

REHABILITATION OF THE ADOLESCENT PATIENT WITH IDIOPATHIC SCOLIOSIS THROUGH PHYSICAL THERAPY METHODS

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Abstract

This paper aims to demonstrate the importance of physical therapy within a rehabilitation program for patients with idiopathic scoliosis. Due to its frequency and the difficulties, it creates—particularly those related to performing daily activities—this condition is becoming increasingly common in society, making it difficult for affected individuals to carry out various tasks.

The purpose of this study is to support the recovery of patients with this condition. The general objective of rehabilitation is to help the patient recover in the shortest possible time, prevent physical discomfort, and, most importantly, stop the progression of the disease.

Following the initial and final assessments, we were able to collect the results presented in this paper and formulate the final conclusions of the study.

The reason for choosing this topic is that a significant part of the population is affected by this condition, and through physical therapy we can improve and correct this problem.

Introduction

Adolescent Idiopathic Scoliosis (AIS) has been studied since the time of Hippocrates, but its systematic management began in the 20th century with the development of bracing techniques and surgical interventions. The Schroth method, developed in the 1920s, and later the SEAS (Scientific Exercises Approach to Scoliosis) in the 2000s, revolutionized non-invasive treatment by emphasizing three-dimensional postural correction and neuromuscular re-education.[4,7,11,12]

Today, AIS affects approximately 1–3% of adolescents worldwide, with girls presenting a higher risk of curve progression. Although bracing remains the standard treatment for moderate curves (Cobb angle 25–40°), growing evidence supports physiotherapy as a first-line intervention for mild to moderate cases. Recent

guidelines (SOSORT 2023) highlight the need for individualized treatment protocols due to variability in patient response.[3,8,10]

Scoliosis is a three-dimensional deformity of the spine and trunk that may worsen rapidly during growth periods [1]. Clinically, it is characterized by a subtle and painless onset in an otherwise healthy patient.

Idiopathic scoliosis can be classified according to age of onset as infantile, juvenile, or adolescent [2].

Adolescent idiopathic scoliosis generally does not cause pain or neurological symptoms. However, several visible signs are associated with AIS. One of the most common is a prominence in the lower back or a rib hump secondary to the rotational component of the deformity [5].

Material and method

Considering that adolescence is a critical period for intervention due to the high potential for spinal growth and remodeling, this study has the potential to substantially contribute to improving therapeutic interventions applied during this stage of development.

In addition to its clinical contributions, the proposed study aims to provide empirical support for the implementation of physical therapy programs within standard scoliosis treatment regimens, arguing for the necessity of a holistic and personalized approach. It investigates not only the physical effects of physical therapy, but also its impact on the psychosocial and emotional status of adolescents—an aspect often overlooked in orthopedic research. The comparative analysis of two confirmed cases offers an applied perspective on the factors that may influence recovery outcomes.

Aim and Objectives of the Study

The purpose of this research is to examine the impact of physical therapy on the clinical and functional parameters of two adolescents with idiopathic scoliosis who underwent different forms of treatment, and to analyze differences in therapeutic response according to individual characteristics.

Previous studies indicate that exercise-based therapy in scoliosis primarily focuses on reducing spinal curvature in adolescents.[6,13] This study aims to evaluate the effectiveness of individualized physical therapy programs in adolescent scoliosis and to analyze specific monitoring parameters within the assessment protocol. It also addresses motor dysfunctions associated with scoliosis-related spinal adaptations.

The present study compares the effectiveness of physical therapy in two patients of similar age but different genders, seeking to highlight differences in therapeutic response.

The relevance of this topic is supported by current evidence showing that structured exercise programs contribute to improved quality of life and reduction of the Cobb angle through the use of updated evaluation and treatment protocols.

General Objectives

- To examine the effect of physical therapy on reducing the Cobb angle and improving posture in patients with idiopathic scoliosis.
- To comparatively analyze the progression of both patients (boy vs. girl) in order to identify differences related to gender, age, or treatment compliance. Both patients will undergo the same physical therapy program.

Specific Objectives

- To analyze baseline parameters: measurement of the Cobb angle prior to therapy, description of the applied protocols, monitoring of treatment frequency, and patient compliance.
- To compare the effectiveness of treatment in two adolescent subjects (one boy and one girl), both diagnosed with Adolescent Idiopathic Scoliosis (radiologically confirmed), presenting a Cobb angle between 20–40° and without other congenital or neuromuscular conditions.

Description of the Patients

Patient 1 (boy) – 14 years old

- Type of scoliosis: right thoracic curve (25° Cobb)
- Risser stage: 3

Patient 2 (girl) – 15 years old

- Type of scoliosis: left lumbar curve (30° Cobb)
- Risser stage: 2, post-menarche

Both patients were enrolled in a physical therapy program to evaluate its effectiveness. Informed consent was obtained from their guardians. The girl's parents declined permission for photographs to be taken during the physical therapy sessions.

Initial data reveal significant differences between the two patients: the girl presents a more pronounced spinal curvature and greater postural asymmetry, while the boy is at a more advanced stage of skeletal maturity. These differences justify a personalized therapeutic approach.

Table 1. Patient Presentation – Initial Values

Parameter	Patient – Boy	Patient – Girl	Clinical Significance
Age	14 years	15 years	The girl is in an active growth phase
Initial Cobb Angle	22° (right thoracic)	27° (left thoracic)	Moderate severity
Shoulder Asymmetry	1.5 cm	2 cm	Greater difference in the girl – indicates more pronounced postural deformity

ATR (Scoliometer)	8°	10°	Values above 7° validate the need for physical therapy (Bunnell, 2005)
Pain (VAS)	5	6	Moderate pain (impacting quality of life)
Risser Stage	3	2	The boy is closer to skeletal maturity

Final Patient Evaluation and Documentation of Progress

At the end of the rehabilitation program, a final patient evaluation will be conducted to highlight progress and development. This assessment will include the same somatic, functional, and motor benchmarks used in the initial evaluation, allowing for direct comparison of the data. Progress documentation will be detailed and will emphasize the improvements achieved as a result of the physical therapy intervention. The final results will be recorded and analyzed in order to evaluate the effectiveness of the rehabilitation program and to determine any necessary future adjustments.

Instruments and Equipment

Clinical evaluation tools:

- X-rays (measurement of the Cobb angle)
- Scoliometer (measurement of trunk rotation angle – ATR)
- Postural photographs (assessment of shoulder and pelvic symmetry)
- Visual Analog Scale (VAS) for pain [10]

Location and Material Conditions

The study was conducted in a professional musculoskeletal rehabilitation center through physical therapy interventions (“**Kineto Clinic Real**” – **Suceava**). The center is equipped with modern devices and state-of-the-art equipment necessary for the evaluation and treatment of patients with various forms of scoliosis.

Material resources included a fully equipped physical therapy room designed for mobility and strengthening exercises, respiratory techniques, and postural correction. The facility includes gym benches, exercise mats, medicine balls, elastic resistance bands, and other resistance devices used throughout the therapy program.

For somatic, functional, and motor assessments, the center is equipped with precise instruments, including stadiometers, electronic scales, spirometers, heart rate and respiratory monitoring equipment, and other devices required for functional measurements. Somatoscopic evaluations were carried out in a specially arranged room equipped with large mirrors and floor markings to ensure accuracy in postural assessment.

The duration of treatment was 3 months, with 3 sessions per week, beginning on January 6, 2025.

Physical Therapy Protocol – Practical Applications

Exercises Applied (Adapted from the Schroth and SEAS Methods):

1. Postural Correction:

- Static positioning exercises for active correction of spinal curves (e.g., “pushing” the rib hump) [12]
- 2. Muscle Strengthening:
 - Paravertebral muscles: Trunk extensions in prone position
 - Abdominal muscles: Bicycle crunches for obliques, plank exercises for stabilization
 - Gluteal muscles: Bridge exercise with elastic resistance [12]
- 3. Breathing Exercises:
 - Lateral costal breathing (to improve thoracic mobility)
 - Controlled diaphragmatic breathing [12]
- 4. Release of Tight Structures:
 - Stretching for the pectoral muscles [2]

These exercises were individualized according to each patient’s curve type, skeletal maturity, and tolerance, and were performed under professional supervision to ensure correct posture and breathing patterns.

Table 2. Demographic Data

Parameter	Boy (14 years)	Girl (15 years)	Clinical Significance
Age of Onset	12 years	11 years	Earlier onset – girl
Family History	No	Yes (mother)	Increased risk of progression – girl
Menarche	–	13 years	Post-menarche acceleration growth

Table 3. Therapeutic Protocol

Intervention	Boy	Girl
Physical Therapy Method	SEAS	Schroth
Frequency	3 sessions/week	3 sessions/week
Exercises	Abdominal strengthening	Costal breathing

Comprehensive Recovery Includes:

Specific physical therapy exercises, Breathing therapy, Postural correction, Pain management, psychological support [13]

Table 4. Physical Therapy Program

Exercise Type	Boy	Girl	Common Therapy Goals
Schroth	Focus on thoracic curve	Adapted for double curve	Improved symmetry
SEAS	65% of program	50% of program	Progressive stability

Stabilization	Emphasis on abdominal muscles	Emphasis on paravertebral muscles	–
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Studies support the efficacy of these methods:

- Weiss et al. (2020) showed that the Schroth method reduces the Cobb angle by 10–15% in adolescents.
- Negri et al. (2019) demonstrated that the SEAS method is effective in slowing progression in adolescent patients.

Postural Correction in Scoliosis

Postural correction plays a crucial role in scoliosis management, aiming to:

- Balance muscle strength between the convex and concave sides of spinal curves.
- Establish and maintain correct body alignment at rest and during movement.
- Prevent further worsening of spinal deformities.

Correct Posture

The first key element in improving posture is body awareness. Patients were instructed that in a vertical position, the ears, hips, and shoulders should be perfectly aligned, and they were encouraged to use a mirror for self-correction.

According to Lehnert-Schroth (2020), active postural correction using mirror feedback reduces asymmetries by 20% in adolescents [12].

Weiss et al. (2020) reported that the Schroth method reduces the Cobb angle by 10–15% in adolescents, while Negri et al. (2019) demonstrated that the SEAS method is beneficial in slowing curve progression in adolescent patients.

Postural Correction in Scoliosis

Postural correction plays a crucial role in scoliosis management and aims to:

- Equalize muscle strength differences between the convex and concave sides of spinal curves.
- Consolidate proper body alignment both at rest and during movement.
- Prevent worsening of spinal deformities.

Correct Posture

A key factor in improving posture is body awareness. Patients were instructed that in a vertical position, the ears, hips, and shoulders should be perfectly aligned, and they were encouraged to use a mirror for self-correction. According to Lehnert-Schroth (2020), active postural correction using mirror feedback reduces asymmetries by 20% in adolescents [12].

Results and Discussion

This study compares the effectiveness of a personalized physical therapy program for two adolescent patients with idiopathic scoliosis (a 14-year-old boy and a 15-year-old girl). The applied methods (Schroth, SEAS, and respiratory exercises) were adapted according to curve type and gender.

Results showed improvements in postural symmetry and Cobb angle, with variations between subjects due to differences in adaptability to the treatment.

Structural release involved stretching the pectoral muscles in the boy and the hamstring muscles in the girl, according to the type of deformity. Lateral costal breathing was emphasized for the girl.

- **Boy (14 years, no family history):** Participated in a SEAS program focusing on abdominal strengthening and pelvic correction aimed at reducing the thoracic curve.
- **Girl (15 years, with genetic predisposition):** Followed the Schroth method adapted for a double curve, including costal breathing and combined rib hump correction.

Both protocols included pectoral/hamstring stretching and diaphragmatic breathing to improve mobility.

These results highlight the importance of individualized therapy programs that consider curve type, skeletal maturity, gender, and genetic predisposition for optimal outcomes in adolescent idiopathic scoliosis.

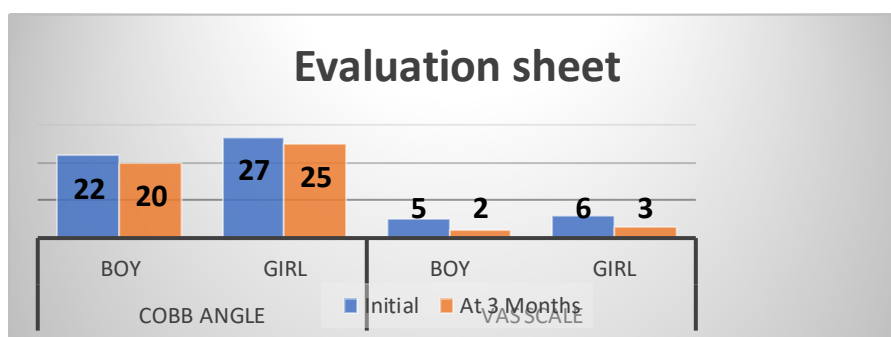
Postural Correction and Functional Exercises

Postural correction involved mirror feedback exercises and static positioning aimed at reducing rib deformities, based on the Schroth method. According to Lonstein (2006), a Cobb angle $>25^\circ$ in patients with Risser <3 requires immediate intervention to prevent progression.[1,2]

Unilateral bridge exercises with an elastic band activate the gluteus medius muscles, which are responsible for pelvic stabilization (Mendonça et al., 2021).

Table 5. Evaluation Sheet (at 3 Months)

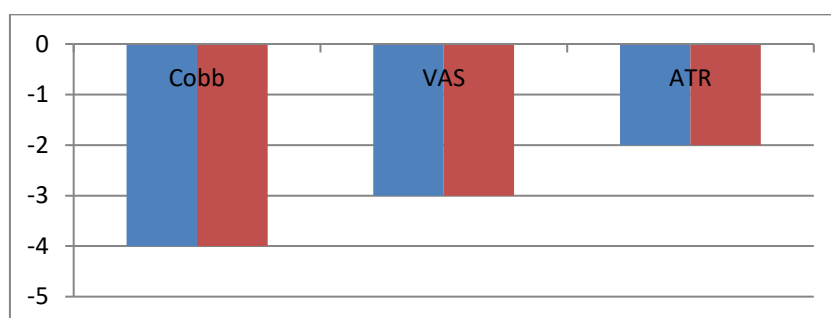
Parameter	Initial	At 3 Months
Cobb Angle	22° Boy	20° Boy
	27° Girl	25° Girl
VAS Scale	5 Boy	2 Boy
	6 Girl	3 Girl



Graph. 1 Reduction of the Cobb angle and VAS score after 3 months

Table 6. Data Comparison

Parameter	Boy	Girl
Cobb Angle	18° (-4)	23° (-4)
Shoulder Asymmetry	1 cm (-0.5 cm)	1.7 cm (-0.3 cm)
ATR	6 (-2°)	8 (-2°)
VAS	2 (-3)	3 (-3)
Risser Stage	3	3 (skeletal progression)



Graph. 2 Reduction of parameters after treatment: boy (blue), girl (red)

These results indicate improvement in both spinal curvature and perceived pain levels, demonstrating the effectiveness of the individualized physical therapy program.

Table 3.3 Compliance and Efficiency

Factor Type	Boy	Girl
Sessions (frequency)	100%	85%
Exercises (at home)	5 days	3 days
Motivation	Active engagement	Needed support

Main Study Findings

- Cobb Angle Reduction – Both cases experienced a 4° reduction, but the boy reached a lower Cobb angle, likely related to his initially milder curve.
- Gender Differences – The girl showed slower improvement in shoulder asymmetry, possibly due to a double curve pattern and lower skeletal maturity.
- Pain Reduction – Decrease in pain intensity was an important factor in the study.
- Personalized Protocols – Tailoring the treatment protocols contributed to better adaptive efficiency.

Conclusions

Following this study, we demonstrated that using kinetic methods successfully improved patients' quality of life.

After implementing a physiotherapy program, notable improvements were observed, reflecting the significant effectiveness of the exercises applied. This progress highlights the efficiency of the physiotherapy program in enhancing spinal functionality.

The final results confirmed the effectiveness of the rehabilitation program, and necessary adjustments will be applied in the future where appropriate.

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