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Original article

THE BODY POSTURE AND ITS IMBALANCES IN CHILDREN AND ADOLESCENTS

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Abstract

Aim. Recent studies show that 30% of the adolescents suffer, during their growth stage, from imbalances at the spinal column level, which may turn into malformations that can last throughout their lifespan. The growth periods in children and adolescents engender imbalances of the bone and muscular systems, circumstances that suppose a serious danger to the emergence of imbalances at the spine level. This danger is augmented by the adoption of inappropriate postures.

Postural attitude is not conditioned only by the muscle tone, the ligament strength and the erector spinae muscles, but also by the human being's personality, that is why it was called the "psychic drive". Depression and intellectual fatigue (overexertion) get worse the posture image and, conversely, joy and success improve it.

Purpose. The present paper aims at achieving a synthesis of a theoretical and methodical approach related to the body posture and the postural imbalances in children and adolescents, but also to some modalities of postural prevention, education and reeducation.

Content. Children and adolescents pass through a growth stage in which all the performed physical activities have consequences on their body structure.

In our study, we shall analyze some of the factors that may induce postural imbalances in children and adolescents, as well as some modalities of postural prevention, education and reeducation, which can be adapted to each subject or category of subjects.

Conclusions. Children and adolescents should be informed and must become aware of the possible postural imbalances and of some asymmetries in their body structure.

The education and reeducation of postural imbalances require the presence of a specialist who must know and implement efficient modalities of postural education and reeducation, because merely the verbal clues are often useless, they leading sometimes even to an adverse effect.

Key-words: body posture, adolescence, postural imbalances.

Introduction

Musculoskeletal imbalances are frequent among the population, particularly those related to the spinal column. Between 45 and 85% of the people suffer from low back pains at a certain moment of their life, pains that, in most of the cases, are determined by vicious postures, over exertions, lack of physical activity etc. Nowadays, this has become a serious concern, because we refer to an increasing health problem that emerges at early ages, especially starting with the age of 12 (Ramos, Gonzales, Mora, Mora, 2005).

About 30% of the adolescents suffer, during their growth stage, from imbalances at the spinal column level, which may turn into malformations that are susceptible to last throughout their lifespan (Masalo, 2001, quoted by Ramos, Gonzales, Mora, Mora, 2005).

The growth periods in children and adolescents engender imbalances of the bone and muscular systems, circumstances that suppose a

serious danger to the emergence of imbalances at the spine level. This danger is augmented by the adoption of inappropriate postures (Sanchez, 2003).

Another important aspect refers to the fact that the postural attitude is not conditioned only by the muscle tone, the ligament strength and the erector spinae muscles, but also by the human being's personality, that is why it was called the "psychic drive". Depression and intellectual fatigue (overexertion) get worse the posture image and, conversely, joy and success improve it (Gomez, Izquierdo, 2003).

1. Purpose of the study

The present paper aims at achieving a synthesis of a theoretical and methodical approach related to the body posture and the postural imbalances in children and adolescents, but also to some modalities of postural prevention, education and reeducation.

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This is an up-to-date issue, because it has been noticed that more and more children and adolescents spend their free time in front of a computer or a TV set, by usually adopting vicious postures, to the detriment of the physical activity or the sports practice.

2. Content of the paper

2.1. Body posture

During his evolutionary process, man has progressively reached different postural stages that culminate with bipedalism. Body posture is inherent to the human being, because it accompanies him 24 hours out of 24 throughout his lifespan. The different body attitudes or postures are defined through the interrelation between trunk and limbs, their stability depending on the subject's capacity to maintain his gravity center projection in the support polygon.

According to Kendall, Kendall, Mc. Creary, 2000, the body attitude represents a "set of postures adopted by all the body's joints at a precise moment", while the static postural alignment is defined in relation with the position of different joints and segments of the body. The ideal skeletal alignment used as a postural model is compatible with the scientific principles, involves a minimum tension and deformation and leads to the obtaining of the body's maximum efficiency.

The assessment and treatment of postural imbalances require the knowledge of many general principles related to the alignment, the joints and the muscles (Kendall, Kendall, Mc. Creary, 2000):

- An inappropriate alignment produces stress and an additional tension that affects the bone system, the joints, the ligaments and the muscles;
- The joint position assessment indicates muscles that are in a stretched or shortened position;
- There is a correlation between the body alignment and the findings resulted from the tests administered at the muscle level, in the situation in which the postural attitude becomes a routine;
- The muscle tone diminution allows the separation of the muscle insertion zones;
- The muscle shortening keeps together the muscle insertion zones;
- The stretching-induced weakening may occur in the monoarticular muscle groups that are in an elongation stage;
- The compensatory shortening may occur in the muscle groups that permanently remain in a shortening stage.

Authors such as Andujar, and Santoja, (1996) make reference to some concepts that are defined as follows: *correct posture*: "posture that

doesn't load either the spinal column or other element of the locomotor apparatus"; *vicious posture*: "posture that loads the bone, the tendon, the muscle, the vascular structures etc., by permanently deteriorating the body at the level of one or many elements and that mainly affects the spinal column"; *harmonious posture*: "posture that is the closest to the correct one and that can be achieved by any person, depending on the individual possibilities at each moment or stage of his life".

The correct posture or the physiologically balanced posture (fig.1) supposes an optimum distribution of the body weight around its vertical axis, as well as a correct position of pelvis, head and shoulders, which determines a minimum energetic consumption.

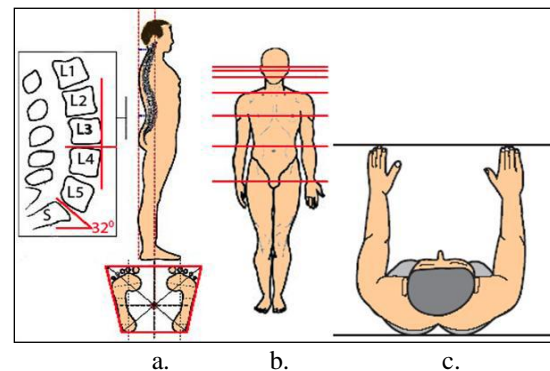


Fig. 1. The physiologically balanced posture in the sagittal (a), frontal (b) and transversal (c) planes (Serban, I., 2011, p.26)

In the sagittal plane (fig. 1a), the vertical axis must cross the following coordinates: vertex; odontoid process of the second cervical vertebra (C2); vertebral body of the 3rd lumbar vertebra and, at the same distance, within the support base, between the two soles; concomitantly, the scapular and gluteal planes are aligned.

In the frontal plane (fig. 1b), the axes defined by natural landmarks must be aligned (they must be perpendicular to the gravitational acceleration direction).

In the transversal plane (fig. 1c), no rotation should exist at the shoulder and pelvic girdle levels.

2.2. Factors that may induce postural imbalances in children and adolescents

Children and adolescents pass through a growth stage in which all the performed physical activities have consequences on their body structure.

A recent study achieved by McGill, (2007) was based on the participation of pupils aged between 6 and 10 years old, whose parents were



instructed to notice the different postures usually adopted by their children, at home. The obtained results were the following:

- **Position in front of the TV set:** 70.7% were adopting a wrong posture, 17.7% were adopting a correct posture, 9.7% were adopting sometimes a correct posture and 2.43% didn't know or didn't respond. The most frequent wrong posture is the ischiosacral support, with the total loss of lumbar curvature and an accentuated dorsal curvature.

- **Sitting position on a chair or for study:** 53.6% were sitting incorrectly or didn't dispose of appropriate furniture, 29.2% were using a correct posture, 9.7% were using sometimes a correct posture and 7.3% didn't know or didn't respond.

- **Lying down position** (while sleeping): 17.07% were sleeping on their back, 9.7% were sleeping on their belly (the most detrimental of all the positions), 51.2% were sleeping on their side and 21.9% were changing many times their position.

Authors such as Casimiro (1999) and Tercedor (1998), quoted by Martin, Recio, (2009), assert that the adolescent's growth stage predisposes to the emergence of some postural imbalances, as a consequence of a series of factors that will be analyzed in the following lines:

- a. Physiological characteristics specific to the growth stage at the locomotor apparatus level
- b. Incapacity to become aware of the alterations at the body schema level
- c. Psychological characteristics
- d. Progressive tendency toward the sedentary life or lack of physical activities
- e. Schooling-specific conditions
- f. Vision disorders and their incidence on the posture

a. Physiological characteristics specific to the growth stage at the locomotor apparatus level

In adolescence, the many sudden alterations that occur at the locomotor apparatus level may engender a series of postural imbalances. In this stage, the bone system is submitted to a considerable growth that is not accompanied by the muscular mass development at the same rhythm, which means that the adolescent grows in height, while his muscular system is not correspondingly adapted to these changes. The fact that the muscular mass doesn't develop at the same rhythm with the bone levers converts the adolescent's locomotor apparatus into an unstable system and, consequently, this predisposes

to the emergence of injuries or of the incorrect fixations at the postural level.

b. Incapacity to become aware of the alterations at the body schema level

As a result of the previously mentioned factor, the adolescent has an incapacity to become aware of the alterations produced in his body schema or, in other words, in this stage, the alterations affecting the adolescent's body are so numerous and accelerated that he has not sufficient time to assimilate or include them through the awareness of the new body schema, and this is due to the quick growth at his bone system level.

Consequently, the adolescent can adopt some determined postures that will lead to wrong postural habits and, finally, to some consolidated structural imbalances, although he is not fully aware of this.

c. Psychological characteristics

According to Silla (1998), quoted by Martin Recio (2009), the postural attitude is defined as a psychophysiological feature, therefore it will be influenced by the individual's psychological stage. Thus, we frequently meet kyphotic attitudes in the depressed individuals or an improper postural attitude that proves a negative self-image and, consequently, a low self-esteem.

At the same time, postural imbalances can result from the existence of a culpability feeling induced by the growth-specific circumstances, such as in the case of the "decency" kyphosis, encountered in the girl adolescents whose breasts are growing or whose height exceeds that of their colleagues.

d. Progressive tendency toward the sedentary life or lack of physical activities

The lack or the abandonment of physical activities is a common feature in this period and engenders a series of physical consequences, such as a decrease in the muscle strength and the joint mobility, physical qualities that are indispensable to maintain the correct posture. Thus, if these physical qualities are debilitated, some vicious positions will be adopted and, in the course of time, functional limitations may occur.

e. Schooling-specific conditions

The schooling-specific conditions compel the adolescents to sit many hours on a chair or in front of a computer. At the same time, the daily carriage of the school stuff converts into another factor susceptible to generate, in the future, postural imbalances (for instance, the unilateral school bags are not recommended, but the backpack utilization is



the correct option). When using a backpack, it must be placed at the lower back level, in order to facilitate the dorsal hyperextension; however, the backpack is not recommended in the severe scoliosis or if the child wears an orthopedic corset.

f. Vision disorders and their incidence on the posture

By having a holistic conception on the human body, we can understand how the postural imbalances are determined by some eye disorders, because the vision organ participates in the adoption and conservation of a correct body posture. Thus, the individuals who use the wrong lens - in myopia or strabismus (ocular torticollis)- have the tendency to adopt a compensatory posture of the head, which modifies the vision distances or angles.

2.3. Modalities for the postural prevention, education and reeducation of children and adolescents

The basic principles for the postural prevention, education and reeducation must meet some personal or individual necessities of each subject or category of subjects, because each subject or category of subjects is different.

In our study, we suggest some modalities of postural prevention, education and reeducation, which can be adapted to each subject or category of subjects.

Authors such as Canto and Jimenez (1998) propose 3 essential principles:

- Awareness of the body attitude
- Strength development in the back and the abdominal muscles
- Joint mobility and muscle suppleness

These 3 principles can be developed through some work modalities with different characteristics, for instance: respiratory reeducation, exercises in the water environment, sports practice or balance exercises.

2.3.1. Awareness of the body attitude

We should know the imbalances, the adopted position asymmetries, as well as the correct position, under the static and dynamic conditions.

The correct position learning must cover, from the chronological point of view, different stages:

- **Awareness of the body attitude.** By using different methods of subjective assessment, we search for the asymmetries provoked by the spinal column curves

that exceed the physiological normality of the child's or the adolescent's body structure.

- **Modeling and awareness of the correct body attitude or posture.** When the child or the adolescent knows the asymmetries in his body structure, we try to correct them through a series of exercises included in the group of the conscious gymnastics technics. Among them, we mention: identification exercises in front of the mirror; stretching exercises; retroversion and anteversion movements of pelvis in different positions: orthostatism, sitting position, dorsal decubitus, ventral decubitus; respiratory exercises; postural exercises in the water environment.

- **Automation of the correct posture.** To finalize this stage, a laborious work is required; it consists of the neuromuscular reprogramming of the current posture to a correct posture, from the physiological point of view.

2.3.2. Strength development in the back and the abdominal muscles

The muscle tone diminution in the spinal column muscles causes some postural abnormalities. The muscular groups that lack strength and consequently may hinder the establishment of the normal postural reflexes and their conservation are the following:

- **The spinal extensors:** deep muscles –erector spinae: spinalis, longissimus, iliocostalis, which inserts between the spinous and the transverse processes, its main role being to hold up the spine and ensure its stability; intermediate muscles: serratus posterior superior, serratus posterior inferior; superficial muscles: rhomboideus minor; these muscles are responsible for the movement.
- **The spinal flexors,** located in front of the spinal column, are the following: rectus abdominis, abdominal internal and external oblique muscles, iliopsoas.

The tonification of these muscle groups determines the trunk stability and protects the spinal column against some processes that generate osteoarticular deformations. We must have in view the following indications:

- Exercises shouldn't stress the column concavity.
- Isometric exercises are recommended (the position is maintained for 7 to 10 seconds, but the interval can increase up to 20 seconds).
- A special emphasis is placed on the controlled therapeutic exercises (slow movements, with the control maintaining while the exercise is performed).



- The head is considered an extension of the spinal column (it shouldn't fall).
One of the very efficient methods to strengthen the trunk muscles is the Pilates method.

2.3.3. Joint mobility and muscle suppleness

The joint mobility in children and adolescents is determined by the bone elongation, in disproportion with the increase in muscular mass at the lower limb and the trunk levels. Thus, mobility is diminished, particularly in the time interval between 10 and 14 years old.

The poor amplitude of different joints doesn't allow the achievement of a satisfactory balance. The normal balance regaining can be hindered by the amplitude limitation in the following joints: coxofemoral joint, spinal column joints (at the lumbar, dorsal and cervical levels) and glenohumeral joint, as a result of the pectoralis major retraction.

When conceiving a work program for the mobility, we should take into account the following aspects:

- The program must have a progressive intensity and must be preceded by an appropriate warm-up.
- The mobility exercises can be combined with the relaxation exercises, because these ones reduce the tension at the muscle tone level.
- Static and dynamic exercises will be associated to slow and controlled movements, which lead the muscle to a tension position, then the stretching is maintained for a period of time.

Among the recommended motor activities that contribute to the development of the above-mentioned basic principles, we enumerate: exercises for the respiratory reeducation, balance exercises, sports practice and exercises in the water environment.

Respiratory reeducation

While the exercises are performed, inspiration accompanies the stretching movements and the rest phase and expiration accompanies the effort phase of the exercises, because it forces the abdominal muscles to contract. The following indications are proposed:

- Exercises for the diaphragm mobility
- Practice of different breathing types (abdominal, thoracic and clavicular ones)
- Work on some respiratory rhythms that are necessary in different activities or sports:

swimming, cycling, expression of some feelings (fury, interior peace) etc.

- Diverse breathing techniques: yoga (pranayama), tai chi, qi gong etc.

Body balance

The balance exercises are destined to the correct postural integration of the body schema. The following indications are proposed:

- Reduction of the support base. For instance: while sitting on a balloon, we try to keep our trunk upright.
- Elevation of the gravity center and reduction of the support base. For instance: on the balance board, we experience different positions, by modifying the support point or by bending our trunk.
- Increase of the body's perceptive level reached in the previous exercises, by suppressing our sight.

The special training of the balance capacity, in order to benefit from all that the biological element gives to the individual in different growth and development stages, is particularly recommended in the age period from 6 to 10 years old (Macovei, 2006).

Sports practice

Sports practice is recommended with precaution in the case of children and adolescents who present postural imbalances. Authors such as Balius, et al. (1987); Martin Recio, (2009) made a classification of the different sports disciplines, according to the effort impact on the spinal column. Among the prescribed sports for the postural education and reeducation, we mention: sports with a positive impact on the spinal column (basketball, handball, volleyball, swimming- except for the butterfly style, fitness gymnastics etc.) and sports with an indifferent impact on the spinal column (running events from the athletics, football, fencing, hockey, tennis, table tennis, golf, archery etc.) (Macovei, Acasandrei, Popescu, 2012).

At the same time, we must have in view that any sports practice has a competitive and recreational character and that it requires the allotment of a more or less important number of hours; moreover, we must take into account the motor exigencies specific to each sports discipline.

Activities in the water environment

In the water environment, the human body is submitted to a series of particular laws (Archimedes force, hydrostatic pressure, water resistance etc.) that make it the ideal ambience for the work on the postural education and reeducation.

Program for the postural education and reeducation in the water environment:



a. Learning the correct trunk position in the water. This is achieved under the guidance of a teacher, who permanently corrects the body position by using his hands or some accurate verbal clues.

b. Adopting the ventral and dorsal decubitus positions (by means of the floats), the vertical floating position or the immersion position. The degree of difficulty is increased by additional movements at the upper and lower limb level.

c. Dynamic muscular work. We use hydrodynamic resistances or the water turbulences. The effort intensity is variable and follows the covered surface while the body or the limbs are moving, but also the movement execution rapidity. As swimming aids, we can use the fins, the floats and the lead belt, which offer a great resistance to the upper and lower limb movements, by performing thus, through these exercises, a progressive muscular work.

d. Static muscular work. It stimulates the trunk muscles (the abdominal and spinal muscles, the retroversor and anteversor pelvic muscles, the shoulder blade fixing muscles), which work in isometry, in order to keep the trunk balance in a correct position that has been previously learned in the gym. The density diminution in different corporal segments by means of the floating aids, which can be used to facilitate the movement or to oppose a bigger resistance, favors the muscle strengthening.

The muscle tonification in the water is globally approached, because we can't work analytically with a specific muscular group without the intervention of other muscular groups. When the body or one of its segments travels in the water environment, there is a dynamic muscular work, which performs the movement, or an isometric one, of the muscles that maintain the body position.

Conclusions

- The education and reeducation of postural imbalances require the presence of a specialist who must know and implement efficient modalities of postural education and reeducation, because merely the verbal clues are often useless, they leading sometimes even to an adverse effect.
- Children and adolescents should be informed and must become aware of the possible postural imbalances and of some asymmetries in their body structure.
- Children and adolescents may practice their favorite sport without restrictions and with corresponding results, inclusively those who are confronted to postural imbalances, if

they benefit from an appropriate training, from efficient prevention modalities and from correct treatments.

- Postural imbalances don't affect a single corporal segment, but they have negative influences on the whole body, which is detrimental to the individual's health condition and this imposes the implementation of some special steps, such as exercises, therapeutic elongations and stretching, which aim at improving or preventing these imbalances.

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