



EFFECTS OF PHYSIOTHERAPY ON ADOLESCENT IDIOPATHIC SCOLIOSIS. A SYSTEMATIC REVIEW

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Abstract

Introduction: Scoliosis is a three-dimensional deformative abnormality of the spine, defined by the Cobb's angle of spine curvature in the coronal plane, and is often accompanied by vertebral rotation in the transverse plane and hypokyphosis in the sagittal plane. Based on the age of presentation, scoliosis is further categorized as infantile, juvenile or adolescent idiopathic. Adolescent idiopathic scoliosis (AIS) has the highest prevalence of the three categories. This type of scoliosis is present at age ten and lasts till the end of growth. Its prevalence is dependent on the curvature of the spine and gender of the patient.

Objective: The purpose of this review is to evaluate the role of physiotherapy in reducing curve progression and pain, postponing or avoiding invasive treatment and improve the quality of life in adolescents with AIS.

Methodology: The study is a Systematic Review, meta-analytic type, consisting of 5 studies (RCT) of the last ten years, which focus on the impact of physiotherapy in AIS. Studies include 210 patients evaluated and treated by physiotherapist, divided into 2 groups: experimental and control group. The measurement and rehabilitation includes Cobb angle, pain and quality of life. Data was extracted from medical websites and scientific journals. The evaluation was realized with the PEDro scale, which shows the validity of each study.

Results: The literature used in the study claimed that physiotherapist in AIS reduces pain and Cobb angle and improve QoL ($p < 0.05$). The 5 studies had an average PEDro score of 5.6/10.

Conclusions: Evidence suggests that physiotherapy is good at reducing the Cobb angle, pain and improving the quality of life in patients with AIS. Scientific research on this topic is limited, so it is suggested to increase research, especially now that AIS incidence is higher.

Keywords: physiotherapy, scoliosis, Schroth, Adolescent Idiopathic Scoliosis.

INTRODUCTION

Scoliosis is a three-dimensional deformative abnormality of the spine. Scoliosis is defined by the Cobb's angle of spine curvature in the coronal plane, and is often accompanied by vertebral rotation in the transverse plane and hypokyphosis in the sagittal plane. These abnormalities in the spine, costal-vertebral joints, and the rib cage produce a 'convex' and 'concave' hemithorax. The rotation component starts when the scoliosis becomes more pronounced. This is called a torsion-scoliosis, causing a gibbus.

Scoliosis can be present from birth. It is then called congenital scoliosis. Congenital scoliosis represents a spinal malformation due to defects of formation, segmentation or mixed ones. It is characterized by a longitudinal and rotational imbalance.[1] Other



sorts of scoliosis can be developed during growth, any causes for this are still not found. We then speak of Weiss Scoliosis. Approximately 85% of cases are idiopathic. Based on the age of presentation, scoliosis is further categorized as infantile, juvenile or adolescent idiopathic.

Adolescent idiopathic scoliosis (AIS) has the highest prevalence of the three categories. This type of scoliosis is present at age ten and lasts till the end of growth. Its prevalence is dependent on the curvature of the spine and gender of the patient.[2] Epidemiological studies have demonstrated that IS is significantly more frequent in girls than boys, reaching a ratio of 4:1. Anwer et al. described a prevalence of 2,5% with a Cobb angle larger than 10 degrees. They also stated that a variety of risk factors may result in a higher curve progression. These factors include the following: female gender, age of 10–12 years, absence of menarche, presence of thoracic curves, curve size at presentation >25 degrees, Risser sign of 0-1, and residual growth potential.[3][4]

Physical therapy and bracing are used to treat milder forms of scoliosis to maintain cosmesis and avoid surgery.[5] Scoliosis is not just a lateral curvature of the spine, it's a three dimensional condition. To manage scoliosis, we need to work in three planes: the sagittal, frontal and transverse. Different methods have already been studied.[6] The conservative therapy consists of: physical exercises, bracing, manipulation, electrical stimulation and insoles. There is still discussion about the fact that conservative therapy is effective or not. Some therapists follow the 'wait and see' method. This means that at one moment; the Cobb degree threshold will be achieved. Then, the only possibility is a spinal surgery.[7]

OBJECTIVE

The purpose of this review is to evaluate the role of physiotherapy in reducing curve progression and pain, postponing or avoiding invasive treatment and improve the quality of life in adolescents with AIS.

METHODS

Data Sources. Electronic databases, including Pubmed, Cochrane Register of Controlled Trials, PEDro, and Web of Science, were searched for published studies using the keywords "scoliosis," "Cobb angle," "quality of life," "Schroth," and "AIS". The bibliographical search was restricted to randomized and nonrandomized controlled trials published in English language.

Study Selection. Studies were included on the basis of the following criteria: randomized controlled methodology; subjects with AIS, studies comparison of exercise with other interventions or controls; and outcome measures of radiological deformity (Cobb angle), MRI, pain (VAS) and quality of life. Studies were excluded if subjects



were >25 years of age, secondary conditions, interventions did not include exercise or compare exercise with a control, or published results were in abstract form only.

Data Extraction. The selected studies are five RCT and are realized after 2010. The metaanalysis consist on evaluating physiotherapy on AIS, presenting the objectives of the studies, patients, outcome measures, intervention, follow-up period, results and conclusions.

Assessment of Methodological Quality. The 11-item PEDro scale was used to assess the quality of included studies. Eligibility criteria item does not contribute to total score.

RESULTS

Identified Studies. The abstracts of 25 studies were assessed for eligibility. Twenty studies were eliminated because they did not match the inclusion criteria or were not available in full text. A total of 5 studies were included in the quality assessment phase.

Quality Assessment of Study. The 5 included studies had an average PEDro score of 5.6/10 (8/10 - 3/10).

Characteristics of Study Populations. This systematic review includes 210 patients, divided in two groups (each study), the experimental and control group. The age of patients were 10-25 years. Most of the studies used the Cobb angle as inclusion criteria for participants with AIS.

Measurement and rehabilitation protocol. The outcome measures include Cobb angle, VAS, QoF and MRI. The intervention are focused on physiotherapeutic scoliosis-specific exercise (PSSE), home-based vibration assisted exercise, Kinesio Taping, Preoperative Protocol Aerobic PT, stretching and mechanical traction.

PEDro Score

The PEDro scale was developed by the Physiotherapy Evidence Database to determine the quality of clinical trials. The PEDro scale consists of a checklist of 10 scored yes-or-no questions pertaining to the internal validity and the statistical information provided.[8]

*high quality = PEDro score 6-10

*fair quality = PEDro score 4-5

*poor quality = PEDro score \leq 3



Study, 1 st author	Eligibility criteria	Random allocation	Concealed allocation	Baseline comparability	Blind subjects	Blind therapists	Blind assessors	Adequate follow-up	Intention-to-treat analysis	Between-group comparisons	Point estimates and variability	Score
Schreiber S	√	√	√	√	-	-	√	√	√	√	√	8/10
Langensiepen S	√	√	√	√	-	-	√	√	-	√	√	7/10
Atici Y	-	√	-	√	-	-	-	-	-	√	√	4/10
dos Santos Alves VL	√	√	-	√	-	-	√	√	-	√	√	6/10
Zakaria A	√	√	-	-	-	-	-	-	-	√	√	3/10

1 st author of the study	Year Place Type	Objective	Patients	Measure s	Intervention Follow-up	Results
Schreiber S	April 2011- November 2013 Canada RCT	To determine the effect of Schroth added to standard of care on the Cobb angle compared to standard of care alone in patients with AIS.	50 patients 10-18 years 10°-45° Cobb	Cobb angle Largest curve Sum of curves	30-45 min daily home program weekly supervised session six months rehabilitation Schroth PSSE vs standart care	Schroth group had significantly smaller Largest Curve than controls (-3.5°, 95% CI -1.1° to -5.9°, p = 0.006). The between-group difference in the square root of the Sum of Curves was -0.40°, (95% CI -0.03° to -



						0.8°, p = 0.046)
Langensiepe n S	2012 Germany RCT	The aim of this study was to evaluate the effect of scoliosis specific exercises (SSE) on a side-alternating whole body vibration platform (sWBV) as a home-training program in girls with adolescent idiopathic scoliosis (AIS).	40 patients 10-17 years 16 hours Chêneau brace	Cobb angle MRI	SSE, WBV home-training six months	The major curve in the sWBV group decreased significantly by -2.3° (SD±3.8) (95% CI - 4.1 to -0.5; P=0.014) compared to the difference in the control group of 0.3° (SD±3.7) (95% CI - 1.5 to 2.2; P=0.682) (P=0.035).
Atici Y	2016 Turkey RCT	This study investigated the short-term effects of KT on back pain (BP) in patients with Lenke Type 1 adolescent idiopathic scoliosis (AIS).	40 patients with Lenke Type 1 AIS and Back Pain 14-18 years	Cobb VAS	Kinesiotape alone KT with tension and home exercises 4 weeks	The decrease in VAS score of Group 1 after taping was higher than that of Group 2. The difference between the pre- and post-treatment VAS scores of both groups was statistically significant



						(p < 0.05).
dos Santos Alves VL	August 2011- March 2012 Brazil RCT	The aim of the study is to determine if a preoperative protocol of aerobic exercise would improve quality of life (QoL) both before and after training and if there would be any differences between patients who received the therapy and those who did not.	40 patients 10-18 years >45° Cobb angle preoperative	QoL	4 months 3 times a week 60 min sess 10 min warm up 40 min aerobic exc 10 min relaxation control group: No PT	QoL scores improved for the study group but did not change for the control group. Mean QoL scores in all domains were not statistically the same over time in both groups (Group × Time, P < .05). For all QoL domains, the study group's mean score increased significantly from baseline to 4 months (P < .05), and, after 4 months, scores were on average higher in the study group (P < .05) than in the control group.
Zakaria A	2012 Saudi Arabia	This study was conducted	40 patients 15-25 years	Cobb VAS FFT	3 times a week 3 months	There was more significant



	RCT	to compare two training programs, traction and stretching exercises, in rehabilitation of moderate scoliotic patients.	20° -40° Cobb		stretching ex group mechanical traction gr	improvement of the Cobb's angle in the stretching exercises group than in the mechanical traction group. There was no sign diff in VAS and FFT values between the groups.
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DISCUSSION

This systematic review investigated current available evidence on the effects of physiotherapy on Cobb angle, pain and quality of life in patients with AIS. The review evaluated 5 studies, including a total of 210 participants.

Among the 5 studies evaluated using the PEDro scale [9], 3 were considered of high methodological quality [8]. The results of the present systematic review provide moderate-quality evidence for physiotherapy intervention with a medium effect size for reducing the Cobb angle, angle of trunk rotation, thoracic kyphosis angle, and lumbar lordosis angle, reducing pain and improving the quality of life in patients with AIS.

Similarly, a systematic review conducted by Fusco et al. [13] reported improvement in the Cobb angle following a regime of exercise. In another review, Negrini et al. [11] confirmed the efficacy of exercises in reducing the progression of deformity and Cobb angles in patients with AIS. In contrast, Mordecai and Dabke [10] reported poor quality evidence supporting the use of an exercise program in the management of AIS, and a Cochrane review conducted by Romano et al. [12] revealed a lack of high-quality evidence to recommend the use of scoliosis-specific exercises to reduce the progression of AIS.



CONCLUSIONS

Evidence suggests that physiotherapy is a good treatment in reducing the Cobb angle, reducing pain and improving the quality of life in patients with AIS. However, the presence of other treatments and PT techniques, poor methodological quality, low number of participants and studies limit the validity of these results.

Scientific research on this topic is limited, so it is suggested to increase research, especially now that the AIS incidence is higher.

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