

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. Efficacy of the treatment was evaluated in 21 patients treated with the six week physiotherapy program. Initial state of musculoskeletal system and efficacy of therapy was 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 efficacy 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. Further progression of the disease process among these patients leads to three dimensional abnormalities of a trunk, respiratory abnormalities and postural muscle imbalance [1]. This demands a precise approach for corrective therapeutic exercises to be applied. The concept of therapeutic exercises based on three dimensional spine correction preserving 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 introduced in multimodality conservative therapy of idiopathic scoliosis. The basis of this program is the special corrective breathing exercises according to Katharina Schroth principles [3].

The aim

To evaluate efficacy 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 Cobb angle from 28° to 50° (average angle 33°, SD 7.2) were included. The patients were treated for six weeks with daily physiotherapy sessions except weekends.

The program of therapeutic exercises consisted of:

1. Symmetric exercises for sagittal profile correction (physio-logic). Exercises for mobility of lumbar lordosis and thoracic kyphosis improvement (“Catwalk”) were used. The aim of these exercises was to influence lumbar lordosis at L2 level. Further exercises in sitting and standing positions aimed at lumbar lordosis preservation (standing position “NUBA”).
2. The program of three dimensional trunk correction (“3-D Exercises made easy”). In standing position the patients were instructed how to achieve 3-D trunk correction with asymmetric diaphragmatic breathing (Fig. 1).
3. Asymmetric exercises according to Schroth method in H.R. Weiss modification. Initial standing and sitting positions and position with side-shifting allowing effective postural 3-D correction and asymmetric rotational breathing were defined in accordance with type of scoliotic deformity. As soon as corrective positions had been mastered, postural stabilization was achieved with isometric muscle exercises (Fig. 2).
4. Maintenance of the corrected posture with principles of activity of daily living (ADL). The patients were instructed to assume corrective positions in everyday activity (while walking, sitting, standing and laying). The aim was to teach the patients to maintain corrected posture throughout the day (Fig. 3).

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



Figure 1. The patient K. K. aged 13. Triple curve scoliosis. On the left – relaxed 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.

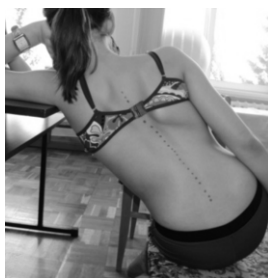


Figure 3. Frontal postural correction in sitting position with principle of activity of daily living (ADL).

Apart from physiotherapy sessions 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 in the water).

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 was also applied to patients [5].

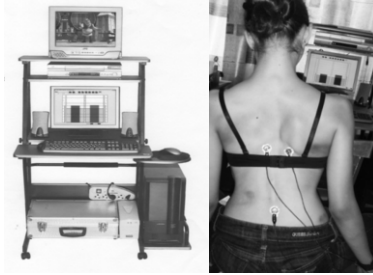


Figure 4. Hardware program system “Ambliocor-01D”. A patient is taking procedure of functional bioregulation for postural correction in sitting position.

According to the types of scoliotic progression, age, clinical and instrumental evaluation results, all patients took courses of physical therapy (no more than 2 procedures a day): iontophoresis, magnetic-pulse myostimulation of spine muscles, spine muscles inductothermy and magnetotherapy.

Initial state of musculoskeletal system and efficacy of therapy was evaluated with the following instrumental diagnostic techniques:

1. 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 (°).
2. 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]
3. 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).

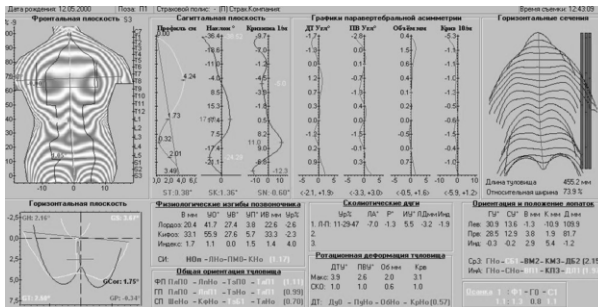


Figure 5. The protocol of a patient computer optical topography.

2. Results

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

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

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

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

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

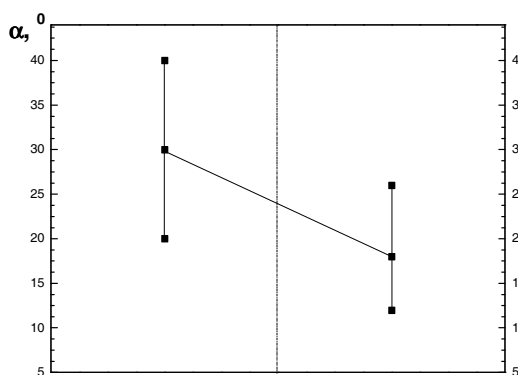


Figure 6. The lateral asymmetry angle in degrees before treatment (on the left) and after treatment (on the right)

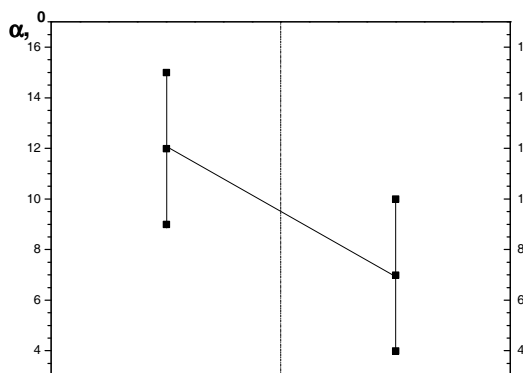


Figure 7. The surface rotation angle in degrees before treatment (on the left) and after treatment (on the right)

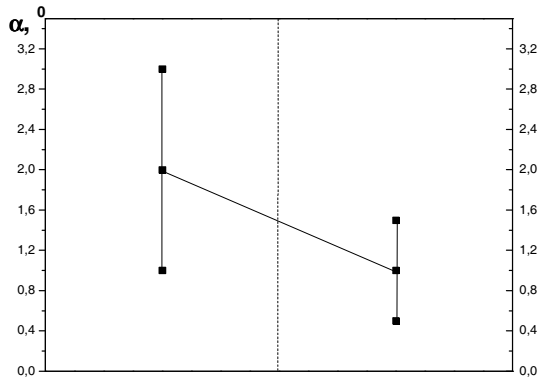


Figure 8. The trunk tilt in degrees in a frontal plane before treatment (on the left) and after treatment (on the right)

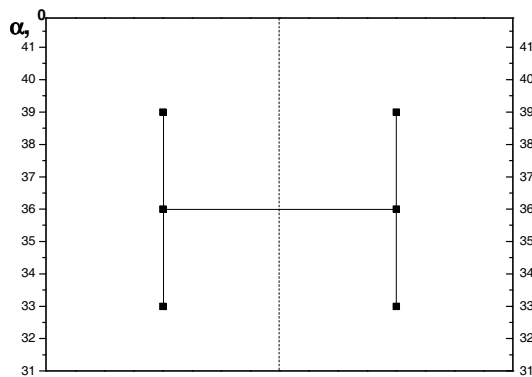


Figure 9. The kyphotic angle in degrees before treatment (on the left) and after treatment (on the right)

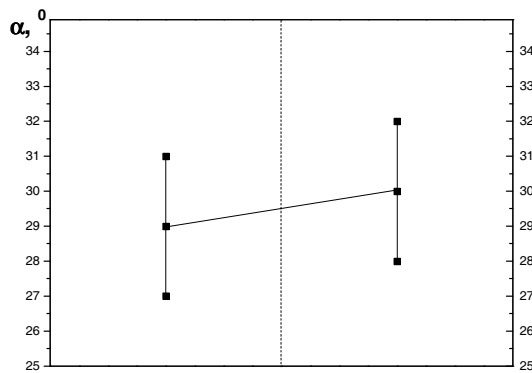


Figure 10. The lumbar lordotic angle in degrees before treatment (on the left) and after treatment (on the right)

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 efficacy of the therapy in children with this pathology.

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