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The effect of comprehensive rehabilitation on correcting muscle imbalance in rural children from the Warmia and Mazury region

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ABSTRACT

Introduction: A complex problem concerning the disability of rural children stems from the specificity of a rural environment. Such an environment frequently serves as the source of negative stimuli, thus leading to muscle imbalances in children. Negative stimuli affecting personality, that children are exposed to sometimes for years, result in a local strain in a child's young organism, and then, commonly, in motor system dysfunctions. In this connection, muscle imbalance develops; whereas muscle balance conditions a correct body posture and appropriate functioning.

Aim: The aim of this study was to discover the sources of negative influences affecting a rural child's development and to design effective preventive measures. Consequently, the intended objective of the designed program was to provide professional rehabilitation for the largest number of children and youth having motor system dysfunctions as well as emotional disorders. Another goal of this program was to determine the effect of comprehensive rehabilitation on correcting muscle imbalance in rural children.

Materials and methods: This study comprised 50 children (30 girls and 20 boys) participating in a rehabilitation course designed for rural children as a three-week program. Children were examined by employing a specially devised chart of examinations and procedures in order to analyze and evaluate their functional problems in detail.

Results and discussion: A comprehensive rehabilitation program implemented by a team of therapists was in many cases beneficial with respect to rehabilitation outcomes: the restoration of muscle balance generated a decrease in or disappearance of the functional problem. Such improvement mostly involved children diagnosed with a shortened lower extremity, kyphosis (round back), winged scapula, or a low-grade functional scoliosis.

Conclusions: Examination results indicate that comprehensive therapy is required. Combining physical rehabilitation with psychotherapy eliminates the sources of negative stimuli that lead to the appearance of or to the increase in the motor system dysfunction.

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A child's conscious involvement in the therapeutic process and work performed in the framework of autotherapy are also very important.

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1. Introduction

People with disabilities are regarded in the European Union as one of the social groups at risk for social exclusion. This is caused mostly due to negative social attitudes, difficult access to, e.g., public utility facilities, low levels of education and employment, insufficient support regarding education, and high additional costs connected with the disability.^{8,12,16,17,23,24}

A large number of rural children with disabilities is particularly worrying. Disabled children from rural regions comprise 18% of the population. This results mostly from privation common to rural areas. Destitution contributes to a passive attitude towards one's fate and that of one's family. Basic problems concerning making one's living frequently veil the need to rehabilitate a child having a disability.^{9,14,17}

In 2003, by the initiative of the Local Branch of the Agricultural Property Agency in Olsztyn, the Warmia and Mazury Branch of the Sovereign Military Order of Malta and the 103rd Military Hospital in Olsztyn, a rehabilitation program was designed for children of former employees of the state agriculture farms from the Warmia and Mazury Region.

2. Aim

The aim of this study was to discover the sources of negative influences affecting a rural child's development and to design effective preventive measures. Consequently, the intended objective of the designed program was to provide professional rehabilitation for the largest number of children and youth having motor system dysfunctions as well as emotional disorders. Another goal of this program was to determine the effect of comprehensive rehabilitation on correcting muscle imbalance in rural children.

3. Materials and methods

This study comprised 50 patients undergoing rehabilitation in the Rehabilitation Center at the 103rd Military Hospital in Olsztyn within the framework of the program named *Rehabilitation of children from post-state farms environments*. This program was implemented in the period of 2003–2007. Children qualified

for this study were heterogeneous with respect to dysfunctions, including congenital defects, postural defects and post-traumatic conditions. A separate control group was not designed. This decision was grounded in the assumption that each rural child qualified for this program should maximally benefit from comprehensive rehabilitation offered because all children required therapy and for many this was the only opportunity to participate in rehabilitative activities.

The study group consisted of 30 girls and 20 boys, aged 7 to 18 years old (average age 12 years). Children participated in three-week rehabilitation courses conducted in the Rehabilitation Center. During these courses, children underwent complex rehabilitation designed according to their individual needs. They also participated in psychotherapy sessions and educational classes, as well as enjoyed recreational activities.

In order to conduct a comprehensive evaluation of each patient's condition, a chart of examinations and procedures was designed as well as a chart evaluating posture and a chart assessing static muscle balance according to Rakowska.¹⁶ These charts were created with a view to provide the largest possible volume of information allowing researchers to analyze thoroughly the problems of each child qualified for a rehabilitation course.

Posture chart was mainly based on a visual evaluation; whereas a chart of examinations and procedures comprised detailed data such as: interview focused on those spheres of life that can have a negative impact on a child, functional disorders, gait analysis, functional examination, cause of dysfunction, therapeutic aim, devising an individual program, indications for further therapy, also at home.

A detailed examination assessing static muscle balance was an important stage when devising an individual therapeutic program for each child.^{16,17,19}

The following muscles were examined and assessed: rectus femoris, iliopsoas, biceps femoris, adductors, piriformis, quadratus lumborum, gastrocnemius, levator scapulae, pectoral, rectus capitis muscles.

Imbalance observed in any of these muscles was an indication for designing a program of autotherapy in order to eliminate their contractures in the shortest possible time.

The program devised for a three-week rehabilitation course included: general exercises, individual exercises intended to restore muscle balance, therapy conducted according to

Table 1 – The most frequent motor system dysfunctions in rural children.

Sex	Dysfunction					
	Scoliosis	Valgus knee	Round back	Gait disorder	Poor physical efficiency	Multiple defects
Girls	16	8	18	12	8	24
Boys	12	6	16	9	6	14
Total	28	14	34	21	14	38

Veronica Sherborne's method, scoliosis therapy according to the proprioceptive neuromuscular facilitation (PNF) method, kinesiology exercises according to Denisson, autotherapy, relaxation exercises, physiotherapy and hydrotherapy, psychotherapy, and recreational activities.^{13,15}

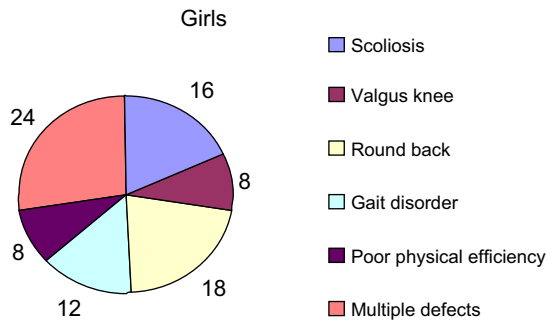


Fig. 1 – Prevalence of particular dysfunctions in girls.

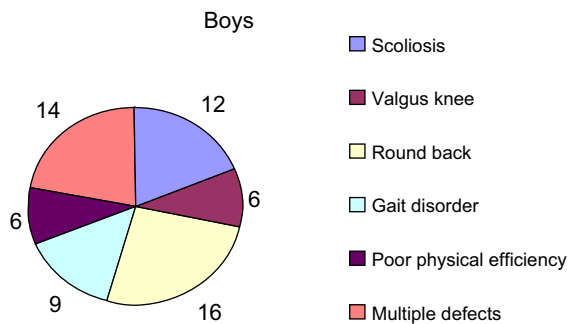


Fig. 2 – Prevalence of particular dysfunctions in boys.

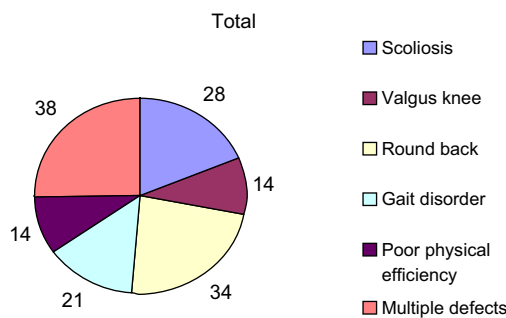


Fig. 3 – Prevalence of particular dysfunctions in both boys and girls.

4. Results

A three-week period devoted to comprehensive rehabilitation of children with various motor system dysfunctions contributed to eliminating many factors causing or exacerbating particular dysfunctions. Based on detailed examinations, the main functional problems were determined (Table 1); on the basis of the muscle balance examinations, it was established that contractures detected in all children either caused or exacerbated the existing dysfunctions (Figs. 1-3; Table 2). Comprehensive rehabilitation combined with psychotherapy allowed us to largely eliminate muscle contractures in children, and consequently to improve their postures considerably. Children diagnosed with multiple defects or poor general physical efficiency achieved good functional results after three weeks of physical therapy combined with psychotherapy (Fig. 4). In many cases, the restoration of mental balance was especially valuable since it facilitated a decrease in muscle tone that frequently was the primary cause of incorrect body postures (Table 3). Children in whom complete normalization of muscle balance was not achieved were provided with an autotherapy program to be followed at home.

As a result of the conducted therapy, 50% of children learned how to sit correctly by mobilizing the pelvis; 35% of rehabilitated patients were able to correct their postures themselves; whereas 15% of children eliminated features of gait abnormality.

5. Discussion

Children were qualified for the rehabilitation program by family physicians at the patients' places of residence. Various dysfunctions were diagnosed: from postural defects to post-traumatic conditions. The selected children functioned under extremely difficult living conditions; poor social conditions

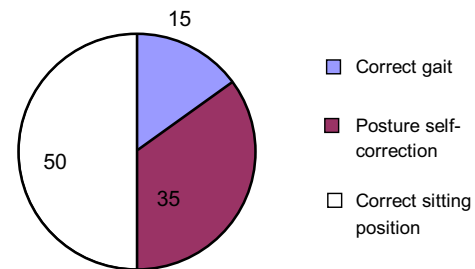


Fig. 4 – Improvement with respect to particular functions (in percentages).

Table 2 – Most often contracted muscles before the therapy.

Sex	Muscle								
	Rectus femoris	Iliopsoas	Biceps femoris	Piriformis	Quadratus lumborum	Gastrocnemius	Levator scapulae	Pectoral	Rectus capitis
Girls	16	25	21	8	7	5	6	23	7
Boys	18	20	19	4	6	8	9	14	4
Total	34	45	40	12	13	13	15	37	11

Table 3 – Muscle balance after a two-week rehabilitation.

Sex	Muscle								
	Rectus femoris	Iliopsoas	Biceps femoris	Piriformis	Quadratus lumborum	Gastrocnemius	Levator scapulae	Pectoral	Rectus capitis
Girls	8	16	12	4	5	3	1	14	4
Boys	12	8	13	1	3	4	4	6	2
Total	20	24	25	5	8	7	5	20	6

and alcohol addictions commonly found in their environment affected their health significantly.

Negative atmosphere at home has an adverse impact on a child's psyche. A child exposed to such atmosphere functions in a state of increased tension, stress and uncertainty for long periods of time. Apart from the home environment, both school and the surrounding community often contribute to creating stressful conditions in which a child grows up. Negative stimuli affecting personality, that children are exposed to for months or years, result in a local strain in a child's young organism, and then in motor system dysfunctions. Defending oneself against stress, a child, often unconsciously, escapes from the surrounding problems and withdraws. This sometimes leads to muscle imbalance.^{3,5,18}

Static muscle balance occurs when the normal length of tonic muscles is balanced by an appropriate strength of phasic muscles. Disturbances in this balance appear because of contractures in tonic muscles and diminishing the strength of phasic muscles. This condition leads to disturbing a correct body posture, whereas the organism is forced to use up its energy in order to adapt itself to gravitational forces.^{17,20}

Maintaining a correct posture requires an ideal balance with respect to the work of agonist and antagonist muscles. Tonic muscles, responding to strain, increase resting muscle tone, which leads to contractures. An inhibitory mechanism, i.e., antagonists (phasic muscles) strength reduction, is a physiological reaction to tonic muscles overstrain.^{2,11} In order to strengthen phasic muscles, the mechanism of reciprocal inhibition needs to be eliminated through stretching and reducing the excessive resting tone of tonic muscles. Static muscle balance is extremely important for a correct functioning of the mechanism involving an upright standing position, because it conditions the physiological ranges of motion of the joints of the vertebral column and peripheral joints, physiological tonus of periarticular structures, conscious relaxation ability, diminishing a tendency towards reactions involving the increased isometric tone of the muscles while under great stress.^{1,2,22,23,24}

Disturbing this balance is manifested by the loss of elasticity in anitgravitational, tonic muscles, working mainly statically, caused by their contractures. This, in turn, facilitates a decrease in strength of the antagonists – phasic muscles. They become amyotonic and no longer support a correct posture. Physiological ranges of motion of the peripheral joints of the vertebral column become limited. The body's elasticity and strength are diminished; thus, the ability to consciously relax muscles disappears. The body becomes more susceptible to reactions involving increased

muscle tone and an unusually strong reaction is caused by an insignificant stimulus.^{4,6,7}

Postural stability is related to the processes occurring in the central nervous system. Controlling one's posture is connected with assuming a specific position, and thus silhouette. Disturbances in postural stability depend on one's physical activity and interactions with the surrounding environment. An uneven distribution of the musculoskeletal mass, differentiated joint range of motion in various planes, distribution and sensitivity of deep receptors significantly affect the spatial position of the body.^{7,10,11,19,21}

6. Conclusions

1. Comprehensive rehabilitation involving physical therapy combined with psychotherapy is beneficial through eliminating those sources of negative stimuli that cause or exacerbate motor system dysfunctions in rural children.
2. Conscious involvement of a child in the therapeutic process, as well as autotherapy, can largely shorten the time required for restoring the complete fitness of rural children.

Conflict of interest

None declared.

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