

EARLY DIAGNOSIS OF JUNIOR SCHOOL AGE CHILDREN'S POSTURE DISORDERS

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Abstract. *Purpose:* to describe specificities of early diagnosis method for junior school age children's posture disorders. *Material:* in pedagogic experiment 156 junior school age children (boys and girls of 7-10 years' age) participated. All children had no experience of training in sport circles. For determination of uniformity of the tested we fulfilled experts' examination for presence or absence of external signs of posture disorders in frontal plane. The children's examination was conducted by qualified specialists at the beginning and at the end of experiment. For determination of early signs of muscular asymmetry in torso right and left sides of the tested children we used methodic, based on registration of tonic vibration reflex. *Results:* the pupils' examination permitted to form a group of 108 persons, who did not have external signs of posture disorders. It was proved that it would be purposeful to take prophylaxis measures at very early stages of imbalance in muscular system's work. Traditional approach in the form of prophylaxis examination can not give confident information about initial stage of imbalance in muscular system's work in child's organism. *Conclusions:* it was found that imbalance of motor nervous centers reflex excitability on both sides of backbone (if no purposeful prophylaxis measures are taken) can result in muscular tonus asymmetry on right and left sides of torso in lumbar spine area.

Key words: posture disorders, pupils, muscular imbalance, tonic vibration reflex, electric myogram.

Introduction

At present, in Ukraine pathologies' control, diagnosis and accounting in pupils with scoliosis deformations are continuing to be studied and developed. Nevertheless, timely diagnosis, treatment and prophylaxis of posture disorders and scoliosis are important tasks of society and government.

In clinic of patho-bio-mechanical signs of muscular-skeletal apparatus's different symptoms, muscular imbalance takes a special place. Muscular imbalance is a regional disorder of muscular functional tonus-power correlations, which is characterized by shortening of one muscles and relaxation of their anatomic antagonists. All these are accompanied by certain motor stereotype [3].

As per the data of P.K. Anokhin motor stereotypes are based on certain functional correlations, which appear in cortex motor centers on periphery [1]. That is why it is rather important to study functional activity of interconnected muscular groups, which form stereotypes in posture and motor functions [8].

Functional disorders in frontal plane are conditioned by muscular tonus asymmetry on right and left sides of torso. The main reason of local muscular hyper tonus is long lasted static load on muscles with minimal intensity [5-8].

Results of the researches of Ye.I. Aukhadeyev [2] permitted to classify muscular-tonus imbalance symptoms in the following way:

1. General (diffuse) muscular hypotension with increased mobility in all joints, naturally increased backbone physiological bending, narrow chest, X-like legs and arms, flat foets and a number of other features of muscular-skeletal apparatus.

2. Imbalance, concentrated mainly around shoulder girdle in the form of expressed asymmetry of shoulder girdle's shape and sizes as well as mobility of shoulder joints. Slouching back with flat chest and scoliosis bending with primary arc in upper thoracic spine are characteristic features.

3. Imbalance, concentrated mainly in lumbar zone in form of asymmetry of lumbar spine shape and sizes, legs, feet, difference in joints' mobility. In this case scoliosis bending with primary arc in lower thoracic and lumbar spines takes place.

Specialists in medicine and health protection [5, 23-25, 39] do not relate posture disorders to disease. The authors note that with started in due time health related measures this status does not progress and is a reversible process. Nevertheless, posture disorders often become satellite of many chronic diseases, owing to general functional weakness, muscular and ligament systems' imbalance of a child. All these result in reducing of functional

physiological reserves and weaken effectiveness of organism's adaptation reactions [9, 11-13, 15].

The mentioned above researches do not open to the fullest extent the problem of early diagnosis of junior school age children's posture disorders. That is why demand in continuation of such researches is an urgent problem for pupils.

Purpose, tasks of the work, material and methods

The purpose of the research is to describe specificities of early diagnosis method for junior school age children's posture disorders.

In the research we used registration of surface electric myogram (EMG) of lumbar spine muscles.

For determination of effectiveness of the offered methodic for early diagnosis of children's posture disorders in frontal plane we organized pedagogic experiment.

In pedagogic experiment junior school age children (boys and girls of 7-10 years' age) participated. All children had no experience of training in sport circles. For determination of uniformity of the tested we fulfilled experts' examination for presence or absence of external signs of posture disorders in frontal plane. The children's examination was conducted by qualified specialists at the beginning and at the end of experiment.

Examination of 156 junior pupils permitted to form a group of 108 persons, who did not have external signs of posture disorders. For determination of early signs of muscular asymmetry in torso right and left sides of the tested children we used methodic, based on registration of tonic vibration reflex (TVR).

Reflex activity of appropriate nervous centers was determined by registration of lumbar spine muscles' tonic vibration reflex at level of 2nd lumbar vertebrae. Tonic vibration reflex was registered in relax state of the tested, lying on couch on abdomen.

The research was approved by ethic committee of Chernigov National Pedagogical University, named after T.G. Shevchenko. We also received written consents of parents.

Results of the researches

Considering all above said we concluded that it would be more rational to take prophylaxis measures at very early stages of imbalance in muscular system's work. As per results of M.O. Nosko [6-8], the first stage of formation of not optimal motor stereotype is stage of functional tension. It is conditioned by functionally inadequate (by strength and/or endurance) physical loads (static and/or dynamic) on certain zone of muscular-skeletal apparatus.

Junior school age (7-10 years) meets these conditions to the largest extent. In this period child's backbone endures high static loads (in sitting position). Just in this period deviations in children's posture have character of unstable functional disorders in work of muscular system. It creates favorable conditions for effective conduct of prophylaxis measures by means of health related physical culture.

At the same time traditional approach to registration of posture disorders in the form of prophylaxis examination can not give confident information about initial stage of imbalance in muscular system's work in child's organism. These measures permit to find out already firm reflex connections, visual picture of which is "scoliosis shape of backbone". Further such disease results in serious and irreversible morphological re-constructions of muscular-skeletal apparatus.

In connection with the above said acute demand in method, which would permit to register first signs of imbalance in muscular systems of junior pupils at early stages and to take appropriate prophylaxis measures, exists.

Tonic vibration reflex (TVR) is slowly and smoothly progressing contraction of skeletal muscles, caused by continuous vibration irritation of its tendon [17-19, 22, 29]. TVR is considered to be polysynaptic reflex. Irritation of mechanic-reflex ends by continuous vibration activates motor neurons of the irritated muscle and motor neurons of the neighboring spinal cord segments through the net of plug inter-neurons [31-33, 35-37]. More expressed back muscles' TVR on right or left torso sides witness about increased excitability of reflex centers. Such reflex centers include mobile and plug neurons, which serve these muscles. It witnesses also about decreasing of excitability threshold on one of torso sides [6, 11-13, 16, 20, 21].

Methodic approaches to assessment of tonic vibration reflex data on both sides of backbone implied the following:

1. Analysis of total electric myogram (EMG) permitted to determine:
 - difference in latent period of tonic vibration reflex (TVR) progressing on right and left sides of backbone;
 - amplitude values of total EMG with simultaneous call of TVR.

The received data were analyzed in the following way. On backbone side with less latent period of TVR progressing and high total EMG amplitude nervous centers' reflex excitability was considered as increased. Accordingly, on the opposite side it was regarded as reduced [30, 34, 38, 40].

2. For more detail assessment electric myogram underwent spectrum computer analysis [26-28]. Spectrum analysis by Furiet's methodic permitted to quantitatively estimate the character of reflex excitability of centers, which innervate skeletal muscles on right and left sides of backbone. During computer aliasing we analyzed:

– maximal peaks of frequency spectrum on right and left sides in the range from 30 Hz to 70 Hz;

Graphs of frequency spectrums of torso right and left sides in the range of high frequencies:

Localization of increased reflex excitability was determined by shift of maximal peak to the side of high frequency indicators (i.e. to the right). Accordingly, lower frequencies were related to the weakened reflex excitability. More expressed EMG power in high frequencies' range (75 Hz and more) on one of the sides permitted to state the presence of reflex excitability imbalance [11-13].

Spectrum analysis permitted to find out that frequency maximal peaks in the range 30 – 70 Hz do not coincide on right and left sides (difference more than 5 Hz). Maximal peak's shift to the left, to the side of high frequency indicators points at increased reflex excitability of left side nervous centers. Spectrum components in the range up to 50 Hz do not differ significantly. In the range from 75 to 150 Hz we registered expressed EMG frequency characteristics on torso left side when initiating TVR. It points at increased reflex excitability of left side of this tested person.

From 108 tested children, who had no visible posture disorders in frontal plane, in 40 children (37%) we did not find early imbalance symptoms of nervous centers reflex excitability on both sides of backbone. In 68 children (63%) we registered differences between tonic vibration reflex (TVR) of right and left sides of torso. Analysis of the obtained data showed that in some children (56 persons – to the right from backbone and 12 persons – to the left) time of skeletal muscles' electrical activity starting in response to mechanical impact on their tendons was shorter than on the opposite side of torso. Difference in time of TVR progressing on both sides of backbone was in the range from 0.4 sec. to 1.0 sec. Voltage characteristics of total electric myogram also were more expressed on right side in one group of the tested and on the left side in other group.

The received data witness that in majority of the tested children (82%) one-side reflex excitability is expressed on the right side from backbone and in 18% - on the left side.

Discussion

In our research we used methodic, based on registration of tonic vibration reflex (TVR). It permits to reveal the character of reflex excitability of appropriate nervous centers on both sides of backbone. Tonic vibration reflex is widely used in experimental and clinical practice for assessment of reflex excitability of motor nervous centers [11-13]. Balance of reflex excitability on both sides of backbone ensures equal level of skeletal muscles' tonic activity, which serve backbone [14]. Researches of other authors showed that with presence of reflex excitability imbalance in appropriate nervous centers asymmetry of muscular tonus is inevitable [11-13]. In its turn stable imbalance of muscular tonus on right and left sides of backbone results in posture disorder in frontal plane [4-6, 10].

It permitted for us to assume that analysis of tonic vibration reflex registration data on both sides of backbone can help to reveal children with bent to posture disorders in frontal plane.

Results of the conducted researches permitted to assume that the found imbalance of reflex excitability on both sides of backbone (in case of absence of purposeful prophylaxis measures) can result in asymmetry of muscular tonus on torso right and left sides in lumbar spine zone. In the future the after effects can cause scoliosis deviations of junior school age children's postures.

Conclusions

Results of pedagogic experiment permit to affirm that early diagnosis method of posture disorders in frontal plane, based on registration of tonic vibration reflex, is an informative because it gives confident information about character of motor centers' functional activity, which innerve symmetric muscles of lumbar spine. In conditions of prophylaxis' absence one-side increased reflex excitability inevitably results in asymmetry of muscular tonus on right and left sides of torso and as after effect – in scoliosis of backbone.

The prospects of further researches imply substantiation of practical recommendations on application of early diagnosis methodic in cases of children's posture disorders in conditions of comprehensive educational

establishment.

Conflict of interests

The author declares that there is no conflict of interests.

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Cite this article as: Razumeiko N.S. Early diagnosis of junior
school age children's posture disorders. *Pedagogics,
psychology, medical-biological problems of physical training
and sports*, 2015;12:96–102.
<http://dx.doi.org/10.15561/18189172.2015.1215>

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Received: 22.08.2015

Accepted: 29.08.2015; Published: 10.09.2015