

Prophylactic/therapeutic rehabilitation modalities in vertebral balance disorders in children aged 10-12

VIZITIU Elena¹, CONSTANTINESCU Mihai^{1,2}, SILIȘTEANU Sînziana Călina^{1,3}

Corresponding author: SILIȘTEANU Sînziana Călina, E-mail: sinzi_silisteanu@yahoo.com

¹ "Stefan cel Mare" University of Suceava, Romania

² Kinetic therapist - "Stefan cel Mare" University of Suceava, Romania

³ Railway Hospital Iasi - Specialty Ambulatory of Suceava, Romania

Abstract

Introduction. Vertebral balance disorders are a health issue for children in general, with long-term consequences. Having in view that the number of new cases with this condition has increased, it is necessary to introduce health programs and it is useful to make a screening for vertebral balance disorders by age groups (prepubertal, pubertal, adolescent). **The objective** of the study was to evaluate the functional status of the child aged 10-12 and the elaboration of the prophylaxis/ treatment program. The purpose was to draw the attention to the prevalence of vertebral balance disorders in youth, with possible consequences in adulthood. **Material and method.** The study was conducted for a period of 1 year and included a number of 86 children. After the clinical, anthropometric, somatoscopic evaluation, the recovery plan was elaborated, but also the prophylaxis plan was elaborated for certain cases. The purpose was to create the correct posture reflex, the toning of the paravertebral and abdominal muscles, the increase in the mobility of the joints and the fight against obesity. The kinetic program took place 3 times/ week, with a duration of 30 minutes/ session. Also, the children attended a weekly therapeutic swimming session. **Results.** It was found in the study group that over 51% were girls, approximately 30.23% of the children were diagnosed with scoliotic attitude, 44.19% with kyphotic attitude and approximately 25.58% had a normal postural attitude. **Conclusions.** After the use of the physiotherapy program (on the land and in the water), it was found that the general alignment, the concentration capacity and the adaptation to the school activities improved. The existence of a multidisciplinary team to ensure the recovery program is an effective method to obtain beneficial results for health in this age group.

Keywords: *vertebral disorders, postural attitude, prophylactic therapeutic modalities, kinetic program,*

Introduction

The interest in obtaining a sanogenic status by reference to the postural attitude of children aged 10 and 12, in a short time led to the intensification of research in this direction. Most of the new scientific information comes from the branch of kinetoprophylaxis and therapeutic swimming, regarding the maintenance and improvement of a correct body posture during the period of growth and development. The paper has the purpose to support future specialists in the physiotherapy field in order to know the current condition of theoretical and practical advanced research. From the viewpoint of objectives, the prophylactic programs proposed to children are considered important in obtaining relevant results related to the maintenance of a correct body posture. The literature currently shows that vertebral balance disorders are a health issue for children in general, with long-term consequences. Having in view that the number of new cases with this condition has increased, it is necessary to introduce health programs and it is also useful to make a screening to identify vertebral balance disorders in the prepubertal age. For this purpose, certain aspects about growth and development depend on the complex endocrine maturation, where the pituitary gland, the thyroid, the adrenal glands and the sex glands have a very important role (1,2,3).

Given that the correct body attitude and the deficient one are determined by reflexes that can continue constant intersegmental relations, it is considered that a possible process of correcting the body attitude should start in childhood, after the age of 5, when the myelination process of nerve fibers has been complete. Once this process is complete, a correct and stable postural reflex will be formed, whereas the muscle tone can be adjusted by educating the posture.

The correct attitude is a function that is based on a series of sensorimotor reflexes that are related to the impulses received by the proprioceptors in the musculoskeletal structures as well as through the skin interoceptors and visual or acoustic-vestibular analyzers. All these excitations are transmitted through sensitive ascending nerve pathways to the analysis of the central nervous system where responses are developed and transmitted to the motor structures by controlling muscular tone in static and dynamic in order to maintain a stable and correct postural attitude (4,5,6).

Heredity as well as the other disturbing factors (environmental factors, growth process, hormonal system, metabolic factors, biomechanical factor) that can trigger the installation of vicious postural deficits partially condition the children's somatic and morphofunctional aspects (7).

It is known that the human skeleton contains about 99% of total calcium but low calcium intake can contribute to diseases such as rickets. The reference range for serum calcium, indicated in CALIPER, in the age group 10-12 is 2.20-2.60mmpl / l (8).

Along with calcium, magnesium is also essential for a child's development. It is an important nutrient for the human body, the fourth mineral in the body, found in the skeleton in a percentage of 50-60% of total serum magnesium. It should be mentioned that magnesium is important for the child during the growth and development periods. In the Lothar Thomas Guide, the reference range for magnesium for schoolers is 0.60-0.95 mmol/l (9).

The idea of elaborating prophylactic programs in order to have a correct body posture is the particular feature that is assessed or calculated after analysing the behavior of prepubertal age children during daily activities. Thus, we consider that the selection of the used means, both in water and on land, in order to achieve the proposed objectives, is an operating way within the proposed program (10,11,12).

The objective of the study was to evaluate the functional status of the child aged 10-12 and the elaboration of the prophylaxis/ treatment program for cases of vertebral balance disorders. The purpose was to draw the attention to the prevalence of vertebral balance disorders in youth, with possible consequences in adulthood.

Material and method. The study was conducted for a period of 1 year and included a number of 86 children. The study was carried out with the consent of the parents/relatives by respecting the norms of ethics and deontology according to the legislation in force. The inclusion criteria in the group were: children aged 10-12 who had vertebral balance disorders, without other conditions and for whom the parents / relatives gave their consent to participate in the study. The exclusion criteria were: children under 10 and over 12 who had other conditions (respiratory, cardiac, renal, digestive, neurological), for whom the parents / relatives did not agree to participate in the study. After the clinical, anthropometric, somatoscopic evaluation, the recovery plan was elaborated, but also the prophylaxis plan was elaborated for certain cases. The purpose was to create the correct posture reflex, the toning of the paravertebral and abdominal muscles, the increase in the mobility of the joints and the fight against obesity. The kinetic program took place 3 times a week, with a duration of 30 minutes a session. Also, the children attended a weekly therapeutic swimming session.

In order to discuss these realities about "VERTEBRAL BALANCE DISORDERS", a study was conducted on those who are directly involved in this issue, namely children aged 10- 12 (girls and boys). For this purpose,

before the beginning of the work programs, information presentations were made on current issues regarding the implications of the functional physical deficiencies of the spine as well as methods and means of prevention and proper management to maintain health at optimal parameters.

The study was conducted throughout the 2018-2019 school year and included a number of 86 children (girls and boys aged 10-12). After the anthropometric, somatoscopic evaluation, the work plan/ prophylaxis for certain vicious postural attitudes was elaborated.

There was a kinetic program 3 times a week, with a duration of 30 minutes a session, whereas the therapeutic swimming program was once a week for 45 minutes a session.

The prophylaxis programs proposed by us were carried out at the Swimming and Physiotherapy Complex of "Ștefan cel Mare" University of Suceava, under the guidance of Associate Professor Vizitiu Elena PhD, together with students from the specialization Kinesiotherapy and special motor skills.

The initial somatoscopic evaluation was made in the beginning of October 2018, whereas the final test was at the end of July 2019, with the help of the students, having as a theme: "Assessment of body posture in prepubertal age children".

It should be also specified in this context that the selected subjects are not diagnosed with functional physical deficiencies of the spine and are not part of other recovery programs or specific treatment. The children who participated in the prophylactic program of having a correct posture were found to have vicious postural attitudes (kyphotic and scoliotic) that can become postural deficiencies of the spine over time. Once the working groups of four were completed, the objectives of the kinetic means programs on the land and in the water were established in order to be achieved. The aim was to create the correct posture reflex, to tone the paravertebral and abdominal muscles but also to increase joint mobility.

The kinetic program on land was structured in three stages:

- The first stage (12 weeks) involved analytical exercises on segments (scapulo-humeral and pelvic belt);

- The second stage (12 weeks) involved more complex exercises in which different materials were introduced: sticks, balls, circles. Exercises for correcting and awareness of the correct postural attitude, then exercises for maintaining / keeping the kinesthetic memory;

- The third stage (10 weeks) consisted in exercises with a higher degree of complexity: bands and weights. The workload was 30 minutes long, and each exercise was dosed according to the program and children's effort skills.

-The last part of the program was reserved, aiming at returning from effort by doing exercises of relaxation, breathing, stretching, etc. for 3-5 min.

The kinetic program in the water was structured in three stages (children worked on the platform).

Objectives: Maintenance of good condition, general relaxation of the body; awareness of swimming effects on correct body posture to fight the beginning of posture deficits; Applying specific swimming techniques to develop joint mobility; Improving postural conduct under overload conditions.

The first stage (12 / week) consists of exercises for getting used to the water, rear float, front float, sliding on the water and pushing from the wall.

The second stage (12 weeks) consists of movements made with legs and arms in the processes: back and bras.

The third stage (10 weeks) consists of specific exercises of the processes mentioned: double rear, rear arms - legs, combinations between procedures etc.

Results and discussions. Following the initial and final evaluations made in the study on the dynamic evolution of postural status in children integrated into the prophylactic program by kinetic methods, on the land and in the water have been obtained that can help the recovery doctor, physiotherapist in the therapeutic program. The somatoscopic evaluation is one of the most common methods used by most practitioners, it is easy to perform and does not require special equipment that involves additional costs. However, somatoscopy is a subjective investigation method, this is why its results must be completed and confirmed by functional tests, anthropometric measurements and last but not least imaging investigation. From a demographic point of view, the study group found that over 51% were girls. Among the 86 studied children, approximately 30.23% were diagnosed with a scoliotic attitude, 44.19% with a kyphotic attitude and approximately 25.58% had a normal postural attitude. This means: 22 children with normal postural attitude = 25.58%; 26 children with scoliotic attitude =30.23%; 38 children with cifotic attitude= 44.19%. (Fig no. 1)

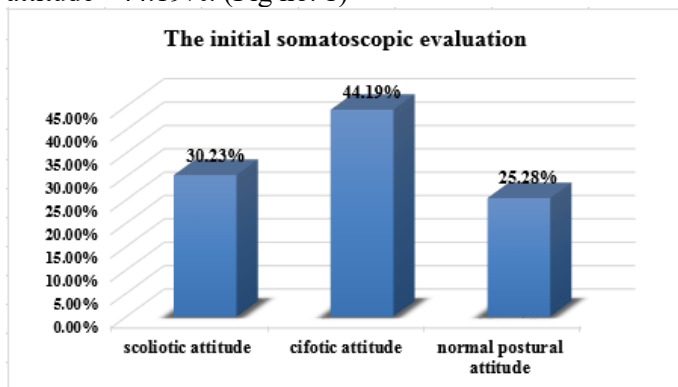


Fig. no. 1. Results at the initial somatoscopic evaluation

The final somatoscopic evaluation found a reduction in the number of children with scoliotic and kyphotic attitudes, as well as an increase in the number of children with normal posture. (Fig 2)

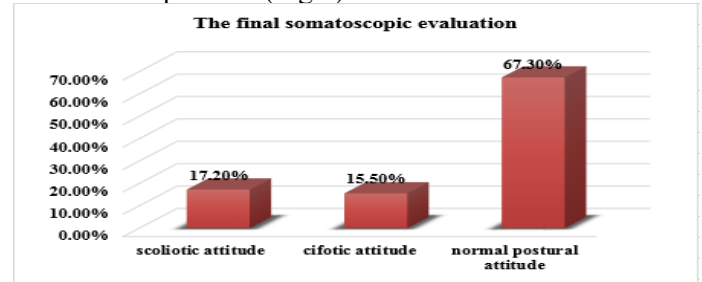


Fig. no. 2. Results of the final somatoscopic evaluation

In order to obtain results on somato-functional health, we used standard measurements that are used in current practice: age, height, weight, body mass index and mobility tests. The table below shows the results of the initial and final evaluations of girls and boys.

Table no. 1. Difference between the initial test and the final one in the group of girls

Difference between the initial test and the final one in the girls' group	HEIGHT (cm)	WEIGHT (kg)	BODY MASS INDEX (uc)	Test fingers-floor in flexion (cm)	Lateral tilt test fingers-floor, right (cm)	Lateral tilt test finger-floor, left (cm)
x	0,76	3,36	0,46	3,62	1,32	1,29
σ	0,09	0,67	0,56	2,62	1,18	1,45
Cv%	0,00	0,02	0,03	0,24	0,02	0,03

Legend: x= arithmetical average, σ = standard deviation, Cv% = variability coefficient, uc = conventional units

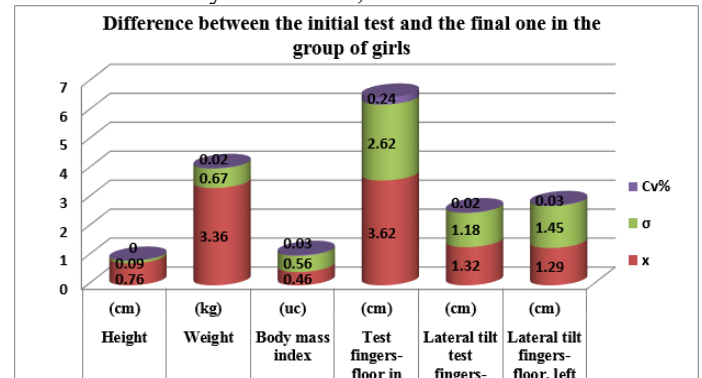


Diagram no. 1. Difference between the initial test and the final one in the group of girls

As for the group of girls, we notice an average of 0.46 mc in the difference between the initial test and the final one in the body mass index test, an average of 3.62 cm in the fingers floor test, whereas in the lateral tilt test right we have an average of 1.32 cm and in the left side we have an average of 1.29 cm. The coefficient of variability is a parameter that gives us the degree of homogeneity of a group and expresses in percentages the ratio between the standard deviation (S) and the arithmetic mean.

The lower the coefficient of variability, is the more the grouping of data around the arithmetic mean is

$$C_v = \frac{S}{X} \cdot 100 \% \text{ pronounced.}$$

Table no. 2 Difference between the initial test and the final one in the group of boys

Difference between the initial test and the final one in the group of boys	HEIGHT (cm)	WEIGHT (kg)	BODY MASS INDEX (uc)	Test fingers-floor in flexion (cm)	Lateral tilt test fingers-floor, right (cm)	Lateral tilt test fingers-floor, left (cm)
\bar{x}	0,92	4,53	1,75	4,73	1,05	0,9
σ	0,03	1,26	0,69	2,83	0,68	0,53
Cv%	0,00	0,04	0,05	0,25	0,02	0,02

Legend: \bar{x} = arithmetical average, σ = standard deviation, Cv% = variability coefficient, uc = conventional units

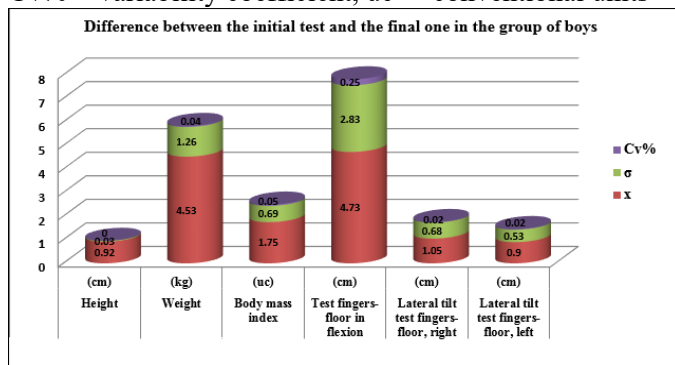


Diagram no. 2. Difference between the initial test and the final one in the group of boys

As for the group of boys, we notice an average of 1.75 mc in the difference between the initial test and the final one in the body mass index test, an average of 4.73 cm in the soil finger test, whereas in the lateral tilt test right we have an average of 1.05 cm and in the left side we have an average of 0.9 cm.

Conclusions

Somatoscopy is a subjective investigation method, this is why its results must be completed and confirmed by functional tests, anthropometric measurements and last but not least imaging investigation.

After the use of the physiotherapy program (on the land and in the water), it was found that the general alignment, the concentration capacity and the adaptation to the school activities improved.

At the initial test, approximately 30.23% of the children were "diagnosed" with scoliotic attitude, 44.19% with kyphotic attitude and approximately 25.58% had a normal postural attitude. The variability coefficient is $\leq 5\%$ in

all the tests made on girls and boys, the variation is small, the groups are homogeneous, for this purpose the average is representative.

At the final results, the average difference (\bar{x}) between the initial test and the final one in the body mass index for girls we achieved a score of 0.46 mc and 1.75 mc in boys.

At the final results, the average difference (\bar{x}) between the initial test and the final one in the indicator fingers-floor test (spine mobility, flexion), we achieved a positive score of 3.62 cm in girls and 4.73 cm in boys.

At the final somatoscopic evaluation, the following values were obtained: 17.20% scoliotic postural attitude;

15.50% kyphotic postural attitude; 67.30% normal postural attitude.

In this context we can notice in the study group that the number of children with scoliotic attitude was reduced by 13.03%, the number of children with kyphotic attitude by 28.69% and the number of children with normal postural attitude increased by 41.72%.

The objectives of the prophylaxis programs have been achieved, but the presented results point out that the kyphotic attitude is easier to correct.

The existence of a multidisciplinary team to ensure the recovery program is an effective method to obtain beneficial results for health in this age group.

Declaration of conflict of interests/Conflict of Interest Statement

The authors declare that there is no conflict of interest regarding the publication of this article.

Acknowledgements

All the authors have read and approved this publication and had equal scientific contribution in publishing this material.

References:

1. Constantinescu M. Optimizarea proceselor de creștere și dezvoltare a funcției aparatului locomotor prin aplicarea exercițiilor din natație la copiii de 10-14 ani. În: Probleme actuale privind perfecționarea sistemului de învățământ în domeniul culturii fizice: Conferința Științifică Internațională. Chișinău, 2013
2. Constantinescu Mihai. Somatoscopia instrumentală a deficiențelor fizice funcționale ale coloanei vertebrale în The Annals of „Ștefan cel Mare” University, Suceava, 2014
3. Dan M. Educație pentru sănătate corporală. Ed. Universității din Oradea, 2004.
4. Alexe D.I. Implicațiile psihomotricității în manifestarea echilibrului la pubertate. Ed. Performantica, Iași, 2012
5. Cordun M. Kinantropometrie. Ed. Cd. Press, București, 2009
6. Farago M, Pop S, Metode și tehnici de evaluare în Kinetoterapie. Ed. Universității, Oradea, 2008
7. Antonescu D, Dragosloveanu M, Obrascu C, Ovezza A. Corectarea deviațiilor coloanei vertebrale, Editura Medicală, București, 2020
8. Antonescu E, Totan M, Boitor GC, Szakacs J, et al. The references intervals used in pediatric medical analysis laboratories to interpret the results analysis for total serum calcium. Rev. Chimie, 2017, Vol. 68, Issue 2, 243-245
9. Antonescu E, Bota G, Serb B, et al. Study of the total serum concentration of serum ionized magnesium in children and adolescents from Sibiu area. Rev. Chimie, 2018, Vol. 689, Issue 12, 3389-3392
10. Rață E. Teoria și practica în sporturi de apă: înot. Curs teoretic. Universitatea „Ștefan cel Mare”, Suceava, 2013
11. Rață E. Teoria și practica în sporturile de apă: Înot. Caiet de lucrări practice. Universitatea „Ștefan cel Mare”, Suceava, 2014
12. Zaharia C. Scolioza. Ed. Medicală, București, 1980