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The Influence of Corrective Gymnastics on Correcting Deformities in Younger School-age Children

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Abstract: *The aim of this paper is to point out the importance and degree of occurrence of postural problems in children of younger school age, with special emphasis on preventive action, in order to detect postural deformities in time and repair or remove them. The research was conducted on a sample of 362 children, of which 300 with some deformity (from 7 to 9 years), in the club "Carpe Diem" in Bijeljina, which deals with corrective gymnastics, where a total of 13 variables indicating postural irregularities were applied. The results showed postural deformity in 114 boys and 186 girls, where in both sexes SKOLI is dominant ($M = 16$; 14.04%, $F = 43$, 23.12%), which in total represents the largest number (59, 19.67%). Corrective exercise corrected the number of deformities in M by 56.39% (62), and in F by 52.15% (97). The obtained research results indicate the importance of regular exercise, with the application of adequate and targeted exercises, in accordance with the postural status of the child, where the implementation of corrective exercises in the school curriculum would significantly contribute to reducing postural disorders and structural disorders.*

Key words: *postural irregularities, deformities, corrective gymnastics*



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Introduction

Proper growth and development of a child are very important for his proper morphological formation, quality of life and for his health in general. The development of the child's organism and its proper posture of the complete body depends on the conditions of everyday life and the way in which the child performs his daily duties. Proper posture is characterized by correct head posture, symmetry of shoulder position, correct shoulder position, normal physiological curvature of the spine, correct structure of legs and feet¹. Deviations from the above are a type of postural problem.

The term abnormalities (posture abnormalities) means a weakened functional state of the musculoskeletal part of the locomotor system, ie poor physical posture is considered to be all irregularities in the position, relationship and shape of the spine, shoulders and lower body that are not the result of skeletal or nerve damage muscular system, are already a consequence of insufficient and irregular muscle function². Causes that impair proper posture can be congenital or arising. Congenital deformities refer to body deformities that occur at birth or immediately after the birth of a child, while other deformities occur during the growth and development of the child, due to incorrect body position (sitting, walking, running, exercising, sitting at the computer), insufficient movement, muscle diversity loads, insufficient muscle strength, inadequacy of footwear and clothing, sudden growth of the child, and many other reasons.³⁻⁵ In the period of mental, motor-morphological and physiological transformations of the child, there may be minor or severe deviations that temporarily or permanently change the basic posture and posture.^{6,7} Postural deformity permanently characterizes the child, both in physical appearance and numerous mental problems arising from the deformity, and therefore it is very important to notice the deformity in time and take the necessary steps to repair its further development.⁸

The high incidence of postural disorders today can be successfully addressed with adequate exercise and if spotted on time. The earlier a certain deformity is noticed, the longer it will take to correct it. Signs of deformity can usually be determined by careful observation of the child in an upright position, analyzing the feet, knees, hips, spine, chest, shoulders and neck.⁹ Sometimes postural irregularities are pronounced and can be easily noticed by parents, which is usually characterized by the stage of progression of a given postural irregularity, while the initial phase of irregular posture of a certain part of the body is usually determined by an expert and then it is usually an early stage of deviation, which further significantly prevents the progression of postural irregularities.¹⁰

Several authors have dealt with similar problems of postural disorders and deformities of children of younger school age. Košinac² somatic examination revealed the frequent occurrence of mild forms of postural irregularities, on a sample of 261 respondents of primary school age, which cannot be claimed for the presence of more severe and extremely common forms of postural deformities. He states that deformities and irregularities differ significantly between the sexes and that girls have more problems in the frontal and sagittal planes, and boys with kyphotic posture, lowered arch of the foot and crooked neck. That the frequency of irregularities is present was proven in a sample of 968 respondents, where research showed that 36% of children are deformed, 55% with one and

9% with two or more deformities.¹¹ The analysis of the structure and frequency of postural disorders in younger adolescents confirmed the impaired posture of a large number of subjects, while the largest number had impaired status of the spine and shoulder blades.¹²

Due to the fact that postural deformities that occur at a younger school age are not only an aesthetic problem, but can cause pain, discomfort or result in permanent deformity, therefore the rationality of the study to indicate the possibility of correcting or minimizing some of the deformities. Therefore, the aim of the study is to point out the increasing presence of postural irregularities and deformities in school-age children of both sexes, and that regular exercise, active performance of targeted therapeutic exercises and corrective gymnastics can correct irregularities or minimize them.

Methods

Sample of participants

The research was conducted on a sample of 362 children (from 7 to 9 years) in the club "Carpe Diem" in Bijeljina, which deals with corrective gymnastics. Subjects were divided into two subsamples, according to gender (boys and girls). Of the observed total number of children, 62 children did not have any postural abnormalities and were excluded from the analysis of postural disorders. The rest of the participants, out of 300 children (114 males and 186 females), have some postural disorder, which will be analyzed in more detail in the table. The study was conducted in accordance with the Declaration of Helsinki.

Sample of variables

The subjects underwent somatic (lateral side - sagittal plane, anterior and posterior side - frontal plane) and X-ray examination, in order to notice the existence of postural irregularities and to record measures of deviation from normal. The somatic examination was performed during the first examination, immediately after the first visit to the club "Carpe Diem" in Bijeljina and a year after regular physical therapy and customized exercises in the club, to identify progress or stagnation of the postural problem. For this purpose, a set of 13 indicators (variables) was used, which indicate possible postural irregularities, namely ASRAG- head asymmetry, ASRAM- shoulder asymmetry, KRILL- wing blades, PECAR- bulging breast (pectus carinatum), PEEXA- concave breast (pectus excavatum), KIFOZ- kyphosis, HIPERL- hyperlordosis, SCHOLI- scoliosis, GEVAR- "O" legs (genu varum), GEVAL- "X" legs (genu valgum), GEREC- knee hyperextension (genu recurvatum), RASTO- flat feet and DIVPS- two or more postural irregularities.

Experimental program

Corrective gymnastics was used to correct and correct the observed deformities. The exercise program is designed to contribute to the development of muscle and bone tissue, the development of proper posture, the development and improvement of motor skills, as well as a better attitude towards life. The groups were formed on the basis of identified postural irregularities and deformities, which performed exercises to: increase the mobility of the whole body; strengthening weak muscles; stretching of shortened muscles; pelvic

girdle; mobility; as well as exercises with props; active, passive and assisted exercises; exercises for overcoming external resistance and breathing exercises. The program lasted one year, where exercises were performed three times a week for 60 minutes (3x60min) for mild deformities and six times a week for 60 minutes (6x60min) for more severe forms of postural irregularities.

Statistical analysis

All statistical analyzes were performed using SPSS Statistics 20 software (SPSS Inc., Chicago, IL). Postural problems were presented through a numerical value and percentage during the initial and final examination, as well as the number and percentage of subjects in whom postural deformity was eliminated after corrective exercise by various methods.

Results

Table 1 shows numerically and percentage data on children's postural problems during the first, initial somatic examination and X-ray. It can be clearly seen that the largest number of respondents is M with postural disorder SKOLI (n = 16; 14.04%), while the lowest percentage is with postural disorder ASRAM and DIVPS (n = 5; 4.39%). In F, SKOLI was dominant (n = 43; 23.12%), and postural disorder GEREC was least present (n = 5; 2.69%). Collectively, most participants had SKOLI (n = 59), which represents 19.67%, and the smallest number of participants had a deformity of PEEEXA (5%), while collectively, the most corrected deformity was SKOLI (n = 33; 20.75%).

Table 1. Postural deformities at first examination

Variables	Ini; M (n)	%	Ini; F (n)	%	In total	%
ASRAG	6	5.26%	11	5.91%	17	5.67%
ASRAM	5	4.39%	12	6.45%	17	5.67%
KRILL	10	8.78%	8	4.30%	18	6%
PECAR	9	7.89%	7	3.76%	16	5.33%
PEEXA	9	7.89%	6	3.23%	15	5%
KYPHO	13	11.40%	15	8.06%	28	9.33%
HYPERL	6	5.26%	18	9.68%	24	8%
SKOLI	16	14.04%	43	23.12%	59	19.67%
GEVAR	10	8.78%	10	5.38%	20	6.67%
GEVAL	7	6.14%	20	10.75%	27	9%
GEREC	6	5.26%	5	2.69%	11	3.67%
RASTO	12	10.53%	19	10.22%	31	10.33%
DIVPS	5	4.39%	12	6.45%	17	5.67%
n¹	114		186			
N					300	

Legend: ASRAG - head asymmetry, ASRAM - shoulder asymmetry, KRILL - wing blades, PECAR - bulging breasts (pectus carinatum), PEEEXA - sunken breasts (pectus excavatum), KYPHO - kyphosis, HIPERL - hyperlordosis, SKOLI - scoliosis, GOLAR - scoliosis, "Legs (genu varum), GEVAL - "X" legs (genu valgum), GEREC - knee hyperextension (genu recurvatum), RASTO - flat feet and DIVPS - two or more postural irregularities, Ini - initial (first) examination, M - male, F - female, N - total number of participants, n - subsample, n¹ - subsample by gender.

Table 2. Postural deformities after one year

Variables	Fin; M (n)	%	Fin; F (n)	%	In total	%
ASRAG	3	5.77%	7	7.87%	10	7.09%
ASRAM	3	5.77%	6	6.74%	9	6.38%
KRILL	6	11.54%	4	4.49%	10	7.09%
PECAR	2	3.85%	3	3.37%	5	3.55%
PEEXA	2	3.85%	4	4.49%	6	4.26%
KYPHO	4	7.69%	5	5.62%	9	6.38%
HYPERL	3	5.77%	10	11.24%	13	9.22%
SKOLI	7	13.46%	19	21.35%	26	18.44%
GEVAR	7	13.46%	4	4.49%	11	7.80%
GEVAL	4	7.69%	9	10.11%	13	9.22%
GEREC	3	5.77%	4	4.49%	7	4.96%
RASTO	5	9.62%	7	7.87%	12	8.51%
DIVPS	3	5.77%	7	7.87%	10	7.09%
n¹	52		89			
n²					141	

Legend: ASRAG - head asymmetry, ASRAM - shoulder asymmetry, KRILL - wing blades, PECAR - bulging breasts (*pectus carinatum*), PEEXA - sunken breasts (*pectus excavatum*), KYPHO - kyphosis, HIPERL - hyperlordosis, SKOLI - scoliosis, GOLOR - scoliosis, "Legs (*genu varum*), GEVAL - "X" legs (*genu valgum*), GEREC - knee hyperextension (*genu recurvatum*), RASTO - flat feet and DIVPS - two or more postural irregularities, Fin – final examination, M - male, F - female, n - subsample, n¹ - number of deformities by poles, n² - total number of deformities.

Table 2 also shows numerically and percentage (in relation to the uncorrected deformity) data on postural problems after one year (final examination) in relation to the number of deformities before the initial condition and the current one. In total, a smaller number of subjects with deformities (n = 141). In M, the largest number of deformities remained in SKOLI and GEVAR, 7 each, which is 13.46%, while in F the most dominant remained in SKOLI (n = 19; 21.35%). Regarding the total corrected deformities, the most dominant percentage is SKOLI (18.44%), which represents a similar number of postural problems of children at the initial examination, but this number is collectively lower (n = 26), and similarly applies to the PECAR deformity (n = 5; 3.55%) and PEEXA (n = 6; 4.26%) where we have the lowest percentage.

Table 3. Corrected postural deformities after physical therapy and exercise

Variables	CD; M (n)	Percentage in relation to corrective deformity	CD; F (n)	Percentage in relation to corrective deformity	In total	%
ASRAG	3	4.84%	4	4.12%	7	4.40%
ASRAM	2	3.23%	6	6.19%	8	5.03%
KRILL	4	6.45%	4	4.12%	8	5.03%
PECAR	7	11.29%	4	4.12%	11	6.92%
PEEXA	7	11.29%	2	2.06%	9	5.66%
KYPHO	9	14.52%	10	10.31%	19	11.95%
HYPERL	3	4.84%	8	8.25%	11	6.29%
SKOLI	9	14.52%	24	24.74%	33	20.75%
GEVAR	3	4.84%	6	6.19%	9	5.66%
GEVAL	3	4.84%	11	11.34%	14	8.81%
GEREC	3	4.84%	1	1.03%	4	2.56%
RASTO	7	11.29%	12	12.37%	19	11.95%
DIVPS	2	3.23%	5	5.15%	7	4.40%

n¹	62	97
n²		159

Legend: ASRAG - head asymmetry, ASRAM - shoulder asymmetry, KRILL - wing blades, PECAR - bulging breasts (*pectus carinatum*), PEEEXA - sunken breasts (*pectus excavatum*), KYPHO - kyphosis, HIPERL - hyperlordosis, SKOLI - scoliosis, GOLAR - scoliosis, "Legs (*genu varum*), GEVAL - " X "legs (*genu valgum*), GEREC - knee hyperextension (*genu recurvatum*), RASTO - flat feet, DIVPS - two or more postural irregularities, CD - number of corrected deformities, M - male gender, F - female, n - subsample, n¹ - number of corrected deformities by sex, n² - total number of corrected deformities.

Table 3 shows numerically and percentage corrected postural deformities in M and F, after one year of targeted exercises and applied corrective gymnastics, as well as percentages in relation to the total number of corrected postural deformities. The largest shift in M, ie reduction of postural problem is in KYPHO and SKOLI (n = 9; 14.52%), while in F the highest percentage of correction (24.74%) occurred in SKOLI (n = 24). When looking at the total number of corrected or corrected deformities, the largest shift was achieved in SKOLI (n = 33), which represents a percentage of 20.75%, followed by KYPHO and RASTO with 11.95%, or a total of 19 corrected deformities.

Discussion

The aim of the conducted research is to indicate the degree of occurrence of postural problems in children of younger school age. Previously, various forms of postural irregularities in children were presented, and the results of the research achieved the basic goal, which is the evident presence of postural irregularities in children of younger school age, especially during the first somatic examination.

Today's, mostly, sedentary lifestyle, spending a lot of time in front of the TV and computer, reduced physical activity, leads to various health problems, from increasing obesity to various postural irregularities. Most pains in adults are not the result of an injury, but originate from childhood or adolescence. Corrective gymnastics included therapeutic exercises, which aimed to restore the balance between the muscles and the musculoskeletal system, and if this was not possible, it was necessary to prevent further progression of the deformity in the future. This is especially true when it comes to spinal deformities, because it requires a long process of exercise and engagement, both by the child and by parents as support and a professional working on repairing the deformity, which has been proven to be well chosen and adequate. the applied therapeutic program provides the possibility of stopping the deformity or its partial correction completely.¹³⁻¹⁵

Children who had one or more postural disorders present regularly came to trainings, performed individual and group exercises, and after a period of one year, and after re-somatic examination, the results of the study indicated that the number of children with postural disorders decreased (n = 159, 53%), which indicates that regular exercise can reduce posture irregularities to a minimum, or eliminate them altogether. In the observed age of the child, regular work, perseverance and persistence, the degree of irregularity of a particular part of the body can be minimized, or, in the case of severe deformity, prevent the progression of postural irregularities, which after the development cycle can create many problems and make it difficult to perform. daily routine activities, as evidenced in this study. Timely action,

detection of posture irregularities, as well as prevention of its occurrence, is extremely important for the health of the human being.

Based on the data presented in Table 1, the existence of postural problems in children is evident. Considering the sample size of 362 children, only 17.13% of children did not have a recorded postural problem (the stated percentage of children reported to the club recreationally). The rest, out of 300 children, represent the sample on the basis of which the examination was performed, which implies that as many as 83% of children have a certain postural deformity. Observing the presented parameters (postural problems), as many as 43 girls have scoliosis, 20 girls have "X" legs, 19 flat feet, 18 hyperlordosis and 15 kyphosis. The previously mentioned postural problems are also more pronounced in boys. When it comes to KRILL and KYPHO, we see that this deformity was corrected in M by 6.45% and 14.52%, and in F by 4.12% and 10.31%, because we know that kyphosis at the age of 6 to 8 years is a consequence of wing blades.¹⁶ This may be due to the fact that the wing blades usually follow the round shoulders¹⁷, which can change the normal mechanics of the neck and back where the result may be kyphosis.¹⁸ What should be noted is that at this age the pelvis begins to lean backwards, reducing lordosis and flattening the abdomen and at this stage boys are taller than girls, but this trend reverses at the age of eleven or twelve when girls reach puberty and begin to grow more of boys.¹⁹

After the established existence of the postural problem, the process of continuous work and exercise with the child began. The progression of postural irregularities was stopped or minimized by regular individual exercise or group exercise six times a week, depending on the degree of postural irregularities, and some subjects exercised twice a day, or 12 times a week. 70% of the respondents had individual training, with targeted exercises, for 10 consecutive hours per week, in order for the exercises to be performed correctly and adequately, which showed results after a year of exercise. After individual training, the therapeutic program yielded results through group exercise. Each of the respondents performed targeted exercises, in accordance with the postural problem they have.

Conclusion

The obtained research results indicate the importance of regular exercise, with the application of adequate and targeted exercises, in accordance with the postural status of the child. The postural status of the examined population of young school-age children is worrying, and can serve as a significant factor in the prognosis of the growing occurrence of postural irregularities. The limitation of the conducted study is reflected in the lack of transit measurement, monthly or quarterly, in order to, with the application of therapeutic and kinesiological exercises, to notice potential progress in a shorter period of time. From the aspect of time dynamics, the process of poor posture transformation can be expected, and for such children it is necessary to provide regular controls and appropriate exercises. The implementation of corrective exercises in the school curriculum would significantly contribute to the reduction of postural disorders, ie the growth of functional postural disorders into structural disorders.



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