

# Corrective Exercises in Multimodality Therapy of Idiopathic Scoliosis in Children

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

## **Introduction**

Therapeutic exercises are one of the basic principles of conservative treatment of idiopathic scoliosis. Programs of such exercises 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 in such 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. Conception of therapeutic exercises based on three dimensional spine correction and keeping of postural balance with application of special breathing exercises was first elaborated by Christa Lehnert-Schroth, Germany [2] and Hans-Rudolf Weiss, Germany [3].

Method of conservative multimodality therapy of children with idiopathic scoliosis has been practiced in our Center since 1960. In 2010 the program of special corrective exercises Hans-Rudolf Weiss «Best Practice» [3] was put in multimodality conservative therapy of idiopathic scoliosis. The basis of this program is special corrective breathing exercises in accordance with Katharina Schroth method [2].

## **The aim**

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

## 1. Materials and Methods

21 female patients age of 13 to 15 with scoliosis (King IV) and mean value of Cobb angle  $33^{\circ}$  were joined into a therapeutic group. Patients were treated for six weeks. They had daily multimodality therapy 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. Aim of exercises was to act upon lumbar lordosis at L2 level. Further under exercises in sitting and standing positions the patients should have kept lumbar lordosis. (standing position “NUBA”).
2. 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).
3. 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 were mastered postural stabilization was achieved with isometric muscle tension (Fig. 2).
4. 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). Aim was to teach the patients to maintenance corrected posture all day long (Fig. 3).

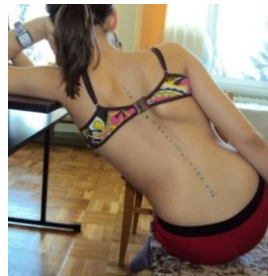
Therapeutic exercises began on the second day of staying in the clinic of our Center for sixty minutes per day. During the first week the patients took exercises for sagittal profile to be corrected and program of 3-D trunk correction (section 1 and 2). From the second week asymmetric Schroth exercises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



**Figure 1.** The patient K. K. age of 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”).



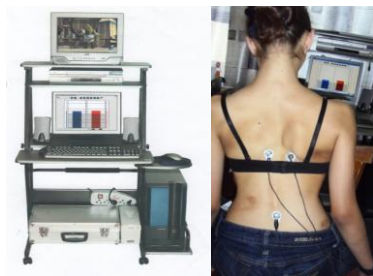
**Figure 2.** Asymmetric Schroth exercises modified by H.-R. Weiss.



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

Out of a gymnasium 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 system “Ambliocor-01D” (NPC “In Vitro” Ltd. Saint-Petersburg) [1] (Fig. 4) for paravertebral muscles correction.



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

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

Initial conditions of musculoskeletal system and effectiveness of therapy were evaluated with instrumental diagnostic techniques: computer optical topography (analogue of Formetric© System) with “Computer Optical Topograph” (Novosibirsk, Russia, 2010) (Fig. 5) [5], surface electromyography of paravertebral muscles with electromyograph “Neuro - MVP – 4” (Ivanovo, Russia, 2004), stabilometry with hardware program complex “DiaSled” (St. Petersburg, 2006) [1].

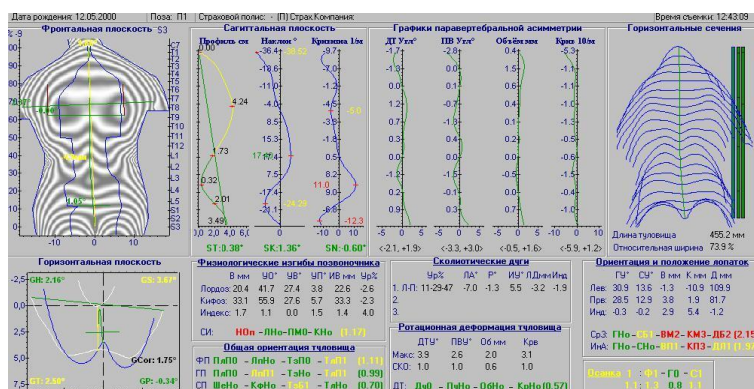
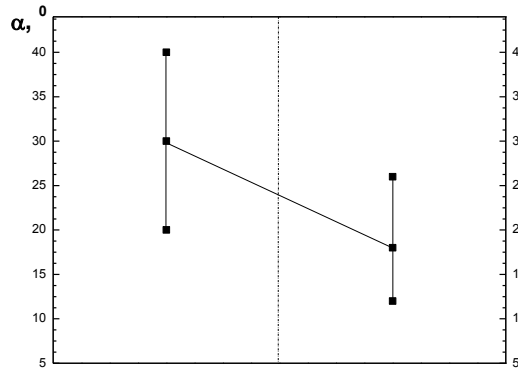


Figure 5. A protocol of computer optical topography of a patient.

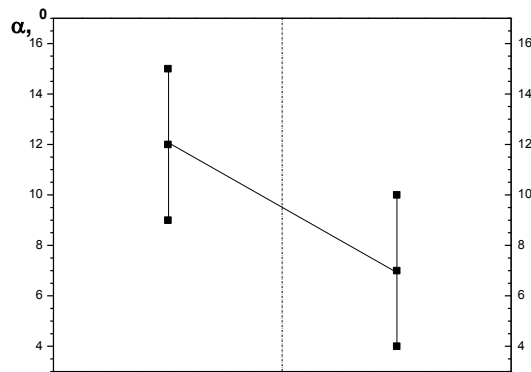
## 2. Results

The following factors were evaluated with computer optical topography:

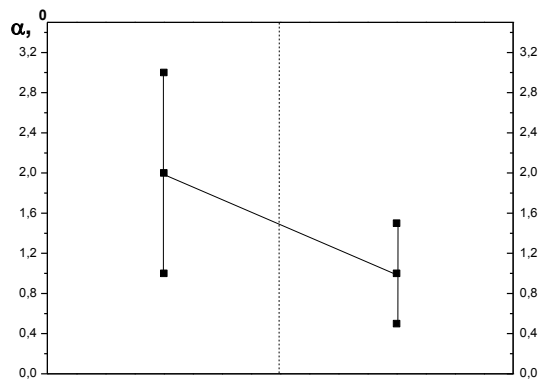
1. Lateral asymmetry angle (topographical analogue of the Cobb angle). Initial level was on average in a group 30°, after treatment - 18°. Effectiveness of treatment was 12° (Fig. 6)
2. Angle of vertebrae rotation on the top of curvature in degrees. Initial level was on average 12°, after treatment - 7°. Effectiveness of treatment was 5° (Fig. 7)
3. Tilt of a trunk in a frontal plane. Initial level was on average in a group 2.2°. After treatment 17 patients (89%) had tilt of a trunk no more than 0.7° (Fig. 8)
4. Range of physiological curvatures in a sagittal plane in degrees. Initial level of thoracic kyphosis was on average 31° and lumbar lordosis 29°. After treatment level of the both curvatures insignificantly increased and was 31.5° and 30° correspondingly (Fig. 9,10).



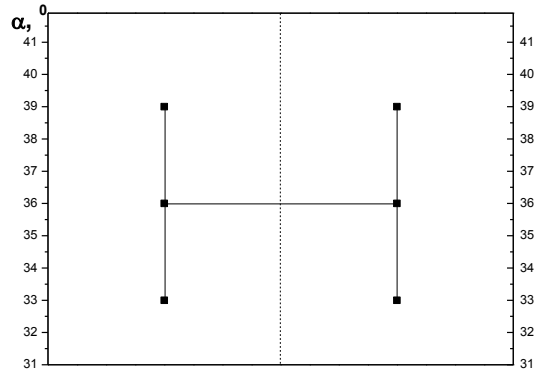
**Figure 6.** The lateral asymmetry angle in degrees before treatment (on the left) and after treatment (on the right)



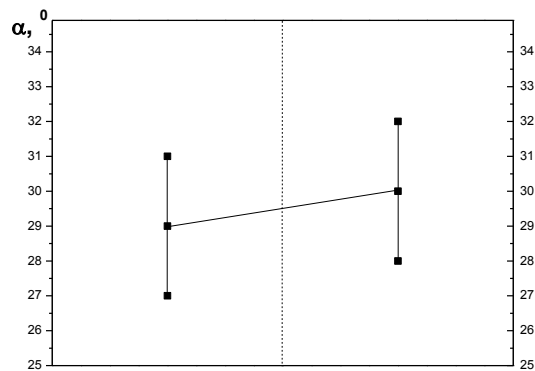
**Figure 7.** The angle of vertebrae rotation on the top of curvature in degrees before treatment (on the left) and after treatment (on the right)



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



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



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

The factor of weight distribution as basic value was analyzed with stabilometry. Before treatment 13 patients (62%) had right foot weight distribution and 8 patients (38%) – left foot distribution. After treatment weight distributed symmetrically in 16 (76%) patients. Right foot weight distribution persisted in 5 patients (24%) but was less expressed.

Coefficient of asymmetry of bioelectric activity of convex side paravertebral muscles to concave one was evaluated with electromyography. In 18 patients (86%) coefficient on average was 30% and in 3 patients (14%) it was within 10%. After treatment coefficient of asymmetry was in 11 patients (52%) within 20% and in 10 patients (48%) – less than 10%.

## Conclusion

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

## References

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