

# Corrective Exercises in Multimodality Therapy of Idiopathic Scoliosis in Children – Analysis of Six Weeks Efficiency – Pilot Study

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**Abstract.** The program of the special corrective exercises according to Schroth method in H. R. Weiss modification was carried out in multimodality conservative therapy of idiopathic scoliosis in our clinic. For efficiency of treatment to be evaluated 21 patients were joined into a group. They were treated with the six weeks program. Initial state of musculoskeletal system and efficiency of therapy were evaluated with instrumental diagnostic techniques: the computer optical topography, the electromyography of paravertebral muscles and the stabilometry. According to the data of clinical investigation and instrumental testing the Schroth program of therapeutic exercises modified by H.-R.Weiss improves efficiency of therapy in children with idiopathic scoliosis.

**Keywords.** Schroth method, idiopathic scoliosis, conservative treatment

## Introduction

Therapeutic exercises are the one of the basic principles of idiopathic scoliosis conservative treatment. Such exercises programs in Russia are usually referred to strengthening of patient's muscles and quite effective in scoliotic deformity less than 15° according to Cobb. Further progression of the disease process among these patients leads to frank three dimensional abnormalities of a trunk, respiratory abnormalities and postural muscle disbalance [1] and demands more precise approach for corrective therapeutic exercises to be chosen. The conception of therapeutic exercises based on three dimensional spine correction and keeping of postural balance with application of special breathing exercises were first elaborated by Christa Lehnert-Schroth, Germany [3] and Hans-Rudolf Weiss, Germany [4].

The method of conservative multimodality therapy of children with idiopathic scoliosis has been practiced in our clinic since 1960. In 2010 the program of special corrective exercises Hans-Rudolf Weiss «Best Practice» [4] was carried out in multimodality conservative therapy of idiopathic scoliosis. The basis of this program is the special corrective breathing exercises in accordance with Katharina Schroth method [3].

## **The aim**

To evaluate efficiency of the «Best Practice» Hans-Rudolf Weiss (Germany) therapeutic exercises program in multimodality therapy of idiopathic scoliosis in children treated in our clinic.

## **1. Materials and Methods**

21 female patients aged from 13 to 15 (mean age 13, SD 1.3) with scoliosis (King IV) and value of Cobb angle from 28° to 50° (average angle 33°, SD 7.2) were joined into one therapeutic group. The patients were treated for six weeks. They had daily multimodality therapy except weekends.

*The program of therapeutic exercises consisted of:*

- Symmetric exercises for sagittal profile correction (physio-logic). Exercises for mobility of lumbar lordosis and thoracic kyphosis improvement (“Catwalk”) were used. The aim of the exercises was an impact on lumbar lordosis at L2 level. Further exercises in sitting and standing positions should have kept lumbar lordosis (standing position “NUBA”) in the patients.
- The program of three dimensional trunk correction (“3-D Exercises made easy”). In initial standing position the patients were instructed how to achieve 3-D trunk correction with using of asymmetric diaphragmatic breathing (Fig. 1).
- Asymmetric exercises according to Schroth method in H. R. Weiss modification. Initial standing and sitting positions and position with side-shifting which allowed achieving effective postural 3-D correction and asymmetric rotational breathing were specified in accordance with type of scoliotic deformation. As soon as corrective positions had been mastered, postural stabilization was achieved with isometric muscle tension (Fig. 2).
- Maintenance of the corrected posture with principles of activity of daily living (ADL). The patients were taught to take corrective positions in everyday activity (while walking, sitting, standing and laying). The aim was to teach the patients to maintenance corrected posture all day long (Fig. 3).

The therapeutic exercises were begun on the second day of treatment in our clinic for sixty minutes per day. During the first week the patients took the exercises for sagittal profile to be corrected and the program of 3-D trunk correction (section 1 and 2). From the second week asymmetric Schroth exercises and principles of ADL were added (section 3 and 4).



**Figure 1.** The patient K. K. aged 13. Three curved scoliosis. On the left – standing free position. On the right is the same patient in standing position while performing 3-D trunk correction (“3-D Exercises made easy”).



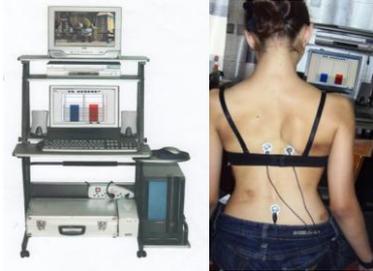
**Figure 2.** Asymmetric Schroth exercises modified by H.-R. Weiss.



**Figure 3.** Frontal postural correction in sitting position with principle of activity of daily living (ADL).

Out of the gym all children used Chêneau braces and took classical manual therapeutic massage (12 procedures stimulating blood circulation of trunk muscles) and swimming (14 procedures having a tonic effect and improving respiratory function included breaststroke arms, crawl legs and symmetrical stretching on the water).

All patients got a course of functional bioregulation (15 procedures on average) with videocomputer autotraining with electromiographic feedback on a hardware programm system “Ambliocor-01D” (NPC “In Vitro” Ltd. Saint-Petersburg) (Fig. 4) for paravertebral muscles correction. [5]



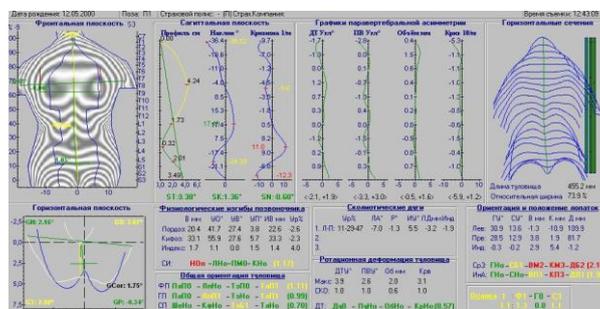
**Figure 4.** Hardware program system “Ambliocor-01D”. A patient is taking procedure of functional bioregulation for postural correction in sitting position.

According to the types of scoliotic progression, an age, clinical and instrumental evaluation results, all patients took courses of hardware physiotherapy (no more than 2 procedures a day): iontophoresis of different medicines on a spine, magnetic-pulse myostimulation of spine muscles, spine muscles inductothermy and magnetic field affecting on a spine.

Initial state of musculoskeletal system and efficiency of therapy were evaluated with next instrumental diagnostic techniques:

- The computer optical topography (analogue of Formetric© System) with “Computer Optical Topograph” (Novosibirsk, Russia, 2010) (Fig. 5) [6]. The following values were evaluated: the lateral asymmetry angle (°), the topographical analogue of the Cobb angle), the surface rotation angle (°), the trunk tilt in a frontal plane (°), the kyphotic angle (°) and the lumbar lordotic angle (°).
- The stabilometry with hardware program complex “DiaSled” (St. Petersburg, 2006) [1]. The coefficient of weight distribution (CWD) was evaluated as the ratio of the right and left foot load. [2]
- The surface electromyography of paravertebral muscles with electromyograph “Neuro - MVP – 4” (Ivanovo, Russia, 2004). The total bioelectrical activity of paravertebral muscles (in  $\mu V*s$ , so called Integral EMG) was measured at the top of scoliotic curve on the convex and concave sides. The coefficient of asymmetry (CA) of the convex side paravertebral muscles bioelectric activity to the concave one was evaluated as their ratio. [7]

Data processing was carried out using correlation, factor and discriminant analysis methods (with software suite Statistica 5.5).



**Figure 5.** The protocol of a patient computer optical topography.

## 2. Results

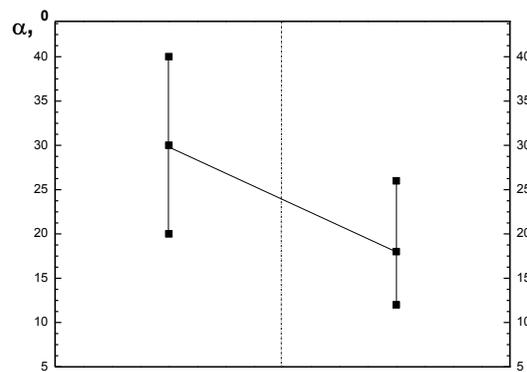
The lateral asymmetry angle before treatment had the average value  $30^\circ$  (SD 5.1). After treatment it had the average value  $18^\circ$  (SD 5.0). The efficiency of the treatment was  $12^\circ$  (SD 5.0) (Fig. 6).

The surface rotation angle before treatment had the average value  $12^\circ$  (SD 2.8). After treatment it had the average value  $7^\circ$  (SD 2.6). The efficiency of the treatment was  $5^\circ$  (SD 2.5) (Fig. 7).

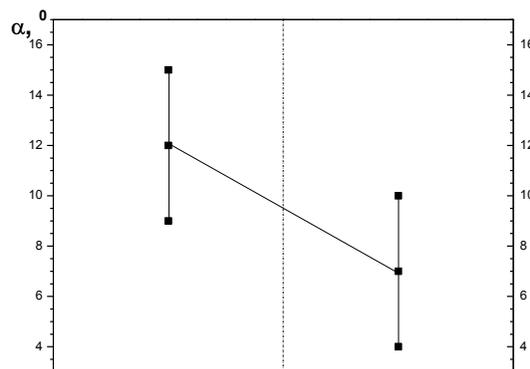
The trunk tilt in a frontal plane before treatment had the average value  $2.2^\circ$  (SD 1.8). After treatment it had the average value  $0.7^\circ$  (SD 0.8). The efficiency of the treatment was  $1.5^\circ$  (SD 0.9) (Fig. 8).

The kyphotic angle before treatment had the average value  $31^\circ$  (SD 10.9). After treatment it had the average value  $31.5^\circ$  (SD 10.8) (Fig. 9).

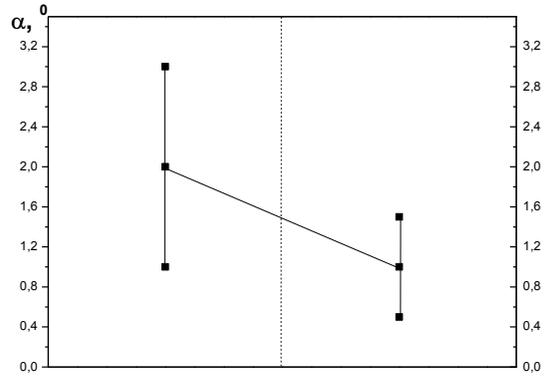
The lumbar lordotic angle before treatment had the average value  $29^\circ$  (SD 10.5). After treatment it had the average value  $30^\circ$  (SD 10.3) (Fig. 10).



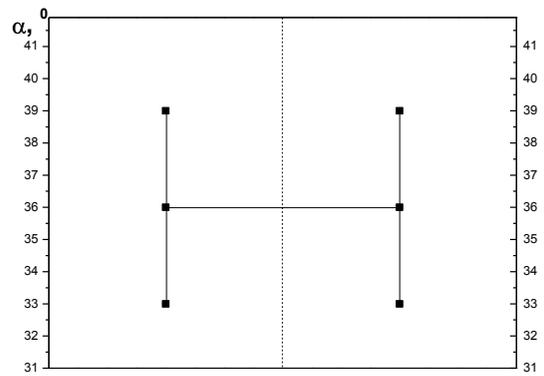
**Figure 6.** The lateral asymmetry angle in degrees before treatment (on the left) and after treatment (on the right)



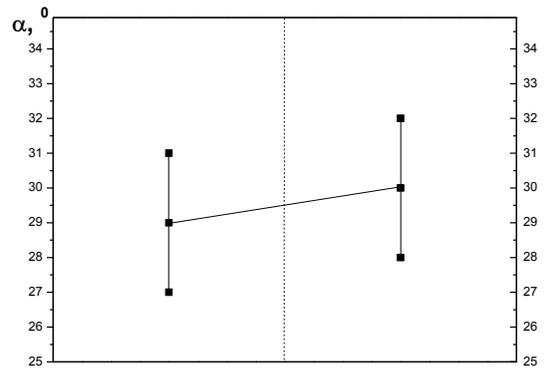
**Figure 7.** The surface rotation angle in degrees before treatment (on the left) and after treatment (on the right)



**Figure 8.** The trunk tilt in degrees in a frontal plane before treatment (on the left) and after treatment (on the right)



**Figure 9.** The kyphotic angle in degrees before treatment (on the left) and after treatment (on the right)



**Figure 10.** The lumbar lordotic angle in degrees before treatment (on the left) and after treatment (on the right)

The CWD before treatment had the average value 0.89 (SD 0.05) with predominant load on the right foot. After treatment it had the average value 0.96 (SD 0.03) with predominant load on the left foot.

The CA before treatment had the average value 1.27 (SD 0.16). After treatment it had the average value of 1.11 (SD 0.06). Bioelectrical activity of paravertebral muscles before and after treatment was higher on the convex side of the scoliotic curve.

## **Conclusion**

According to the data of clinical investigation and instrumental evaluation the Schroth program of therapeutic exercises modified by H.-R. Weiss is well-correlated with the system of conservative treatment of idiopathic scoliosis practiced in Russia and improves the efficiency of the therapy in children with this pathology.

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