameters in the basic position in the sagittal plane using the SpinalMouse®

The average values of postural parameters in the basic position in the sagittal plane (SpinalMouse®)				
individual sections of the spine	FHC mean ±SD	FS mean ±SD	T	p
sac/hip	19.73 ±6.54	20.53 ±10.29	0.147	0.703
thoracic	38.26 ±9.85	38.36 ±9.17	0.002	0.966
lumbar	-31.76 ±12.01	-32.80 ±11.41	0.148	0.702

Table 4 Percentage representation of changes in the shape of the spine in the frontal plane using the SpinalMouse® with the Faculty of Healthcare students

The shape of the spine in the basic position in the frontal plane (SpinalMouse®)		
individual sections of the spine	standard (%)	scoliotic curvature (%)
sac/hip	43.3	56.6
thoracic	43.3	56.6
lumbar	3.3	96.6

In the frontal plane the biggest problems with the FHC students were observed in the lumbar section of the spine. Up to 96.6% of the subjects had a curvature in this section. In the thoracic and cross section of the spine 56.6% of the subjects have a scoliotic curvature. (Table 4)

Table 5 Percentage representation of changes in the shape of the spine in the frontal plane evaluated using the SpinalMouse® with Faculty of Sports students

The shape of the spine in the basic position in the frontal plane (SpinalMouse®)		
individual sections of the spine	standard (%)	scoliotic curvature (%)
sac/hip	36.6	63.3
thoracic	36.6	63.3
lumbar	3.3	96.6

The biggest problems with the students of the Faculty of Sports were diagnosed in the frontal plane in the lumbar section of the spine. Up to 96.6% of the subjects had a scoliotic curvature in this section. In the thoracic and cross section of the spine, 63.3% of the subjects had pathological curvature. (Table 5)

Table 6 Average values of the postural parameters in the basic position in the frontal plane using the SpinalMouse®

The average values of postural parameters in the basic position in the frontal plane (SpinalMouse®)				
individual sections of the spine	FHC	FS	T	p
sac/hip	42.73 ±15.18	43.26 ±15.87	0.869	0.536
thoracic	21.67 ±12.02	17.53 ±18.92	1.316	0.255
lumbar	59.20 ± 12.90	60.13 ± 9.99	0.115	0.735

The biggest problems are observed in the lumbar and the cross section of the spine. The students of the individual faculties did not show a statistically significant difference in the quality of the postural system.

DISCUSSION

We evaluated the quality of the postural system in the basic position in the sagittal and frontal plane of the university students. The study confirms the unfavorable changes in the shape of the axial organ, which are not negligible. The biggest problems were diagnosed in the frontal plane of the spinal cord. More than 90% of the subjects were diagnosed with pathological curvature without emphasizing the degree of this curvature. The results of the study confirm the unfavorable trend in the increase of functional disorders of the locomotor system in youth [Turzová 1998]. The Grabara study [2012] has shown that regular sport and exercise activity can be an important indicator of the proper development of the postural system. Conversely, other studies confirm the maladaptation of the locomotor system to inappropriate movement activity [Kanasová 2006; Medeková, Bekö 2009]. In several studies, changes in spine curvature have been observed in relation to particular sports disciplines. Lichota et al. (2011) recorded increased chest kyphosis in volleyball, handball, sprinters and taekwondo wrestlers. Lopez-Minarro et al. [2010] evaluated the spine curvature in the sagittal plane and the slope of the pelvis in young kayakers. In his research Naglak [2011] dealt with basketball players (32 girls), whose training took 3-4 years and the frequency of their training was 4 to 7 times per week. These athletes were compared to girls not dedicated to physical activity (37 girls). He found that the more pronounced the asymmetry of the pelvic position, the more the rotation of the pelvis, and a smaller angle of the thoracic kyphosis was manifested in athletes more than the non-sportive girls. However, he did not notice significant

differences in holding the body. He concluded that the greater frequency of training could be the cause of more frequent changes. Wojtys et al. [2000] pointed to the increased curvature of thoracic kyphosis and lumbar lordosis in sportive children, the largest curvatures were diagnosed in gymnasts. Reduced curvature have been observed in non-sportive children. We must emphasize that the asymmetric burden, especially during periods of intense growth, can lead to pathological spine curvatures. Therefore, it is important to let young athletes know that a training program should not be a means to achieve the best sports results but a harmonious development of a young body. The results demonstrate that even in the students of the Faculty of Sports there was a pathological curvature of the spine, especially in the thoracic section of the spine in the sagittal plane and a scoliotic curvature in the frontal plane. It is necessary to consider compensatory exercises and overall regeneration during each training process [Lenková 2000]. We consider the influence of holding the body as the main pillar of the healthy development of the body. It is paradoxical that body posture often does not improve with sport, but continues to deteriorate unilaterally [Kučera, Kolář, Dylevský et al. 2011]. The corrective physiotherapy of the postural system is involved in each training unit. Through the positive joyful emotion from playing, we try to fix the acquired motor development programs in the memory and to automate the properly acquired muscular habits positively influencing the motor development of a young individual. By focusing on postural functions, we can prevent many sports injuries. In children, when postural functions are formed, this fact is many times enhanced. In terms of the prevention and treatment of movement disorders, it is clearly necessary to address the issue of the forces acting on the skeleton and soft structures. These forces have different effects on the developing the pathology of the locomotor system [Kolář et al. 2009].

The students of the individual faculties did not show a statistically significant difference in the quality of the postural system. The biggest problems were diagnosed in the frontal plane in the lumbar section of all examined subjects. Regular physical activity is an important factor in the formation of the postural system. However, it should be emphasized that unilaterally applied sport activity can lead to serious errors in holding the body of adolescents. Therefore it is necessary to consider compensatory exercises and overall regeneration during each training process.

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