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A Comprehensive Review of Current Evidence of the Schroth Method in Non-Surgical Treatment of Pediatric Idiopathic Scoliosis

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Abstract

Background: The World Health Organization (WHO) recognizes scoliosis as a musculoskeletal disorder leading to postural imbalances, compromised pulmonary function, and long-term disability. Pediatric idiopathic scoliosis is less commonly seen, specifically referring to cases that develop in children and adolescents during periods of rapid growth. The Schroth Method incorporates three-dimensional postural correction, targeted breathing techniques, and muscular rebalancing to counteract spinal deformities.

Objective: To review the Current evidence on the Schroth Method as a Conservative Management Strategy for Pediatric Idiopathic Scoliosis

Methodology: The review was carried out in 5 phases that included comprehensive, systematic data extraction, where n=450, and based on PRISMA guidelines, CASP>9, n=11 articles were reviewed for the result analysis.

Result: The review encompassing 11 studies indicates that the Schroth method effectively improves posture, trunk symmetry, and balance in adolescents with idiopathic scoliosis (AIS). The Schroth-based physiotherapeutic scoliosis-specific exercises (PSSEs) focus on improvement in functional outcomes such as respiratory efficiency, sensorimotor control.

Conclusion: An early intervention with Schroth exercises in the paediatric population can aid in the reduction of brace dependency and surgical risk by overall improving quality of life.

Keywords: Schroth Method, Scoliosis, Pediatric, Rehabilitation, current evidence, Cobb's angle

1. Introduction

Scoliosis is a complex three-dimensional deformity of the spine diagnosed as a lateral spinal curvature typically exceeding 10 degrees and often accompanied by vertebral rotation. The World Health Organization (WHO) recognizes scoliosis as a musculoskeletal disorder leading to postural imbalances, compromised pulmonary function, and long-term disability. Clinically, scoliosis is classified into two main types: structural scoliosis, characterized by a fixed and irreversible curvature often due to vertebral anomalies or neuromuscular conditions; and non-structural (functional) scoliosis, which is typically a reversible curvature secondary to factors such as muscular imbalance, poor posture, or leg length

discrepancy [1]. The lateral spinal curvature is commonly measured using the Cobb angle on standing radiographs, which remains the gold standard in clinical and research settings. Among the various types, idiopathic scoliosis is a form with no identifiable cause and represents most cases, particularly in the adolescent population.

Pediatric idiopathic scoliosis is less commonly seen, specifically referring to cases that develop in children and adolescents during periods of rapid growth. They are classified into infantile (0-3 years), juvenile (4-10 years), and adolescent (11-18 years) types, where adolescent idiopathic scoliosis (AIS) is the most common. Multiple hypotheses have been proposed, including genetic predisposition, abnormal spinal growth, hormonal imbalances, neuromuscular factors, and biomechanical issues, where researchers found a higher prevalence rate among females, affecting 2-4% of adolescents globally. Many cases are detected between the ages of 10 and 18 during routine school screening or physical examination.[3] Untimely intervention in scoliosis can contribute to worsening functional limitations and may culminate in long-term disability, adversely affecting an individual's daily functioning and overall well-being

The prominent clinical features of scoliosis include noticeable thoracic prominence, lateral deviation of the trunk, and compromised pulmonary function due to restricted chest wall expansion. Individuals may experience chronic respiratory insufficiency, persistent back pain, and various functional limitations that affect daily activities.[4] In more severe cases, neurological symptoms may arise due to spinal cord or nerve root compression, leading to psychosocial distress related to body image and self-esteem, potential cardiovascular implications in progressive cases, and significantly reduced spinal flexibility and mobility, all of which can negatively impact overall quality of life .[5] An untreated scoliosis may lead to progressive spinal curvature, which can result in chronic back pain, impaired respiratory function, diminished physical endurance, and psychological challenges stemming from body image concerns, thereby heightening the likelihood of long-term complications. Conservative management of pediatric idiopathic scoliosis focuses on preventing curve progression, enhancing posture, improving functional abilities, and promoting overall quality of life. Common approaches include bracing, physical therapy targeting core strength and flexibility, manual spinal mobilization, and education and counseling. Among scoliosis-specific exercise (SSE) programs, the Schroth Method has emerged as a leading approach due to its comprehensive and individualized nature.

The Schroth Method incorporates three-dimensional postural correction, targeted breathing techniques, and muscular rebalancing to counteract spinal deformities. This method emphasizes axial elongation, rotational angular breathing, and sensorimotor training, allowing patients to develop a better sense of posture and actively self-correct in daily life. Early identification and conservative management are critical, as progression during growth spurts may lead to more severe deformities and functional limitations. Hence, the studies aimed to determine the current evidence on the effectiveness of the Schroth method during periods of rapid growth in children and adolescents, when the risk of curve progression is highest.

Objective

To review the Current evidence on the Schroth Method as a Conservative Management Strategy for Pediatric Idiopathic Scoliosis

Methodology

Study design: Comprehensive Literature review
Search engines: PubMed, Google Scholar, Cochrane Library, Scopus, Web of Science, ScienceDirect
Keywords: pediatric scoliosis, adolescent idiopathic scoliosis, congenital scoliosis, thoracogenic scoliosis, scoliosis-specific exercises, Schroth method
Search year: Articles from 2018–2024
Inclusion Criteria

- **Population:** Children and adolescents (aged 4–18 years) diagnosed with any form of scoliosis (idiopathic, congenital, or thoracogenic).
- **Intervention:** Conservative management methods such as physiotherapy, the Schroth method, bracing, posture correction, and manual therapy
- **Outcomes:** Cobb angle, angle of trunk rotation, postural stability, pulmonary function, quality of life, scoliosis progression
- **Study Types:** Randomized controlled trials (RCTs), systematic reviews, meta-analyses, and retrospective cohort studies

Procedure

The literature review was conducted in 5 phases to ensure a comprehensive result, where
Phase 1: Identification of Article: Based on the title, eligibility criteria were established to screen and guide the inclusion and exclusion of studies, where a total of 520 articles were reviewed and evaluated.
Phase 2: Literature Search and screening: A structured search was carried out using the predefined keywords and Databases like PubMed, Scopus, Google Scholar, and Web of Science, where n= in 420 articles. Boolean operators and full text articles of n=120 were formulated to capture a comprehensive range of studies.
Phase 3: Data Extraction; A standardized data extraction form based on PRISMA guidelines was developed to systematically record study characteristics, including author, year, design, sample size, population, intervention, where n=84.
Phase 4: Quality Appraisal; The methodological quality of the included studies was assessed using appropriate critical appraisal tools such as the CASP> 9 and the study was evaluated for potential biases, clarity of methodology, and validity of outcomes.
Phase 5: Data Synthesis and Interpretation; The articles selected n=11 were synthesized thematically and summarized narratively by identifying the gaps.

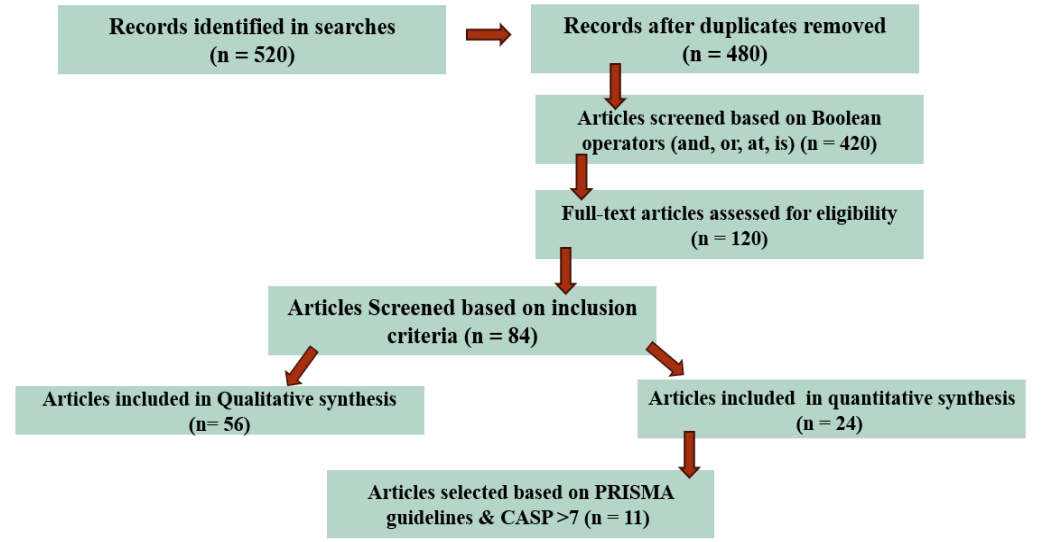


Figure 1: Flow chart Selection of article

Literature Reviewed

1.1 Section 1: Prevalence of Pediatric Scoliosis

Author and Year	Study Design	Result	Level of evidence
Thoracogenic scoliosis: coronal deformity progression in pediatric patients **Riccardo Sacco et al., 2023**	Retrospective study	Contralateral LT led to more severe deformity; left-side LT and age >5 years showed lower THS risk	2
Effectiveness of scoliosis-specific exercises for alleviating adolescent idiopathic scoliosis: a systematic review **Yunli Fan et al., 2020**	Systematic Review	Some evidence for Cobb reduction; insufficient evidence for trunk asymmetry and QoL improvements	1
A comprehensive review of the diagnosis and management of congenital scoliosis **Charles E Mackel et al., 2018**	Narrative Review	Congenital scoliosis accounts for 10% of pediatric cases, is associated with systemic abnormalities, and requires complex treatment decisions	3

Table 1: Review on Pediatric Scoliosis

1.1.2 Section 2: Conservative Treatment for Scoliosis

Author and Year	Study Design	Result	Level of evidence
Treatment of idiopathic scoliosis with conservative methods based on exercises: A systematic review and meta-	Systematic Review & Meta-	Positive effects on Cobb angle, QoL, FVC, and FEV1; weak evidence for ATR	1

analysis **Vanja Dimitrijević et al., 2024**	analysis		
Effective factors on brace compliance in idiopathic scoliosis: a literature review **Sara Rahimi et al., 2020**	Literature Review	Compliance is influenced by brace type, wear pattern, psychological factors, and family involvement	2
Physiotherapeutic Scoliosis-Specific Exercise Methodologies Used for Conservative Treatment of Adolescent Idiopathic Scoliosis, and Their Effectiveness: An Extended Literature Review of Current Research and Practice **Vaiva Seleviciene et al., 2022**	Extended Literature Review	Schroth showed the strongest evidence for trunk rotation and QoL; other methods are effective but less validated	2

Table 2: Conservative treatment for scoliosis

1.1.3 Section 3: Schroth Method in Pediatric Scoliosis

Title, Author, and Year	Study Design	Result	Level of Evidence
A systematic review titled The Schroth Method for Paediatric Scoliosis: A Systematic and Critical Analysis Review **Antony N Baumann et al., 2024**	Systematic Review	Grade A: trunk rotation & safety; Grade B: posture; insufficient evidence for Cobb angle, cost-effectiveness	1
The Effect of the Cheneau Brace on Respiratory Function in Girls with Adolescent Idiopathic Scoliosis Participating in a Schroth Exercise Program. **Anna Badowska et al., 2024**	Clinical Study	Brace use reduced VC, FVC, FEV1; Schroth increased PImax; correlation between PImax and therapy duration	2
Comparison of two periods of Schroth exercises for improving postural stability indices and Cobb angle in adolescent idiopathic scoliosis. **Nadia L Radwan et al., 2022**	Experimental Study	3-month Schroth significantly improved stability indices and Cobb angle; MLSI strongly correlated with Cobb angle	1
Comparison of Two Periods of Schroth Exercises for Improving Postural Stability and Cobb Angle **Nadia L. Radwan, Marwa M (2022)**	Controlled Experimental Study	Compliance is influenced by brace type, wear pattern, psychological factors, and family involvement	1
Standing in Schroth-Trained Position Significantly Changes Cobb Angle and LLD	Retrospective Study	Schroth showed the strongest evidence for trunk rotation and QoL; other methods are effective but	1

Kira Skaggs, Adrian J. Lin et al. (2023)		less validated	

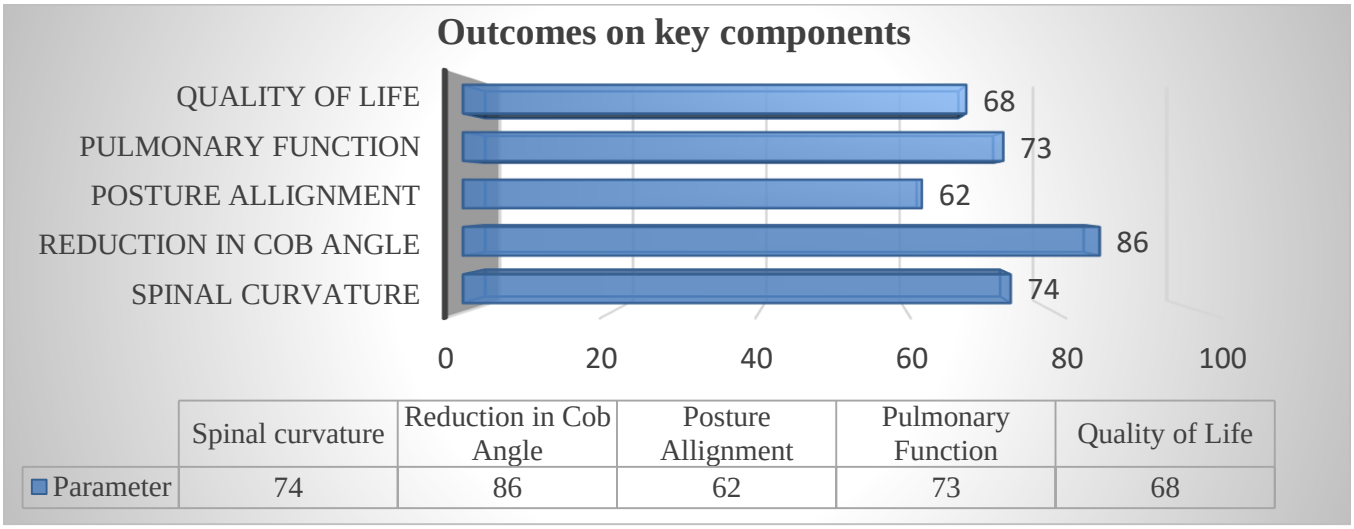
Table 3: Review of the Schroth method in pediatric scoliosis

Result

The literature review encompassing 11 studies indicates that the Schroth method effectively improves posture, trunk symmetry, and balance in adolescents with idiopathic scoliosis (AIS). The Schroth-based physiotherapeutic scoliosis-specific exercises (PSSEs) focus on three-dimensional alignment of spinal curvature, biomechanical posture correction, respiratory function, rotational angular breathing, and muscle activation, promising in reducing Cobb angles and improving the structural growth of children. According to the studies, functional outcomes such as respiratory efficiency, sensorimotor control, and early intervention with Schroth exercises have also been associated with a reduction in brace dependency and surgical risk by overall improving quality of life.

Baumann et al. (2024) concluded that Schroth therapy produced significant improvements in trunk rotation and body posture among adolescents with AIS, with better outcomes in cases where treatment duration exceeded three months. Similarly, Badowska et al. (2024) found that combining Schroth exercises with bracing helped maintain pulmonary function, mitigating the typical decline in forced vital capacity (FVC) and forced expiratory volume (FEV_1) often observed with brace use alone. Radwan et al. (2022) highlighted that a 12-week Schroth program significantly improved postural stability measures (overall, anterior-posterior, and mediolateral indices) in adolescents. Notably, improvements in mediolateral stability were strongly correlated with Cobb angle reductions, indicating a direct link between balance control and spinal alignment. These functional gains suggest Schroth therapy contributes not just to cosmetic or structural correction but also to sensorimotor rehabilitation.

Meta-analytic findings and systematic reviews supported the Schroth method as a conservative treatment capable of improving trunk alignment, balance, and respiratory parameters, with moderate potential for structural curve management. The magnitude of improvement was often dependent on the duration and adherence to the program. These results support the role of Schroth as a valuable non-surgical intervention for adolescent scoliosis management.



Graph 1: The data is pictured in the graph.

Discussion

The findings from the reviewed literature strongly support the use of the Schroth method as an effective conservative intervention for adolescents with idiopathic scoliosis (AIS). Across the articles analyzed, consistent improvements were observed in key postural parameters such as trunk symmetry, balance, and overall posture. Although a complete reversal of spinal curvature was not universally reported, most studies emphasized curve stabilization as a significant clinical outcome, with some demonstrating a notable reduction in the Cobb angle. These results suggest that the Schroth method may not only halt the progression of scoliosis but also improve musculoskeletal function and alignment. Adherence and longer therapy durations emerged as critical factors influencing the magnitude of improvement, underlining the need for structured, supervised, and consistent rehabilitation programs.

Scoliosis impacts both the biomechanics and sensorimotor control of the spine, leading to poor posture, reduced balance, and often compromised breathing mechanics. The Schroth method, through its specific postural correction, rotational breathing, and muscle re-education techniques, appears to counteract these issues by promoting spinal symmetry and improving postural awareness. Studies consistently indicated that incorporating Schroth therapy in conservative AIS management improved balance indices, posture, and in some cases, pulmonary parameters like FVC and FEV_1, enhancing thoracic mobility. For instance, when breathing exercises were added to core-based Schroth routines, gains in respiratory function and postural control were significantly higher compared to standard therapy alone, illustrating how combining respiratory and postural retraining optimizes functional rehabilitation. These results align with current rehabilitation perspectives that emphasize patient-specific, functionally oriented approaches rather than purely structural correction.

Strengths and limitations: The available evidence on Schroth therapy in AIS includes multiple controlled trials with standardized outcome tools such as Cobb angle measurement, balance indices, and respiratory parameters. However, many of the studies had small sample sizes (often fewer than 50 participants), short durations (typically 6–12 weeks), and limited follow-up. Such limitations reduce the ability to generalize long-term outcomes or determine lasting structural changes. A limitation was variability in adherence, especially in home-based components of Schroth therapy, which may influence outcomes. Future research should include larger multicenter trials with standardized Schroth protocols, longer follow-up periods, and objective adherence tracking.

Conclusion

In conclusion, the literature strongly supports the Schroth method as an effective, non-surgical intervention for adolescents with idiopathic scoliosis. The reviewed studies demonstrate consistent benefits in posture correction, trunk symmetry, balance, and respiratory function, with several reporting stabilization or even reduction of the Cobb angle. Early implementation, along with other conservative measures like bracing, Schroth exercises, can significantly enhance functional abilities and quality of life in the pediatric population. Hence, the Schroth method presents a clinically valuable and evidence-backed approach to managing AIS, especially when integrated early and adhered to consistently in the pediatric population. These results suggest that conservative, exercise-based interventions may offer substantial benefits in managing scoliosis progression while improving quality of life. For clinicians, a

key insight is that the Schroth method should be considered a core, non-invasive strategy in the conservative treatment of Pediatric Idiopathic Scoliosis.

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