Vitamin: Jurnal ilmu Kesehatan Umum
Volume. 3 Nomor. 3 Juli 2025
e-ISSN: 3031-0105; p-ISSN: 3031-0091, Hal. 283-301
DOI: https://doi.org/10.61132/vitamin.v3i3.1472
Available online at: https://journal.arikesi.or.id/index.php/Vitamin

Posture Correction, Pain Reduction, and Improved Mobility Through Corrective Physiotherapy in Individual Patients with Scoliosis : Case Report

Anggita Nurul Ikshanty[1*], Adnan Faris Naufal[2], Reza Arshad Yanuar[3]
[1,2] Physiotherapy Study Program, Muhammadiyah University Surakarta, Indonesia
[3]Physiotherapist at RSUD Salatiga, Indonesia

Address: Jl. A. Yani, Mendungan, Pabelan, Kec. Kartasura, Kab. Sukoharjo, Jawa Tengah 57162
Author correspondence: anggiitanrl@gmail.com

Abstract. Adolescent Idiopathic Scoliosis (AIS) is the most common progressive musculoskeletal disorder among adolescents, characterized by a lateral curvature of the spine with an unknown cause. This condition often results in postural asymmetry, chronic low back pain, and reduced mobility. This case report involves a 17-year-old female high school student diagnosed with AIS, presenting with lower back pain and functional limitations. The physiotherapy intervention included three sessions over two weeks, utilizing Microwave Diathermy (MWD) as a physical modality, along with Schroth method and strengthening exercises. The outcomes demonstrated a reduction in pain intensity, improved muscle strength, increased spinal mobility, and enhanced thoracic expansion. Additionally, the patient showed an improvement in quality of life as measured by the Scoliosis Research Society-22 (SRS-22) questionnaire. These findings suggest that structured conservative physiotherapy, combining physical modalities and specific exercises, is effective in alleviating clinical symptoms, improving postural awareness, and supporting the functional well-being of AIS patients. This case highlights the importance of early and consistent physiotherapeutic intervention to manage symptoms and potentially slow curve progression.

Keywords: Physiotherapy, Adolescent Idiopathic Scoliosis, Low Back Pain, Schorth Methode Exercise, Postural Correction

1. INTRODUCTION

Adolescent Idiopathic Scoliosis (AIS) is the most common musculoskeletal problem, with the condition typically beginning to manifest and progress during puberty between the ages of 10 and 18. It is characterized by a lateral curvature of the spine with a Cobb angle of $\geq 10^0$ degrees, often accompanied by vertebral rotation. Approximately 80–90% of all scoliosis cases are idiopathic, with unknown and unclear causes. It has a global prevalence of 3.1% among children and adolescents, varying by gender, age, body mass index, and environmental factors (Li *et al*., 2024). Scoliosis is classified into functional and structural types (Zhou *et al*., 2023). AIS is a type of structural scoliosis characterized by a persistent spinal curvature when lying down, accompanied by anatomical changes in the vertebrae such as vertebral rotation, disc asymmetry, or vertebral fusion, which are clearly visible on radiology, and is progressive. Internal factors (genetic) are the primary cause (Negrini *et al*., 2022).

As many as 30% of AIS patients have a family history of scoliosis (Grauers *et al*., 2016). Additionally, recent genomic studies have identified several variants, such as the GPR126, LBX1, and PAX1 genes, that are more commonly found in AIS patients (Petrosyan *et al*., 2024). Polymorphisms in the estrogen receptor alpha (ESR1) gene, such as the XbaI variant

Received: Mei 10, 2025; Revised: Mei 24, 2025; Accepted: Juni 07, 2025; Online Available: Juni 11, 2025

(rs9340799), may increase the risk of AIS in adolescent females. A study by Basindwah *et al*., (2018) on 304 women with AIS found an association between these polymorphisms and the occurrence of idiopathic scoliosis. AIS is more common in females, influenced by estrogen hormones, which play a crucial role in bone growth and skeletal maturation during puberty. Melatonin hormone dysfunction affects osteoblasts, myoblasts, and lymphocytes in AIS patients, caused by the inactivation of the Gi protein. Additionally, the melatonin receptor 1B (MTNR1B) was found to influence susceptibility to scoliosis (Burwell *et al*., 2009).

Individuals with a curvature exceeding 40^0 may experience respiratory issues, postural imbalance, and chronic back pain (Menger & Sin, 2023). Physical therapy can play a role in alleviating these symptoms through various types of exercises and methods developed to address scoliosis cases. The Schroth method is a specific exercise approach aimed at correcting posture through rotational breathing exercises, spinal elongation, and strengthening of postural muscles, while maintaining good posture consciously in various conditions and incorporating it into daily activities. These exercises are based on kinesthetic and sensorimotor principles and involve active and passive posture corrections performed repeatedly. Core stability exercises can be an intervention for scoliosis cases, focusing on strengthening the transverse abdominis, diaphragm, and multifidus muscles to improve spinal muscle stability and coordination. This exercise program consists of three phases aimed at enhancing proprioception, muscle coordination, stability, and endurance (Kocaman *et al*., 2021).

This study was conducted to observe the development and evaluate the posture, back pain, and mobility of patients with adolescent idiopathic scoliosis through corrective physiotherapy.

2. RESEARCH METHOD

The method used in this study was a case report with single subject research. It was conducted at the Salatiga City Hospital with direct consent from the respondent in January 2025. The subject of this study was a 17-year-old student diagnosed with Adolescent Idiopathic Scoliosis, complaining of stiffness in the shoulders down to the lower back, discomfort when sitting for long periods, shortness of breath when walking long distances, and frequent feelings of dizziness/imbalance when walking. In the past month, the patient has experienced worsening shortness of breath and back pain, which often interfere with daily activities. The symptoms began at age 15, when the back started to appear curved, prompting a visit to the doctor for an X-ray. The results showed a left thoracic curvature of 31^0 (T4–T12) and a right lumbar curvature of 40^0 (L1–L4).

Figure 1. Thoracolumbar X-ray (AP and Lat)

Scoliosis samples were taken because it is one of the most common musculoskeletal disorders found in adolescents, especially females. In addition, scoliosis has long-term effects on posture, lung function, and quality of life. The selection of this sample is relevant to the research objectives. Data collection techniques use participatory observation methods, including a general examination covering the patient's consciousness, intra- and interpersonal abilities, vital sign measurements such as blood pressure, pulse rate, respiration, height, and weight, followed by a physical examination using the IPPA, basic motor function assessment, quality of life evaluation, and supplementary examinations to support the research findings.

The Scoliosis Research Society-22 (SRS-22) is a screening tool for scoliosis (Jinnah et al., 2025) and assesses patients' quality of life because it has high internal reliability with Cronbach's alpha values ranging from 0.75 to 0.92 and good concurrent validity when compared to other instruments (Alamrani *et al*., 2023). The Numeric Pain Rating Scale (NPRS) has higher sensitivity at 93% compared to the Visual Analogue Scale (VAS) at 85.4% (Merdekawati *et al*., 2019). Range of motion measured with a goniometer has an ICC ranging from 0.18 to 0.99, indicating significant variability (Canevera *et al*., 2025). anthropometry of leg length and thoracic cage expansion with midline has an ICC of 0.70 to 0.90, indicating high to very high reliability (Farahmand *et al*., 2019), assessing muscle strength with Modified Manual Muscle Testing (MMT) has an ICC ≥ 0.99 (Oliveira *et al*., 2022), and various specialized tests such as the Patrick test have moderate sensitivity and specificity, SLR has high sensitivity of 89.02% with low specificity of 25% (Montaner-Cuello *et al*., 2023), Copatrick, and SIJ distraction have high sensitivity, but their specificity tends to be low, so the Patrick, SLR, Copatrick, and SIJ distraction tests should be combined with other tests. The Adam forward bend measurement tool in patients with scoliosis 40^0 has a sensitivity of 0.83 and specificity of 0.99 (Physiopedia, 2025), and Schober's and modified Schober's tests have an ICC value of 0.85–0.96, indicating moderate–high validity (Amjad *et al.*, 2022) To assess trunk mobility in patients and address complaints of back pain.

The physiotherapy intervention provided to patients consisted of MWD modalities and exercise therapy.

3. RESULTS AND DISCUSSION

The data collection process for this study was conducted over a period of two weeks, consisting of four meetings ranging from observation to evaluation of therapy carried out in the gymnasium of the Salatiga City Hospital, resulting in the following findings and discussion:

Result

Table 1. Vital Signs

Blood pressure	113/64 mmHg
Heart rate	92x/minute
Respiratory rate	15x/minute
Temperature	36^0
Height	158 cm
Body weight	53 kg
BMI	21,2

Overall, the patient's vital signs indicate a stable systemic condition and no signs of acute distress.

Table 2. Physical Examination of IPPA

<table>
<tr><th colspan="2">Inspection</th></tr>
<tr><td>Static</td><td>Dynamic</td></tr>
<tr><td>- Elevation of the right shoulder
- Depression of the left shoulder
- Right rib hump visible
- Slight difference in leg length
- Pelvic asymmetry</td><td>- Using chest breathing
- Visible expression of pain when lumbar extension</td></tr>
<tr><td colspan="2">Palpation
- Spasms of the upper trapezius, rhomboid, and latissimus dorsi muscles on the right side, erector spinae, multifidus, psoas major, and iliopsoas muscles on the right side, quadratus lumborum muscle on the left side, and costal muscles.
- Weakness of the rhomboid, latissimus dorsi, psoas major, iliopsoas on the left side, and serratus anterior, quadratus lumborum on the right side.
- There is tenderness in the area of spasm.</td></tr>
<tr><td colspan="2">Auscultation
Vesicular</td></tr>
</table>

Inspection revealed limited movement due to pain and muscle dysfunction. Palpation revealed muscle imbalance and limited mobility due to discomfort. Auscultation revealed normal vesicular breath sounds, indicating no respiratory distress, although the dominant chest breathing pattern and spinal deformity may affect respiratory efficiency.

Table 3. Examination of Trunk Movement

Active Movement				
Movement	**Able/Not Able**	**ROM**	**Pain**	
Fleksi	Able	Full	-	
Ekstensi	Able	Limited	+	
Lateral fleksi dextra	Able	Full	-	
Lateral fleksi sinistra	Able	Full	-	
Rotasi dextra	Able	Limited	+	
Rotasi sinistra	Able	Limited	-	
Passive Movement				
Movement	**Able/Not Able**	**ROM**	**Pain**	**End Feel**
Fleksi	Able	Full	-	Firm
Ekstensi	Able	Full	+	Firm
Lateral fleksi dextra	Able	Full	-	Firm
Lateral fleksi sinistra	Able	Full	-	Firm
Rotasi dextra	Able	Limited	+	Firm
Rotasi sinistra	Able	Full	-	Firm
Isometric Movement Against Resistance				
Movement	**Able/Not Able**	**ROM**	**Nyeri**	**Tahanan**
Fleksi	Able	Full	-	Maximum
Ekstensi	Able	Limited	+	Minimum
Lateral fleksi dextra	Able	Full	-	Maximum
Lateral fleksi sinistra	Able	Full	-	Maximum
Rotasi dextra	Able	Limited	+	Minimum
Rotasi sinistra	Able	Full	-	Minimum

Active movement examination results: the patient is able to perform all lumbar movements well. Right-left flexion and lateral flexion movements show full ROM without pain. However, right extension and rotation movements show limited ROM accompanied by pain, while left rotation shows limited ROM without pain. Passive movement examination: overall, can still be performed well. Bilateral flexion and lateral flexion movements demonstrate full ROM without pain, with a firm end feel, which remains within normal limits. During extension and rotation to the right, there is pain, especially during rotation to the right, which also shows limited ROM, while rotation to the left shows full ROM and no pain. The end feel of all joints is firm, indicating no signs of joint instability. During isometric movement against resistance, the patient is able to maintain all movements with varying degrees of resistance. Right and left flexion and lateral flexion movements show maximum resistance without pain. However, during right extension and rotation, there is limited movement accompanied by pain when minimal resistance is applied. This suggests possible weakness in the back muscles. Left rotation shows full ROM without pain, but with minimal resistance.

Table 4. Pain Measurement (NPRS)

NPRS	Score
Silent pain	5/10
Movement pain	4/10
Pressure pain	5/10

The patient feels pain even when not engaging in intense activity, with moderate intensity, when walking long distances or engaging in activity, and when pressure is applied to the affected area, there is moderate pain.

Table 5. Muscle Strength Measurement (Modified MMT)

Modified MMT	Score
Flexor	5
Extensor	4-
Lateral fleksi dx	4
Lateral fleksi sx	4
Rotator dx	4-
Rotator sx	4

Interpretation of the results of trunk muscle strength measurements on the flexor muscles showed a score of 5, meaning that the patient was able to move through full ROM against gravity and maximum resistance. The extensor and right rotator muscles scored 4, meaning that the patient moved through full ROM against gravity without minimal resistance, and the lateral and left rotator muscles scored 4, meaning that they moved through full ROM with moderate resistance.

Table 6. ROM Measurement (Goniometer)

Lumbar Movement	Active	Passive	Normal Value
Ekstensi/Fleksi	S($25^0 - 0^0 - 80^0$)	S($35^0 - 0^0 - 85^0$)	S ($30^0 - 0^0 - 85^0$)
Lat. Fleksi dx/sx	F ($30^0 - 0^0 - 30^0$)	F ($35^0 - 0^0 - 35^0$)	F ($30^0 - 0^0 - 30^0$)
Rotasi dx/sx	R ($30^0 - 0^0 - 40^0$)	R ($40^0 - 0^0 - 45^0$)	R ($45^0 - 0^0 - 45^0$)

The patient's movement limitations tend to be in lumbar extension and rotation due to pain. However, with additional movement from the physiotherapist, the patient is able to reach normal limits.

Table 7. Anthropometric Measurements

Antropometri	Segment	Dextra	Sinistra	Difference
Panjang tungkai	Apperent lenght	91 cm	90 cm	1,5 cm
	True lenght	86,5 cm	84,5 cm	2 cm
	Bone lenght	62 cm	61,5 cm	0,5 cm
Lateral fleksi	Lumbal	16,5 cm	19 cm	2,5 cm
Fleksi	Lumbal	Score 20 with a 5cm increase in distance		
Ekspansi thorax	Axilla	2,5 cm		
	ICS 5	2 cm		
	Xypoid	2,5 cm		

Anthropometric measurements of the patient's normal leg length in all segments showed no differences greater than 2 cm. Lateral flexion ROM measurements with the midline were also normal, indicating that the patient's flexibility was adequate. The modified Schober's test showed results within normal limits. Thoracic expansion measurements showed limited thoracic cage expansion.

Various specific examinations were then conducted to observe any body asymmetry, assess mobility, and evaluate the level of pain in the patient's lower back.

1. Adam Forward Bend Test (+) shows spinal asymmetry

Figure 2. Adam Forward Bend Test

2. Patrick Test, to assess the sacroiliac joint, iliopsoas muscle, and psoas major. Pain (+) in the groin. Pain when sitting, limited rotation, difficulty sitting cross-legged.

Figure 3. Patrick Test

3. SIJ Distraction Test, by applying pressure to one SIAS alternately. The result (+) is that the patient feels pain in the sacroiliac during the test up to the left side of the abdomen.

Figure 4. SIJ Distraction Test

4. Straight Leg Raise Test (-), to assess sciatic nerve compression. Positive finding if there is radiating pain 30^0–70^0. Pain when sitting with legs stretched out, bending over, limited flexion.
5. Copatrick Test (-), to assess the piriformis muscle. Positive finding if there is pain in the buttocks. Pain when standing, walking, limited side flexion.
6. Schober's Test (-) due to a score of 20 cm, an increase of 5 cm. To measure the flexibility and mobility of the spine. Normal if >15 cm. If the increase is less than 5, there is limited mobility of the spine accompanied by pain.
7. Modified Schober's Test (-) due to a difference in distance between the upright and lateral flexion positions of 15-20 cm. To measure the flexibility and mobility of the spine.
8. Trendelenburg Test (-), to assess weakness of the abductor and gluteal muscles, stability, subluxation, and arthritis. A positive finding is indicated if the hip on the side not supporting the body drops downward.

In addition, to assess mental health, functional/daily activities, pain, self-image, and satisfaction with treatment, measurements were taken using the Scoliosis Research Society-22 (SRS-22) and results of ≥4 were obtained, with a high score interpretation indicating good quality of life, such as little pain, positive self-image, and high level of satisfaction with treatment (Tombak *et al*., 2024).

Based on the results of a holistic physiotherapy assessment, interventions were carried out with the aim of reducing pain and spasms, increasing muscle strength and joint range of motion, and improving thoracic expansion. It is hoped that this will reduce the progression of the scoliosis curve and improve chest mobility as a long-term intervention goal.

Table 2. Schroth Exercise

	Early Phase	**Mid-Phase**	**Advanced Phase**
Schroth Exercise	3D corrective breathing	3D corrective breathing	3D corrective breathing
	Shoulder counter-traction in supine position	Shoulder counter-traction in sitting position	Shoulder counter-traction in sitting position
	Shoulder counter-traction in prone position	Chest twister	Chest twister
	Shoulder counter-traction in side-lying position	Muscle cylinder in sitting position	Muscle cylinder in kneeling position
	Muscle cylinder in supine position	Big bow	Big bow
	Muscle cylinder in side-lying position	Shoulder counter-traction between two poles	Shoulder counter-traction between two poles
	Muscle cylinder in sitting position	Schroth gait	Schroth gait
	Chest twister	Removing the stool	Removing the stool

Table 9. Core Stabilzation Exercise

	Early Phase	Mid-Phase	Advanced Phase
Core Stabilization Exercise	Learning activation of TrA and ML muscle in supine hook position	Warm up stretching	Warm up stretching
	Training of the continuation of the neutral lumbopelvic control during exercises	Supine leg lift with yellow theraband	Supine leg lift with red theraband
	Warm up stretching	Supine contralateral limb lift	Abdominal curl
	Supine single leg lift	Supine bicycles	Supine bridge ball rolls
	Supine flexed knee pull	Supine bridge single leg	Supine bridge; knee flexed and legs on the ball
	Supine single arm lift	Supine bridge; knee extended and legs on the swiss ball	Prone bridging
	Supine bridge	Supine ball rolls with legs	Side bridge
	Clamshell	Side bridge with bent knee	Side leg lift with red theraband
	Side lying leg lift	Side leg lift with yellow theraband	Clamshell with red theraband
	Cat-camel	Clamshell with yellow theraband	Cat-camel
	Superman (arm)	Cross limb superman	Cross limb superman
	Superman (leg)	Cat-camel	Seated cross limb raise on the swiss ball
	Seated arm raise on the swiss ball (PNF exercises)	Seated arm raise on the swiss ball with yellow theraband (PNF exercises)	Standing arm raise (PNF exercises) with red theraband
	Standing arm raise (PNF exercises)	Standing arm raise on the swiss ball with yellow theraband (PNF exercises)	Cool down stretching
	Cool down stretching	Cool down stretching	-

e-ISSN: 3031-0105; p-ISSN: 3031-0091, Hal. 283-301

Figure 5. 3D Corrective Breathing

Figure 6. Superman

Figure 7. Cat-Camel

Figure 8. Supine Bicycles

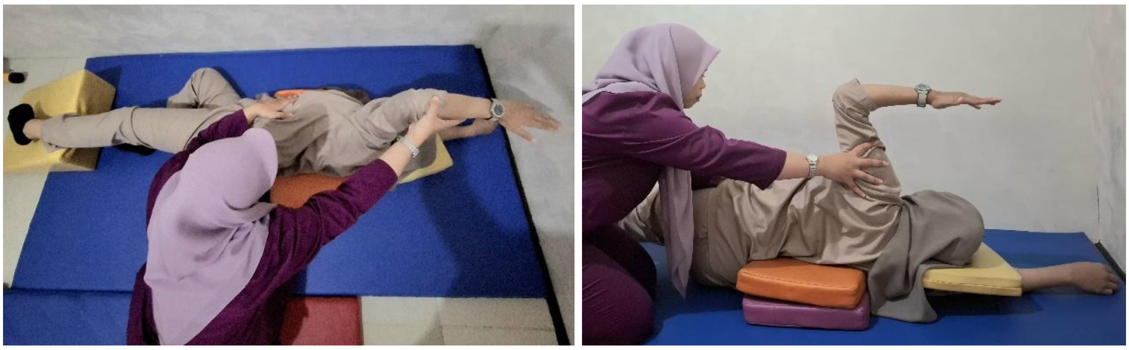

Figure 9. Shoulder Counter-Traction in Side-Lying Position

This exercise is structured into three phases, from the initial to the advanced phase, and its application depends on the patient's scoliosis condition (Kocaman *et al*., 2021). The physical therapist is responsible for correcting posture during each movement and ensuring the patient always uses diaphragmatic breathing. Generally, the early phase of the Schroth method is applied to scoliosis curves $<30^0$ with mild to moderate pain and no significant respiratory limitations. The mid phase is applied to curves between 30^0–45^0, where awareness of postural imbalance has begun to develop, enabling the patient to independently correct their posture. The advanced phase is applied to stable, non-progressive curves with no pain. Like Schroth, core stabilization also has phases. Early phase core stabilization exercises are given when there is weakness in the core and trunk muscles and compensatory patterns still occur while sitting/standing. The mid phase is when the patient can maintain static positions and transition to dynamic movements without pain. The advanced phase is given when there is awareness of proper movement and the ability to maintain those positions, making the exercises functional task training. This exercise serves as a home program that must be performed regularly at home daily to strengthen muscles and enhance the patient's body awareness, thereby fostering postural improvement through proper movement awareness (Çelik *et al*., 2025).

After 3 interventions over 2 weeks and a home exercise program, there were pretty significant results from the first to third sessions.

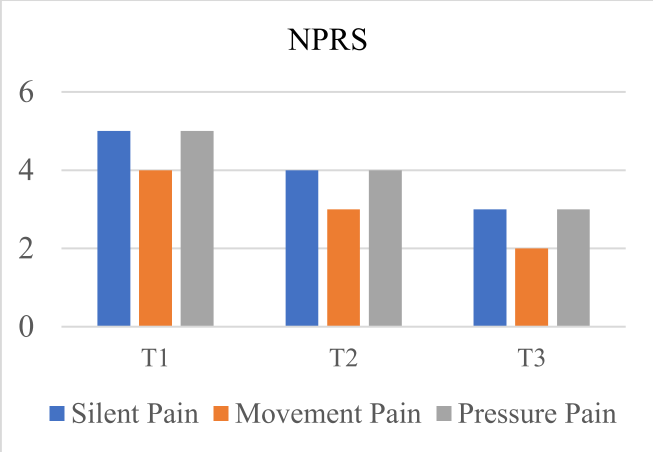

Figure 10. Pain Level Assessment

The pre-test results (T1) showed moderate pain at rest (5), movement (4), and pressure (5). At the end of the post-test measurement (T3), there was a significant decrease in pain to mild pain. This indicates that the intervention was effective in reducing the overall intensity of pain.

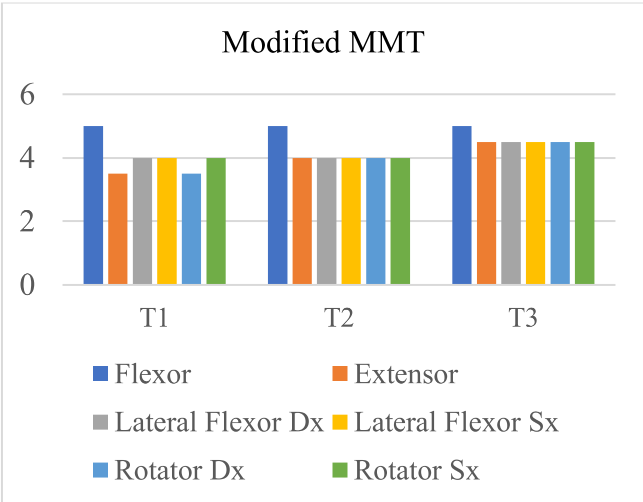

Figure 11. Evaluation of Muscle Strength

At the start of the T1 measurement, the flexor muscle was already optimal with a value of 5, but there was weakness in the extensor and rotator dextra with a value of 4-. At T2, there was an increase in the strength of the extensor and rotator muscles, as well as consistency in strength in other muscle groups. At T3, the increase in lumbar muscle strength was almost at the normal limit.

Table 10. Muscle Strength Test Results

Regio	Score	T1	T2	T3
Lumbar	Flexor	5	5	5
	Extensor	4-	4	4+
	Lateral flexor dx	4	4	4+
	Lateral flexor sx	4	4	4+
	Rotator dx	4-	4	4+
	Rotator sx	4	4	4+

Measurements of muscle strength from T1–T3 showed significant improvements, particularly in the extensors and trunk rotators, indicating that core stabilization exercises can improve the stability and strength of postural muscles.

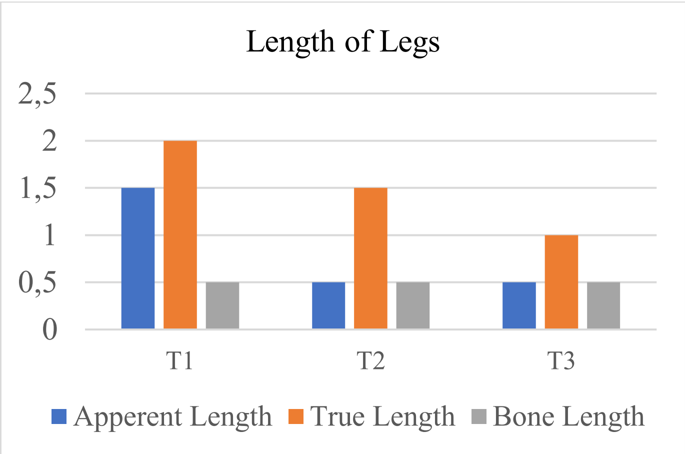

Figure 12. Measurement of Limb Length

Measurement T1 showed a difference in leg length, indicating the possibility of pelvic malalignment or postural asymmetry. At T2, there was a significant decrease in apparent length and true length. At T3, the difference in leg length became smaller, indicating that pelvic alignment was beginning to improve.

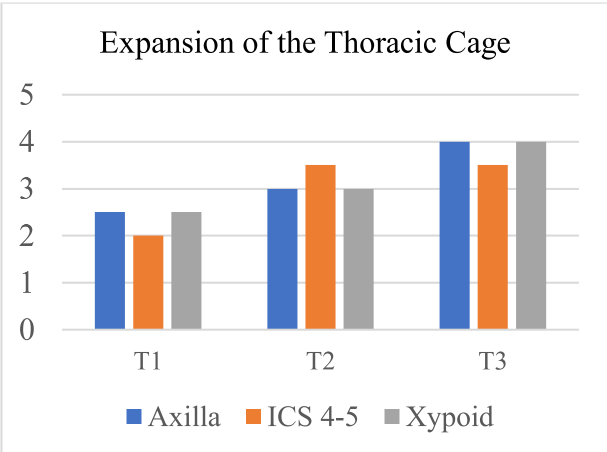

Figure 13. Measurement of Thoracic Cage Expansion

Pre- and post-expansion of the patient's thorax increased significantly in all three areas of thorax cage measurement, which means that breathing exercises can strengthen the chest wall.

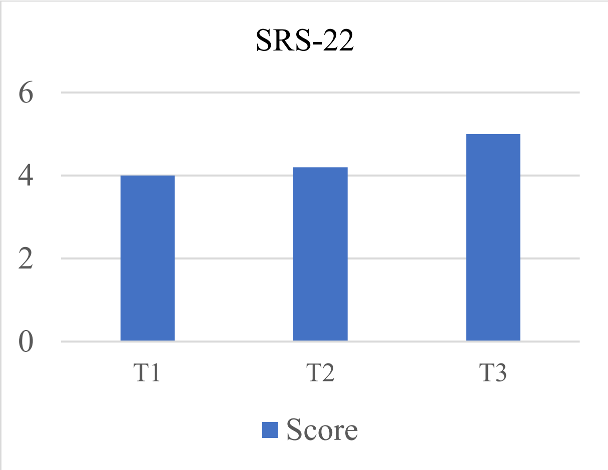

Figure 14. Measurement of Functional Ability

There was a consistent increase in scores from T1 to T3, indicating that Schroth intervention, core stabilization, postural training, and breathing exercises were not only physically effective but also had a positive psychological and emotional impact on patients.

Discussion

Scoliosis can be diagnosed directly by an orthopedic specialist through X-rays by measuring the Cobb angle, laboratory tests, and other methods. However, physical therapy can identify scoliosis patients based on habits such as sitting with poor posture or standing on one foot, and prolonged use of a sling bag with heavy loads. These habits can lead to disc degeneration, costal displacement, and costal adhesion. These three effects can be confirmed through an X-ray. Costal adhesions can cause reduced lung capacity, leading to shortness of breath in scoliosis patients due to hyperventilation and inactive breathing. If there is disc degeneration, vertebral rotation occurs, causing endocortical apposition. Endocortical apposition can also occur due to costal displacement, leading to changes in load distribution on the deformed spine and the formation of new bone layers on the endosteal (inner bone) surface to strengthen the bone structure as an adaptation to higher mechanical loads (Addai *et al.*, 2020). This is what causes the rib hump, which typically occurs on the convex side due to increased traction and pressure. The presence of a convex-side rib hump is one of the signs of adolescents with Adolescent Idiopathic Scoliosis (AIS).

A decrease in Bone Marrow Mesenchymal Stem Cells (BM-MSC) affects enzymes, proteins, hormones, and adipocytes, leading to reduced bone density and mineralization, as well as increased calmodulin concentration, which impacts muscle contractility. This results in asymmetrical paravertebral and convex-side costae muscles. The muscle imbalance affects the vestibular system (Peng *et al*., 2020). Individuals with scoliosis inevitably experience balance disorders due to shifts in the center of gravity (COG) and body orientation system (BOS), caused by vestibular system deficits that disrupt the integration of postural information, including postural control and sensory input, resulting in asymmetrical body activity and sensory perception, and an inability to maintain bodily balance. This also contributes to the development of AIS due to increased asymmetric paraspinal muscle tone (J. Li *et al*., 2023; Sun *et al*., 2025).

From the pathophysiology described above, the presence of uneven load distribution, asymmetrical posture, and muscle imbalance can cause pain due to the adaptive mechanism to excessive muscle tension in the back, known as low back pain. To reduce pain, MWD modality is provided as a supportive measure. A study by Lee & Cha (2023) titled "The Effect of Microwave Diathermy on Pain and Function in Chronic Low Back Pain Patients," using a case study research method, demonstrated that administering MWD at a dose of 80W for 20 minutes, three times a week over six weeks, can reduce pain, improve disability, and enhance functional outcomes in patients with chronic low back pain (LBP). Additionally, exercise therapy was provided as the primary exercise, specifically Schroth and strengthening exercises. A study by Kocaman *et al*. (2021) on Schroth and core stabilization exercises over 10 weeks, three times a week, demonstrated that both exercises were effective for scoliosis patients. However, Schroth exercises are more effective in managing AIS cases to reduce Cobb angle and vertebral rotation. Meanwhile, core stabilization is more effective in enhancing peripheral muscle strength (Kyrkousis *et al*., 2024). However, Fitratilla *et al*. (2024) demonstrated that combining Schroth with core stability can reduce pain and improve muscle stability.

The modalities provided do not only focus on muscles but are also expected to influence cortical input so that postural awareness can create good movements, and good movements are followed by good muscle strength as well.

4. CONCLUSION AND RECOMMENDATIONS

Pain reduction is the primary goal of intervention, as reduced pain can improve mobility, enabling patients to perform and follow all exercises programmed by the physiotherapist. This study had a positive impact, with the application of microwave diathermy combined with core stabilization exercises and the Scroth method, monitored over 3 therapy sessions, resulting in pain reduction and improved mobility. However, changes in posture/curve cannot be directly observed. Recommendations for patients with scoliosis include continuing to perform exercises consistently until proper breathing control, posture correction awareness, and good muscle stabilization control are established, thereby fostering sustainable postural habits.

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