

# THE CONCEPT OF TREATMENT OF SCOLIOSES EMPLOYING ASYMMETRICAL AQUATIC EXERCISES

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**Abstract.** According to the statistical data, there is being observed a definite increase in percentage of children affected by posture defects, particularly scolioses. The aquatic environment facilitates treatment of scolioses, since it provides relief conditions used in order to perform prophylactic, corrective and therapeutic tasks. Hydrokinetic therapy is one of the many rehabilitation methods. It seems, however, that corrective and therapeutic swimming is far too rarely used as an auxiliary measure for treatment of scolioses. This paper presents the concept of treatment of scolioses employing asymmetrical exercises in aquatic environment, the author of which in Poland is Iwanowski. In the study desk research of literature studies was applied along with the analysis of publications, including available study reports, articles, documents and also own video and photographic materials. The author suggests the concept of conservative treatment of scolioses through the application of asymmetrical swimming exercises in aquatic environment. Such procedure is efficient in preventing significant spinal deformations, which may protect against surgical intervention.

**Key words:** corrective and therapeutic swimming, asymmetric swimming exercises, hydrokinetic therapy, rehabilitation in water, scolioses

## Introduction

The results of studies, carried out in different regions of the country, regarding evaluation of body posture found significant percentages (from 32.5 to 93.2%) of children and youth with apparent abnormalities within the scope of motor organ and body statics (Janiszewska et al. 2009; Łubkowska 2003, 2012; Maciałczyk-Paprocka et al. 2011, 2012; Mrozkowiak 2007; Stoliński and Kotwicki 2011; Żukowska 2012; Żukowska et al. 2014).

Advanced scolioses, which in Poland are also called lateral spinal distortions, are particularly hazardous to health. The incidence of this dysfunction amounts to 4–18% of the general population, depending on a source (Grudzień 2012). In children and youth the most numerous group of scolioses are the so-called idiopathic scolioses, without determined etiology – 80–90% (Kasperczyk 2002; Schleip et al. 2005, 2007; Szulc 2011). It is probable that there exists a relation between distortions in proprioception and development of scolioses (Keesen et al. 1992). The

studies carried out by the team of Łubkowska et al. (2000) and Łubkowska and Troszczyński (2011), regarding the scope of the shape of posterior and anterior curvatures of the spine in children and youth demonstrated that they may be a symptomatic element in diagnosing scolioses. When planning physiotherapy sessions for children with idiopathic scoliosis (IS) the spine mobility should be systematically evaluated (Łubkowska et al. 2014). Any symptoms of body posture asymmetry should not be underestimated by treating them as manifestations of individual variation (Zeyland-Malawka and Prętkiewicz-Abajcew 2006). The team of Łubkowska et al. (2002) considered detecting asymmetry symptoms and striving to eliminate them the appropriate course of action. The team of Czaprowski et al. (2011) demonstrated that the excessive spinal mobility appears more often in children with idiopathic scoliosis (51.4%) than in healthy children (19%). Using one arm (right or left) predominantly is detrimental from the point of view of the body functions (Zeyland-Malawka and Prętkiewicz-Abajcew 2006), and Starosta (1993, 2012) sees a symmetrization of movements as a measure preventing spinal deformation and injuries in sports. Diagnosing asymmetry is not time-consuming and is based on tests that are easy to carry out. They can be carried out by means of a Bunnel's scoliometer (Kotwicki 2008, 2011), the presence of which in each primary school would be a valuable objective of the health policy (Stoliński and Kotwicki 2011). In the United States and Europe this device is used for screening tests in kindergartens and schools (Kotwicki 2011).

In the reference books regarding conservative treatment of scolioses exercises that stabilize scoliosis and active triplanar self-correction exercises carried out in functional positions with the use of proprioceptive stimulation and biofeedback dominate. The possibilities of using manual therapy in treatment of scoliosis are demonstrated. The studies conducted by Białek (2011) and Białek and M'hango (2008) showed a significant reduction in scoliosis angle within a very short period as a result of manual therapy, post-isometric exercises for relaxation of cramped muscles and strength training of weakened muscles. The advantages of Active Movement Participation (AMP) during manual myofascial release within the scope of chest (Schleip 2003) are also underlined. Balls and elastic tapes (Schleip et al. 2005, 2007), triplanar scoliosis correction device (Haręźlak 2005) and scoliosis self-correction device with pelottes (Rusin et al. 2007) are employed.

An alternative for children and youth with idiopathic scoliosis is corrective and therapeutic swimming and corrective swimming exercises that take place in relief conditions thanks to the properties of the aquatic environment (Łubkowska et al. 2014) and constitute a method for relaxing muscles (Starosta 2012).

Despite the variety of methods and differences in the therapeutic procedure, the treatment of scolioses is still one of the main problems of physiotherapists, rehabilitation therapists, physical education teachers and corrective gymnastics teachers. Haręźlak and Ślężyński (2009) are of the opinion that, unfortunately, it happens too often that the inefficiency of corrective actions is explained by idiopathic nature of distortions. The more likely cause of lack of corrective effects should rather be sought within the methodology adopted and sometimes also in insufficient abilities to apply it.

Depending on the views on the complex process of changes that accompany scolioses, either symmetrical exercises or asymmetrical exercises exclusively are preferred. As Grudzień (2012) rightfully notes, the current knowledge on the pathomechanics of scolioses speaks clearly in favour of asymmetrical exercises. The asymmetrical therapy conducted by the author slowed down the progression of scolioses. Additionally, an earlier view suggesting that a strong muscular corset provides protection against progression of distortions and results in correction of it has not been confirmed either scientifically or empirically (Grudzień 2012). Irrespective of these disputes, most of the experts in the field do not question the necessity of concurrent triplanar correction of scolioses.

This paper presents the concept of treatment of scolioses employing asymmetrical exercises in aquatic environment. The aim of this elaboration is the attempt to evaluate the significance of asymmetrical swimming exercises as a factor forming the posture of children and youth with lateral dystonic distortion of the spine. Additionally, selected corrective and therapeutic exercises in aquatic environment with application of various forms of swimming are presented. In the study desk research of literature studies was applied along with the analysis of publications, including available study reports, articles, documents and also own video and photographic materials. The concept of asymmetrical swimming exercises

The corrective and therapeutic swimming in cases of scolioses with application of asymmetric swimming exercises was suggested for the first time in Poland by Iwanowski (1997). In hydrokinetic therapy of scolioses, in asymmetrical exercises the correction is achieved by appropriate asymmetrical positioning of the body and diagonal positioning of the lines of shoulders and hips. This concept requires individual selection of corrective, hypercorrective and isolated output positions. They enable a triplanar influence. The basis for rational corrective actions is an inquisitive analysis of each case. The influence on the spine takes place through asymmetrical mobilization of muscular, ligamental and fascial structures on the concave side of the distortion and relaxation of structures and derotation of the convex side. This method is included among difficult treatment methods since it requires high qualifications of the person conducting the sessions.

Asymmetric swimming should not be applied:

- in multiple curve scolioses,
- in double curve scolioses with short curves located close to each other,
- in scoliosis with small curve arc (Iwanowski 1997).

### Static scheme of Rubcowa

In order to analyze the influence of asymmetrical swimming exercises on lateral distortions of the spine, Iwanowski (1997) used the static scheme of Rubcowa, determining static changes in standing position, depending on the positioning of the shoulder line and hip line. It is characterized by the following:

- a) the spine maintains a vertical straight line during symmetrical parallel positioning of the shoulder line and hip line;
- b) with diagonal position of the shoulder line the spine bends in the thoracic section in the direction of the raised shoulder;
- c) with diagonal position of the hip line bending of the spine in the lumbar section takes place, with its bulge directed towards the lowered hip.

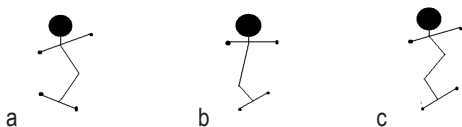
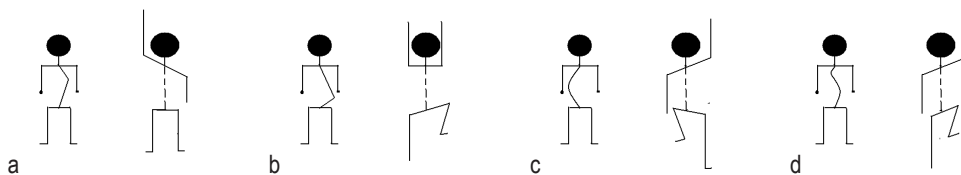


Figure 1. The static scheme specifying spinal changes depending on the positioning of the shoulder and hip lines

This scheme can be used for planning corrective exercises for particular cases of scoliosis. In the aquatic environment, particularly in the lying position, the spine behaves slightly differently. Iwanowski (1997) underlines that e.g. in swimming exercises only the maximum pull-up of a lower extremity results in change to the line of the lumbar section, in contrast to the standing position where each change in the hip line results in the spine bending in the frontal plane.

Making such assumptions and analyzing them in practice, Iwanowski (1997) found that:

- in a single curve thoracic scoliosis what has a decisive influence on the distortion correction is the position of shoulders, which is controlled by proper arrangement of upper extremities (top-down control). Extending an arm on the concave side of the distortion forwards and upwards and bringing the arm close to the body on the convex side results in maximum reduction of the distortion. The legs should be straightened and joined, which guarantees an even positioning of the hip line (Figure 2a);
- in a single curve lumbar scoliosis it is the arrangement of lower extremities that decides on the distortion correction (bottom-up control). The leg on the convex side of the distortion should be bent in the hip joint and knee joint, and the leg on the concave side should be straightened. The arrangement of arms should ensure an even positioning of shoulders - the arms should be straightened and stretched to the front (Figure 2b);
- in a single curve thoracic-lumbar scoliosis the correction depends on diagonal positioning of the shoulder line and hip line, so the arrangement of both arms and legs. On the convex side the arm should be placed along the torso and the leg should be bent in the hip and knee joints, while on the concave side both the arm and leg should be straightened and extended (Figure 2c);
- in a double-curve thoracic-lumbar scoliosis the corrections are also achieved by asymmetric positioning of the shoulders and hip lines. A corrective position in such case is the sum of arrangements of extremities in a single curve thoracic scoliosis and single curve lumbar scoliosis, so the arm is straightened and extended on the concave side of distortion and the arm on the convex side of the thoracic distortion the arm remains along the torso. As for the legs, the one on the convex side of the lumbar distortion should be bent and the one on the concave side should be straightened (Figure 2d).

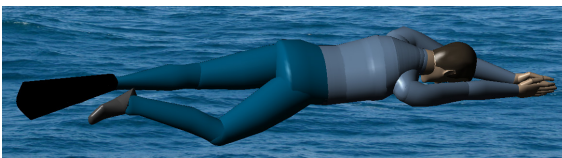


**Figure 2.** Positions of the shoulder and hip lines and movement of extremities recommended for correction in case of: a) single curve thoracic right-sided scoliosis, b) single curve right-sided lumbar scoliosis, c) single curve thoracic-lumbar left-sided scoliosis, d) double curve thoracic-lumbar left-sided scoliosis



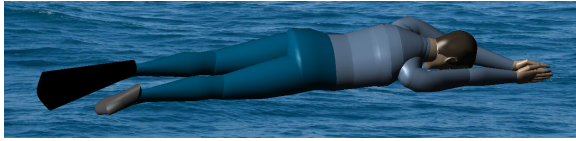
**Figure 3.** Example of the effect of exercising on a single curve thoracic-lumbar right-sided scoliosis. As a result of movement of extremities, the spine bent to the left. Output position: prone position, the arm on the concave side of distortion is straightened along the long axis of the torso, while the other arm is moving like in breaststroke, the leg on the concave side does not move and the leg on the convex side of the distortion moves like in breaststroke

Source: author's own materials. Corrective swimming classes with students of the physical education major at the Physical Education and Health Promotion Faculty of the University of Szczecin.



**Figure 4.** Example of the exercise for a single curve lumbar right-sided scoliosis. Output position: prone position, the arms move like in breaststroke, legs: right leg moves like in breaststroke, left one with a flipper is still

Source: author's own materials. Corrective swimming classes with students of the physical education major at the Physical Education and Health Promotion Faculty of the University of Szczecin.



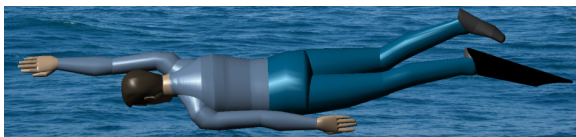
**Figure 5.** Example of the exercise for a single curve lumbar left-sided scoliosis. Output position: prone position, both arms are still, both legs oscillate like in crawl on the chest – a flipper is worn on the leg on the convex side of the distortion



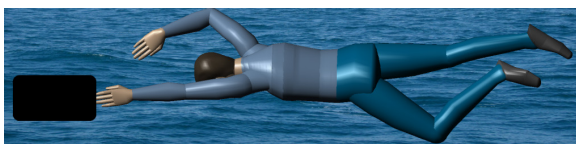
**Figure 6.** Example of the exercise for a single curve thoracic left-sided scoliosis. Output position: prone position, the arm on the concave side of distortion is extended along the long axis of the body, the other arm is close to the torso, legs are oscillating



**Figure 7.** Example of the exercise for a single curve thoracic right-sided scoliosis. Output position: prone position, the arm on the concave side of distortion is extended along the long axis of the body, the other arm moves like in breaststroke, legs are oscillating



**Figure 8.** Example of the exercise for a single curve thoracic-lumbar left-sided scoliosis. Output position: prone position, the arm on the concave side of distortion is extended along the long axis of the body, the other arm is close to the torso, legs are oscillating - a flipper is worn on the leg on the convex side of distortion



**Figure 9.** Example of the exercise for a double curve thoracic-lumbar right-sided scoliosis. Output position: prone position, the arm on the concave side of distortion is with board and is straightened along the long axis of the body, while the other arm is moving like in breaststroke, the leg on the convex side is straightened and the other moves like in breaststroke

## Discussion

The issue of posture defects, including scolioses, is still valid. The use of aquatic environment as one of the forms of supplementation of treatment procedure is well known. The relief provided by the aquatic environment causes the muscles to relax, which facilitates maintaining correct posture (Barczyk et al. 2005, 2009; Barczyk-Pawelec et al. 2012; Bulicz and Murawow 2004; Deskur and Zawadzki 2006; Iwanowski 1997; Łubkowska et al. 2014; Naal et al. 2007; Nonn-Wasztan et al. 2011; Nonn-Wasztan 2012; Ozer et al. 2007; Pasek et al. 2009; Radzimińska et al. 2013; Rożek et al. 2005; Rusin et al. 2007; Różański and Dorosz 2002; Sefańska and Zawadzka 2006; Stefańska et al. 2008; Tuzinek 2004; Weber-Nowakowska et al. 2011). The spasticity is reduced and thus it is possible to make movements within a larger painless scope, which would be difficult to achieve in the conditions of a gymnasium (Pasek et al. 2009; Radzimińska et al. 2013).

As a result of many years of research and investigation, Iwanowski (1997) confirmed the therapeutic influence of aquatic environment and the efficiency of asymmetrical swimming exercises for treatment of scolioses. In the experiment conducted, he discovered, on the basis of radiological examinations, that the progress of distortion was halted in 80% of children examined, with the group that noted improvement having average reduction of distortion angle by  $8.45^\circ$  and the group that did not note any changes – by  $1.24^\circ$ . The experiment encompassed all the therapy stages (1st, 2nd and 3rd), according to the methodology of hydrokinetic therapy procedure suggested by Iwanowski (1997). The average length swum during the whole experiment for the people who achieved improvement amounted to 137 800 meters, which gives on average 880 metres swum during a single hour of classes (total amount of swimming hours – 156.5). The therapy applied showed that the thoracic-lumbar and thoracic scolioses respond best to correction.

Until now, there have been no analytic studies within that scope in the literature that could be used for comparing the study results obtained. In the Roman Liszka School Corrective and Compensatory Gymnastics Centre in Bielsko Biała, asymmetrical exercises conducted in aquatic environment are applied as a supplementation of the applied concept of asymmetrical exercises for correction of lateral spinal distortions (Rusin et al. 2007). It includes exercises on a triplanar scoliosis corrector, lumbar section scoliosis corrector and asymmetric equipment-free exercises. The cyclic clinical and radiologic examinations of about a thousand permanent participants of corrective classes within the age range from 7 to 19 in the Centre showed a large percentage of improvements and stabilizations of spinal distortions (Haręźlak and Ślężyński 2009).

Deskur and Zawadzki (2002) suggested a corrective aquatic procedure program scheme taking into account examinations of body posture and corrective exercises in a hall conducted simultaneously with aquatic classes. The same authors (Deskur and Zawadzki 2006) demonstrated a positive impact of corrective aquatic exercises on lateral spinal distortions in 40% of children examined. The program of corrective aquatic exercises encompassed asymmetrical breathing exercises. Within the framework of the program presented, the corrective aquatic exercises conducted allowed to obtain a reduction in spinal distortion and approximation of distortions of particular spinal sections in the sagittal plane down to physiological values in children with body posture defects and lateral spinal distortions. The changes in transverse plane receded. Selected organizational issues within the framework of corrective exercises and corrective swimming in case of scolioses in school-age children were presented by Wiażewicz and Zawadzki (2014).

## Conclusions

The concept of application of asymmetrical swimming exercises in aquatic environment has two aspects of influence – therapeutic and prophylactic. Such procedure is efficient in preventing significant spinal deformation, which may protect against surgical intervention, constituting a conservative treatment for scolioses.

However, asymmetrical swimming exercises are employed far too rarely as a supplementary measure in treatment of scolioses, in spite of the fact that the aquatic environment facilitates the therapy of these ailments, enabling various types of swimming movements and combinations of exercise movements.

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