



Effectiveness of Schroth-based PSSE combined with bracing and Pilates on pain, function and spinal curvature in adolescent idiopathic scoliosis: A case report

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Abstract

Adolescent idiopathic scoliosis (AIS) is a deformity of spine which causes pain, functional limitations, respiratory compromise, reduced quality of life and is a challenge when considering treatment due to varying unpredictable treatment options. Various treatment options depend on the amount of curvature present, currently for moderate curvature conservative management is followed when surgery is deferred. This case report includes use of Schroth-Based Physiotherapeutic Scoliosis-Specific exercises (PSSE-Schroth) combined with bracing and Pilates, understanding its effect on pain, function, spinal curvature, postural perception, Respiratory capacity and Quality of life (QOL) in an 18-year-old adolescent female patient. Following 6 months of individualized physiotherapeutic intervention and 3 months of bracing there was a significant difference in all the domains and a reduction in Cobb angle from 37 to 31. By this study it suggests that this individualized intervention might serve as a useful alternative to non-surgical management option for idiopathic scoliosis in adults.

Keywords: Scoliosis, PSSE-Schroth, Bracing, Pilates

Introduction

Adolescent idiopathic scoliosis (AIS) is a three-dimensional spinal deformity with onset of symptoms between age 10 to 18 years and is characterized by alterations in spinal curvature with lateral shift and rotation [1]. Almost 75-85% of idiopathic scoliosis cases are seen in adolescent as it commonly progresses during the time when there is rapid skeletal growth [2]. Even though no particular causative factor is present it usually is varied and is assumed to be present because of Altered postural control, genetic predisposition, neuromuscular imbalance and asymmetrical growth alignment [3, 4].

The magnitude of spinal curvature is measured by calculating the Cobb angle. For moderate scoliosis the value lies between 25 to 45 degrees. According to the treatment options available, conservative treatment strategies are recommended for moderate scoliosis. Apart from structural malformations, other symptoms include musculoskeletal pain, impaired functional capacity, and reduced respiratory efficiency, deteriorating quality of life [5].

For AIS, evidence based conservative treatment known as Schroth-Based Physiotherapeutic scoliosis-specific exercises (PSSE-Schroth) have gained much popularity in recent times. A widely utilized three-dimensional therapeutic approach is Schroth method that focusses on spinal elongation, de-rotation, and asymmetrical muscle activation to improve spinal alignment [2, 4]. According to recent clinical studies and systematic reviews, Schroth-based interventions can contribute to reductions in Cobb angle, improvements in trunk symmetry, enhanced respiratory function, and better patient-reported outcomes [3, 5].

Another key component is Bracing which is used for moderate scoliosis and evidence suggests that both bracing and PSSE-Schroth in combination when used have shown

improvements in the muscular balance, postural awareness and adherence to corrective strategies [3]. Despite of growing evidence there is a lot of variability seen in the response to the treatment and effectiveness depending on its adherence, which makes it important to document clinical case report which has a multidimensional conservative approach and outcomes which will be valuable in real world challenges and remain helpful in guiding clinical practice.

The present case report describes multidimensional conservative physiotherapy approach of an adolescent with moderate thoracic AIS using PSSE-Schroth, Pilates, adjunctive exercise therapy and partial bracing, with evaluating pain, function, postural perception, respiratory capacity and radiographic outcomes.

Case presentation

Patient information

An 18-year-old female standing 164cm tall and weighing 80 kg presented with complaints of chronic mid-back pain, postural asymmetry, and a subjective sensation of right-sided trunk deviation. At eight years of age, the patient sustained a fall from a swing, after which a mild thoracic curvature was incidentally identified. Due to family-related constraints, no follow-up was undertaken.

At 16 years of age, the patient began experiencing progressive intermittent episodes of mid-back pain and postural changes. At 18 years during an Orthopaedic consultation standing radiographs of full spine revealed right C shaped thoracic scoliosis with a Cobb angle of 37°. Multiple orthopaedic consultations recommended either surgical correction or conservative management. The patient elected to pursue non-surgical treatment and was referred for physiotherapy in August 2025.

The patient had no family history of scoliosis. The patient has no history of substance use, and reports no previous

surgeries or drug allergies. The patient complained of intermittent dull aching pain at the right lower thoracic region. Additionally patient also felt shortness of breath on exertion and reduced breathing capacity.

Clinical evaluation

The patient's consent was taken before the examination. She was cooperative and well-oriented toward people, places, and time. On clinical evaluation patient was afebrile, vitals showed normal blood pressure, respiratory rate and heart rate. No neurological deficits were identified on examination, including normal sensation, and reflexes in all extremities. The patient demonstrated visible thoracic asymmetry with right-sided thoracic prominence and compensatory left lumbar curve, uneven shoulder height, and rib hump prominence on the Adam's forward bend test. Postural analysis revealed altered alignment with left head tilt, right shoulder elevated, right hip elevated standing, with difficulty maintaining an upright corrected posture for prolonged periods. Palpation elicited localized tenderness

over right T8, right T9, right T10, right T11, right T12 paraspinal musculature. The spinal range of motion (ROM) is significantly restricted for thoracic rotation on right side. The core strength was noticeably reduced. There was reduced chest expansion at the supra mammary and mammary level attributing to the shortness of breath.

Initial Radiograph

Standing radiographs of anteroposterior and lateral radiograph were taken with patient in upright, weight-bearing and in a neutral position. It revealed a right C shaped thoracic scoliosis with a Cobb angle of 37°.

Therapeutic intervention

The physiotherapist designed suitable exercise sessions based on the patient's clinical status which included PSSE-Schroth, Pilates, Stretching and Strengthening exercises and bracing. Table 1 depicts the physical therapy protocol. The following intervention was given in due course of six months with appropriate progression and loading.

Table 1

Week	Goal	Intervention	Regimen
Weeks 0-8	To reduce pain	TENS, Type – Conventional	15 Mins, Once Daily
	To improve flexibility and mobility of thoracic and lumbar spine	Stretching of the tightened structures – Quadratus Lumborum, Upper Trapezius, Pectoralis Major Bal asana	30secs hold × 3 reps, twice daily
	To improve strength of scapular muscles and core muscles	Scapular retractions, Scapular setting exercises, Wall Push ups Core activation with Straight leg raise, Prone on Elbow	10 reps × 1 set twice daily
	To improve spinal alignment and reduce muscle imbalance	PSSE-Schroth including auto correction, postural education in sitting and standing	10 reps × 1 set twice daily
	To improve respiratory function and aerobic capacity	Thoracic Expansion exercises, Lateral Costal expansion, swimming (One hour thrice a week)	10 reps × 1 set twice daily
Weeks 8-16	To improve flexibility and mobility of thoracic and lumbar spine	AROM exercises for thoracic and lumbar spine Bal asana	10 reps × 1 set twice daily
	To improve strength and endurance of scapular muscles and core muscles	WTY Exercise in Prone Lying, Abdominal and oblique crunches and prone on hands, Pilates – Table top	10 reps × 1 set once daily
	To improve spinal alignment and reduce muscle imbalance	PSSE-Schroth including auto correction, postural education in sitting and standing	15 reps × 1 set twice daily
	To improve respiratory function and aerobic capacity	Thoracic Expansion exercises, Lateral Costal expansion, Jumping Jacks, Walking (Thirty minutes thrice a week)	10 reps × 1 set twice daily
Weeks 16-24	To improve flexibility and mobility of thoracic and lumbar spine	AROM exercises for thoracic and lumbar spine Bal asana	15 reps × 1 set twice daily
	To improve strength and endurance of scapular muscles and core muscles	WTY Exercise in Prone Lying with 1kg weight, Pilates – Curl ups, toe taps, Bridging with Marching, Hundreds, Back extensor strengthening	10 reps × 1 set once daily
	To improve spinal alignment and reduce muscle imbalance	PSSE-Schroth including auto correction, postural education in sitting and standing, angular rotational breathing Bracing	15 reps × 1 set twice daily

TENS: Transcutaneous Electrical Nerve Stimulation

AROM: Active Range of motion exercises

Results

Follow up and Outcome Measures

For six months, the patient underwent a structured physical therapy program, followed by a subsequent follow-up evaluation. The findings of the pre and post intervention clinical examination of the upper limb are shown in Table 2.

Table 2:

Examination	Pre-Intervention	Post-Intervention
Pain Assessment NPRS	On Activity - 7/10 At Rest – 1/10	On Activity - 7/10 At Rest – 0/10
MMT	Fair (5)	Good (8)
Upper Abdominal muscles	Fair (5)	Good +(9)
Lower Abdominal muscles Back Extensors muscles	Fair (5)	Fair+ (6)
Cobb Angle	37°	31°

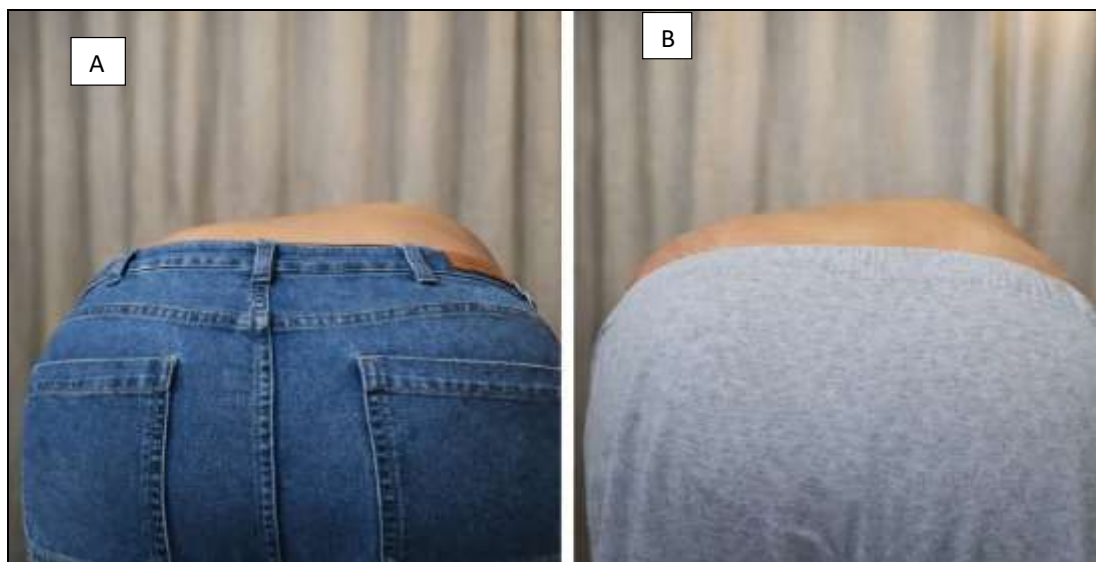


Fig 1A and 1B: FIGURE 1A and 1B shows improvement in angle of trunk rotation (ATR) and truncan shift A) ATR during first consultation pretreatment B) Demonstrates significant improvement. The rib hump was reduced.

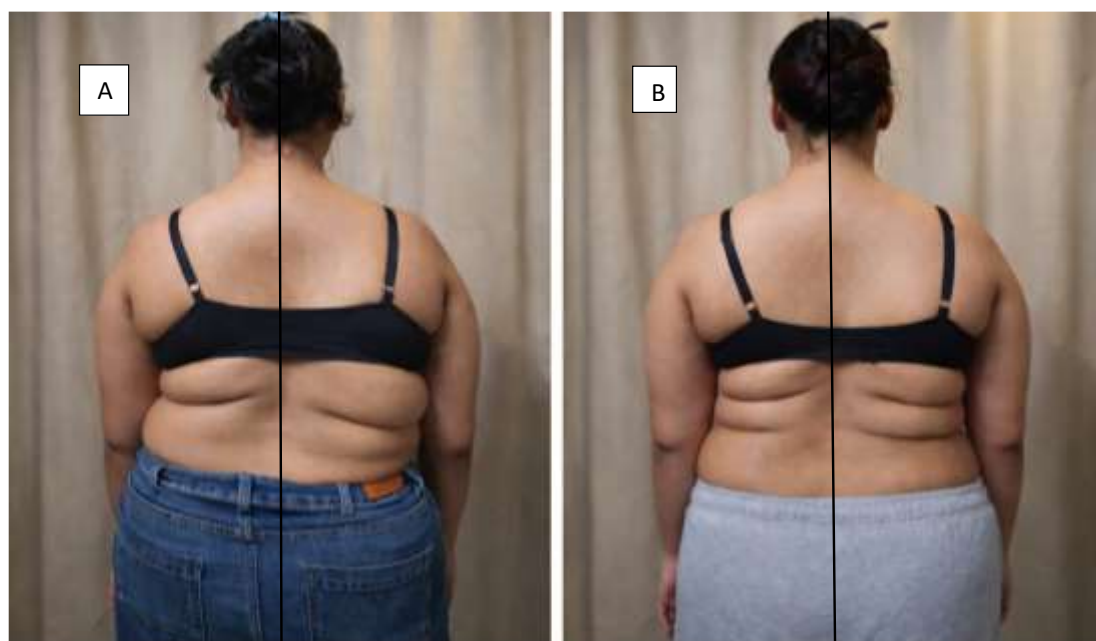


Fig 2A and 2B: Figure 2A and 2B describes posture in posterior view A) Pre Intervention B) After intervention shows marked reduction in right trunk shift.

Functional outcomes assessed using the Scoliosis Research Society-22 revised (SRS-22r) demonstrated improvement across pain, functional activity, self-image, and mental health domains ^[13].

improvement in (Walter Reed Visual Assessment Scale) WRVAS scores reflected improved patient perception of trunk symmetry and spinal alignment. Subjectively, the patient reported enhanced confidence during daily activities and reduced postural fatigue ^[11].

Chest expansion measurement showed improvement in thoracic mobility, accompanied by resolution of exertional breathing difficulty. Radiographic reassessment revealed an estimated 7° reduction in Cobb angle, representing a clinically significant structural improvement.

Discussion

In this case report it demonstrates that an individualized physiotherapeutic conservative rehabilitation program for

moderate thoracic AIS which consists of Schroth-based PSSE, adjunctive Pilates-based training, and partial adherence bracing which led to clinically meaningful improvements in pain, functional ability, postural perception spinal alignment and functional capacity. Overall improvements were seen across pain, functional capacity and psychological well-being in these 6 months of treatment. According to few previous studies the improvements in SRS-22 outcomes were similar as this study following Schroth-based PSSE programs in adolescents with idiopathic scoliosis ^[2,5]. Along with that WRVAS scores was also seen which indicates enhanced patient perception of trunk symmetry, reduced postural fatigue, improved confidence during daily activities. Previous systematic studies have likewise reported improvements in trunk symmetry, body image perception and functional outcomes following Schroth-based PSSE programs in adolescents with idiopathic scoliosis ^[4, 11]

The reduction in Cobb angle observed after the intervention is consistent with the growing evidence that measurable radiographic improvements were seen along with improvements in trunk rotation, spinal alignment and paravertebral muscle activation after scoliosis specific corrective exercises were used in the program, suggesting a potential role in modifying curve progression risk ^[7, 10]. Another important keystone of conservative management which shows meaningful improvement is bracing, despite its partial adherence, it suggests that active physiotherapeutic correction accompanying with orthotic bracing enhances postural awareness, self-correction strategies and muscular stabilization ^[1, 3].

Adjunctive use of Pilates exercise in this case has shown a multidimensional improvement. Recent randomized clinical evidence suggests that Pilates-based rehabilitation programs focusing on core stabilization and breathing control may improve trunk mobility, respiratory muscle strength, posture, and functional capacity in adolescents with idiopathic scoliosis ^[12]. There is an observed improvement in chest expansion and resolution of exertional breathing following intervention. Thoracic scoliosis has resulted in altered ventilatory biomechanics, reduced pulmonary function due to ribcage deformity. Exercise based scoliosis rehabilitation programs which includes corrective breathing strategies have shown improvements in respiratory efficiency and functional thoracic mobility ^[2, 4].

Conclusion

This case supports the role of individualized conservative physiotherapy incorporating Schroth-based PSSE, Bracing, Pilates along with conservative management in managing moderate AIS. Significant improvements were observed in pain, function, quality of life, respiratory capacity, and spinal alignment, highlighting physiotherapy as an important component of non-surgical AIS management.

Patient Consent

Written informed consent was obtained from the patient.

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