

Schroth Exercise Vs. Schroth Combined Exercise for Adolescent Idiopathic Scoliosis: A Systematic Review

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Abstract. The spinal deformity known as adolescent idiopathic scoliosis (AIS) is common in teenagers and can have both physical and psychological effects. Schroth exercise, a non-invasive treatment, is widely used for AIS. However, studies comparing the efficacy of Schroth exercise alone and in combination with other methods are limited. They included randomized controlled trials (RCTs) in this systematic review were published between January 2020 and February 2025. focusing on AIS patients aged 10 - 18. Studies were retrieved from CNKI, PubMed, and Google Scholar. Cobb angle change was the main result, while quality of life (QoL) and trunk rotation angle were the secondary results. The PEDro scale was used to evaluate the methodological quality. There were 10 RCTs in all, with 540 participants. With a mean PEDro score of 5.3, the studies' quality varied from low to high. Schroth exercise alone showed significant improvement in Cobb angle in some studies, but combined training (e.g., with Pilates or asymmetric spinal stabilization exercises) demonstrated more significant effects on Cobb angle, trunk rotation angle, and QoL. Schroth combined training is more effective in improving AIS-related outcomes compared to Schroth exercise alone. Future studies should focus on increasing sample size, standardizing protocols, and exploring the mechanisms of combined training to further validate its efficacy and optimize treatment plans.

Keywords: Schroth; AIS; Adolescent idiopathic scoliosis; Cobb angle.

1. Introduction

A complicated three-dimensional(3D) malformation of the spine and trunk is named idiopathic scoliosis (IS). IS is responsible for about 80% of cases of scoliosis. Adolescent idiopathic scoliosis (AIS) is the most prevalent subtype of IS, affecting individuals aged 10 to 18 with a prevalence of 0.47 to 5.2% [1]. Axial rotation, sagittal curvature abnormalities, and lateral deviation of the spine are common features of AIS [1]. The most widely used metric to check the condition of AIS is the Cobb angle, and Cobb angle $\geq 10^\circ$ is defined by the International Society for the Study of Scoliosis (SRS) as a typical characteristic manifestation of AIS [2]. AIS causes loss of flexibility, asymmetry of the body, back pain, and muscular imbalance, which adversely affects the adolescent's condition, appearance, and psychological aspects, and in severe cases, leads to respiratory distress and mobility impairment, causing a heavy burden on the family and society [3,4].

Although the etiology of AIS is currently unknown, a number of potential causes affecting the incidence of this deformity have been identified, such as central nervous system anomalies, aberrant platelet calmodulin levels, genetics, hormonal dysfunction, and changed bone density [5].

Correcting the deformity profile and stopping progression are the primary objectives of AIS treatment. To treat and manage the progression of AIS, Numerous non-invasive (usually braces and therapeutic exercises) and invasive (surgical) methods have been put forth. However, patients with AIS may experience anxiety and fear due to the possible risks of surgery as an invasive procedure. In addition, non-invasive treatments such as prolonged braces can lead to lack of flexibility, muscle weakness, flat back, impaired lung function, demoralization, and even resistance to treatment in adolescent patients [5]. Therefore, therapeutic exercise is more popular among patients. Physiotherapy scoliosis specific exercises (PSSE) is one of the therapeutic exercise methods for scoliosis, and the Society of Orthopaedic and Rehabilitation Therapies for Scoliosis (SOSORT) defines PSSE as personalized exercises that include patient education, 3D self-correction, adjustment of daily activities, and stabilization of correct posture, training and stabilization of correct posture. One of the most widely used PSSE interventions nowadays is Schroth's method [6]. The Schroth

technique was developed in 1921 by German Katharina Schroth. Using breathing and self-correcting techniques in front of a mirror, along with additional equipment (such as wall poles, sticks, and Swiss balls), this method's primary goal is to eliminate muscle imbalances by strengthening and stretching soft tissues [7].

Schroth Exercise (SE) is widely recognized as being very effective in the treatment of AIS [8]. So far, there are many studies focusing on SE in combination with other methods for the treatment of AIS. However, there is a lack of review articles comparing the efficacy of SE alone and multiple SE combination therapies for AIS. This study will focus on exploring the comparison of the efficacy of SE alone and multiple SE combination therapies for AIS in a review format.

2. Methods

2.1. Research Sources

This is a systematic review study. Relevant studies published in Chinese or English from January 2020 to February 2025 were first searched in databases such as CNKI, PubMed, and Google Scholar with the following keywords: adolescent idiopathic scoliosis, AIS, Schroth, Schroth, physical therapy scoliosis-specific exercise, PSSE.

2.2. Inclusion Criteria

Only PICO programs in particular patient populations met the inclusion criteria.

All of the studies that were part of this study's design were randomized controlled trials (RCTs).

Patients: AIS patients between the ages of 10 and 18.

Interventions: presence of Schroth exercise or one of the combined treatments containing Schroth exercise, or both.

Comparisons: combined group vs. separate group, combined group pre- and post-treatment data, combined group vs. other combined groups.

Primary outcome: change in Cobb angle (CA).

Secondary outcome: quality of life (QoL), trunk rotation angle (ATR), etc.

2.3. Exclusion Criteria

Papers with diseases and abnormalities (e.g., osteoporosis and kyphosis, etc.) in the study population other than idiopathic scoliosis, as well as papers using other interventions (e.g., surgery, non-Schroth's combination therapies) were excluded from the study.

2.4. Methodological Quality Assessment

The papers' quality was evaluated by using the Physiotherapy Evidence Database (PEDro) scale [9]. A response to the first item on the scale is not equivalent to a positive point, but a positive response to each of the 11 items is. Low, moderate, and high scores fall into the following ranges: 0-4, 5-7, and 8-10, respectively [7].

3. Results

In the initial search, 3924 papers in all were retrieved from the three databases. Then, 2827 non-RCT studies were excluded through the system. By reading the titles, 271 irrelevant papers and 356 duplicates were removed. Then, by screening the titles, reading the abstracts, screening the research methods and reading through the full text. Ultimately, this review was permitted to include 10 RCTs with 540 participants and valid outcome data. (Figure 1).

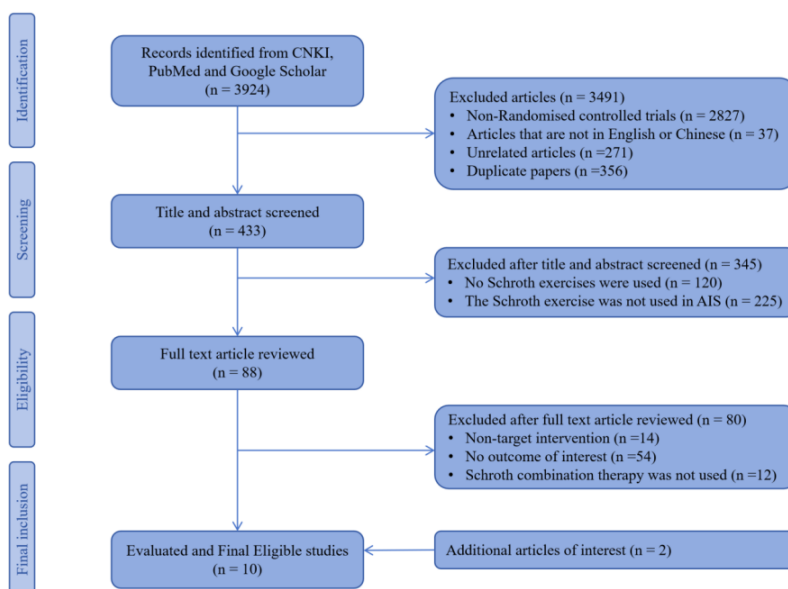


Fig. 1 Flow chart of search

3.1. Level of Evidence and Assessed Quality

One of the studies was of high quality [10], eight were of moderate quality [5,8,11-16], and one RCT was of low quality [4]. This means that the papers are of moderate quality because the PEDro scale scores range from 4 to 8 and the mean of these scores is 5.3(Table 1).

Table 1 Assessing the quality level of the studies based on PEDro scale

Abbreviations: RCT=Randomized Controlled Trial

Author	Score	Quality and design of study	1.Eligibility	2.Random allocation	3.Concealed allocation	4.Baseline measure	5.Blind subjects	6.Blind therapist	7.Blind assessor	8.Adequate follow up	9.Intention to treat	10.Between group	11.Point Estimate of Variability
Rrecaj-Malaj et al. [2020][4]	4	Low RCT	Yes	No	No	Yes	No	No	No	Yes	No	Yes	Yes
Khaledi et al. [2024][5]	5	Moderate RCT	Yes	Yes	No	Yes	No	No	No	Yes	No	Yes	Yes
Khaledi et al. [2024][8]	5	Moderate RCT	Yes	Yes	No	Yes	No	No	No	Yes	No	Yes	Yes
Zhang et al. [2024][10]	8	Strong RCT	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes
Kocaman et al. [2021][11]	6	Moderate RCT	Yes	Yes	No	Yes	No	No	Yes	Yes	No	Yes	Yes
Chen et al. [2022][12]	5	Moderate RCT	Yes	Yes	No	Yes	No	No	No	Yes	No	Yes	Yes
Li et al. [2024][13]	5	Moderate RCT	Yes	Yes	No	Yes	No	No	No	Yes	No	Yes	Yes
He et al. [2024][14]	5	Moderate RCT	Yes	Yes	No	Yes	No	No	No	Yes	No	Yes	Yes
He et al. [2024][15]	5	Moderate RCT	Yes	Yes	No	Yes	No	No	No	Yes	No	Yes	Yes
Xv et al. [2020][16]	5	Moderate RCT	Yes	Yes	No	Yes	No	No	No	Yes	No	Yes	Yes

3.2. Characteristics of the Included Papers

One of the studies was of high quality [10], eight were of moderate quality [5,8,11-16], and one RCT was of low quality [4]. This means that the papers are of moderate quality because the PEDro scale scores range from 4 to 8 and the mean of these scores is 5.3(Table 1).

9 RCTs used SE [5,8,10-16]. 9 RCTs used SE in combination with a treatment approach [4,5,8,10,12-16], and 2 of them tested SE in combination with Pilates treatment [4,15] (one of these RCTs compared the effects of two types of AIS patients, those who wore braces and those who did not, who were treated with SE in combination with Pilates treatment [4]), 2 tested SE combined with asymmetric spinal stabilization treatment(ASSE) [5,8], 2 tested SE combined with core stabilization treatment [12,14], and 1 study each of SE combined with spinal micro-adjustment manipulation(SMAT), myofascial chain rehabilitation techniques(MCRT), and pelvic rotation

correction[10,13,16]. Specifically, the treatment effects of SE and core stabilization training in patients with AIS were compared in 1 randomized controlled trial [11].

There were 4 RCTs with a study period of 24 weeks [4,10,13,14], 4 RCTs with a study period of 12 weeks [5,8,12,15], 1 RCT with a study period of 10 weeks [11], and 1 RCT with a study period of 4 weeks [16]. Among these studies, the frequency of training was daily in some studies [4,16], 5 times per week in some studies [12], 3 times per week in some studies [5,8,11,13,15], and 2 times per week in some studies [10], whereas other studies did not address the specific frequency of training [14]. In addition, the training duration of a single session varied across studies [4,5,8,10-16] (Table 2).

Table 2. Summary of Included Studies (Sample, Intervention, Outcome Measures, Result)

Author and year	Participant	Treatment length	Intervention	Outcomes measured	Results
Rrecaj-Malaj et al. [2020][4]	(N=69, 18 with brace, 51 without brace)	24 weeks (outpatient).	SE+PE in clinic SE+PE at home	CA ATR Chest exp. Trunk flex. QoL	The CA decreased from 21.97° to 18.11° (with brace), from 14.19° to 11.66° (without brace) (P<0.05).
Khaledi et al. [2024][5]	(N=40, three groups, 15 in SE, 15 in SE+ASSE and 10 in CON)	12 weeks	SE SE+ASSE	CA ATR QoL	The CA (-7.44°; P=0.003) significantly reduced, in the SE+ASSE in the clinic compared to the SE and CON.
Khaledi et al. [2024][8]	(N=40, three groups, 15 in SE, 15 in SE+ASSE and 10 in CON)	12 weeks	SE SE+ASSE	TE Pain(VAS)	The SE+ASSE had a significant reduction in the VAS Score (2.9 to 0.1) (P<0.001)
Zhang et al. [2024][10]	(N=42, two groups, 21 in SE and 21 in SE+PNF)	24 weeks	SE SE+PNF	Concave/convex ratio CA ATR SRS-22 self-image Apical vertebral translation and pelvic obliquity	The CA changed with 3.81 in the SE and with 2.19 in the SE+PNF (P=0.14).
Kocaman et al. [2021][11]	(N=28, two groups, 14 in SE and 12 in CE)	10 weeks	SE CE	CA ATR Muscle strengths Cosmetic trunk deformity Spinal mobility QoL	The SE (9.71°) had a significantly smaller largest curve than CE (13.57°) (P<0.001).
Chen et al. [2022][12]	(N=60, two groups, 30 in SE and 30 in SE+CE)	12 weeks	SE SE+CE	CA ATR QoL	The SE+CE had a significant reduction in the CA (29.17° to 21.58°) (P<0.05).
Li et al. [2024][13]	(N=60, two groups, 30 in SE and 30 in SE+SMAT)	24 weeks	SE SE+SMAT	CA ATR Pain(VAS)	The CA changed significantly in the SE+SMAT (23.65° to 10.87°), compared to the SE (P<0.05)
He et al. [2024][14]	(N=100, two groups, 50 in SE and 50 in SE+CE)	24 weeks	SE SE+CE	CA ATR QoL	The SE+CE showed greater improvement in CA (32.22° to 22.60°) than SE (33.36° to 25.80°) (P<0.05).
He et al. [2024][15]	(N=81, two groups, 41 in SE and 40 in SE+PE)	12 weeks	SE SE+PE	CA ATR QoL	A significant reduction in CA was observed in both groups, especially in SE (from 22.01° to 13.57° and 22.26° to 10.49° for SE+PE, respectively) (P<0.05)
Xv et al. [2020][16]	(N=60, two groups, 30 in SE and 30 in SE+MCRT)	4 weeks	SE SE+MCRT	CA ATR Electromyography indicators	The CA changed significantly from 24.13° to 18.86° in the SE and from 22.66° to 13.98° in the SE+MCRT (P<0.05).

Abbreviations: ATR= Angle of Trunk Rotation, CA= Cobb angles, TE=Trunk Extensor Muscle Endurance, QoL= Quality of Life, SE= Schroth exercises, PE= Pilates exercises, ASSE=Asymmetric Spinal Stabilization Exercises, CE= Core-stabilization exercises, PNF= Proprioceptive Neuromuscular Facilitation, SMAT=Spinal micro-adjustment technique, MCRT=Myofascial chain rehabilitation technique

3.3. SE Alone is Effective in Treating AIS

Several studies have shown that SE reduces the CA in AIS, but the significance and persistence of the effect varies across studies. For example, in the study by Kocaman et al, patients in the Schroth group showed a significant improvement in CA after treatment, with thoracic CA decreasing from 17.64° to 9.71° (P<0.001) and lumbar Cobb angle decreased from 15.80° to 9.40° (P=0.002) [11]. In

some other studies [5,8,10,12-16], the CA improved when SE was used alone, although the improvement was smaller compared to combined training. These findings suggest that SE, as a conservative treatment, can reduce the CA in patients with AIS and can effectively slow down the progression of scoliosis and improve the CA to some extent.

3.4. Schroth Training Combination Therapy Can Effectively Treat AIS

SE has also shown positive results in reducing the CA in patients with AIS when used in combination with other treatments. For example, Rrecaj-Malaj et al. combined Schroth training with Pilate's training, and after 24 weeks of training, the CA of the patient was significantly reduced from $21.97^{\circ} \pm 4.99^{\circ}$ to $18.11^{\circ} \pm 6.39^{\circ}$ ($P < 0.05$) [4], while A study utilizing the same combination therapy obtained the same results [15], which further supports the efficacy of combination training in lowering the CA. Another RCT examined the effect of SE in combination with asymmetric spine stabilization training (ASSE) and found that Patients experienced a significant decrease in their CA from 16.45° to 9.01° ($P < 0.001$) [5]. In addition, Zhang et al. combined SE with pelvic rotation correction and found that this combined training was effective in improving axial pelvic rotation, which in turn positively affected scoliosis, with an average reduction in the CA of approximately 3.81° ($P < 0.001$) [10]. These findings suggest that Schroth's combined training significantly lowers the CA in AIS patients while also improving the spinal morphology of the patients in a more comprehensive manner [4,5,8,10,12-16].

3.5. Combined Schroth Training has Better Results Compared to Schroth Alone

Existing studies also provide strong evidence that combined training is more advantageous. For example, 1 study found that Schroth training plus Pilates improved both CA and ATR more effectively than Schroth training alone [15]. Similarly, another study found that the combined training group was superior to the Schroth training group by itself in terms of lowering CA and raising ATR. In particular, the combined training group demonstrated a significant decrease in ATR and a greater improvement in CA [14]. Meanwhile, an RCT investigated the effectiveness of combined SE and ASSE therapy in relieving back pain in adolescents with idiopathic scoliosis and enhancing trunk muscle endurance as well [8]. The results of these studies consistently showed that combined Schroth training was significantly better than training alone in lowering the CA, ATR, and other related indices. Additionally, the combined therapy could provide a more comprehensive and effective treatment plan for AIS patients than Schroth training alone, improving spinal morphology and function more effectively, and thus raising the AIS patients' QoL [4,5,8,10,12-16].

4. Discussion

If you follow the “checklist” your paper will conform to the requirements of the publisher and facilitate a problem-free publication process.

AIS is a common spinal deformity that affects the growth and development as well as the physical and mental health of adolescents. SE, as a traditional conservative treatment method, has been widely used in the treatment of AIS. In recent years, Schroth combined training has gradually emerged, aiming to further improve the therapeutic effect by combining other training methods. This systematic evaluation compares and analyzes the effectiveness of SE and Schroth combined training in the treatment of AIS.

4.1. Improvement of AIS-related Indicators

CA is a key indicator of scoliosis severity. Several studies have shown that SE is effective in improving the AIS patients' CA [2,11,17-20]. However, when SE is applied in combination with other methods, the effect is more significant [5,10,12-16]. ATR is one of the most important indicators for assessing scoliosis. It has been found that SE can significantly reduce ATR, and combined training further improves the improvement on this basis [5,10,12-16]. QoL improvement is one of the

important goals of AIS treatment. SE has a role in improving patients' quality of life, but the effect of combined training is more significant [4,5,12-16]. Combined training has more obvious advantages in improving patients' self-image, function and satisfaction. In addition to the above indicators, joint training also showed some advantages in improving patients' core muscle group stability, flexibility and balance [4,8,10,12,16]. For example, a study found that Schroth combined core stability training significantly improved patients' core muscle group endurance and stability, resulting in better spinal support, reduced pain and improved posture.

4.2. Limitations of the Evidence and Directions for Future Research

Although current research suggests that Schroth combination training has some advantages in the treatment of AIS, a number of limitations remain.

First, there is a lack of studies comparing different SE combination therapies. Second, it is challenging to collect enough information to draw any definitive conclusions because high-quality studies and RCTs are not readily available. Third, there are differences in intervention protocols and assessment methods between studies, which may affect the comparability and consistency of results and therefore preclude meta-analysis. Fourth, most studies had small sample sizes and short follow-up periods, which did not allow for adequate assessment of long-term efficacy and safety. Fifth, there were some phenomena that could not be elaborated due to insufficient evidence and unclear descriptions, especially the effects of different therapies on different regions of deformity (thoracic, thoracolumbar, etc.) and on different levels of severity (especially moderate), on different frequencies of training, and on different levels of physical fitness and lifestyle habits of the patients (exercise, activity, or sedentary AIS). Sixth, the results of this review were limited to CA, ATR, and QoL; and were restricted to Mandarin and English studies.

Therefore, it is strongly recommended that future researchers take these recommendations into account in their future research while being aware of the review's limitations.

5. Conclusion

In summary, Schroth combined training has shown some advantages in improving the AIS patients' CA, ATR, and QoL. However, in clinical application, it is still necessary to individualize the treatment plan based on the patient's unique situation and combine with other treatments to achieve the best efficacy. Future studies should focus on the following aspects: first, increase the sample size and prolong the follow-up period to more comprehensively assess the long-term efficacy and safety of combined training; second, standardize the intervention protocols and assessment methods to improve the comparability and consistency of the results of the studies; third, stratify the analysis of patients with different severity and types of AIS in order to determine the optimal applicability of the combined training; fourth, further explore the mechanism of the combined training, in order to optimize the treatment of the combination training; and fourth, further explore the mechanism of the combined training, in order to optimize the treatment of the combination training. Fourth, to further explore the mechanism of combined training to provide a theoretical basis for optimizing the treatment plan. In this way, more high-quality studies will be produced to further validate the efficacy and safety of combined training and provide stronger evidence to support the treatment of AIS.

References

- [1] Fan, Yunli et al. "Effectiveness of scoliosis-specific exercises for alleviating adolescent idiopathic scoliosis: a systematic review." *BMC musculoskeletal disorders* vol. 21,1 495. 27 Jul. 2020, doi:10.1186/s12891-020-03517-6
- [2] Dimitrijević, Vanja et al. "Application of the Schroth Method in the Treatment of Idiopathic Scoliosis: A Systematic Review and Meta-Analysis." *International journal of environmental research and public health* vol. 19,24 16730. 13 Dec. 2022, doi:10.3390/ijerph192416730

- [3] Chinese Society of Physical Medicine and Rehabilitation. Guideline for rehabilitation assessment and treatment of adolescent idiopathic scoliosis (2024 edition) [J]. National Medical Journal of China, 2024, 104(39): 3647-3660.
- [4] Rrecaj-Malaj, Shkurta et al. "Outcome of 24 Weeks of Combined Schroth and Pilates Exercises on Cobb Angle, Angle of Trunk Rotation, Chest Expansion, Flexibility and Quality of Life in Adolescents with Idiopathic Scoliosis." Medical science monitor basic research vol. 26 e920449. 13 Apr. 2020, doi:10.12659/MSMBR.920449
- [5] Khaledi, Arash et al. "Outcomes of 12 Weeks of Schroth and Asymmetric Spinal Stabilization Exercises on Cobb Angle, Angle of Trunk Rotation, and Quality of Life in Adolescent Boys with Idiopathic Scoliosis: A Randomized-controlled Trial." The archives of bone and joint surgery vol. 12,1 (2024): 26-35. doi:10.22038/ABJS.2023.71875.3356
- [6] Ceballos-Laita, Luis et al. "The effectiveness of Schroth method in Cobb angle, quality of life and trunk rotation angle in adolescent idiopathic scoliosis: a systematic review and meta-analysis." European journal of physical and rehabilitation medicine vol. 59,2 (2023): 228-236. doi:10.23736/S1973-9087.23.07654-2
- [7] Khaledi, Arash et al. "Core Stabilization Exercises vs. Schroth's Three Dimensional Exercises to Treat Adolescent Idiopathic Scoliosis: A Systematic Review." Iranian journal of public health vol. 53,1 (2024): 81-92. doi:10.18502/ijph.v53i1.14685
- [8] Khaledi, Arash et al. "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 vol. 38 90. 6 Aug. 2024, doi:10.47176/mjiri.38.90
- [9] Moseley, Anne M et al. "Evidence for physiotherapy practice: a survey of the Physiotherapy Evidence Database (PEDro)." The Australian journal of physiotherapy vol. 48,1 (2002): 43-9. doi:10.1016/s0004-9514(14)60281-6
- [10] Zhang, Yafei et al. "Pelvic rotation correction combined with Schroth exercises for pelvic and spinal deformities in mild adolescent idiopathic scoliosis: A randomized controlled trial." PloS one vol. 19,7 e0307955. 30 Jul. 2024, doi: 10.1371/journal.pone.0307955
- [11] Kocaman, Hikmet et al. "The effectiveness of two different exercise approaches in adolescent idiopathic scoliosis: A single-blind, randomized-controlled trial." PloS one vol. 16,4 e0249492. 15 Apr. 2021, doi: 10.1371/journal.pone.0249492
- [12] Huanzhou Chen, Yanbi Guo, and Ning Liu. "Study on Effect of Core Stability Training Combined with Schroth Orthopedic Gymnastics on Idiopathic Scoliosis." REFLEXOLOGY AND REHABILITATION MEDICINE 3.07(2022):65-67.
- [13] LI Zhi-xin, et al. "Observation on the clinical efficacy of spinal micro-adjustment manipulation combined with the Schroth method in adolescent idiopathic scoliosis." JOURNAL OF GANNAN MEDICAL UNIVERSITY 44.12(2024):1220-1223+1241.
- [14] HE Yang, and LIU Peng-fei. "Clinical study of Schroth therapy combined with core muscle training in the treatment of adolescent idiopathic scoliosis." ZHONGGUO LIAOYANG YIXUE 33.10(2024): 14-19. doi: 10.13517/j.cnki.ccm.2024.10.003.
- [15] HE Xiao-pei, et al. "Application of Schloss therapy combined with Pilate's training in rehabilitation treatment of adolescent idiopathic scoliosis." Hainan Medical Journal 35.23(2024):3383-3387.
- [16] XU Sixie, et al. "Effect of Schloss Therapy Combined with Myofascial Chain Rehabilitation on Adolescent Idiopathic Scoliosis." Medical Innovation of China 17.32(2020):144-147.
- [17] Chen, Chenting et al. "Effects of Schroth 3D Exercise on Adolescent Idiopathic Scoliosis: A Systematic Review and Meta-Analysis." Children (Basel, Switzerland) vol. 11,7 806. 1 Jul. 2024, doi:10.3390/children11070806
- [18] Day, Joseph M et al. "Review of scoliosis-specific exercise methods used to correct adolescent idiopathic scoliosis." Archives of physiotherapy vol. 9 8. 23 Aug. 2019, doi:10.1186/s40945-019-0060-9
- [19] Ceballos-Laita, Luis et al. "The effectiveness of Schroth method in Cobb angle, quality of life and trunk rotation angle in adolescent idiopathic scoliosis: a systematic review and meta-analysis." European journal of physical and rehabilitation medicine vol. 59,2 (2023): 228-236. doi:10.23736/S1973-9087.23.07654-2

- [20] Park, Jaeyong, and Wi-Young So. "The Effect of the Schroth Rehabilitation Exercise Program on Spinal and Feet Alignment in Adolescent Patients with Idiopathic Scoliosis: A Pilot Study." *Healthcare* (Basel, Switzerland) vol. 10,2 398. 20 Feb. 2022, doi:10.3390/healthcare10020398