The Annals of the "Ştefan cel Mare" University of Suceava.
Physical Education and Sport Section. The Science and Art of Movement
eISSN 2601 - 341X, ISSN 1844-9131

EFFICACY OF THE SCHROTH METHOD IN THE MANAGEMENT OF ADOLESCENT IDIOPATHIC SCOLIOSIS: A CASE SERIES

Holubiac Iulian Ștefan
Stefan cel Mare University of Suceava, Romania
holubiac.iulianstefan@usm.ro

Keywords: idiopathic scoliosis, schroth physiotherapy, cobb angle, postural correction, spinal deformity.

Abstract
Adolescent idiopathic scoliosis (AIS) is a complex three-dimensional spinal deformity that can significantly impact posture, function, and quality of life. Non-invasive, individualized interventions such as the Schroth method have been proposed as effective alternatives to surgical management, aiming to reduce spinal curvature and improve postural control. The primary aim of this study was to evaluate the effectiveness of Schroth physiotherapy in the management of AIS, focusing on curve reduction, postural improvement, and avoidance of surgical intervention. Three adolescent patients with varying severities of scoliosis (Cobb angles 62°, 30°, and 28°) underwent individualized Schroth therapy programs. Treatment duration ranged from three months to fourteen months, with session frequencies of 2–3 times per week. Exercises were tailored to each patient's spinal curvature, incorporating derotation, lateral shift, concavity stretching, and pelvic stabilization techniques. Cobb angles were assessed at baseline and after the intervention to determine the degree of curve reduction. All three patients demonstrated significant improvement. Patient 1 (62°) reduced the Cobb angle to 50°, avoiding surgical intervention. Patient 2 (30° thoracic, 30° lumbar) showed reductions of 5° and 15° in the primary and secondary curves, respectively, following three months of therapy. Patient 3 (28°) achieved a dramatic reduction to 10° over five months, supported by skeletal maturity. The interventions were well-tolerated, and patients adhered to individualized programs, resulting in favorable functional and postural outcomes. Schroth physiotherapy is an effective, non-invasive intervention for adolescent idiopathic scoliosis, capable of reducing spinal curvature, improving postural alignment, and potentially preventing surgical intervention. Early and individualized application, combined with patient engagement, is critical to optimizing outcomes.

Introduction
Adolescent idiopathic scoliosis (AIS) represents the most frequently observed structural deformity of the spine in the pediatric and adolescent population [6]. This

condition is characterized by a three-dimensional alteration of the vertebral column, involving a lateral curvature accompanied by rotational displacement, which typically manifests during the pubertal growth spurt in otherwise healthy children [18]. Clinically, AIS is identified when the spinal curvature measured in the coronal plane reaches or exceeds 10 degrees, a parameter quantified using the Cobb angle methodology. The Cobb angle is determined by assessing the inclination between the superior and inferior end vertebrae of the scoliotic segment. This measurement serves not only as a diagnostic criterion but also as a tool for stratifying disease severity [16]. Scoliosis with a Cobb angle of 10–25° is generally classified as mild, whereas curves between 25° and 45° are considered moderate, and any curvature exceeding 45° is categorized as severe. Notably, spinal curves surpassing 30° at skeletal maturity are associated with a heightened risk of long-term complications in adulthood, including musculoskeletal pain, deformities of the thoracic cage and shoulder girdle, functional limitations, decreased health-related quality of life, and potential respiratory compromise [2]. These observations underscore the clinical significance of early detection, ongoing monitoring, and intervention strategies in managing AIS. The Schroth method is a scoliosis-specific physiotherapeutic exercise protocol that aims to achieve three-dimensional correction of spinal deformity through targeted breathing, postural correction, and muscle activation tailored to the individual's curve pattern. A recent meta-analysis including 11 randomized controlled trials with 446 participants found that Schroth exercises were associated with a statistically significant reduction in Cobb angle when compared to no treatment or non-specific exercise programs. However, the review also noted significant methodological limitations among existing trials and that the average change in Cobb angle did not exceed the conventional 5° threshold considered clinically meaningful. This highlights both the potential efficacy of Schroth therapy and the need for more high-quality research in this area [19]. Research examining short-term Schroth intervention, such as exercise camps with daily intensive training, suggests that even brief programs can yield positive outcomes in trunk muscle endurance, postural symmetry, dynamic balance, and subjective quality of life measures. In a cohort of 45 adolescents with AIS participating in a 7-day Schroth exercise camp, significant improvements were reported in trunk muscle endurance and postural indices alongside reductions in angle of trunk rotation. These findings support the notion that Schroth exercises influence not only structural curve characteristics but also functional adaptations relevant to everyday movement and balance [1]. Comparative studies have evaluated Schroth exercises in combination with other therapeutic approaches such as asymmetric spinal stabilization exercises (ASSE) or core-stabilization regimens. In one randomized controlled trial, combining Schroth exercises with ASSE resulted in greater reductions in back pain compared to Schroth alone or control, although improvements in trunk extensor muscle endurance were not significantly different among groups. Such combination protocols may enhance symptom relief and functional capacity, suggesting that tailored exercise combinations could augment the standard Schroth approach [9]. Non-surgical strategies for managing adolescent idiopathic scoliosis (AIS) primarily encompass careful monitoring and conservative interventions. Initial management often involves routine observation, in which patients undergo regular clinical evaluations over predetermined intervals to track curve progression. For spinal curvatures measuring less than 25°, standard practice typically entails follow-up appointments every six to twelve months. The overarching objectives of conservative care are twofold: to prevent further progression of the spinal deformity and to achieve aesthetic improvement of the trunk profile. Among the most widely employed conservative approaches are spinal bracing, structured exercise regimens, and manual therapy techniques [13]. Bracing involves the application of external orthotic devices designed to stabilize and correct spinal alignment while promoting rotational correction of the pelvis and shoulder girdle, thereby facilitating more symmetrical posture and body mechanics. This intervention is typically indicated for patients exhibiting a Cobb angle exceeding 25°. Beyond mechanical support, braces exert proprioceptive and neuromuscular effects that modulate abnormal loading patterns across the spine and rib cage, enhancing postural control, promoting balanced muscular activation, and supporting adaptive motor behaviors [14]. The effectiveness of bracing is closely linked to patient adherence, as the device must be worn for prolonged durations—generally 23 hours per day—over several years until skeletal maturity is reached, which occurs around age 16 for females and age 18 for males. Despite its therapeutic benefits, bracing can impose psychosocial burdens, negatively affecting self-perception, body image, social interactions, and overall quality of life, which are already challenged by the presence of AIS. Moreover, the bulky design and discomfort associated with many orthoses contribute to poor compliance, further limiting clinical effectiveness [4].

Material-method

This study involved three adolescent patients diagnosed with idiopathic scoliosis, who underwent individualized Schroth physiotherapy as a non-invasive treatment approach. The primary aim was to assess the efficacy of the Schroth method in managing scoliosis and improving patients' quality of life. Patient 1: Cobb angle of 62°; treatment duration of 14 months, with therapy sessions conducted 2–3 times per week. Patient 2: Thoracic Cobb angle of 30° and lumbar Cobb angle of 30°; treatment duration of 3 months, with sessions 3 times per week. Patient 3: Cobb angle of 28°; treatment duration of 5 months, with sessions 2 times per week. All patients received personalized Schroth physiotherapy, which included posture correction, rotational breathing exercises, and specific strengthening routines aimed at reducing spinal curvature and improving postural alignment. Each program was tailored to the patient’s specific spinal deformity, Cobb angles, and physical condition.

The primary outcome measure was the change in Cobb angle over the course of treatment. Secondary outcomes included improvements in posture, spinal flexibility, and patient-reported quality of life. Regular assessments were performed at the beginning, during, and at the end of the treatment period. Descriptive analysis was used to summarize patient characteristics, treatment duration, frequency of therapy sessions, and changes in Cobb angles. Comparative evaluation of pre- and post-treatment measurements was performed to assess the effectiveness of the Schroth method.

Figure 1. Anteroposterior spinal radiographs of scoliosis patients. The images show lateral spinal deviation and vertebral rotation, with curve severity quantified using the Cobb angle between the most inclined vertebrae, illustrating varying degrees of scoliotic deformity.

Table 1. Exercise protocol applied during the intervention

eISSN 2601 - 341X, ISSN 1844-9131

Exercise Name	**Purpose / Target**	**Position / Method**	**Notes**
Thoracic Block Rotation (Chest Twister)	Derotation of thoracic block; stretch/decompress thoracic concavity (weak side)	Seated or standing; therapist stabilizes pelvis and shoulder block	Adds external stimulus via arm activity; focuses on weak side
Lateral Pelvic Weight Shift	Correct lateral pelvic alignment	Standing; weight shifted onto left side; therapist assists	Strengthens abductor muscles;
Side-Lying Thoracic Concavity Stretch	Stretch thoracic concavity	Side-lying on thoracic concavity; passive support under rib hump	Gradual derotation of thoracic block
Active Thoracic Derotation (Weak Side Mobilization)	Improve thoracic flexibility and rib hump derotation	Therapist in front applies pressure to ventral prominence and shoulder; patient breathes into weak side	Enhances active engagement
Standing Thoracic Concavity Lateral Shift	Stretch thoracic concavity; lateral thoracic shift	Standing; lateral shift of thoracic block	Postural correction upright
Crossed Arm Thoracic and Pelvic Stretch	Stretch thoracic concavity; third pelvic correction	Standing; arms on cross frame	Combines thoracic stretch with pelvis alignment
Sideways Hanging Thoracic Stretch	Stretch thoracic concavity; pelvic correction	Hanging sideways	Gravity-assisted spinal elongation
Standing Hip Abductor Strengthening (Prominent Hip Exercise)	Correct prominent hip; third pelvic correction	Standing; isometric abductor tension	Supports pelvic alignment
Pelvic Stabilization – Basic Tension (Standing)	Pelvic stabilization	Standing; engage core and pelvic muscles	Foundation for advanced corrections
Pelvic Stabilization – Basic Tension (Seated)	Pelvic stabilization	Seated; maintain core engagement	Supports seated thoracic/spinal exercises

Seated Shoulder Counter Traction with Thoracic-Lumbar Correction	Thoracic curve correction and compensatory lumbar correction	Seated; lift and rotate left hip to counterflex lumbar spine	Focus on weak thoracic and lumbar alignment
Kneeling Pelvic Stabilization with Thoracic SCT	Pelvic correction (5th pelvic correction)	Kneeling; press down with left leg; SCT applied on thoracic side	Stabilizes pelvis for thoracic correction
Seated Spinal Elongation Exercise (Removed Stool – Seated)	Spinal elongation; strengthen superficial back muscles	Seated; concentric-excentric lifting of body weight	Enhances postural strength
Standing Thoracic Lateral Shift with Concavity Stretch	Stretch thoracic concavity; lateral shift	Standing upright	Emphasizes postural correction
Prone Rib Hump Derotation (SCT Prone)	Pelvic stabilization; rib hump derotation	Prone; pressure with elbow on roll, external rotation by lifting roll	Activates thoracic derotation
Prone SCT with Lumbar Compensation	Lumbar curve correction via psoas activation	Prone; rib hump derotation + psoas engagement	Enhances synergistic correction
Lateral Thoracic Derotation with Lumbar Support	Thoracic curve correction and lumbar adjustment	Side-lying; small bag under lumbar prominence	Supports lumbar curve while correcting thoracic rib hump
Side-Lying Spinal Elongation (Removed Stool – Lateral)	Spinal elongation; back muscle strengthening	Side-lying; concentric-excentric lifting	Strengthens paraspinal muscles
Lateral SCT for Thoracic Derotation	Thoracic curve correction	Side-lying; therapist applies SCT	Emphasis on lateral thoracic derotation
Ball-Seated Pelvic and Thoracic Correction	Pelvic correction; thoracic block correction; basic tension	Seated on ball; SCT applied; thoracic corrections	Combines core stabilization with spinal corrections
Pelvic and Lower Limb Alignment Between Poles	Pelvic and lower limb axis correction; basic tension	Standing; forearms on poles; maintain alignment	Combines postural correction with limb alignment

Supine Thoracic SCT with Neutral Pelvis	Thoracic curve correction; pelvis neutral	Supine; SCT applied to thoracic side	Maintains neutral pelvic alignment
Seated Side Shift with Thoracic SCT	Lateral thoracic shift; weak point opening	Seated; glide thoracic block; SCT applied	Focus on weak thoracic concavity
Prone Thoracic SCT with Pelvis Stabilization	Thoracic correction with pelvic support	Prone; stabilize pelvis, apply SCT	Ensures combined spinal and pelvic stability

Results and discussions

The patient presented with a scoliosis Cobb angle of 62°, which developed following a growth spurt. The Schroth therapy intervention was initiated relatively late due to the lack of early referral to this specialized treatment. Despite the delayed intervention, the therapeutic goal of avoiding surgical treatment was successfully achieved. Over the course of one year and two months, with 2–3 sessions per week, the patient demonstrated a reduction in the Cobb angle from 62° to 50°, indicating a favorable response to the exercise-based intervention. This patient exhibited improvements in both the primary and secondary scoliotic curves. The main curve decreased by 5°, while the secondary curve decreased by 15° over a three-month treatment period with sessions conducted three times per week. The patient's consistent and active participation contributed to a successful therapeutic outcome. The results demonstrate the efficacy of Schroth exercises in managing moderate idiopathic scoliosis when therapy adherence is high.

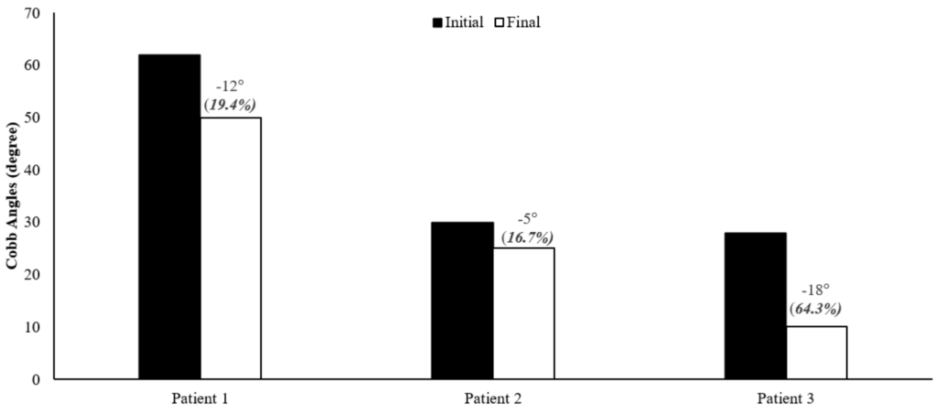

Figure 2. Changes in clinical measurements before and after intervention. The bar chart illustrates individual patient values at baseline and post-intervention, along with the absolute difference (degrees) and the percentage of improvement (%) between initial and final assessments, highlighting the magnitude of change achieved following the therapeutic program.

Over a five-month period, this patient achieved **remarkable improvement**, with the Cobb angle decreasing from 28° to 10°. The favorable outcome was further supported by skeletal maturity, which contributed to the stabilization of the scoliotic curve. The rapid and substantial reduction highlights the potential effectiveness of early and individualized Schroth therapy in adolescents with mild-to-moderate scoliosis

Beyond combinations with other exercises, studies have directly compared Schroth with alternative exercise protocols. In a randomized trial contrasting Schroth with a supervised core stabilization approach, the Schroth group demonstrated more substantial improvements in Cobb angle, thoracic trunk rotation, spinal mobility, and quality of life, whereas core training exhibited superior peripheral muscle strength gains. These results point to the unique value of Schroth in addressing spinal deformity and related functional outcomes that are specific to scoliosis pathology [11]. Understanding the muscle response during corrective exercises is key to validating physiotherapeutic strategies. Surface electromyography (sEMG) studies have shown that Schroth exercises can influence paraspinal muscle activity and symmetry. One study involving nine AIS patients reported significant changes in the paraspinal muscle symmetry index (PMSI) after performance of specific Schroth exercises, indicating modified muscle recruitment patterns. Such neuromuscular adaptations are thought to support improved spinal alignment and stability during postural tasks [8]. The characteristics of paraspinal muscles themselves have been examined in relation to spinal curvature. A systematic review pooling data from observational studies suggests that muscles on the convex side of the scoliotic curve tend to exhibit higher volume and type I fiber prevalence, while the concave side is associated with increased fatty infiltration and reduced muscle activity. These asymmetries may influence curve progression and motor control, reinforcing the rationale for therapeutic exercises that address muscle imbalances as part of conservative management [5]. Several systematic reviews and meta-analyses underscore the evidence that Schroth therapy improves Cobb angle, trunk rotation, and quality of life in AIS compared to standard care or no intervention. One review found significant effects of Schroth exercises on these outcomes at both 12 and 24 weeks, though methodological limitations and the small number of high-quality studies restrict the strength of recommendations. Clinicians are advised to interpret these findings cautiously and consider Schroth exercises as part of a broader conservative management plan [3]. Evidence suggests that participation in a supervised Schroth exercise regimen over 12 weeks [10] or 24 weeks [12] resulted in a meaningful reduction of the spinal curvature relative to patients receiving non-specific non-surgical interventions. Moreover, meta-analytic synthesis of data from Kuru et al. [12] and Schreiber et al. [17] demonstrated that engagement in structured Schroth programs was associated with statistically significant improvements in health-related quality of life at both the 12- and 24-week time points. These findings underscore the potential of supervised, curve-specific physiotherapeutic exercises not only to alter structural parameters of scoliosis but also to enhance functional and psychosocial outcomes for adolescent patients. Considerable variability exists among published studies regarding both the frequency and overall duration of Schroth-based interventions. A meta-analytic investigation conducted by Park et al. [15], which synthesized data from 15 independent studies, evaluated the pre- to post-treatment effect of Schroth exercises in individuals with idiopathic scoliosis. Their analysis highlighted the importance of intervention length, indicating that programs lasting fewer than six months produced a moderate therapeutic impact, corresponding to an effect size of ≥0.50 based on Cohen's classification [7]. In contrast, extending treatment to six months or longer was associated with a substantially greater benefit, yielding large effect sizes (≥0.80) for Cobb angle reduction. Interestingly, the study reporting the briefest intervention period—12 weeks in the trial by Kim and HwangBo [10] —also demonstrated the most pronounced improvements in spinal curvature across both Schroth and Pilates cohorts. This seemingly paradoxical outcome may be partially explained by the higher intensity of supervised therapy provided in that protocol, consisting of 36 guided sessions within three months, compared with the 18 supervised sessions over six weeks in the study by Kuru et al. [12] and the limited five supervised sessions during the initial two weeks in the trial conducted by Schreiber et al. [17]. Additionally, baseline curve magnitude may have influenced responsiveness to treatment, as Kim and HwangBo [10] enrolled participants with smaller initial Cobb angles than those included in the investigations by Schreiber et al. [17] and Kuru et al. [12]. Further supporting this observation, Park et al. [15] examined the relationship between pre-intervention curve severity and treatment effect, revealing an inverse association between baseline Cobb angle and therapeutic gain. Specifically, individuals presenting with curves below 30° achieved the greatest benefit, with effect sizes exceeding 0.80, whereas patients with curvature ranges between 30° and 50°, as well as those exceeding 50°, experienced only moderate improvements. These findings suggest that both treatment intensity and initial curve magnitude are critical determinants of the effectiveness of Schroth-based rehabilitation programs

Conclusion

The present study demonstrates that Schroth physiotherapy is an effective non-invasive approach for managing adolescent idiopathic scoliosis. Individualized exercise programs targeting thoracic derotation, lateral shift, concavity stretching, and pelvic stabilization resulted in significant reductions in Cobb angles across all patients, improved postural alignment, and functional outcomes. Notably, early intervention and consistent patient engagement were key factors contributing to success. These findings support the use of Schroth therapy as a viable alternative to surgical management in moderate AIS, emphasizing the importance of tailored treatment plans and patient adherence. Further studies with larger cohorts are warranted to confirm long-term effectiveness and to refine exercise protocols for optimal outcomes.

References:

1. Aktan, D., & Erdoganoglu, Y. (2021). Effect of Short-Term 3-Dimensional Schroth Exercises In Adolescent Idiopathic Scoliosis: An Observational Study. *Journal of Manipulative and Physiological Therapeutics*, *44*(8), 612–620. https://doi.org/10.1016/j.jmpt.2022.02.001
2. Altaf, F., Gibson, A., Dannawi, Z., & Noordeen, H. (2013). Adolescent idiopathic scoliosis. *BMJ*, *346*(apr30 1), f2508–f2508. https://doi.org/10.1136/bmj.f2508
3. Burger, M., Coetzee, W., Du Plessis, L. Z., Geldenhuys, L., Joubert, F., Myburgh, E., Van Rooyen, C., & Vermeulen, N. (2019). The effectiveness of Schroth exercises in adolescents with idiopathic scoliosis: A systematic review and meta-analysis. *South African Journal of Physiotherapy*, *75*(1). https://doi.org/10.4102/sajp.v75i1.904
4. Canavese, F., & Kaelin, A. (2011). Adolescent idiopathic scoliosis: Indications and efficacy of nonoperative treatment. *Indian Journal of Orthopaedics*, *45*(1), 7–14. https://doi.org/10.4103/0019-5413.73655
5. Chan, W. W. Y., Fu, S.-N., Chong, T.-F., Singh, G., Tsai, D. S. J., Wong, M. C. Y., Zheng, Y.-P., Parent, E. C., Cheung, J. P. Y., & Wong, A. Y. L. (2024). Associations between paraspinal muscle characteristics and spinal curvature in conservatively treated adolescent idiopathic scoliosis: A systematic review. *The Spine Journal*, *24*(4), 692–720. https://doi.org/10.1016/j.spinee.2023.11.008
6. Cheng, J. C., Castelein, R. M., Chu, W. C., Danielsson, A. J., Dobbs, M. B., Grivas, T. B., Gurnett, C. A., Luk, K. D., Moreau, A., Newton, P. O., Stokes, I. A., Weinstein, S. L., & Burwell, R. G. (2015). Adolescent idiopathic scoliosis. *Nature Reviews Disease Primers*, *1*(1), 15030. https://doi.org/10.1038/nrdp.2015.30
7. Durlak, J. A. (2009). How to Select, Calculate, and Interpret Effect Sizes. *Journal of Pediatric Psychology*, *34*(9), 917–928. https://doi.org/10.1093/jpepsy/jsp004
8. He, C., Yang, J.-T., Zheng, Q., Mei, Z., & Ma, C. Z.-H. (2022). How do Paraspinal Muscles Contract during the Schroth Exercise Treatment in Patients with Adolescent Idiopathic Scoliosis (AIS)? *Bioengineering*, *9*(6), 234. https://doi.org/10.3390/bioengineering9060234
9. Khaledi, A., Minoonejad, H., Daneshmandi, H., Akoochakian, M., & Gheitasi, M. (2024). Schroth and Asymmetric Spinal Stabilization Exercises’ Effectiveness on Back Pain and Trunk Muscle Endurance in Adolescents’ Idiopathic Scoliosis: A Randomized Controlled Trial. *Medical Journal of The Islamic Republic of Iran*. https://doi.org/10.47176/mjiri.38.90
10. Kim, G., & HwangBo, P. (2016). Effects of Schroth and Pilates exercises on the Cobb angle and weight distribution of patients with scoliosis. *Journal of Physical Therapy Science*, *28*(3), 1012–1015. https://doi.org/10.1589/jpts.28.1012

11. Kocaman, H., Bek, N., Kaya, M. H., Büyükturan, B., Yetiş, M., & Büyükturan, Ö. (2021). The effectiveness of two different exercise approaches in adolescent idiopathic scoliosis: A single-blind, randomized-controlled trial. *PLOS ONE*, *16*(4), e0249492. https://doi.org/10.1371/journal.pone.0249492
12. Kuru, T., Yeldan, İ., Dereli, E. E., Özdinçler, A. R., Dikici, F., & Çolak, İ. (2016). The efficacy of three-dimensional Schroth exercises in adolescent idiopathic scoliosis: A randomised controlled clinical trial. *Clinical Rehabilitation*, *30*(2), 181–190. https://doi.org/10.1177/0269215515575745
13. Lewis C. (2012). A review of non-invasive treatment interventions for spinal deformities’. In *Physical Therapy Perspectives in the 21st Century – Challenges and Possibilities 3* (pp. 67–88). InTech.
14. Negrini, S., Minozzi, S., Bettany-Saltikov, J., Zaina, F., Chockalingam, N., Grivas, T. B., Kotwicki, T., Maruyama, T., Romano, M., & Vasiliadis, E. S. (2010). Braces for Idiopathic Scoliosis in Adolescents: *Spine*, *35*(13), 1285–1293. https://doi.org/10.1097/BRS.0b013e3181dc48f4
15. Park, J.-H., Jeon, H.-S., & Park, H.-W. (2018). Effects of the Schroth exercise on idiopathic scoliosis: A meta-analysis. *European Journal of Physical and Rehabilitation Medicine*, *54*(3). https://doi.org/10.23736/S1973-9087.17.04461-6
16. Romano, M., Minozzi, S., Bettany-Saltikov, J., Zaina, F., Chockalingam, N., Kotwicki, T., Maier-Hennes, A., & Negrini, S. (2012). Exercises for adolescent idiopathic scoliosis. *Cochrane Database of Systematic Reviews*. https://doi.org/10.1002/14651858.CD007837.pub2
17. Schreiber, S., Parent, E. C., Moez, E. K., Hedden, D. M., Hill, D., Moreau, M. J., Lou, E., Watkins, E. M., & Southon, S. C. (2015). The effect of Schroth exercises added to the standard of care on the quality of life and muscle endurance in adolescents with idiopathic scoliosis—an assessor and statistician blinded randomized controlled trial: “SOSORT 2015 Award Winner.” *Scoliosis*, *10*(1), 24. https://doi.org/10.1186/s13013-015-0048-5
18. Weinstein, S. L., Dolan, L. A., Cheng, J. C., Danielsson, A., & Morcuende, J. A. (2008). Adolescent idiopathic scoliosis. *The Lancet*, *371*(9623), 1527–1537. https://doi.org/10.1016/S0140-6736(08)60658-3
19. Zhu, Y., Zhu, C., Song, H., & Zhang, M. (2025). Effectiveness of Schroth exercises for adolescent idiopathic scoliosis: A meta-analysis. *PeerJ*, *13*, e19639. https://doi.org/10.7717/peerj.19639