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Assessment and affects hamstrings contracture on the formation of posture defects in children of preschool age

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Abstract

Purpose. The main aim of the paper is analysis connection between hamstrings contracture and fault posture.

Methods. Examination covered a group of 40 children aged 4-6 from nonpublic kindergarten "Buziaczek" in Bydgoszcz. The study was divided into two parts. The first part included: evaluation of child's figure, analysis of specified anthropometric points and identification of posture defects in particular areas of child's body. The second part of study involved tests: "the end of the toe" and "fingers-floor" and measurement of hip joint's range of mobility.

Results. Executed tests shown that 47,5% from examined group of children have fault posture. Occurrence of hamstrings contracture, which was diagnosed in 40%, disrupts pelvis balance causing oblique position of pelvis.

Conclusion. 1. Posture faults are major problem in our population. During examination near half of the group possessed at least one of the fault posture. 2. Hamstrings contracture disrupts

pelvis balance causing oblique position of pelvis. Further it leads to increase frequency of fault posture. 3. Proper rehabilitation can prevent hamstring contracture, in advance prevents also occurrence of fault posture. 4. Rehabilitation study, in which analysis of specified anthropometric points and a few functional tests will be a component, can detect and correct diagnose fault posture among children.

Keywords: fault posture, hamstrings, scoliosis, asymmetry of pelvis, children

Introduction

Health is one of the most important value and we should look after it from the earliest years of life. Scientific and technological progress of the twenty-first century, despite of its benefits entails many threat for human development and health. The fast pace of life, lack of time parent's duty leads to a reduction of physical activity of children, which is negative influence on their physical fitness [1,2]. Nowadays the major problem is faults posture. Such significant that we can call it a civilization disease. Acquired faults posture are formed by many environmental factors like: low physical activity, maladjustment of child's learning position, malnutrition, overweight, inappropriate footwear and many others [3,4,5]. We should also be aware of idiopathic ground of some faults posture, which formation is still incomprehensible and unknown to doctors nor physiotherapists. Understanding the etiology and coexisting dependence is the key to an effective correction, otherwise therapeutic becomes symptomatic. Effective therapy of faults posture depends on the specific diagnosis and knowledge of the causes of the problem. For this it is necessary to know the anatomy of the human body under physiological conditions. Further on the article the relationship between hamstring contracture and pelvis balance and its influence on the asymmetry of the body will be presented.

Hamstrings

Group of the rear thigh, called the hamstrings constitute three muscles: biceps femoris, semitendinosus and semimembranosus. They have a direct influence on the pelvis balance due to location of each insertio proximal on the ischial tuberosity. All serve a similar function, namely, are adductor and extensor for the hip and the flexor for the knee. The strongest muscle group is semimembranosus [6].

Type of pelvis

Position of the pelvis can have a significant influence on the formation of faults posture and scoliosis in particular. Gutmann identified three types of pelvic in the sagittal plane (fig. 1):

1. Correct pelvis
2. High-assimilated pelvis
3. Overloaded pelvis

In first type of pelvis, correct, inclination angle of sacrum and inclination angle of upper sacrum surface to horizontal plane is 45°. Intervertebral disc L4-L5 is located on the height of iliac crest, while body of vertebra L5 in sagittal plane is shaped trapezoidal like.

Second type of pelvis, high-assimilated, is likely to be caused by symmetric hamstrings contracture. Inclination of rear sacrum surface in correlation to horizontal plane varies between 50°-70°, whereas upper sacrum surface is tilted at an angle 15°-30°. Intervertebral disc L4-L5 is located on the upper line connecting iliac crests, while body of vertebra L5 in sagittal plane is shaped rectangular like. In this type of pelvis it comes to the shallowing of lumbar lordosis, whereas pelvis itself is in retroversion position.

Third type of pelvis, overloaded, characterized near horizontal sacrum setup, tilted at an angle 15°-30° to horizontal plane. Upper sacrum surface creates angle 50°-70° to horizontal plane. Intervertebral disc L4-L5 is located on the below line connecting iliac crests, while body of vertebra L5 in sagittal plane is shaped wedge like. In this type of pelvis it often comes to coxae articulations as well as lumbosacral connection overload [7].

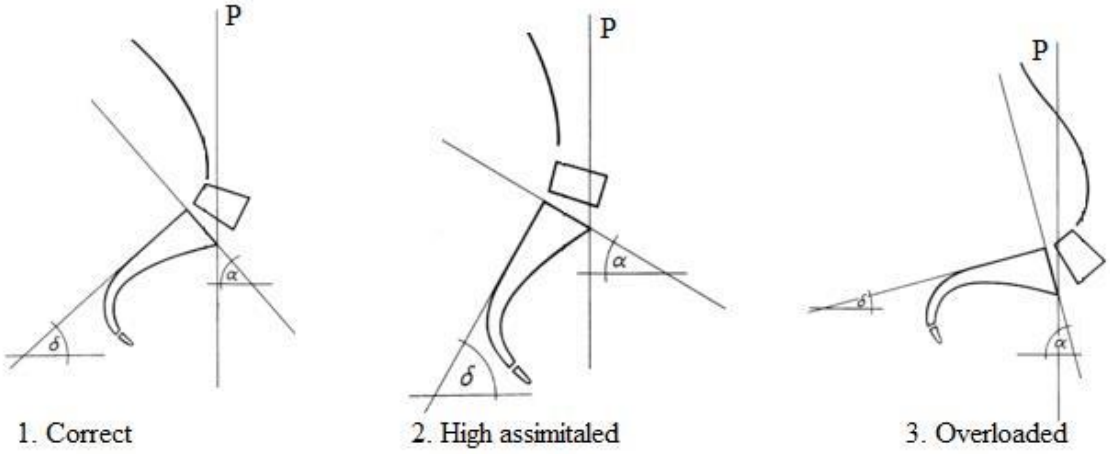

Fig. 1. Type of pelvis by Gutmann

Types presented above referred to pelvis seen from lateral position. Meanwhile in frontal as well as in combine (frontal and transverse) plane, oblique and convolute pelvis can

be mark out. This pelvis position could be a result of asymmetric hamstring contracture. In case of oblique pelvis, presented on figure 2, it comes to upshift of right iliac crest while left side shifts down. Figure 3 illustrates convolute pelvis where on the right side posterior superior iliac spine is shifted down while anterior superior iliac spine is shifted up. On the left side of pelvis situation is reversed: posterior superior iliac spine is shifted up while anterior superior iliac spine is shifted down. Pelvis oblique as well as pelvis convolute setup could predispose to scoliosis occurrence. Early diagnostics together with poor posture causes identification allows effective response and correction of existing problems [8,9,10,11,12,13,14,15].

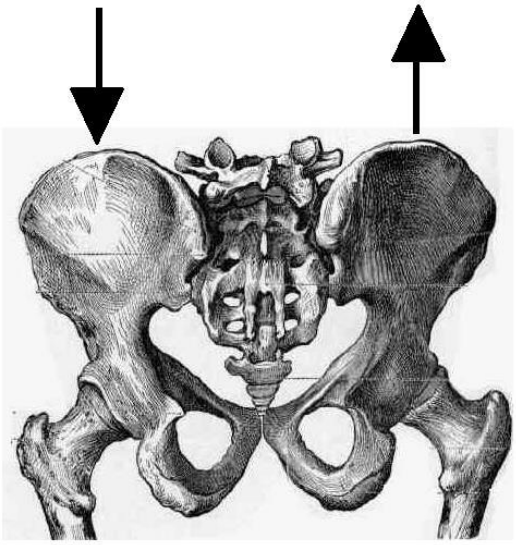

Fig. 2. Oblique pelvis

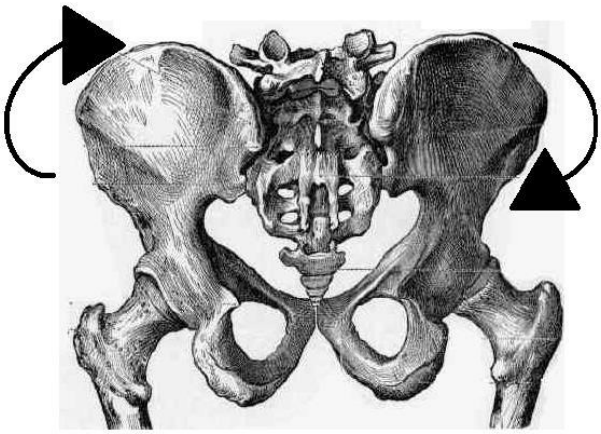

Fig. 3. Convolute pelvis

Material and methods

Examination covered a group of 40 children aged 4-6 from nonpublic kindergarten "Buziaczek" in Bydgoszcz. The study was divided into two parts. The first part included:

evaluation of child's figure, analysis of specified anthropometric points and identification of posture defects in particular areas of child's body. The second part of study involved tests: "the end of the toe" and "fingers-floor" and measurement of hip joint's range of mobility.

"Fingers-floor" test is performed by a bend down with straight knees and measuring the distance between the fingers and the floor. This is a test used to assess hamstring contracture. Child touching a floor is the correct test result. „The end of the toe" test is used to evaluate hamstring contracture for the right and left leg. It is performed in long sitting position. Separately performed measuring the distance between the fingers and toes to the right and left lower limb. Child touching the toes means a standard and correct result. In line with the theme of work, research has focused primarily on those elements of the human body, which have the biggest influence hamstring contracture. Therefore, during the study assessed:

a) posterior superior iliac spines setup position
b) iliac crests height
c) indentation waist symmetry
d) scapulas lower angles setup
e) shoulders symmetry and setup
f) shape of physiological spinal curvatures in the sagittal plane
g) shape of the spine in the frontal plane and detection of any possible scoliosis,
h) knees setup

Results

Own research analysis in a preschool children group brought the following results: in group of 40 children, 19 of them were detected with at least one posture fault which constitutes 47.5%. The remaining 21 children - 52.5% presented correct body posture.

Scoliosis was stated most often in the group of children with posture defects, as many as 17 individuals, representing 42.5% of children in the entire group. There have been seven cases of knees valgus which represents 17.5% of the children. Other posture faults does not occur too often - two cases with back flat and varus knees, one case back concave (fig. 4).

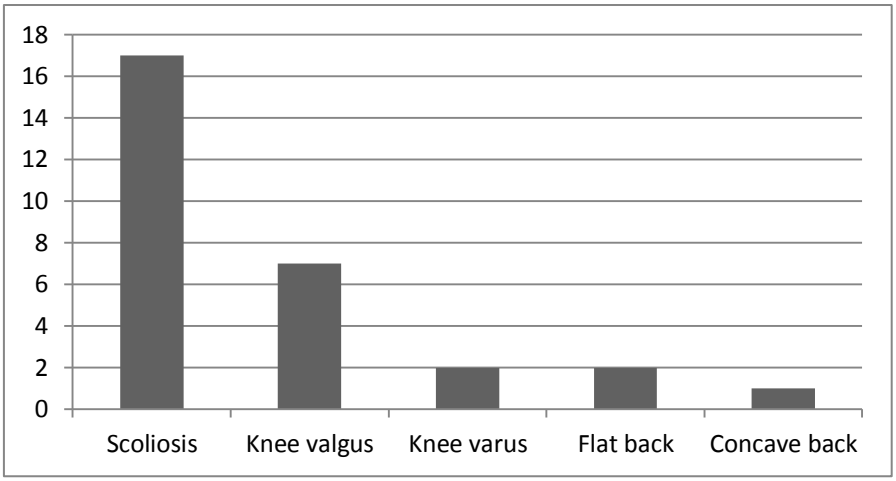

Fig. 4. Most common fault posture in examination group

The average result of "finger-floor" test for all children with hamstring contracture is 7.25 cm. The highest test results were achieved by six years old children where the average was 9.14 cm. Five and four years old children were characterized by a lower average result "finger-floor" test, which amounted accordingly 6.2 cm for five years old children and 5.25 for four years old children. The average result "finger-floor" test is much higher among six years old children. Compared to the average results of the test group of children with hamstring contracture, an average of six years old children is higher by 2.91 cm. Similar results are for "the end of the toe" test. The results of six years old children are higher by about 0.89 cm for the left leg, and 0.69 for the right leg (tab. 1).

Tab. 1. A "finger-floor" and "the end of the toe" test results comparison by age group.

	"Finger-floor" test result [cm]				"The end of the toe" test result- left leg [cm]				"The end of the toe" test result- right leg[cm]			
	A	SD	Min	Max	A	SD	Min	Max	A	SD	Min	Max
6yr old	10,16	3,98	3	15	1,83	1,92	0	5	2,5	1,64	0	5
5yr old	6,2	0,98	5	7	0,8	0,98	0	2	1,4	1,2	0	3
4yr old	5,25	1,79	3	8	0	0	0	0	1,75	1,79	0	4
Total	7,25	3,31	3	15	0,94	1,52	0	5	1,81	1,59	0	5

Significant differences in the study of the angular value for flexion of the hip joint with extended knee amongst children were observed. Children with hamstring contracture reached a count lower than their peers without contracture by 15.8 ° to the right leg and 15.2 ° for the left leg. What is worth underlining is that both groups reached higher results in the right than left leg (fig. 5).

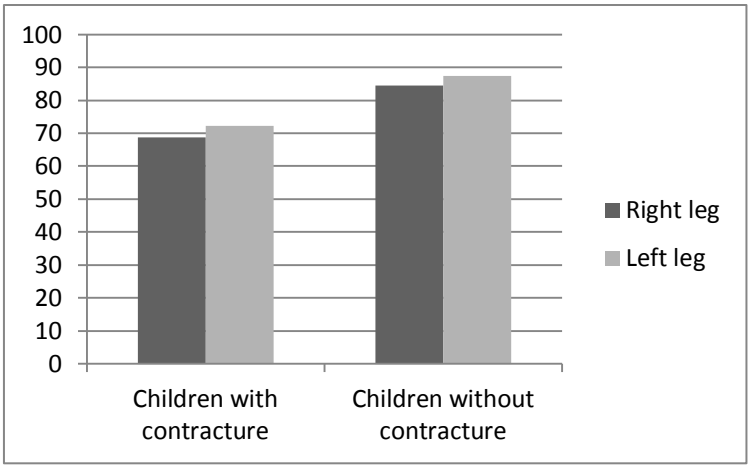

Fig. 5. Angular value for flexion of the hip joint with extended knee in group of children with and without contracture.

The average "fingers floor" test result for children with pre-existing back and knees defects are higher by about 2.82 cm than for children with single fault posture. The same situation is a for "the end of the toe" test for the left and right lower limb. For the left leg, this result is higher by 0.8 cm and for the right leg by 1.32 cm (tab. 2).

Tab. 2. Tests results for children with single or multiple postural defects

	Tests results for children with more than single postural defect		
	„Fingers-floor" test [cm]	„The end of the toe" test- left leg [cm]	„The end of the toe" test- right leg [cm]
A	6,63	1,25	2,13
SD	5,477	1,785	1,536
Max	15	5	5
Min	0	0	0
	Tests results for children with single postural defect		
	„Fingers-floor" test [cm]	„The end of the toe" test- left leg [cm]	„The end of the toe" test- right leg [cm]
A	3,81	0,45	0,81
SD	3,039	0,987	1,402
Max	8	3	4
Min	0	0	0

Among 40 children from the study group, 19 of them were ascertained with oblique posterior superior iliac spines setup position. From a group of individuals with oblique

posterior superior iliac spines setup position, hamstring contracture was diagnosed among 16 children from which 13 were detected with scoliosis. Considering the total number of individuals with scoliosis, which was 17, it should be underline that the vast majority of them, as many as 13 children had hamstring contracture. Above relationships are presented in figure 6.

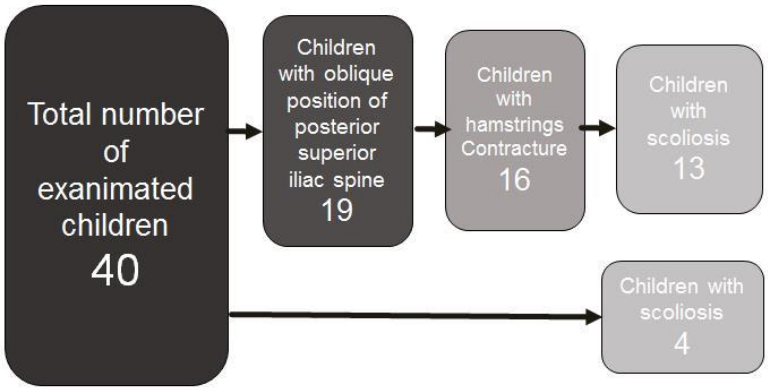

Fig. 6. Dependencies

Discussion

Nowadays faults posture is one of the most underestimated health problem among preschool age children. Civilization progress came with many diseases, where in addition to overweight and obesity, musculoskeletal defects are the main problem. Evaluation of posture defects occurrence can be carried out by various methods, but regardless of each method specific body components setup is being evaluated. We can deduct, that on the basis of a number of research the number of children with posture will maintain an upward trend. Practice shows that we are lacking of standard, simple methods for detecting abnormalities in body posture among children. The conducted study confirms that the posture faults are affecting younger and younger children. Nearly half of the children have posture defects that require correction procedure. Studies of other authors only confirm this data [16,17]. However, due to research group selection or data interpretation model, fluctuation of faults posture occurrence rate is considerable. Research conducted by Kluszczyński, and Maciełczyk-Paprocka indicates that the posture faults relate to approx. 75% of the population in preschool children [5,16]. Research under direction of Kaźmierczak and Wojna do not indicate for such a high percentage of posture defects. Their findings states that fault posture affect around 50% of the population in each age [3,17]. Our study demonstrates that posture faults among pre-school children relate to 47.5% of the examined group. The most common posture fault was scoliosis. Other authors reports indicate that distribution of individual

posture defects percentage differs in each case [5,16,17,18]. Research conducted by Kazmierczak shows that scoliosis constitute about 15% of posture defects among preschool children [16]. Our study showed that 57.1% of all posture defects are scoliosis within the study group. Nowadays hamstring contracture is becoming more frequent. This is caused by low physical activity, static lifestyle and careless in the correct posture formation. It is disturbing that hamstring contracture concerns already children in preschool age. Own research results analysis show that 40% of preschoolers possess hamstring contracture. Similar test results can be observed in Standera's studies, where hamstring contracture is being held by more than 40% of children aged six years [14]. According to his research and forecasts every second person has a hamstring contracture at the age of 10 years. Analysis of the finger-floor and the end of the toe test results confirms the scale and magnitude of the problem. In our study, the criteria to determine existence of hamstring contracture was a finger-floor positive test result. To verify study end of the toe test was also carried out, which proved that bigger contracture was in right leg. Our observations evidence that abnormal pelvic setup apply to 47.5% individuals from examined group. According Standera those disorders relate to as much as 75% of children aged six years [14]. Relationship between hamstring contracture and pelvis oblique setup are likely to be observed. Research direct attention was mainly focused on hamstrings group, however other pelvis statics disorders, which caused her oblique setup, cannot be ruled out. Incorrect pelvis setup are caused by muscle contractures within pelvis area. Some irregularities are passing on the higher segments causing their faulty setup [11,14,16,19]. The occurrence of scoliosis is closely associated with the existing hamstring contracture. Own studies showed that this correlation occurred in 81.2%. Analysis of these results indicates that the existence of hamstring contractures have a significant influence on the frequency of development and advancement of postural defects. Pelvis oblique position influence scoliosis development and disrupts normal spinal curves formation.

With such a high number of children with posture faults important question seems to be: what can be done for the faulty posture prevention? First of all, children should have a lot of physical activity every day. Important would also be regular stretching exercises under the supervision of a therapist, evaluation of child's figure and analysis of specified anthropometric points. These steps can prevent functional disorders and, if those exists, their correct diagnosis. In case of hamstring contracture already being diagnosed, it is recommended to use for example corrective exercises, exercises of PNF method, post isometric muscle relaxation, hamstrings contracture control. Properly conducted rehabilitation could prevent functional or

structural disorders. We cannot forget that defects formed at such young age, in the absence of rehabilitation, will only be magnified as the child grows.

Conclusions

1. Posture faults are major problem in our population. During examination near half of the group possessed at least one of the fault posture.
2. Hamstrings contracture disrupts pelvis balance causing oblique position of pelvis. Further it leads to increase frequency of fault posture.
3. Proper rehabilitation can prevent hamstring contracture, in advance prevents also occurrence of fault posture.
4. Rehabilitation study, in which analysis of specified anthropometric points and a few functional tests will be a component, can detect and correct diagnose fault posture among children.

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