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Review Article

Analysis of diagnostic methods in trunk deformities in the developmental age

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ABSTRACT

Introduction: Postural disorders are classified as simple, often called faulty posture, and complex, which are associated with spine curvature disorders. Postural disorders correctable with passive and active correction need to be distinguished from severe spinal disorders such as idiopathic scoliosis, Scheuermann's disease and congenital spine deformities.

Aim: The aim of this research was to prove the necessity of combined clinical and instrumental examination in the diagnosis of trunk deformities.

Material and methods: Trunk abnormalities and deformities in the developmental age affect approximately 50%–60% of population, depending on the region of Poland. In this study, clinical and instrumental diagnosis of trunk deformities was analyzed.

Results: Clinical assessment with the use of instrumental methods is fundamental in diagnosis of trunk deformities. Causes of faulty posture need to be identified, both in terms of location within the musculoskeletal system and etiology, and pathologies that require different diagnostic and therapeutic approaches need to be excluded.

Discussion: Diagnosis of the cause of faulty posture is frequently possible only after a clinical and instrumental evaluation is performed. It results in isolating a group of children with structural deformities of musculoskeletal system that require a separate, specific treatment, from a group of children with postural disorders that require physiotherapy.

Conclusions: There is a need for implementing combined clinical and instrumental examination in the diagnosis of trunk deformities in the developmental age.

1. Introduction

In the literature one can find numerous definitions of faulty posture in reference to good posture, meaning a harmonized, symmetrical and energetically balanced system of individual body parts (head, trunk, pelvis, limbs) in a relaxed erect position.[5,10] Particular emphasis is put on frontal symmetry, maintaining physiological curvatures and normal joint range of motion.[19] Defining good posture must take into account differences of various stages of child development, their gender,

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constitutional body type, population characteristics. It is important to identify key factors that influence posture formation, and therefore determine possibility of re-education. Emphasis should be put on the role of control organ – central nervous system – which by harmonious development of musculoligamentous structures and muscle system is responsible for programming and postural memory patterns.[5,10,19,22] There are simple postural disorders, frequently called faulty posture, and complex postural disorders that are associated with the change in spinal curvatures. Postural disorders correctable with passive and active correction need to be distinguished from severe spinal disorders, such as idiopathic scoliosis, Scheuermann's disease and congenital spine deformities that involve spine, chest, hip joints, feet. Numerous classifications of postural disorders include a reference to physiological curvatures of the spine, pelvic anteversion angle, shape of the chest, and position of the head, shoulders and scapulae.[22]

2. Aim

The aim of this research was to prove the necessity of combined clinical and instrumental examination in the diagnosis of trunk deformities.

3. Material and methods

3.1. *Material*

Trunk abnormalities and deformities in the developmental age occur in approximately 50%–60% of population, depending on the region of Poland. In general, these are the habitual faulty postures that significantly contribute to the increase of postural disorders in population. Postural changes of skeletal elements directly connected to the spine (chest, pelvis) and disorders of the remaining components of the motor system (upper and lower limbs) constitute in total 45%–55% of the overall postural disorders.

3.2. *Methods*

Clinical and instrumental diagnosis of the following trunk deformities was analyzed:

- rounded back – hyper-kyphosis and compensatory deepening of cervical lordosis, forward tilt of head and shoulders, protruding scapulae, reduced pelvic anteversion angle;
- hollow back – increased lumbar lordosis, reduced thoracic kyphosis, increased pelvic anteversion angle;
- flat back – reduced thoracic kyphosis and lumbar lordosis, reduced pelvic anteversion angle, flattening and limited mobility of the chest;
- round-concave back – increased lumbar lordosis, compensatory increase of thoracic kyphosis, increased pelvic anteversion angle, protruding scapulae, flattening and limited mobility of the chest;
- cradle back – short increased lumbar lordosis, long kyphosis of the thoracolumbar spine, increased pelvic anteversion angle;
- buckling of the spine – usually a slight C-shaped curvature of the spine, without a three-dimensional curvature (scoliosis), which may be accompanied by typical abnormalities of physiological spinal curvatures.[5,10,19,22]

4. Results

Of particular importance in the diagnosis of trunk deformities is a clinical examination, including evaluation of standing and sitting posture and gait, based on detailed examination of musculoskeletal system, with the assessment of resting position of joints, range of motion, muscular strength and alignment of body parts in relation to one another. Physical examination of a child with suspected postural disorder should include: clinical assessment of the quality of posture with the use of documented instrumental methods, identification of causes of faulty posture, both in terms of location within the musculoskeletal system and etiology, and exclusion of pathologies that require a different diagnostic and therapeutic approach.[3,7] An important role in posture assessment is played by a rehabilitation physician that has the knowledge and skills for a proper functional diagnosis, based on which the appropriate measures, forms and methods of therapeutic program are chosen. Considering the characteristics of ontogenetic changes in posture, physiological changes in the maturing body and stages of development of the various motor skills, it is essential that the diagnosis and physiotherapy of children with postural disorders were performed by physiotherapists specializing in the treatment of children and adolescents with musculoskeletal disorders.[5] Cooperation between rehabilitation specialist, orthopedist and physiotherapist who specialize in diagnosis and treatment of postural disorders, with the school nurse, physical education teacher and corrective exercise specialist is required. This cooperation should include creating a coherent system of diagnosis and treatment, as well as preventive measures.[5,7,19]

4.1. *Instrumental examination*

One of the methods used in the assessment of posture is photogrammetry.[14,21] This is a method that provides imaging and physical measurements by means of electromagnetic radiation in a wide range of wavelengths. Limited use of this contemporary non-invasive diagnostic techniques results from unavailability of new technologies, as well as ignorance of the advantages offered by measuring devices. The use of photogrammetry in biological sciences and medicine is called biostereometry. Conventional method of stereometry includes measurement of an object using two pictures taken with cameras of a known geometry in two various positions. This allows restoring the shape of light beams that irradiated the pictures. Intersection of pairs of beams that passed through the image of a point on both pictures creates a spatial image. This way a three-dimensional model of the object recorded on the picture is created.[14,21]

Another method widely used in the assessment of body posture is a light beam refraction technique (interference of light waves), which uses a device called “raster” for measurements. As a result, an image contour map is created, which