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Original Article

Exploring the Impact of Spinal Mobilization in Adolescent Idiopathic Scoliosis

Amna Ahmad[1], Atif Malik[1]*, Rameen Mahboob[1], Rumaisa Asif[1], Aruba Ansar[1], Zovish Qayoum[1]

[1]University of Sargodha.

Corresponding Author: Atif Malik; Email: muhammad.atif@uos.edu.pk

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ABSTRACT

Background: Adolescent idiopathic scoliosis (AIS) is a prevalent musculoskeletal condition in adolescents, characterized by a complex etiology and significant impact on health. The condition is typically managed through various physical therapies, but the effectiveness of combining different therapeutic approaches, particularly the integration of spinal mobilization with conventional exercises, is not well established.

Objective: This study aimed to evaluate the effectiveness of combining Schroth exercises with spinal mobilization in improving Cobb's angle in patients with AIS, compared to Schroth exercises alone.

Methods: A randomized controlled trial was conducted at Mubarak Hospital, Sargodha, involving 12 patients aged 10-20 years with diagnosed AIS. Participants were divided into two groups: a Control Group (n=6) receiving Schroth exercises and an Experimental Group (n=6) receiving Schroth exercises plus spinal mobilization. The treatment duration was four weeks. Pre- and post-intervention Cobb's angles were measured using radiographs. Data analysis was performed using SPSS version 25.

Results: Both groups demonstrated a significant reduction in Cobb's angle post-intervention. The Control Group showed a decrease from a mean ± SD of 20 ± 3.46 degrees to 17.5 ± 3.61 degrees ($P < 0.001$). The Experimental Group exhibited a more pronounced reduction, from 20.3 ± 2.80 degrees to 15.5 ± 3.08 degrees ($P < 0.001$).

Conclusion: The study concluded that the integration of spinal mobilization with Schroth exercises is more effective in reducing Cobb's angle in patients with AIS compared to Schroth exercises alone. This combination therapy may represent a more potent approach for the management of AIS.

Keywords: Adolescent Idiopathic Scoliosis, Cobb's Angle, Schroth Exercises, Spinal Mobilization, Randomized Controlled Trial, Musculoskeletal Health.

INTRODUCTION

Scoliosis, an abnormal lateral curvature of the spine, shifts the spine's normal sagittal plane curvature to the coronal plane. This condition is prevalent in adolescents, leading to the term adolescent idiopathic scoliosis, which accounts for approximately 80% of all scoliosis cases after excluding other causes (1). Scoliosis is multifaceted in its etiology, categorized mainly as idiopathic, congenital, or neuromuscular. Congenital scoliosis arises from vertebral abnormalities during embryogenesis, while neuromuscular scoliosis is associated with conditions affecting the nervous and muscular systems, such as spinal cord injuries, muscular dystrophy, and cerebral palsy (2).

Patients with scoliosis typically present with asymmetrical shoulders, forward-pointing shoulder blades, misalignment of the head with the pelvis, and uneven waist, leading to a noticeable body tilt (3). Diagnosis involves a physical examination complemented by imaging techniques like X-rays, spinal radiographs, CT scans, and MRIs. The Cobb's method, measuring the curve's angle, is pivotal in diagnosing scoliosis, with a coronal curve exceeding 10 degrees being indicative of the condition. Curves greater than 25-30 degrees are considered significant, while those surpassing 45-50 degrees often necessitate more intensive treatment (4).

Adam's forward bending test is a commonly used initial screening tool for scoliosis. This test involves the patient bending forward at the waist with feet together, allowing the examiner to identify any abnormal spinal curvature or trunk asymmetry. However, for precise assessment, radiographic evaluation is essential (5). Adolescent idiopathic scoliosis (AIS) is a common orthopedic challenge,

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with conservative treatments like physical therapy exercises and treatments remaining subjects of debate (6). Manual therapy techniques, known for their ability to enhance range of motion and reduce muscle tone and pain, might offer therapeutic benefits in AIS.

The treatment approach for scoliosis varies based on severity, patient age, and underlying causes. Moderate scoliosis in developing children and teenagers (curvatures between 25 and 40 degrees) might be managed with bracing. In contrast, severe scoliosis (curvature exceeding 40 to 50 degrees) or cases unresponsive to conventional treatments may require surgical intervention, with Vertebral Body Tethering (VBT) being a contemporary surgical method that straightens the spine while preserving some spinal flexibility (8).

Physical therapy, incorporating specific stretching and strengthening exercises, can bolster muscle strength, flexibility, and posture. The Schroth method, a specialized physical therapy approach for scoliosis, integrates movements and breathing exercises targeting trunk elongation, postural alignment, and asymmetrical muscle imbalances. Exercises promoting balance, such as Body Weight Changes and Balance Training, assist in postural correction and stability. Moreover, stretching exercises address tight muscles potentially contributing to curvature, while strengthening exercises focus on supporting the spine, enhancing flexibility, and targeting muscles like hip muscles, back extensors, and the core (10). In spinal mobilization, a lateral gliding technique corrects thoracic lateral shifts, applying glide against the patient's elbow and thoracic cage while pulling the pelvis in the opposite direction.

MATERIAL AND METHODS

This randomized controlled trial was conducted at Mubarak Hospital, Sargodha, from June to July 2023. The study spanned four weeks and received approval from the hospital's ethical board. A total of 12 patients, aged between 10 and 20 years, were enrolled and provided informed consent. Baseline data, including age, gender, and Cobb's angle, were collected for each participant.

Patients were randomly allocated into two groups: the Experimental group and the Control group, each consisting of six participants. The inclusion criteria encompassed patients under 20 years of age with diagnosed scoliosis and a Cobb's angle of less than 10 degrees. Exclusion criteria included patients older than 19 years, those with malignancies, fractures, a Cobb's angle greater than 45 degrees, or any other pathological disorder.

The Control group underwent a regimen of exercises, including cobra exercises, spinal extensions, spinal strengthening (performed by lying on the concave side and lifting the upper trunk to strengthen the convex side), active self-correction, bridging exercises, reverse Straight Leg Raise (SLR), and stretching exercises targeting the Latissimus dorsi and pectoralis muscles. Each exercise was repeated 20 times. Additionally, exercises such as modified SLR, bridging, heel slides, clam exercises, and stretching were employed for the correction of pelvic tilting.

In contrast, the Experimental group received the same exercise protocol as the Control group, supplemented with spinal mobilization techniques. These techniques aimed to decrease the scoliotic curve and enhance involuntary neuromuscular control of posture and balance. The specific manipulative and rehabilitative methods included the lateral glide technique, wherein the misaligned spinal segment was identified, and lateral glide was applied at the convexity side to minimize curvature and realign the spine. Central Posterior-Anterior (PA) Glide involved applying a posterior to anterior glide to the affected thoracic spine segment while the patient lay prone. The Side Shift method, conducted in a lying position, aimed to correct scoliotic curves through trunk movements, facilitating the somatosensory integration of spinal posture. Additionally, soft tissue release techniques involved applying gentle pressure and stretch to relax tightened muscles and fascia around the spine.

Figure 1 Slide Application Variations

Data collection and assessment were systematically conducted. Cobb's angle measurements were obtained using X-ray images taken in both anterior-posterior (AP) and lateral views by radiologists at a specialized radiological center. The X-rays were taken with the patients in a standing position. For data analysis, the collected information was processed using the Statistical Package for the Social Sciences (SPSS) version 25, with all analyses performed in retrospect and described in the third person. The outcomes of the interventions were evaluated and compared between the two groups to assess the effectiveness of the added spinal

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mobilization in the Experimental group. This comparative analysis was crucial in determining the efficacy of the different treatment modalities in managing adolescent idiopathic scoliosis.

RESULTS

In this study, the demographic characteristics of the participants were carefully analyzed and are presented in Table 1. The Control Group and the Experimental Group each consisted of 6 participants. The average age in the Control Group was 15 years (±2.5 SD), with a range from 10 to 19 years, while the Experimental Group had a slightly lower average age of 14.5 years (±2.7 SD), ranging from 10 to 18 years. In terms of gender distribution, the Control Group comprised an equal split of 3 males (50%) and 3 females (50%). The Experimental Group, however, had a higher proportion of males, with 4 (66.7%) males and 2 (33.3%) females. Height and weight were also comparable between the two groups. The average height in the Control Group was 160 cm (±5.2 SD) and 158 cm (±6.1 SD) in the Experimental Group. Similarly, the average weight was 55 kg (±4.5 SD) for the Control Group and 53 kg (±5.0 SD) for the Experimental Group. The baseline Cobb's angle was nearly identical in both groups, with the Control Group having an average of 20 degrees (±3.46 SD) and the Experimental Group 20.3 degrees (±2.80 SD).

The efficacy of the interventions is detailed in Table 2. Both groups showed a significant reduction in the Cobb's angle post-intervention. The Control Group, which underwent Scroth exercises, exhibited a decrease in the Cobb's angle from an average of 20 degrees (±3.46 SD) pre-intervention to 17.5 degrees (±3.61 SD) post-intervention, demonstrating a notable improvement with a P-value of <0.001. This indicates a statistically significant reduction in the curvature of the spine due to the exercises. The Experimental Group, which received both Scroth exercises and spinal mobilization, displayed an even greater reduction. Their Cobb's angle decreased from an average of 20.3 degrees (±2.80 SD) pre-intervention to 15.5 degrees (±3.08 SD) post-intervention, also with a P-value of <0.001. This suggests that the addition of spinal mobilization to the exercise regimen had a considerable impact on improving the spinal curvature in patients with scoliosis.

Table 1 Demographics

Demographic	Control Group (n=6)	Experimental Group (n=6)
Age (years)		
Mean ± SD	15 ± 2.5	14.5 ± 2.7
Range	10-19	10-18
Gender		
Male	3 (50%)	4 (66.7%)
Female	3 (50%)	2 (33.3%)
Height (cm)		
Mean ± SD	160 ± 5.2	158 ± 6.1
Weight (kg)		
Mean ± SD	55 ± 4.5	53 ± 5.0
Cobb's Angle (degrees)		
Mean ± SD	20 ± 3.46	20.3 ± 2.80

Table 2 Comparison of Cobb's Angle Before and After Intervention

Group	Pre-Intervention Cobb's Angle (Mean ± SD)	Post-Intervention Cobb's Angle (Mean ± SD)	P-value
Control Group (Scroth Exercises)	20 ± 3.46	17.5 ± 3.61	< 0.001
Experimental Group (Scroth Exercises + Mobilization)	20.3 ± 2.80	15.5 ± 3.08	< 0.001

The comparative analysis of the Cobb's angle before and after intervention between the two groups indicates that while both interventions were effective in reducing the curvature, the inclusion of spinal mobilization in the Experimental Group led to a more pronounced improvement. The results underscore the potential benefits of combining physical exercises with spinal mobilization techniques in the management of adolescent idiopathic scoliosis.

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DISCUSSION

Adolescent idiopathic scoliosis (AIS) presents a significant challenge in musculoskeletal health, primarily due to its intricate etiology and considerable impact on adolescent well-being. The causative factors for AIS are multifaceted, involving genetic influences, abnormal growth patterns, and neuromuscular anomalies. Clinically, AIS is identified through the observation of spinal asymmetry and confirmed using radiographic imaging to ascertain the curvature degree. The necessity for early detection is underscored by the need to understand the genetic and environmental interplay, which can enhance early intervention strategies and overall management of AIS (14).

In treating scoliosis, a key focus is on controlling the alignment of the spine's segments, aiming to restore and maintain the normal position of spinal joints. This approach is critical for integrating improved spinal alignment into daily activities, contributing to the rapid recovery of spinal curvature. Although Schroth exercises emphasize segmental spine straightening, the precise correction at the segmental level remains elusive. Consequently, combining manipulative and rehabilitative methods is suggested to achieve structural improvements in scoliosis treatment (15).

Various studies have investigated different interventions for AIS. Research indicates that Schroth rehabilitation exercises can improve Cobb's angle, scoliometer readings, lumbar lordosis, and calcaneal valgus angles (16). Other studies have shown that self-correction movements reduce spine deviation and enhance balance, while posterior spinal correction and fusion have been found to improve postural stability (17, 18). The increased risk of fracture and spinal nerve compression in AIS patients with osteoporosis has also been highlighted. The efficacy of 3D printed braces in immediate treatment has been demonstrated, and comparisons between Schroth exercises and proprioceptive neuromuscular facilitation have favored Schroth exercises for reducing scoliosis angle and enhancing functional capacity (19-22).

A pivotal study in 2020 revealed the effectiveness of spinal mobilization on Cobb's angle and respiratory function in AIS patients, where joint mobilization resulted in a notable shift in Cobb's angle (23). In contrast, our study, which combined Schroth exercises with mobilization, reported a change in Cobb's angle from 20.3 to 15.5. We modified certain aspects such as the sample size and treatment duration, reducing the number of patients from 22 to 12 and the treatment duration from 6 weeks to 4 weeks.

While our study underscores the efficacy of combining spinal mobilization with Schroth exercises in AIS treatment, it is not without limitations. The small sample size and the confinement of the study to a single clinic are significant constraints. Additionally, the impact of spinal manipulation on respiratory function in AIS patients was not analyzed, representing an area for future research.

CONCLUSION

The current study corroborates that a combined approach of spinal mobilization and Schroth exercises is more effective for treating AIS and improving Cobb's angle. This finding highlights the potential benefits of integrating joint manipulation and exercises in managing scoliotic deformities. Future studies should consider larger, more diverse sample sizes and multi-center trials to validate these findings further and explore additional aspects such as the impact on respiratory function.

REFERENCES

1. Weinstein SL, Dolan LA, Cheng JC, Danielsson A, Morcuende JA. Adolescent idiopathic scoliosis. The lancet. 2008;371(9623):1527-37.
2. Shakil H, Iqbal ZA, Al-Ghadir AH. Scoliosis: review of types of curves, etiological theories and conservative treatment. Journal of back and musculoskeletal rehabilitation. 2014;27(2):111-5.
3. Karol LA. The natural history of early-onset scoliosis. Journal of Pediatric Orthopaedics. 2019;39:S38-S43.
4. Addai D, Zarkos J, Bowey AJ. Current concepts in the diagnosis and management of adolescent idiopathic scoliosis. Child's Nervous System. 2020;36:1111-9.
5. Oetgen ME, Heyer JH, Kelly SM. Scoliosis screening. JAAOS-Journal of the American Academy of Orthopaedic Surgeons. 2021;29(9):370-9.
6. Lotan S, Kalichman L. Manual therapy treatment for adolescent idiopathic scoliosis. Journal of Bodywork and Movement Therapies. 2019;23(1):189-93.
7. Weinstein SL, Dolan LA, Wright JG, Dobbs MB. Effects of bracing in adolescents with idiopathic scoliosis. New England Journal of Medicine. 2013;369(16):1512-21.
8. Lonstein JE. Scoliosis: surgical versus nonsurgical treatment. Clinical Orthopaedics and Related Research®. 2006;443:248-59.

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9. Monticone M, Ambrosini E, Cazzaniga D, Rocca B, Ferrante S. Active self-correction and task-oriented exercises reduce spinal deformity and improve quality of life in subjects with mild adolescent idiopathic scoliosis. Results of a randomised controlled trial. European spine journal. 2014;23:1204-14.
10. Zapata KA, Sucato DJ, Jo C-H. Physical therapy scoliosis-specific exercises may reduce curve progression in mild adolescent idiopathic scoliosis curves. Pediatric Physical Therapy. 2019;31(3):280-5.
11. Kisner C, Colby LA, Borstad J. Therapeutic exercise: foundations and techniques: Fa Davis; 2017.
12. Chu EC-P. Improvement of quality of life by conservative management of thoracic scoliosis at 172: a case report. Journal of Medicine and Life. 2022;15(1):144.
13. Berdishevsky H, Lebel VA, Bettany-Saltikov J, Rigo M, Lebel A, Hennes A, et al. Physiotherapy scoliosis-specific exercises–a comprehensive review of seven major schools. Scoliosis and spinal disorders. 2016;11(1):1-52.
14. Morningstar MW, Woggon D, Lawrence G. Scoliosis treatment using a combination of manipulative and rehabilitative therapy: a retrospective case series. BMC Musculoskeletal Disorders. 2004;5(1):1-10.
15. Won S-H, Oh D-W, Shen M. An 18-month follow-up study on the effect of a neuromuscular stabilization technique on Cobb's angle in adolescent idiopathic scoliosis: A single-blind, age-matched controlled trial. Journal of Back and Musculoskeletal Rehabilitation. 2021;34(1):87-93.
16. Marin L, Lovecchio N, Pedrotti L, Manzoni F, Febbi M, Albanese I, et al. Acute Effects of Self-Correction on Spine Deviation and Balance in Adolescent Girls with Idiopathic Scoliosis. Sensors (Basel, Switzerland). 2022;22.
17. Park JJ, So W-Y. The Effect of the Schroth Rehabilitation Exercise Program on Spinal and Feet Alignment in Adolescent Patients with Idiopathic Scoliosis: A Pilot Study. Healthcare. 2022;10.
18. Pezham H, Babaee T, Bagheripour B, Asgari M, Jiryaei Z, Vahab Kashani R, et al. Stress level and quality of life of adolescents with idiopathic scoliosis during brace treatment. Turkish Journal of Physical Medicine and Rehabilitation. 2022;68:231- 7.
19. Akoja MI, Anjorin AG, editors. Social Media and Women's Culture of Silence on Sexual Violence: Perception of Babcock University's Female Undergraduates2020.
20. Kocaman H, Bek N, Kaya MH, Büyükturan B, Yetiş M, Büyükturan Ö. The effectiveness of two different exercise approaches in adolescent idiopathic scoliosis: A single-blind, randomized-controlled trial. PloS one. 2021;16.
21. Mohamed Ra, Yousef AM. Impact of Schroth three-dimensional vs. proprioceptive neuromuscular facilitation techniques in adolescent idiopathic scoliosis: a randomized controlled study. European review for medical and pharmacological sciences. 2021;25 24:7717-25.
22. Osuka S, Sudo H, Yamada K, Tachi H, Watanabe K, Sentoku F, et al. Effects of Posterior Spinal Correction and Fusion on Postural Stability in Patients with Adolescent Idiopathic Scoliosis. Journal of Clinical Medicine. 2022;12.
23. Hong G-R, Kim Y-Y, Kim B-K, Kim D-J, Kim A, Kim S-H. Effects of Spine Mobilization on Cobb's Angle and Respiratory Function in Patients with Adolescent Idiopathic Scoliosis. 2020;11(4):2191-6.