Effectiveness of Schroth Therapy in Improving Self-Perception, Body Image, and Quality of Life in Patients with Adolescent Idiopathic Scoliosis: A Systematic Review

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KEYWORDS

Adolescent idiopathic scoliosis, body image, Schroth therapy, self-perception, quality of life.

ABSTRACT

Introduction: Adolescent idiopathic scoliosis is a structural spinal deformity that not only affects physical health but also has significant psychosocial consequences, such as body image disturbances, reduced self-perception, and diminished quality of life (QoL). Schroth therapy, a physiotherapeutic intervention designed to address scoliosis through three-dimensional exercises, has shown promise in managing these outcomes. This systematic review aims to evaluate the effectiveness of Schroth therapy in improving self-perception, body image, and QoL in adolescents with AIS.

Methods: A systematic review was conducted following PRISMA guidelines. Studies published between 2015 and 2024 were identified using PubMed, Embase, and Cochrane Library databases. Randomised controlled trials (RCTs) involving adolescents aged 10-18 years with AIS, receiving Schroth therapy as the primary intervention, were included. Outcomes measured were self-perception, body image, and QoL, assessed using tools like the SRS-22/23 and WRVAS. The risk of bias was evaluated using the Pedro scale.

Results: Six studies, with sample sizes ranging from 28 to 60 participants, were included in this review. The Schroth therapy group demonstrated significant improvements in self-perception, as measured by the Walter Reed Visual Assessment Scale (WRVAS), with a between-group difference of 6.5 points (95% CI: 3.2 to 9.9, $p < 0.01$, $F = 169.5$) reported by Buyukturan et al. (2024). Additionally, improvements in the self-image domain of the SRS-22 questionnaire were observed, with a mean change of 0.149 (95% CI: 0.001 to 0.297, $p = 0.049$) noted by Zhang et al. (2024). In terms of quality of life (QoL), one study by Kocaman et al. (2021) found a 15% increase in overall SRS-22 scores ($p = 0.02$), while the combined SE + ASSE group exhibited significant improvements in QoL compared to the SE-only group ($p = 0.019$) as shown by Khaledi et al. (2024). While other measures, such as Cobb angle and back muscle endurance, showed significant results, the focus of this review highlights the notable benefits of Schroth therapy on self-perception and QoL.

Conclusions: Schroth therapy appears effective in enhancing self-perception, body image, and quality of life in adolescents with AIS. While current evidence supports its psychosocial benefits, further long-term studies with larger sample sizes and more sensitive assessment tools are needed to validate these findings.

1. Introduction

Adolescent idiopathic scoliosis (1) Is the most common spinal deformity occurring during adolescence, characterized by a lateral and rotational curvature of the spine. This condition typically manifests around puberty in otherwise healthy individuals. (2). AIS is diagnosed when the spinal curvature, measured in the coronal plane using the Cobb angle, exceeds 10 degrees. Based on the Cobb angle, scoliosis is categorized as mild (up to 25°), moderate (25° to 45°), or severe (above 45°) (3). If left untreated, scoliosis can progress and lead to complications such as thoracic deformity, back pain, reduced quality of life (QoL), and even respiratory issues in adulthood. (4).

Although AIS was traditionally thought to be pain-free (5), studies have shown that back pain is common, particularly as patients reach adulthood. Ramirez, Johnston, and Brown (1997) reported that 31.5% of scoliosis patients experienced back pain, often as a result of spinal imbalance, facet arthropathy, or muscle fatigue. (6). Beyond the physical discomfort, scoliosis can have profound psychological effects, especially in adolescents. Visible spinal deformities can lead to negative self-perception, particularly among females, causing psychological disturbances such as depression and anxiety. (7).

Conservative treatment for AIS focuses on preventing curve progression and improving body appearance. The

most commonly used interventions include observation, bracing, and exercise therapy. (8). When spinal curvature is mild, regular observation is recommended, but for curves greater than 25°, bracing is typically prescribed to prevent further progression. (9). While bracing can be effective, its success depends heavily on patient compliance. Extended brace wear, often up to 23 hours a day, can negatively impact body image and self-esteem, and discomfort from wearing a brace can lead to poor adherence. (10).

In recent years, Physiotherapeutic Scoliosis-Specific Exercises (PSSE), particularly the Schroth method, have emerged as important components of conservative scoliosis management. PSSE programs are tailored to each patient's specific curvature and involve three-dimensional postural corrections, sensorimotor control, and corrective breathing techniques (8). Schroth therapy, as a form of PSSE, aims not only to reduce spinal curvature but also to improve psychosocial outcomes like self-perception and body image. Studies have shown that Schroth therapy can significantly reduce Cobb angles and improve trunk rotation, particularly when combined with bracing. (2). Schroth therapy, as part of Physiotherapeutic Scoliosis-Specific Exercises (PSSE), has demonstrated significant outcomes in reducing the Cobb angle and improving psychosocial factors like self-perception and body image (Weiss et al., 2022). A recent study by Karavidas et al. (2024) further highlights the effectiveness of PSSE, particularly in reducing curve progression for adolescents with mild curves below 25°, thereby lowering the risk of future complications(11). These findings align with the broader evidence supporting PSSE as a critical component of scoliosis management, enhancing both physical and psychological well-being, especially when combined with other conservative treatments like bracing. Furthermore, by focusing on postural realignment and correcting body asymmetries, Schroth therapy has the potential to alleviate the psychological burden associated with scoliosis.

While the physical benefits of PSSE, including reductions in Cobb angle and improved posture, are well-documented, its impact on psychosocial factors such as self-perception, body image, and quality of life requires further exploration. This has become increasingly relevant given the growing recognition of scoliosis' broader effects on adolescent mental health and social well-being (12). A more detailed exploration of Schroth therapy's holistic benefits, including both physical and psychosocial outcomes, is warranted.

2. Objectives

This systematic review aims to evaluate the effectiveness of Schroth therapy in improving self-perception, body image, and quality of life in patients with adolescent idiopathic scoliosis. (1). Specifically, the review seeks to synthesize existing evidence on whether Schroth therapy improves psychological outcomes and quality of life in adolescents diagnosed with AIS, compared to standard care or no therapy.

3. Methods

Eligibility Criteria

This systematic review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure transparency and rigour. The eligibility criteria were established using the Population, Intervention, Comparison, and Outcome (PICO) framework. The population included adolescents aged 10 to 18 years diagnosed with adolescent idiopathic scoliosis. (1). Studies focusing on patients with degenerative, congenital, or post-surgical scoliosis were excluded. The intervention of interest was Schroth therapy, a physiotherapeutic scoliosis-specific exercise (PSSE) and the Scientific Exercise Approach to Scoliosis (SEAS) was also included. The comparison group included either standard care, no therapy, or other treatments. The primary outcomes were self-perception, body image, and quality of life, measured using validated tools such as the Trunk Appearance Perception Scale (TAPS), the Body Image Disturbance Questionnaire, and health-related quality of life instruments like the SF-36. The review only included primary studies, such as randomized controlled trials (RCTs), non-randomized controlled studies, and cohort studies. Secondary studies like systematic reviews, meta-analyses, case reports, editorials, and studies with inaccessible full texts were excluded.

Search Strategy

A comprehensive search was conducted across five major databases: PubMed, Embase, Cochrane Library, Medline, and Scopus. Manual searches were also carried out by reviewing reference lists of selected articles to ensure the inclusion of all relevant literature. The search strategy employed Medical Subject Headings. (13) Terms and Boolean operators. Search terms were grouped into relevant themes, and terms within each theme were combined using the OR operator, while different themes were combined using the AND operator. The search terms were divided into four primary categories: terms related to Schroth therapy (e.g., "Schroth method"

OR "Schroth therapy"), body image and self-perception outcomes (e.g., "Body Image" OR "Trunk Appearance Perception Scale"), quality of life outcomes (e.g., "Quality of Life" OR "Health-Related Quality of Life"), and adolescent idiopathic scoliosis (e.g., "AIS" OR "Physiotherapeutic Scoliosis-Specific Exercises"). No language or publication date restrictions were applied to ensure comprehensive coverage of the available literature.

Study Selection

The study selection process began with importing all identified records into EndNote, where duplicate entries were removed both automatically and manually. Two reviewers independently screened the titles and abstracts of the remaining studies to assess their relevance to the research question. Studies were considered if they focused on adolescent idiopathic scoliosis, Schroth therapy, and the primary outcomes of self-perception, body image, or quality of life. Articles that did not meet these criteria were excluded during this initial screening phase. Full-text versions of the shortlisted articles were then reviewed in detail to confirm that they met the eligibility criteria. Disagreements between reviewers regarding the inclusion of specific studies were resolved through discussion and consultation with a third reviewer. The entire selection process was documented using a PRISMA flow diagram, which recorded the number of studies identified, screened, included, and excluded, along with reasons for exclusion.

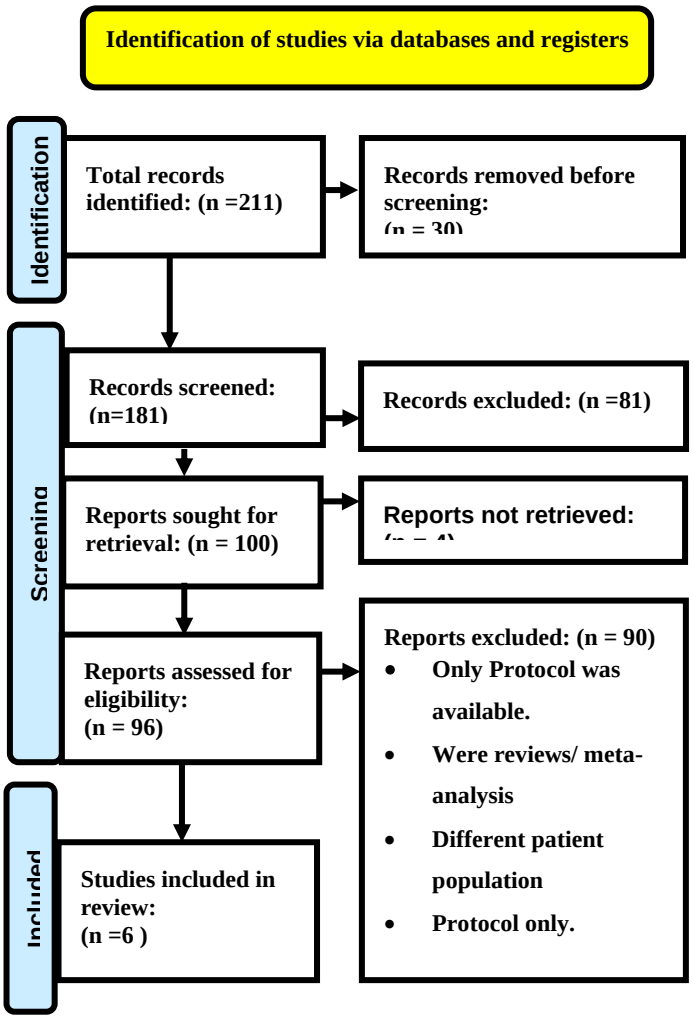

Figure1 PRISMA Flow Diagram showing complete process of screening

Data Collection Process

Data extraction was performed using a standardized form that captured key details from each study. Information extracted included the study title, authors, year of publication, geographical location, and participant characteristics such as age, gender, and diagnosis of AIS. Study design (e.g., RCT, non-randomized controlled study, or cohort study) and sample size were also recorded. Detailed information about the intervention, including the frequency and duration of Schroth therapy, was noted. The primary outcome measures—self-perception, body image, and quality of life—were extracted along with the specific tools used for assessment,

such as TAPS or SF-36. Key findings related to the effectiveness of Schroth therapy in improving these outcomes were summarized for further analysis.

Risk of Bias assessment

Perdro scale was used to assess the risk of bias in selected studies. It has 11 items and each study is given a score out of 10.

4. Results

Study selection:

Literature was searched in different databases to identify the available literature on the impact of resistance training on neuromuscular fatigue. A total number of 211 published, peer-reviewed articles were initially identified. Bibliographic scanning was also done to look for the articles that answered the research question. All the selected articles were later imported into EndNote software to remove the duplicates. It identified 30 articles as duplicates, and they were removed, leaving behind 181 articles. These articles were screened based on the "Title and Abstract", and 81 irrelevant articles were removed. (The reasons for this were the unavailability of full text, reviews or analysis, had different patient populations, and were protocol only) . This left us with 96 records which were screened for full text to look for articles fulfilling the inclusion criteria exactly. Once full-text screening was performed, Only six articles were left behind after following all the steps as per the PRISMA flowchart. These articles were reviewed and qualitatively analysed in the study. The PRISMA flow diagram shows a diagrammatic representation of all these steps.

Study Characteristics: Six studies were included in this systematic review, published between 2015 and 2024. The sample sizes ranged from 28 to 60 participants, with adolescents aged between 10 and 18 years, all diagnosed with adolescent idiopathic scoliosis (1). The severity of scoliosis varied, with Cobb angles ranging from 10 to 60 degrees across the studies. All studies were randomized controlled trials (RCTs), although the intervention designs varied, including Schroth therapy in combination with other therapies like pelvic rotation correction (Zhang et al., 2024) and asymmetric spinal stabilization exercises (Khaledi et al., 2024).

The primary focus of this review was on outcomes related to self-perception, body image, and quality of life. Quality of life was assessed in five of the six studies, predominantly using the Scoliosis Research Society questionnaires (SRS-22 and SRS-23) (Kocaman et al., 2021; Kuru et al., 2016; Schreiber et al., 2015). These questionnaires evaluated various domains, with an emphasis on the self-image and quality of life subscales. Self-perception and body image were explicitly measured in four studies, primarily using tools such as the Walter Reed Visual Assessment Scale (WRVAS) and the Spinal Appearance Questionnaire (SAQ) (Buyukturan et al., 2024; Schreiber et al., 2015; Zhang et al., 2024).

Sr No	Authors and publication year	Baseline Characteristics	Study Design	Intervention details	Follow up	Variables measured	Key findings
1	O. Buyukturan M. H. Kaya, H. Alkan, B. Buyukturan and F. Erbahceci 2024	- Adolescents aged 10-18 years old - Diagnosed with adolescent idiopathic scoliosis (1) for the first time - Risser sign of 0-3 and Cobb angle of 10-30 degrees - Sander's classification of 0-6 - Lenke curve Type 1 or Type 1A - Volunteered to participate in the study	Double-blind Randomized Controlled Trial (RCT)	1. Schroth group (SG): Received Schroth exercises, 3 times per week for 6 months, 90 minutes per session 2. Lyon group (LG): Received Lyon exercises, 3 times per week for 6 months, 90 minutes per session	6 months	Cobb angle (CA) to measure the curve magnitude of the spine The angle of trunk rotation (ATR) was measured using the Bunnell scoliometer and Adam's forward bend test Scoliosis Research Society-22 (SRS-22) questionnaire to assess health-related quality of life Walter Reed Visual Assessment Scale (WRVAS) to evaluate perceived trunk appearance	The Schroth group showed significantly better improvements in self-perception (WRVAS) (between-group difference: 6.5 points, 95% CI: 3.2 to 9.9, $p < 0.01$, $F = 169.5$) and Cobb angle (thoracic/lumbar) (CA-T: 4.1°, 95% CI: 2.0 to 6.2, $p < 0.01$; CA-L: 1.7°, 95% CI: 1.0 to 2.4, $p < 0.01$). Lyon group had significantly better improvement in quality of life (SRS-22 total score) (between-group difference: -0.9, 95% CI: -0.2 to -1.6, $p < 0.01$, $F = 15.7$).

2	H. Kocaman, N. Bek, M. H. Kaya, B. Buyukturan, M. Yetis and O. Z. Buyukturan 2021	- Adolescents diagnosed with adolescent idiopathic scoliosis - Aged 10-18 years - Lenke curve type 1 - Risser stage ≥ 3 - Cobb angle between 10-30 degrees - No history of other medical conditions - No prior treatment for scoliosis - 21 females, 7 males	randomized controlled trial (RCT)	1) Schroth group (SG): Performed Schroth exercises 2) Core group (27): Performed core stabilization (CS) exercises Both groups also performed supervised traditional exercises.	6 months	1. Primary outcome: Cobb angle 2. Secondary outcomes: - Trunk rotation angle (ATR) - Cosmetic trunk deformity (WRVAS) - Spinal mobility (Spinal Mouse) - Health-related quality of life (SRS-22 questionnaire) - Peripheral muscle strength (Biodex dynamometer)	Cobb Angle Improvement: The Schroth group showed greater improvement compared to the core group with a statistically significant p-value of <0.05. Thoracic Trunk Rotation Angle: Similar to the Cobb angle, the Schroth group had a significant improvement over the core group (p<0.05). Cosmetic Trunk Deformity: The Schroth group demonstrated significant enhancement in cosmetic trunk deformity (p<0.05). Spinal Mobility: Improvements in spinal mobility were significantly greater in the Schroth group (p<0.05). Quality of Life (SRS-22): The Schroth group reported significant improvements in quality of life (p<0.05). Peripheral Muscle Strength: The core group showed greater improvement in peripheral muscle strength with a significant p-value of <0.05 compared to the Schroth group
3	Tuğba Kuru, İpek Yeldan, E Elçin Dereli, Arzu R Özdinçler, Fatih Dikici, İlker Çolak, Lütfi Kırdar, Kartal Eğitim 2016	- Adolescents aged 10-18 years old - Diagnosed with adolescent idiopathic scoliosis - Cobb angle between 10-60 degrees - Risser sign of 0-3 (indicating skeletal immaturity) - No other treatments that could affect scoliosis - Excluded those with contraindications to exercise, mental problems, neurological-muscular or rheumatic diseases, previous spinal operations, and non-idiopathic scoliosis	randomized controlled trial (RCT)	1. Schroth exercise group - Patients received the Schroth 3D exercise program under the supervision of a physiotherapist in the clinic. 2. Home exercise group - Patients were taught the Schroth 3D exercises by a physiotherapist and then asked to perform them at home. 3. Control group - Patients received no treatment and were simply observed.	6 months	1. Cobb angle (measured by x-ray) 2. Angle of trunk rotation (measured by scoliometer) 3. Waist asymmetry (measured by ruler) 4. Maximum height of the hump (measured by rulers) 5. Quality of life (measured by the SRS-23 questionnaire)	Cobb Angle Changes: • The exercise group showed a significant decrease of -2.53° (P=0.003) compared to other groups [1]. The angle of Rotation: • The exercise group had a significant reduction of -4.23° (P=0.000) [1]. Gibbosity (Maximum Hump Height): • Improvement of -68.66mm (P=0.000) was noted only in the clinic exercise group [1]. Waist Asymmetry: • Significant changes were observed in the exercise group, with better improvement compared to home and control groups [2]. Quality of Life (SRS-23 Scores): • No significant changes were reported among the groups

4	Yafei Zhang, Tingting Chai, Hao Weng, Yang Liu 2024	- Adolescents aged 10-18 years (mean 13.33 ± 2.41 years) - Newly diagnosed with idiopathic scoliosis - Recruited from a rehabilitation clinic in Beijing, China - Balanced between experimental and control groups in terms of age, sex, BMI, and other baseline characteristics	randomized controlled trial (RCT)	The intervention group received a combined program of Schroth exercises and a pelvic rotation correction program based on PNF, while The control group received only the Schroth exercises.	6 Months	1. Concave/convex ratio (measured by linear distance between iliac crest landmarks on x-ray) 2. Cobb angle (measured by the angle between horizontal lines at superior and inferior borders of the major curve on x-ray) 3. Angle of trunk rotation (measured by Scoliometer) 4. Scoliosis Research Society (SRS-22) self-image domain score (measured by questionnaire) 5. Apical vertebral rotation (measured by Nash-Moe 5-point scale on x-ray) 6. Apical vertebral translation (measured as the distance from apical vertebra to centre sacral vertical line on x-ray) 7. Pelvic obliquity (measured as an angle between the upper sacral border and horizontal on x-ray)	- The primary outcome, the change in concave/convex ratio, showed a significantly greater improvement in the combined training group compared to the Schroth-only group (mean difference of 2.89%, 95% CI: 1.58 to 4.20, p<0.001). - The angle of trunk rotation decreased significantly more in the combined training group compared to the Schroth-only group (mean difference of -1.26°, 95% CI: -2.20 to -0.32, p=0.01). - The self-image domain of the SRS-22 questionnaire improved significantly more in the combined training group compared to the Schroth-only group (mean difference of 0.149, 95% CI: 0.001 to 0.297, p=0.049). - The proportion of patients with improved apical vertebral rotation was significantly higher in the combined training group compared to the Schroth-only group (42.9% vs 14.3%, p=0.04).
5	Sanja Schreiber, Eric C Parent, Elham Khodayari, Douglas M Hedden, Doug Hill, Marc J Moreau Edmond 2015	- 82% male, 18% female - Mean age of 13.4 years (SD = 1.6) - Adolescents with idiopathic scoliosis (1) curves between 10-45 degrees - Risser sign mean of 1.60, indicating a range of skeletal maturity - Variety of scoliosis curve types based on the Schroth classification system	randomized controlled trial (RCT)	The intervention group received Schroth exercises in addition to the standard of care, while the control group received the standard of care alone.	6 Months	- Biering-Sorensen back muscle endurance test - Scoliosis Research Society (SRS-22r) questionnaire for quality of life - Spinal Appearance Questionnaire (SAQ) for patients perception of their appearance	1) The Schroth group showed a statistically significant improvement in back muscle endurance (BME) compared to the control group after 3 months (27.5 s difference, 95% CI 1.1 to 53.8 s, p = 0.04). 2) The Schroth group had a statistically significant improvement in self-image compared to the control group from 3 to 6 months (0.3 difference, 95% CI 0.01 to 0.59, p = 0.049). 3) The Schroth group had a statistically significant improvement in the SRS-22r pain score compared to the control group from 3 to 6 months (85.3 difference, 95% CI 8.1 to 162.5, p = 0.03).

6	Arash Khaledi, Hooman Minoonejad, Hassan Daneshmandi, Mahdieh Akoochakian, Mehdi Gheitasi 2024	- Adolescent boys aged 10-18 years old - Diagnosed with mild idiopathic scoliosis, defined as having a Cobb angle between 10-30 degrees and a Lenke curve type 1 or 5 -Excluded participants with more severe scoliosis (Cobb angle >30 degrees), as well as those with other medical conditions that could affect scoliosis	randomized controlled trial (RCT)	1. SE+ASSE group (n=15): Received both Schroth exercises (SE) and asymmetric spinal stabilization exercises (1) 2. SE group (n=15): Received only Schroth exercises (SE) 3. Control group (n=10): Received no intervention during the 12-week study period	3 Months	Cobb angle, angle of trunk rotation (ATR), and quality of life (QoL)	The combined SE+ASSE group showed significantly greater improvements in Cobb angle, angle of trunk rotation (ATR), and quality of life (QoL) compared to the SE-only group ($p<0.001$). The SE-only group also showed significant improvements in these measures compared to the control group ($p<0.001$), while the control group remained largely unchanged. Additionally, the SE+ASSE group showed significantly greater improvements in QoL compared to the SE-only group ($p=0.019$).

Outcomes

Quality of Life

The effect of Schroth therapy on quality of life was evaluated in five out of the six included studies, using various forms of the Scoliosis Research Society (SRS-22/23) questionnaires, which assess different domains of health, with a particular focus on self-image and quality of life Kocaman et al. (2021), Buyukturan et al. (2024), Schreiber et al. (2015), Kuru et al. (2016), Zhang et al. (2024)). In the study by Kocaman et al. (2021), Schroth exercises significantly improved the overall quality of life in adolescents with idiopathic scoliosis (1), with marked enhancements in the self-image domain compared to core stabilization exercises (14). Similarly, Buyukturan et al. (2024) found that while the Lyon exercise group showed greater improvements in overall quality of life as reflected by the total SRS-22 score, the Schroth therapy group demonstrated more pronounced improvements in self-image and perceived trunk appearance(15).

In contrast, Schreiber et al. (2015) observed that the addition of Schroth exercises to standard care led to significant improvements in self-image and pain, although other.

Domains of the SRS-22, such as function and total quality of life, did not show significant changes when compared to standard care alone.(16). In the study by Kuru et al. (2016), although scoliosis-specific measures like the Cobb angle showed improvements, no significant change in overall quality of life was detected.(17). However, minor gains in the self-image subdomain were observed, suggesting that while Schroth therapy may have limited overall impact in some cases, it still plays a role in improving self-perception.

Lastly, Zhang et al. (2024) investigated the combination of Schroth therapy with pelvic rotation correction, which led to greater improvements in self-image than Schroth therapy alone, as assessed by the SRS-22 questionnaire.(18). These results suggest that integrated therapeutic approaches may provide additional benefits in improving both self-image and quality of life in AIS patients. Collectively, these studies demonstrate that Schroth therapy can positively influence self-image and certain aspects of quality of life, although the degree of improvement varies depending on the intervention design and duration.

Self-Perception and Body Image

Self-perception and body image were key outcomes in four studies, which primarily utilized the Walter Reed Visual Assessment Scale (WRVAS) which is a valid instrument and has Cronbach's alpha value of 0.9 (19). And, in some cases, the Spinal Appearance Questionnaire (SAQ) (which has a Cronbach's $\alpha \geq .86$ and test-retest $r \geq .80$) to assess participants' perception of their own body and appearance (20). In the study by Buyukturan et al. (2024), significant improvements in self-perception were observed in the Schroth group, with the WRVAS showing that patients felt more positive about their trunk appearance compared to those in the Lyon exercise group. This suggests that Schroth therapy may be more effective in addressing perceived trunk deformity and improving body image in patients with AIS.

Similarly, Schreiber et al. (2015) reported substantial gains in self-perception, with improvements in self-image

and appearance scores among participants who received Schroth therapy alongside standard care. However, the study also noted that ceiling effects on the SAQ may have limited the ability to detect changes in patients with milder forms of scoliosis, thereby potentially underestimating the full impact of the intervention. In a study by Kocaman et al. (2021), Schroth exercises again outperformed core stabilization exercises, with the WRVAS showing a more pronounced reduction in cosmetic trunk deformity, further supporting Schroth therapy's effectiveness in enhancing self-perception and body image in AIS patients.

In line with these findings, Zhang et al. (2024) showed that the combination of Schroth therapy and pelvic rotation correction produced greater improvements in self-perception than Schroth therapy alone, as reflected in participants' reports of improved trunk appearance. This highlights the potential for combined interventions to amplify the benefits of Schroth therapy on body image.

Overall, these studies underscore the consistent positive effects of Schroth therapy on self-perception and body image in adolescents with idiopathic scoliosis. By reducing perceived trunk deformity and improving confidence in appearance, Schroth therapy plays a crucial role in enhancing the psychological well-being of patients.

Risk of Bias assessment

Risk of Bias assessment was done using the Pedro scale. Scores ranged from 6 to 8, where 2 studies scored 6 and four studies scored 8 . implicating that the majority of studies were of good quality and with less/ minimized risk of bias as shown in Table 2: risk of bias using Pedro scale.

Included study	1	2	3	4	5	6	7	8	9	10	11	Study score
(28) (Büyükturan et al., 2024)	✓	✓	✓	✓	-	-	-	✓	✓	✓	✓	**8**
(29) (Kocaman et al., 2021)	✓	✓	-	✓	✓	-	✓	-	✓	✓	✓	**8**
(32) (Zhang et al., 2024)	✓	✓	✓	-	-	✓	-	-	✓	-	✓	**6**
(15) (Khaledi et al., 2024)	✓	✓	✓	-	-	✓	-	-	✓	-	✓	**6**
(30) (Kuru et al., 2016)	✓	✓	✓	✓	-	-	✓	✓	✓	✓	-	**8**
(31) (Schreiber et al., 2015)	✓	✓	✓	✓	✓	✓	-	✓	✓	-	-	**8**

5. Discussion

This systematic review presents a comprehensive analysis of the effects of Schroth therapy on self-perception, body image, and quality of life in adolescents with idiopathic scoliosis. (1). The findings demonstrate the multidimensional benefits of Schroth therapy, not only in correcting physical deformities but also in positively influencing psychological outcomes, which are crucial for the holistic management of scoliosis.

Impact on Self-Perception and Body Image

The results indicate that Schroth therapy significantly improves self-perception and body image among adolescents with AIS. For instance, the study by Buyukturan et al. (2024) reported substantial improvements in self-image and trunk appearance as assessed by the Walter Reed Visual Assessment Scale (WRVAS). This aligns with existing literature that emphasizes the psychological impact of scoliosis on adolescents, where visible spinal deformities can lead to feelings of self-consciousness and diminished self-esteem (12, 21). Adolescents undergoing Schroth therapy benefit not only from physical improvements but also from the enhanced self-perception that comes with reduced visible deformities. The results of this review are consistent with those reported by Karavidas et al. (2024), who found that PSSE, including Schroth therapy, significantly reduces the risk of curve progression in adolescents with mild scoliosis. Their study supports the importance of early intervention in improving both physical and psychosocial outcomes, including quality of life. These findings complement the improvements in self-perception and body image observed in the current review, reinforcing the role of PSSE in managing scoliosis and addressing its psychological impacts(11).

Moreover, Schreiber et al. (2015) highlighted that patients receiving Schroth therapy in conjunction with standard care experienced significant gains in self-image and pain scores compared to those receiving only standard care. This suggests that integrating physical therapy with conventional management strategies may yield superior psychosocial outcomes, which is critical in this age group. The psychological benefits of improved body image are especially relevant for the younger female population, who are often more affected by body

image issues related to scoliosis. (7).

However, limitations such as high ceiling effects on the SRS-22 and SAQ questionnaires were noted, indicating that these tools may not effectively capture changes in self-perception and body image among conservatively treated patients. Future research should explore more nuanced measurement tools that can better assess the subtle shifts in self-image and psychological well-being associated with scoliosis treatment.

Quality of Life Enhancements

Regarding quality of life (QoL), the review revealed consistent positive outcomes associated with Schroth therapy. Multiple studies reported significant improvements in QoL scores, particularly in psychological domains, suggesting that the therapy contributes to enhanced overall well-being. For instance, Kocaman et al. (2021) found that patients undergoing Schroth therapy showed marked improvements in the SRS-22 total scores, which encompasses various domains such as self-image and function. These findings are consistent with previous research that identifies a correlation between physical and psychological health in adolescents with scoliosis, where improved physical outcomes lead to better psychosocial functioning. (22).

In contrast, Kuru et al. (2016) noted a lack of significant changes in overall QoL despite improvements in scoliosis-specific measures. This highlights the complexity of QoL assessments and suggests that while physical deformities may improve, the broader psychosocial challenges faced by these adolescents require ongoing attention. The absence of significant QoL improvements in some studies may be attributed to the short intervention durations, such as in the study by Kocaman et al (2021), which lasted only 10 weeks. A more extended treatment and follow-up period may be necessary to fully capture the long-term benefits of Schroth therapy on QoL.

Limitations in the Current Research

The limitations identified across the studies also warrant consideration. Many studies, including those by Khaledi et al. (2024) and Zhang et al. (2024), noted restricted sample populations, such as the exclusion of female participants in the study by Schreiber et al (2015), which limits the generalizability of findings. Additionally, the short treatment durations observed in several studies, like the 12-week intervention in Schreiber et al (2015), are insufficient for assessing the long-term impacts of Schroth therapy. This limitation is particularly significant in a condition like scoliosis, where long-term management is crucial for maintaining physical and psychosocial health.

Moreover, the reliance on specific curve classifications, such as the Lenke type in the study by Kocaman et al (2021), constrains the applicability of the results to broader patient populations. It is essential for future studies to include diverse curve types and to assess the effects of Schroth therapy across various severity levels of scoliosis.

Reference

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