

## PHYSIOTHERAPEUTIC INTERVENTION THROUGH THE APPLICATION OF SPECIFIC EXERCISES IN THE TREATMENT OF SCOLIOSIS: AN ANALYSIS OF THE SCHROTH, SEAS, BSPTS AND LYON METHODS

---

*Marcio Marinho Magalhães*

Centro Universitário de Ciências e  
Tecnologia do Maranhão - UNIFACEMA  
Caxias; Maranhão  
<https://orcid.org/0000-0001-6020-381X>

*Walax Henrique Morais Silva*

Faculdade de Educação São Francisco -  
FAESF, Pedreiras; Maranhão  
<https://orcid.org/0009-0001-8659-780X>

*Luís Eduardo De Sousa Abreu*

Faculdade de Educação São Francisco -  
FAESF, Pedreiras; Maranhão  
<https://orcid.org/0000-0001-7515-3413>

All content in this magazine is licensed under a Creative Commons Attribution License. Attribution-Non-Commercial-Non-Derivatives 4.0 International (CC BY-NC-ND 4.0).



**Abstract:** Scoliosis is a progressive three-dimensional deformity of the spine that affects individuals of different age groups. It presents with lateral deviations with an angulation greater than 10°, where torsional forces can lead to rotation of the vertebral bodies, which is seen next to the convexity of the scoliotic curve. The main objective was to analyze the main methods of specific exercises in the physiotherapeutic treatment of individuals with scoliotic conditions. This research is an integrative review of the literature using the MEDLINE, LILACS and SCIENCE DIRECT databases. Articles published between 2015 and 2023 were included. All duplicate articles, research published in years prior to 2015, integrative reviews, articles that were not case studies, and articles with less than six months of intervention were excluded. A total of 2,988 articles were identified by crossing the descriptors, which, after applying the filters and eligibility criteria provided by the PEDRO scale, resulted in 10 articles to compose the database of this review. The application of specific exercises using methods such as Schroth, SEAS, BSPTS and Lyon in individuals with scoliosis has shown transcendence and important benefits in its treatment. Therefore, the studies identified improvements in the reduction and stabilization of the Cobb angle, flexibility, peripheral muscle strength, spinal mobility, body awareness and quality of life. However, further studies are needed, particularly randomized clinical trials, aiming to explore longer intervention periods.

## INTRODUCTION

Scoliosis is a progressive, three-dimensional deformity of the spine that affects individuals of different age groups and, in some cases, can be identified at birth. It presents with lateral deviations with an angle greater than 10°, where these torsional forces can lead to rotation of the vertebral bodies, which is seen alongside the convexity of the curve by the Adams test, which is widely used to detect scoliosis. These changes can occur in healthy individuals and have become a public health problem every day, given the limitations that this pathology can cause to the population (WONG, 2019).

Scoliosis cases can be divided into: Functional or non-structural, and structural or morphological. A spine with a more flexible deviation that has a certain ease in resolving the case, can be corrected with a simple inclination to the convex side, are characteristics of functional scoliosis. On the other hand, structural scoliosis already exhibits gibbosity, which can progress over time. The classification regarding its etiology can be observed in three types: congenital, is characterized by the malformation of the vertebral bodies of newborns. Neuromuscular, is caused by diseases that affect the peripheral nervous system and its components, such as muscular dystrophy and cerebral palsy. And idiopathic, has no determined cause that can explain its appearance (FREITAS; MEDEIROS; CÂMARA, 2020).

According to Alassiri et al. (2022), idiopathic scoliosis stands out, reaching around 88% of the cases of scoliosis currently diagnosed. It can be referred to as infantile (ages 0 to 3), juvenile (4 to 9) and adolescent (10 to +18). Adolescence is the age group in which scoliosis appears in a milder form, leading to the search for medical procedures. Its prevalence can vary in different regions of Brazil and the world, and can vary between

0.47 and 5.2% in healthy children worldwide. Among the most affected genders, females are ahead of males, with a proportion of 90% of cases.

Regarding the causes of idiopathic scoliosis, several suspicions have been raised to explain its onset and its greater incidence in females, such as genetic issues that are possibly linked to genetic inheritance linked to the regions of the X chromosomes, chromosomal abnormalities and variations in genetic loci.

Hormonal factors such as a lack of the hormone estrogen, which may be affecting bone maturation, may participate in the development of scoliosis. Muscular factors that are related to less stimulated development in women and muscle groups that would be influencing the progression of the curve, such as the paravertebral muscles that end up causing postural changes, impairing the control of movement of the spine (PENG et al., 2020).

In this sense, an early clinical investigation becomes essential to reach a diagnostic conclusion. These approaches can start from orthopedic tests, such as the Adams test that is constantly used together with the scoliometer, which is a prominent application for measuring the rotation of the gibbosity. Technological means are also presented as an option for recognizing scoliosis, such as 2D computerized photogrammetry and 3D ultrasound system. The Cobb method is considered the gold standard for measuring scoliotic curves. Through frequently requested X-rays, it is possible to obtain these angles that will classify them as mild ( $20^\circ$ ), moderate ( $20$  to  $40^\circ$ ), and severe ( $>50^\circ$ ) (AROEIRA et al., 2019).

The types of interventions for treating scoliosis can vary, ranging from conventional approaches to surgical treatments for more severe cases. Therefore, non-surgical treatment is more indicated, given that

surgery can be very invasive for the patient. Procedures may include the use of a brace, global postural reeducation techniques, Pilates, and the Klapp method. All of these are worked together for a specific purpose, which addresses the interruption of the scoliotic curve and improving the aesthetics of the spine (FARIA et al., 2021).

We know the approaches and methods that are described in different schools of physiotherapy in different countries, which are applied to patients with curvatures of less than 50 degrees, the methods are: Schroth method, scientific exercise approach (SEAS), Dobosiewicz technique, Side-shift program, Barcelona School of Scoliosis Physiotherapy (BSPTS) and Lyon method (DYA et al., 2019). Therefore, the general objective of the present study was to analyze the main methods of specific exercises in the physiotherapeutic treatment of individuals with scoliotic conditions.

## **METHODOLOGY**

### **TYPE OF STUDY**

This research was an integrative review of the literature, related to the area of Orthopedic Trauma in the field of Physiotherapy, highlighting the concept, Physiotherapeutic intervention through the application of specific exercises in the treatment of scoliosis: an analysis of the SCHROTH, SEAS, BSPTS and LYON methods. Integrative review (IR) is a method that allows for the synthesis of knowledge through a systematic and rigorous process, and its purpose is to synthesize results obtained in research on a topic or issue in a systematic, orderly and comprehensive manner (MENDES; SILVEIRA; GALVÃO, 2019).

A literature search has the main objective of finding solutions to problems or hypotheses through elaborated and published materials,

mainly including books and scientific articles that are analyzed and discussed. This type of review has advantages, as the author is able to investigate a wider range of phenomena than a more direct study. This research contributed with other readers to what was studied and the way in which the scientific research was presented based on the analysis of the authors who supported it. It was a comprehensive study, as it provided more knowledge on current and specific topics for the search for results on the same topic, ensuring a beneficial impact on the research results (MENDES; SILVEIRA; GALVÃO, 2019).

## RESEARCH DEVELOPMENT PROCESS

The bibliographic survey was carried out in October 2023, in the following databases: MEDLINE via Pubmed, LILACS via BVS (Virtual Health Library) and SCIENCE DIRECT. The research was prepared following the six-step model of the integrative review process, following the points shown in (figure 10): 1) elaboration of the review question; 2) search and selection of primary studies; 3) extraction of data from the studies; 4) critical evaluation of the primary studies included in the review; 5) synthesis of the review results and 6) presentation of the method, (MENDES; SILVEIRA; GALVÃO, 2019).

## STEPS OF THE INTEGRATIVE LITERATURE REVIEW

**1st Stage:** Definition of the review question.

It served as a guide for the construction of an integrative review. The construction must support theoretical reasoning and include definitions learned in advance by the researchers. Thus, the first stage of the process of preparing the integrative review began with the definition of a problem and the formulation of a research question,

where the PICO strategy was used, which is detailed as: What are the main interventions in the physical therapy treatment of patients with scoliosis? where, P patient or problem, I intervention, C control or comparison, O outcome, thus determining for this study: P (Scoliosis), I (Specific exercises), C (not applicable), O (Treatment result).

**2nd Stage:** Search and selection of primary studies.

Inclusion and exclusion criteria were established to search for and select studies to be included in this review. Articles published between 2015 and 2023, freely accessible via electronic means, corresponding to the search terms written in English, Spanish and Portuguese, and which addressed aspects related to physical therapy intervention through the application of specific exercises in the treatment of scoliosis: an analysis of the SCHORTH, SEAS, BSPTS and LYON methods were included. All duplicate articles, research published in years prior to 2015, integrative reviews, duplicate studies, articles that were not case studies, articles with less than six months of intervention using the method and those that deviated from the proposed theme were excluded.

**3rd Stage:** Extraction of data from studies.

In order to extract the best studies to compose this research, the PICo strategy was used, where the use of acronyms has been valuable, as it guides the formulation of the question and the search for bibliographies, allowing the researcher, when faced with uncertainty or doubt, to find, correctly and efficiently, the best and most appropriate, most complete scientific information available (NEVES et al., 2021).

To identify the studies, a careful reading of the titles, abstracts and keywords of all complete publications located by the search

strategy was carried out, and subsequently their adequacy to the inclusion criteria of the study was verified. In cases where the title, abstract and keywords were not sufficient to define the selection, the full article was read.

To select the controlled descriptors, the terms contained in the Health Sciences Descriptors (DeCS) and Medical Subject Headings (MeSH) in three languages: Portuguese, English and Spanish (Table 1) were consulted.

Descriptors controlled			
	DECS	MESH	IN SPANISH
<b>P</b>	Scoliosis	Scoliosis	``Escoliosis``
<b>I</b>	Specific exercises	Specific exercises	``Ejercicios especificos``
<b>C</b>	Not applicable	Not applicable	``No es aplicable``
<b>O</b>	Treatment result	Treatment result	``Resultado del tratamiento``

**Table 1:** Descriptors selected using the PICO strategy.

**Source:** Own elaboration, 2024.

**4th Stage:** Critical evaluation of the primary studies included in the review.

This involves categorizing the data, which was searched through an independent screening process, carried out by two researchers in separate environments. At the end of the searches, the studies were compared and analyzed to ensure whether or not they met the inclusion and exclusion criteria. Boolean operators were used to combine the descriptors “AND”, thus allowing combinations between the expressions.

**5th Stage:** Synthesis of the results of the review and presentation of the method.

This involves analyzing the texts that were selected in the integrative review, as they were placed in tables for data separation. The researchers interpreted the data and, with this, were able to identify existing knowledge gaps and suggest guidelines for future research. The researchers made it clear which gaps were

found in the literature and which future paths other researchers will adopt in their scientific research.

**6th Stage:** Presentation of the method | synthesis of knowledge.

This last stage consisted of preparing the document that included a detailed description of all the phases undertaken by the researchers, in addition to presenting the main results obtained.

## ETHICAL ASPECTS

This study was based on ethical principles, in order to maintain the utmost care in the veracity of the information, thus avoiding mistakes, distortions, contradictions and improper appropriation of previous works and/or studies so that the originality of this study supports the authors’ research and that it can be another public reference available for subsequent studies.

## RISKS AND BENEFITS

A literature review encompasses several points: how to present bias, difficulties in finding studies that meet the inclusion and exclusion criteria. Regarding the externalization of the data collected by the authors, they were analyzed and transcribed indirectly in accordance with the Brazilian Association of Technical Standards (ABNT). In addition, failure to adopt a clear and specific approach may compromise the integrity of the study. The research brings benefits to the scientific community and to readers, as it presents content rich in information about physical therapy intervention through the application of specific exercises in the treatment of scoliosis.

## RESULTS AND DISCUSSION

Author/ Year	Type of study	Goal	Treatment Frequency	Sample	Intervention	Outcome
Kuru <i>et al.</i> , (2015).	Randomized controlled clinical trial.	To compare the effectiveness of three-dimensional (3D) Schroth exercises in patients with adolescent idiopathic scoliosis.	G. PE: Duration: Six weeks with eighteen sessions. G.P.D: 6 months of home treatment G.P.C: They received guidance every six weeks for six months. The assessments were repeated at the 6th, 12th and 24th week and the results were compared between the groups.	G.PE 15 patients. G.P.D: 15 Participants. G.P.C: 15 Participants.	G.PE: Performed, stretching, deflection, rotation, detorsion G.P.D: Guidelines for performing the Schroth exercise at home. G.P.C: Postural recommendations	G.PE: Decreased mean Cobb angle, trunk rotation angle, hump height and improved waist asymmetry in children. G.P.D: Increased mean Cobb angle, trunk rotation angle and hump height. G.P.C: Increased mean Cobb angle, trunk rotation angle and hump height.
De Mauroy <i>et al.</i> , (2015).	Prospective case series.	The aim of the study was to analyze the results of 148 scoliosis treated with the ART brace after 1 year, in comparison with the last 100 patients with the old Lyon brace.	The two groups were evaluated before treatment, with the device, after six months without the device, and after one year without the device and during treatment.	G.P.A 148 Patients. G.P.B 100 Participants.	G.P.A: treated with ARTbrace. G.P.B: treated with the old Lyon brace.	There was no significant difference in the thoracic hump, thoracic rib, lumbar rib and thoracic bunnel ATR scores between the two groups before the brace. There was a significant difference in the thoracic rib and lumbar rib scores at six months between the two groups.
Aulisa <i>et al.</i> , (2015).	Prospective study based on SRS and SOSORT criteria.	The aim of this study was to evaluate the effectiveness of the Lyon orthosis in the conservative treatment of female adolescents with idiopathic thoracic curves.	Full-time (maximum 22 hours per day; minimum 18 hours per day). Assessment at 6-month intervals. And minimum follow-up of 24 months after the end of treatment.	102 Female patients	All patients received Lyon orthosis	Improved stabilization and correction of thoracic curves in idiopathic scoliosis.
Schreibe <i>et al.</i> , (2016).	Parallel clinical trial, phase II, blinded for evaluator and statistician, randomized and controlled.	To determine the effect of a Schroth PSSE intervention added to standard care on the Cobb angle compared to standard care alone in patients with AIS.	It consisted of a daily 30- to 45-minute home program and weekly supervised sessions for 6 months.	G. PE: 25 Participants. G.P.C: 25 Participants.	G.PE: Schroth PSSE G.P.C: Standard treatment (orthosis or observation).	G.PE: Improvement in curve severity in adolescents with idiopathic scoliosis. G.P.C: There was no improvement in curve severity in adolescents with idiopathic scoliosis.
Schreibe <i>et al.</i> , (2017).	Randomized clinical trial	To determine the need for Schroth PSSE application added to standard treatment to prevent curve progression.	Weekly supervised 1-hour Schroth exercise sessions combined with a 30- to 45-minute daily home exercise program for six months	G. PE: 25 Participants. G.P.C: 25 Participants.	G.PE: Schroth PSSE and standard treatment. G.P.C: Standard treatment (orthosis or observation).	G.PE: Absolute reduction of 28% and 32% in the risk of curve progression, reduction in the risk of curve deterioration. G.P.C: No improvement, showing progression of the scoliotic curve of more than 10°.

Zapata; Sucato; Chan-Hee Jo, (2019).	Prospective cohort study.	To assess the magnitude of the curve in participants with adolescent idiopathic scoliosis (AIS).	8 hours of therapy sessions, 15 minutes a day, 3 days a week. Over a 6 month period.	G. P.E: 19 participants. G.P.C: 14 participants.	G.P.E: Barcelona School of Physiotherapy (BSPPTS). G.P.C: Standard Treatment (Observation)	G.P.E: Overall, the scoliotic curves remained stable. G.P.C: The scoliotic curves progressed at least 5°.
Schreibe <i>et al.</i> , (2019).	Randomized clinical trial.	To determine the threshold of change in the Cobb angle in adolescents with idiopathic scoliosis (AIS).	G.P.E: Five individual 1-hour sessions during the first 2 weeks, and 30-45 min of home exercise instruction over a period of six months. G.P.C: Standard care (observation and bracing). Over a period of six months.	G. P.E: 25 Participants G.P.C: 25 Participants.	G.P.E: Schroth PSSE, associated with standard treatment. G.P.C: Received only standard treatment (observation or orthosis).	G.P.E: Improvement in the condition of the back, even with minimal improvement in the Cobb angle. G.P.C: There was no improvement, showing deterioration of the scoliotic curve.
Fan <i>et al.</i> , (2021).	Prospective non-randomized clinical trial.	To investigate the long-term therapeutic effects of Schroth exercises on the main thoracic and lumbar curves.	Supervised for 6 months, occurring once a month for 1 hour. And home exercises for 30 minutes, 5 times a week. Duration of 2 years.	G.P.T: 22 participants G.P.L: 18 participants	BSPTS PSSE Program.	There was no significant difference in relation to the type of curve. However, an improvement was noted in relation to the prevention of curve progression and in the stabilization of the spine.
Mohamed; Yousef, (2021).	Randomized controlled study.	To investigate the effect of PNF and compare its effect to Schroth exercises on the scoliosis angle, static plantar pressure distribution and functional capacity in AIS.	G.P.E: Duration of one hour with a two-minute rest period between each exercise, three days a week for six successive months. G.P.C: It was performed with two sets of 10 repetitions with a two-minute rest period between each exercise, three days a week, for six successive months.	G. P.E: 17 Participants. G.P.C: 17 Participants.	G.P.E: Schroth Exercises G.P.C: PNF Technique	G.P.E: Significant reduction in the Cobb angle, showed significant improvements in angular trunk rotation (ATR) measurements. G.P.C: Significant reduction in the Cobb angle, did not show significant improvement in the angular trunk rotation (ATR) measurements.
Yuan <i>et al.</i> , (2022).	Combined retrospective and prospective analysis.	Evaluate the effectiveness of PASSE in the NIS.	G.P.E: Duration of four to six months, for thirty minutes a day and more than five times a week. G.P.C: follow-up every 4-6 months.	G. P.E: 24 Participants. G.P.C: 24 Participants.	G.P.E: SEAS Approach. G.P.C: Observation	G.P.E: The Cobb angle and trunk rotation wave decreased significantly. G.P.C: The Cobb angle increased significantly.

**Table 2:** Distribution of articles according to authors, type of study, objective, frequency of treatment, sample, intervention and outcome related to physiotherapeutic intervention through the application of specific exercises in the treatment of scoliosis: An analysis of the Schroth, SEAS, BSPTS and Lyon methods.

**Source: Own elaboration, 2024.**

**Subtitle:** G.P.E= Experimental group; G.P.D = Domestic group; G.P.C = Control group; G.P.O = Observation group; G.P.A = Group A; G.P.B = Group B; G.P.T = Thoracic group; G.P.L = Lumbar group.

Through the selected studies, it was possible to identify that the predominant methods were Schorth, SEAS, BSPTS and Lyon, as they demonstrated significant results in improving the Cobb angle, curve severity, stabilization, preventing scoliosis progression, improving flexibility and quality of life.

Kuru et al. (2015) conducted a 6-month randomized controlled clinical trial to compare the effectiveness of three-dimensional Schroth exercises in patients with idiopathic scoliosis, including 45 participants divided into three groups: experimental, home-based, and control. The results showed that the experimental group, which received Schroth treatment, achieved significant improvements in the mean Cobb angle, rotation angle, and thoracic gibbosity height, while the other groups showed progression of the aforementioned points, demonstrating the superiority of the Schroth exercise group over the other groups.

In collaboration with Kuru et al. (2015), the findings of Schreiber et al. (2015) reinforce the use of the Schroth method for patients with scoliotic conditions. They analyzed 50 participants for a period of 3 months of intervention (Schroth associated with standard treatment (observation and orthosis). In their results, the aspects, degree of pain, muscular resistance, self-image and increased resistance to spinal extension improved significantly. In their observational prospective controlled cohort study by Mauroy et al. (2014), 289 participants were investigated, divided into two groups, experimental and control. After the application of the intervention (use of ARTbrace) for 3 days, it was possible to identify a decrease in the Cobb angle of the thoracic and lumbar region. However, the immediate reduction in the brace is not the result of the treatment, this tendency for reduction is perceived even more in the period of 6 months to 1 year. In response to

the gap left by the aforementioned study, the same author De Mauroy et al. (2015), one year later, in their prospective case series study including 248 participants divided into two groups, experimental (treated with the new ARTbrace) and control (treated with the old Lyon brace), experimented with the same intervention for a period of 6 months and 1 year of application, achieving considerable results for the experimental group in the score for thoracic and lumbar curves, demonstrating the superiority of the new ARTbrace over the old brace, in the reducibility of up to 50% of the scoliotic curve.

Regarding the treatment of scoliosis with a Cobb angle above 20°, in the study by Mauroy et al. (2011), when analyzing 1,338 completed treatments, the results showed that individuals with double main curves and thoracolumbar curves responded well to the Lyon brace. Complementing the results of the study discussed, Negrini et al. (2009), in their retrospective study, reinforced that the treatment of scoliotic conditions using the use of orthosis associated with PSSE has better results.

Besides, in relation to the results presented by De Mauroy et al. (2011), Aulisa et al. (2015), in a more recent study, aimed to determine the effectiveness of the Lyon orthosis in correcting thoracic curves in female patients. The research included 102 patients with an intervention of at least 18 hours daily using the Lyon brace for all patients. The study demonstrated considerable results in the correction and stabilization of the curve after the Lyon support. However, the study was limited by not having a control group and by the small sample size.

Otman et al. (2005) conducted a study with 50 participants with a 1-year follow-up Schroth exercise program, in which patients followed the Schroth technique protocol, including 4 hours of daily treatment for 5



days a week in the first 6 weeks. Afterwards, patients continued the same program in their home environments. Through the analyses, their results consistently suggest that three-dimensional Schroth exercises decrease the Cobb angle, increase vital capacity, increase strength and reduce postural defects in patients with scoliotic conditions.

Schreibe et al. (2016) had similar findings to those of Otman et al. (2005), regarding the positive results of the method. In their study, it was possible to verify the comparison between the Schroth intervention in conjunction with the standard treatment and the standard treatment alone (brace or observation) in patients with idiopathic scoliosis. It was identified that the group that received the Schroth treatment associated with the standard treatment showed a significant improvement in the severity of the curvature compared to those who received only the standard treatment. It is important to emphasize that these results are justified by the fact that the Schroth method involves the practice of sensory-motor, postural and respiratory exercises with the objective of readjusting posture, improving postural control in both static and dynamic situations and strengthening the stability of the spine.

Bezalel et al. (2019) conducted a randomized, controlled, single-blind clinical trial, including 50 participants divided into two groups, (Schroth) and (classical antigravity exercises) aiming to evaluate the efficacy of Schroth therapy on the thoracic curve angle and pain. After the end of the intervention, the Schroth group managed to obtain improvement in kyphotic deformity, body image and thoracic kyphosis. In this study, the Schroth intervention was preferable compared to antigravity exercises.

Scheibe et al. (2017) have findings similar to Bezalel et al. (2019), regarding the application of the Schroth method in the treatment

of scoliotic conditions. In their study, it was possible to identify that the Schroth experimental group associated with standard treatment (observation and orthosis), after 6 months of intervention, the experimental group obtained an absolute decrease of 28 and 32% in the risk of progression of the largest scoliotic curve, proving that the Schroth method associated with standard treatment favored a clinically important benefit compared to the control group.

Considering the conception of Zapata; Sucato; Chan-Hee Jo, (2019), when evaluating the magnitude of the curve in participants with mild adolescent idiopathic scoliosis, the participants were divided into 2 groups for analysis, experimental (Barcelona Scoliosis Physiotherapy School-based (BSPTS) and control (observation), applied to individuals with curves of 12° to 20°. The analysis was divided into two moments, at 6 months of intervention where there was no positive difference in curves between the groups, however the Cobb angle of the curve of the control group increased significantly when compared to the experimental group, and at 1 year of intervention, where the experimental group presented curvatures with smaller Cobb angles. Overall the study shows stabilization of scoliotic curves.

According to the study discussed, Fan et al. (2021), in their recent study strengthens the findings of Zapata; Sucato; Chan-Hee Jo, (2019), when investigating the effect of curve patterns on Cobb angles using the PSSE. Their study included 40 participants who were divided into a major thoracic group and a lumbar group, where all underwent an intensive BSPTS protocol with supervision for 6 months. Participants were instructed to perform exercises at home for 30 minutes more than 5 times a week. After 6 months, all participants reduced the frequency of assisted PSSE to once, every 3 months, continuing

until completing 2 years of follow-up and maintaining the frequency of exercises at home. The results are similar to those of Zapata; Sucato; Chan-Hee Jo, (2019), since 20% of the participants had regression of the curve and 80% stabilized.

In their study, Schreibe et al. (2019) sought to determine the threshold of change in the Cobb angle in patients with idiopathic scoliosis. The research included 50 participants aged between 10 and 18 years, divided into two homogeneous experimental groups (Schroth associated with standard treatment) and control group (standard treatment). The Cobb angles of prominent scoliotic curves were measured on a coronal plane radiograph, both at baseline and after six months. The analyses were performed before and after the intervention period, in which it was possible to identify that Schroth exercises associated with standard treatment lead to significant improvement in the condition of the spine, even with minimal improvement in the Cobb angle. The control group presented adverse results and deterioration of the scoliotic curve.

Corroborating the findings of Schreibe et al. (2019), Kocoman et al. (2021) reinforce that the practice of the Schroth method can provide improvement in individuals with idiopathic scoliosis. They conducted a study with 28 individuals with mild scoliotic curves, divided into two groups, with the aim of comparing the effects of the Schroth approach and core stabilization exercises. Schroth exercises, through their three-dimensional approach, can reduce the deformity of pathological curves identified in scoliosis, through their basic component, self-correction. Thus, the researchers verified improvements in the Cobb angles, thoracic trunk rotation angle, trunk deformity, spinal mobility, and quality of life, but did not show improvements in peripheral muscle strength.

The studies by Kuru et al. (2015), Schreibe

et al. (2016), Schreibe et al. (2017), Schreibe et al. (2019) and Fan et al. (2021) show important results regarding the benefits that the Schroth method can offer to individuals with scoliotic conditions, strengthening the applicability of exercises in the clinical management of scoliosis cases. Ratifying the ideas of the aforementioned authors, Mohamed; Yousef, (2021), confirms that these benefits may occur because the exercises involve conscious repetition with feedback, providing mental reeducation and correct posture recognized by the subconscious, increasing flexibility and isometric resistance of the limbs, resulting in positive findings, such as a decrease in angular rotation measures of the trunk. Yuan et al. (2022) conducted a combined retrospective and prospective analysis, including 52 participants who were self-selected into a group (SEAS) and observation (No intervention).

The SEAS group was asked to maintain the corrective position in their daily life and performed excessive corrective exercise for at least 30 minutes per day, more than 5 days a week. After 1 year of intervention, there were significant differences between the groups. The Cobb angle and trunk rotation angle (ATR) decreased significantly in the SEAS group, while the observation group increased. With the increase in the Cobb angle and ATR in the observation group being statistically significant and not clinically significant, the results indicate that PSSE was efficient in reducing these two points.

In contrast, Yagci; Yakut, (2019), tested the effects of combined core stabilization exercise (CS) and orthosis treatment, compared with SEAS and orthosis treatment in 30 female participants for a period of 4 months. The comparison between the groups did not indicate significant asymmetry in the thoracic, lumbar Cobb angle and ATR. In general, the intervention with the CS and

SEAS methods in addition to the orthosis had a positive impact on the progression of the scoliotic curve. These results indicate that the two intervention protocols were efficient in preventing the progression of the curve in patients with adolescent idiopathic scoliosis.

Through the investigation of the studies that made up the database, six studies, representing 60% of the total, revealed benefits despite the Schroth method, thus being the most studied by researchers. The remaining studies, representing 40%, demonstrate benefits related to the other methods discussed.

## FINAL CONSIDERATIONS

This study aimed to analyze the main methods of specific exercises in the physiotherapy treatment of individuals with scoliotic conditions. Thus, a study was carried out with a time frame from 2015 to 2023. After analyzing all the findings listed and discussed in the results tables, it is possible to observe that scoliosis is a pathological condition of the spine that alters this structure in a three-

dimensional way, affecting individuals of different age groups.

In this perspective, despite the low diversity of researchers who address the proposed theme, it was possible to identify the transcendence and benefits driven by the application of specific exercises through the use of the Schroth, SEAS, BSPTS and Lyon methods, however with greater beneficial results for the Schroth method, in individuals with scoliotic conditions.

Thus, the studies discussed demonstrated improvements in the reduction and stabilization of the Cobb angle, trunk rotation angle, improved flexibility, increased peripheral muscle strength, improved spinal mobility, body awareness and quality of life, therefore our objectives in general were achieved. However, it is suggested that new studies are needed, particularly randomized clinical trials that include a longer intervention duration aiming at new results, since most of the studies analyzed included a relatively short intervention period lasting six months.

## REFERENCES

- ALASSIRI, S. et al. Prevalência e preditores de escoliose e dor nas costas em 591 adolescentes: um estudo randomizado, estratificado e transversal em Riyadh, Arábia Saudita. **Cureu**, v. 14, n. 7, 2022.
- AROEIRA, Rozilene Maria Cota et al. Método não ionizante de rastreamento da escoliose idiopática do adolescente em escolares. **Ciência & Saúde Coletiva**, v. 24, p. 523-534, 2019.
- AULISA, Angelo G. et al. Lyon bracing in adolescent females with thoracic idiopathic scoliosis: a prospective study based on srs and osort criteria. **Bmc Musculoskeletal Disorders**, v. 16, n. 1, p. 316, 2015.
- BEZALEL, Tomer et al. The Effect of Schroth Therapy on Thoracic Kyphotic Curve and Quality of Life in Scheuermann's Patients: a randomized controlled trial. **Asian Spine Journal**, v. 13, n. 3, p. 490-499, 2019.
- DAY, Joseph M. et al. Review of scoliosis-specific exercise methods used to correct adolescent idiopathic scoliosis. **Archives of physiotherapy**, v. 9, p. 1-11, 2019.
- DE FARIA, Cintia Alencar et al. A eficácia do tratamento fisioterapêutico para escoliose idiopática do adolescente: revisão integrativa. **Revista eletrônica saúde e ciência**. v. 11, n. 01, 2021.
- DE MAUROY, J., LECANTE, C., BARRAL, Frédéric. "Brace Technology" Thematic Series-The Lyon approach to the conservative treatment of scoliosis. **Scoliosis**, v. 6, p. 1-14, 2011.
- DE MAUROY, Jean Claude et al. Prospective study and new concepts based on scoliosis detorsion of the first 225 early in-brace radiological results with the new Lyon brace: ARTbrace. **Scoliosis**, v. 9, n. 1, p. 1-19, 2014.

DE MAUROY, Jean Claude et al. The new Lyon ARTbrace versus the historical Lyon brace: a prospective case series of 148 consecutive scoliosis with short time results after 1 year compared with a historical retrospective case series of 100 consecutive scoliosis; SOSORT award 2015 winner. **Scoliosis**, v. 10, n. 1, p. 1-16, 2015.

FAN, Yunli et al. Does curve pattern impact on the effects of physiotherapeutic scoliosis specific exercises on Cobb angles of participants with adolescent idiopathic scoliosis: A prospective clinical trial with two years follow-up. **Plos one**, v. 16, n. 1, p. 829, 2021.

FREITAS, Maria Gerlane; DE MEDEIROS, Sarar Maria Lopes; CÂMARA, Gislainy Luciana Gomes. Recursos fisioterapêuticos nos desvios posturais da coluna vertebral: uma revisão integrativa. **Revista Pesquisa em Fisioterapia**, v. 10, n. 2, p. 355-364, 2020.

KOCAMAN, Hikmet et al. The effectiveness of two different exercise approaches in adolescent idiopathic scoliosis: A single-blind, randomized-controlled trial. **PLoS One**, v.16, n. 4, 2021.

KURU, Tuğba *et al.* The efficacy of three-dimensional Schroth exercises in adolescent idiopathic scoliosis: a randomised controlled clinical trial. **Clinical Rehabilitation: an essay randomized controlled clinical**, v. 30, n. 2, p. 181-190, 2015.

MENDES, Karina Dal Sasso; SILVEIRA, Renata Cristina de Campos Pereira; GALVÃO, Cristina Maria. Uso de gerenciador de referências bibliográficas na seleção dos estudos primários em revisão integrativa. **Texto & Contexto-Enfermagem**, v. 28, 2019.

MOHAMED, R. A.; YOUSEF, A. M. Impact of Schroth three-dimensional vs. proprioceptive neuromuscular facilitation techniques in adolescent idiopathic scoliosis: a randomized controlled study. **European Review For Medical And Pharmacological Sciences**, v. 25, n. 24, p. 7717-7725, 2021.

NEVES, Simone Carvalho et al. Os fatores de risco envolvidos na obesidade no adolescente: uma revisão integrativa. **Ciencia & saude coletiva**, v. 26, p. 4871-4884, 2021.

OTMAN, S., KOSE, N., YAKUT, Y. The efficacy of Schroth's 3-dimensional exercise therapy in the treatment of adolescent idiopathic scoliosis in Turkey. **Neurosciences Journal**, v. 10, n. 4, p. 277-283, 2005.

PENG, Yue et al. Research progress on the etiology and pathogenesis of adolescent idiopathic scoliosis. **Chinese medical journal**, v. 133, n. 04, p. 483-493, 2020.

SCHREIBER, Sanja et al. Patients with adolescent idiopathic scoliosis perceive positive improvements regardless of change in the Cobb angle—Results from a randomized controlled trial comparing a 6-month Schroth intervention added to standard care and standard care alone. SOSORT 2018 Award winner. **BMC musculoskeletal disorders**, v. 20, n. 1, p. 1-10, 2019.

SCHREIBER, Sanja et al. Schroth scoliosis-specific physical therapy exercises for adolescent idiopathic scoliosis: how many patients require treatment to prevent deterioration? – results of a randomized clinical trial – “2017 SOSORT Award Winner”. **Scoliosis and Spinal Disorders**, v.12, n.1, pg. 1-8, 2017.

SCHREIBER, Sanja et al. 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**, v. 10, n. 1, p. 1-12, 2015.

SCHREIBER, Sanja *et al.* Schroth Physiotherapeutic Scoliosis-Specific Exercises Added to the Standard of Care Lead to Better Cobb Angle Outcomes in Adolescents with Idiopathic Scoliosis – an Assessor and Statistician Blinded Randomized Controlled Trial. **Plos One**: v. 11, n.12, p. 746, 2016.

WONG, Christian. Behandling af smertefulde skoliose. **Ugeskr Læger**, v. 181, p.180-449, 2019.

YAGCI, G., YAKUT, Y. Core stabilization exercises versus scoliosis-specific exercises in moderate idiopathic scoliosis treatment. **Prosthetics & Orthotics International**, v. 43, n. 3, p. 301-308, 2019.

YUAN, Wangshu et al. Effects of physiotherapeutic scoliosis-specific exercise in patients with mild juvenile scoliosis. **BMC Musculoskeletal Disorders**, v. 23, n. 1, p. 918, 2022.

ZAPATA, Karina A.; SUCATO, Daniel J.; JO, Chan-Hee. Physical therapy scoliosis-specific exercises may reduce curve progression in mild adolescent idiopathic scoliosis curves. **Pediatric Physical Therapy**, v. 31, n. 3, p. 280-285, 2019.