POSITION AND STABILITY OF THE BODY IN CASE OF CHILDREN IN YOUNGER SCHOOL AGE

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Abstract

Introduction: Nowadays the physical activity is very low. Frequent, long-lasting sitting and higher educational demands cause postural disorders especially in case of children. The main aim of this work was examination of relation between the balance and the position of the body among 10–11 years old pupils of an elementary school.

Material and methods: Surveyed group consisted of 71 pupils of an elementary school: 37 boys and 34 girls. As a method the superficial topography was used – the optical technology used for evaluation of asymmetry of contours of the back area connected with scoliosis. The Moiré's system moves the shape of the back and it got the greatest popularity in rehabilitation. Evaluation of the superficial topography has got a good potential of repeatability and reproducibility. Using of the superficial topography is potentially a valuable method of the early detection of scoliosis.

Results: Measured data were processed by the use of the statistic programme Excel. We were watching the mutual dependence expressed by the index of correlation of the ratio data expressed by the descriptive statistics. For expression of mutual dependences of qualitative data, the chi-square test was used. All data were processed and verified on the level of significance 0,05.

Conclusions: In connection with the occurrence of scoliosis we supposed the dependence of the sex of respondents, of their weight and height. Not all assumptions were fully confirmed, we state dependences in the following article.

Keywords: posture defects, postural stability, surface topography, children, screening

Introduction: Position of the human body had a lot of definitions. Most of them find out that there is a free configuration of the body in the standing position – „how to keep an object“ (Jopkiewicz A, Suliga E.1998). Carriage of the body is „an individual shape of the body and placement of particular parts of the trunk and legs in the standing position“ (Kasperczyk T. 1994, Žuk T, Dziak A., Gusta A 1980). Configuration of the body is an expression of the physical and health state of the body influenced by genetic and environmental factors (Dourros et al, 2000).

After Kasperczyk, configuration of the body is an order of particular parts of the body on which lesions for the optimal stability of the body don't relate, which require minimal muscular effort and create conditions for the optimal internal organ, which are expressed by its contour (Kasperczyk,1994)

Changes in configuration of the body

Configuration of the human body changes during the evolution since the birth until the death

(Chowańska, J.2011). It is influenced not only by the age, but also by many other factors as the life-style, the kind of employment, daytime, tiredness or by the psycho-emotional state of the person (Chowańska, J.2011). Therefore various authors are concerned with evaluation of the configuration of the body for a longer time who use various testing methods and records of the configuration of the body (Chowańska, J.2011). Nowadays a number of public resources are invested into performing of diagnostic and therapeutic programmes connected with disorders of configuration of the body especially in case of children. These programmes with the aim of reviewing of their position seem to be substantial because incorrect configuration of the body has negative consequences for the next evolution and health which can be accompanied by the pain and functional disorders which can influence the quality of the next life in childhood and adulthood (Mrozkowiak, M. 2010). In this article, we are concerned with the possibility of using one of the methods of the superficial topography during screening providing at the detection of scoliosis. Majority of scoliosis cases remains stable, but in

some cases it comes to worsening during puberty. Superficial topography is an optic method for evaluation of the surface of the back including asymmetry connected with scoliosis.

Topography of the surface of the body. Moiré technique

Topography of the surface of the body present photographic methods. They are photogrammetric methods, known also as the phototopography or the moiré method. Phototopography deals with the shape and position of the body and with measuring of space objects on the base of so called photograms. In case of children in the period of their growth, but also in case of adults, the reviewing of the space arrangement of particular structures, especially of the axial system is an important indicator of the state of the movement system. It is clear that especially the pathological state (after the injury, degenerative changes etc.) is usually manifested on the change of filling a certain function. Another principle is the technology of moiré stripes which uses for example the system Wicks @ Wilson's TriForm (2001). In case of this system, contour lines are depicted on the monitored surface in the outcome of the light and shadow interference shed by the fibres of the grid. By this way, it is possible to identify also the third space dimension of the monitored object from the plane photograph. The method is based on the moiré effect creating the shadow picture of the contour lines on the monitored surface which enables us to perform the space reconstruction of the shape (Otáhal 1989). From the acquired information, there are shadow pictures of the contour lines additionally detected besides the shape of the own object in the plane. Their shape and mutual arrangement on the monitored surface describe expressly the shape of the object in the space, it means the superelevation in the direction of the axis which is vertical on the plane of the photograph.

Methodology of the research: The group of children in the age from 10 to 11 years was the object of the research. Whole file was created by 70 children, 33 from them were girls and 37 were boys. In the file, we examined the spine deflection. We observed if these groups are comparable in the marks height and weight. Measurements were made by the photogrammetric method in two phases: with open and closed eyes. We were interested especially in the fact if these measurements are equally reliable. If determined differences are statistically notable or not.

If yes what they are dependent on. In the processing, we used the photogrammetric method known also as phototopography or the moiré method. For evaluation of results, statistic methods for hypothesis testing – indexes of correlation and regression were used, data were processed in the program Excel with the use of the packet of the data analysis.

Hypotheses

1. We suppose that the parameters for the evaluation of the spine are weight and height dependent regardless of the gender of the respondent.
2. We suppose that the measured values in the AP projection are equal in the case of open, but also closed eyes.
3. We suppose that measured values of the spine deflection in the middle abnormality in the frontal plane (ML) with closed eyes are significantly higher than with open eyes.
4. We suppose that values of abnormalities of the angles α , β and γ are statistically confident and they have a character of system abnormalities.

Analysis of results:

Hypothesis 1: We suppose that the parameters for the evaluation of the spine are weight and height dependent regardless of the gender of the respondent.

Basic characteristics of the file:

Sex		Weight	Height
Boys	AVERAGE	142,784	38,378
	STDEVP	6,261	10,344
Girls	AVERAGE	145,061	40,667
	STDEVP	6,125	10,528

The t-test of two middle values with the dispersion unlevelness was used for verification. Values of the F-test for the dispersion:

F-Test Two-Sample for Variances		
	Boys	Girls
	Weight	Height
Mean	38,37838	40,66667
Variance	109,964	114,2917
Observations	37	33
df	36	32
F	0,962135	
P(F<=f) one-tail	0,452905	
F Critical one-tail	0,56688	

The F-test confirmed the dispersion unlevelness. The value t_{stat} lies in the interior of admissible intervals, therefore we recommend to accept the zero hypothesis on the level 0,05. The weight in both files is comparable. By the same way we verified also the height of elements in monitored files. The assumption of equality of average physical heights was also confirmed. Therefore we will watch the evaluation on the monitored files from the point of view of the sex of particular respondents.

During monitoring of the weight we found out that in case of girls correlation achieves their value 0,835. The dependence is more expressive between the weight and the alpha angle (lumbosacral tilt), the beta angle (the tilt in the thoracolumbal area) and the gama angle (the tilt in the upper breast part). In case of boys the correlation achieves the r value 0,548 – this means that this dependence is lower than in case of girls.

Hypothesis 2: We suppose that the measured values in the AP projection are equal in the case of open, but also closed eyes.

For verification of the presumption, we used the F-test for dispersion and on the base of its results the t-test of two middle values with the dispersion equality.

t-Test: Two-Sample Assuming Equal Variances		
	AP (mm) anterior posterior/open eyes	AP (mm) anterior posterior/ eyes closed
t Stat	0,623863	
P(T<=t) one-tail	0,266866	
t Critical one-tail	1,655811	
P(T<=t) two-tail	0,533732	
t Critical two-tail	1,977054	

On the base of obtained data, we recommend to accept the zero hypothesis. In cases of open and closed eyes, the differences in measured values are statistically irrelevant.

Hypothesis 3: We suppose that measured values of the spine deflexion in the middle abnormality in the frontal plane (ML) with closed eyes are significantly higher than with open eyes. For verification was the F-test for the dispersion used again and

subsequently the t-test of two middle values with the dispersion equality. Results of both tests state following charts.

F-Test Two-Sample for Variances			
	ML (mm) Side length Right left open eyes	ML (mm) Side length Right left closed eyes	
Mean	263,3944	281,2535	
Variance	2392,357	3589,135	
Observations	71	71	
df	70	70	
F	0,666555		
P(F<=f) one-tail	0,045984		
F Critical one-tail	0,673088		

On the base of these values, we recommend to accept an alternative hypothesis. In case of closed eyes are the values significantly higher than in case of open eyes. The object is able to correlate his/her position with open eyes and by this way to reduce values of the deflection. Values are at the border of confidence.

Hypothesis 4: We suppose that values of abnormalities of the angles α , β and γ are statistically confident and they have a character of system abnormalities.

We monitored values of the abnormalities KNT, the angle α , the angle β , the angle γ . For the norm, we consider the zero abnormality, the constant will be marked as $\mu=0$. For verification of the confidence of this abnormality, we used the t-test of the middle value and the known constant. The testing characteristics has a form and it was compared with the critical value t on the level 0,05 with the propriate number of freedom $v=70$.

	KNT (degrees)	angle alpha (degrees)	angle beta (degrees)	angle gamma (degrees)
AVERAGE	0,733803	8,65493	8,357746	10,98732
STDEV.S	0,724459	1,763826	1,135739	1,874333
t_{stat}	8,474508	41,05412	61,56865	49,04495
t_{krit}	1,666914			

In all monitored parameters was the statistically confirmed. What are the dependences between monitored marks like, we expressed by the help of the correlation r. Values are stated in the following chart.

Together Boys and girls	Body height	Weight	angle alpha (degrees)	angle beta (degrees)	angle gamma (degrees)	height of arms (mm)	height of blades (mm)
Body heigh	0,687162	1					
Weight	0,138583	0,110005	1				
angle alpha (degrees)	-0,18382	-0,2362	-0,00631	1			
angle beta (degrees)	-0,24215	-0,11853	-0,2839	0,396557	1		
angle gamma (degrees)	0,094058	0,136759	-0,07256	-0,04973	-0,01913	1	
height of arms (mm)	0,103657	0,02634	0,083646	-0,13358	-0,19754	0,04226	1

The highest value was confirmed only in the marks weight. In other combinations are the values of correlation low, they move at the border of a weak dependence.

Discussion: After the Wilczyński's research of persons with eye disorders, the kyphosis occurs more frequent than in case of healthy persons. The position of the body is connected with the eye activity (Penha et al. 2005). Function of variability in case of children is relatively small and the visual impact on variability of the angle COP. After Wilczynski's research results support the opinion that in case that weight parameters with closed eyes which are not impaired, we can speak about the lack of ability to use visions in the process of the balance in case of children. There are no sensual integrations which are in case of children in this process of growth (Przewęda, R. 1973).

In our study it was found out that increasing of the chest angle of kyphosis doesn't change the value of stabilometric parameters in the sagittal level in case of open and closed eyes very much. The weight in both files is comparable. The assumption about equality of average physical heights was also confirmed. During monitoring of the weight we found out that in case of girls the dependence between the weight and the angles α , β and γ is more expressive. In case of boys, this dependence is lower than in case of girls.

Results of the tests show that in case of open and closed eyes, differences in measured values are statistically irrelevant. A lot of studies proved that people with idiopathic scoliosis are with the control of stability of the carriage of the body comparable with the control of healthy people (Roczninak et al. 2015; Sahlstrand T, Ortengren R, Nachemson A. 1988). Complex responses of the regulation system, equivalent of reflexes, positions and movement in case of people with idiopathic sclerosis can be disturbed (Silferi, Rougier, Labelle, Allard, 2004). Some decades ago, Swedish doctors Sahlstrand,

Ortengren and Nachemson Lidström pointed out to an important correlation between the unbalance and the curvature angle, between the progression speed and the skeletal ripeness grade. In their opinion, belated development of the balance can be an aetiologic factor for the rise of idiopathic scoliosis (Stoliński, Ł, Kotwicki, T. 2011; Świec, A. 2005). Mechanism of the balance managing in the calm can be changed in case of healthy population of the same sex because the results demonstrate us various strategies during the work, caused for example by the excessive relaxation or by intentional rustiness of muscles. Examples of the relation between the quality of the carriage of the body and some reactions equivalently confirm improved legitimacy of position reflexes reeducation (Zawieska, D. 2000) through corrective exercising or biofeedback and by this way the quality of carriage and balance of the body will be increased (Błaszczuk, 2004). In case of children in the age 6–7 years the development of processes of carriage and balance of the body is harmonic. There are no clear biological factors with the consequence of wrong carriage of the body. We can monitor negative changes only in new conditions for the child – at school. There are some factors as: dimensions of desks, distance of eyes from the desk, from the board, sitting in an incorrect position, the type of the chair, a heavy school bag, tiredness etc. With regard of using of the whole series of factors in evaluation of the body posture and the interaction between variables, sectional material and also a small number of publications which could be considered as the same ones in the results of comparison, conclusions can be difficult and not always clear.

Conclusion: A sufficient obstacle of evaluation of the body posture are often various research methodologies in which various indicators are used and they point to the borders between pathology and correct formation of carriage of the body. Studies evaluating the effect on the postural stability of carriage of the body are important in the practice of physiotherapy.

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