

Schroth's Method Exercises for Treating Idiopathic Adolescent Scoliosis; A Narrative Review

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Review Article

Abstract

Introduction: Scoliosis is a 3-dimensional spinal deformity. In recent years, more attention has been paid to scoliosis specific exercises. Among different exercise methods for treating scoliosis, the Schroth's method is the most recognized and widely used. This study aimed to determine the effect of Schroth's scoliosis specific exercises on different outcomes and quality of life in patients with idiopathic scoliosis.

Materials and Methods: In this narrative review, databases such as PubMed, PEDro, Trip, ScienceDirect, and Google Scholar were searched from 2009 till 2019 using words "schroth AND scoliosis AND (quality of life/ muscle endurance/cobb angle/ respiration/respiratory function) PSSE AND scoliosis, 3 dimensional exercises AND scoliosis.

Results: Finally, 15 studies were included. Most of the studies discussed Cobb's angle changes and other outcomes such as pain, back muscle endurance, respiratory volumes, chest expansion, pulmonary function, cosmetics and patient's satisfaction, trunk deformities, weight distribution, and quality of life in patients with idiopathic scoliosis.

Conclusion: Schroth's method's and 3-dimensional exercises had a positive effect on Cobb's angle, pain, back muscle endurance, respiratory volumes, chest expansion, cosmetics and patient's satisfaction, trunk deformities, weight distribution, and quality of life in patients with idiopathic scoliosis. However, the effect of such exercises on pulmonary function is controversial.

Keywords: Scoliosis, Schroth, Exercise therapy

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Introduction

Scoliosis is a generic term and involves all disorders that cause changes in the shape and position of the spine, trunk, and thorax (1). The term idiopathic scoliosis was first applied by Kleinberg in patients with scoliosis without pathology or specific cause (2). Epidemiologically, 80% of cases of scoliosis are classified as idiopathic. If scoliosis is not treated, it can cause severe deformities, which limit the capacity and biomechanical function of the chest, decrease the individual's athletic capacity, reduce overall body health, limit the ability to perform tasks, and finally decrease the individual's quality of life (QOL) (3).

Several classifications exist for scoliosis. James chronologically classified scoliosis into four categories based on of the patient's age, including

infantile (birth to 2 years), juvenile (3 to 9 years), adolescent (10 to 17 years), and adult (over 18 years) (4). Given this classification, adolescent idiopathic scoliosis (AIS) is the most common form of spinal deformity in adolescents that progresses rapidly during adolescence, with a 5.2% likelihood of development in the general adolescent population (5,6).

In North America, standard non-surgical treatment of scoliosis includes observation of the individual in 10-25-degree arcs, use of a brace for 25-45-degree arcs at puberty, and surgery in 45-degree arcs at growth and in above 50-degree arcs at growth stopping period (7). The standard treatment method is accompanied by some drawbacks, including lack of receiving any treatment in patients with less than 25-degree arcs (8), limitation of the individual's social

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activities while wearing the brace (1), higher rate of development of degenerative changes and low back pain (LBP), and lower physical activity and public health in subjects undergoing a surgery (9).

The Society on Orthopedic and Rehabilitation Treatment (SOSORT) was launched in Europe in 2004 to meet the need for the most effective treatment for patients with scoliosis (10). According to the SOSORT clinical guidelines, the general goals in the non-surgical treatment of scoliosis include preventing or decreasing the arch progression during maturity (11,12), reducing or treating respiratory disorders (13), reducing or treating spinal pain syndromes (9,13,14), and improving the appearance of the patient by posture correction (15-17); these goals ultimately prevent the need for a surgery (1). In order to save time and use the best treatment method in the sensitive adolescent age group, reduce health care costs, prevent physical and mental disorders, prevent loss of self-confidence, and improve QOL, adopting an appropriate treatment for exposure to AIS seems necessary. Therapists need to be familiar with various non-invasive scoliosis treatments so that while helping the individuals suffering this disorder, prevent additional costs such as the surgery costs and subsequent complications in the patients and at the macro level in the community.

The SOSORT clinical guideline recommends physiotherapeutic scoliosis specific exercises (PSSE) both as a separate treatment and while using a brace as well as in the post-surgery period (1,18-20). There are seven major institutes in Europe each offering the PSSE treatments following the SOSORT rules. These seven institutions include Lyon (France), Schroth (Germany), SEAS (Italy), BSPTS (Spain), Dobomed (Poland), Side Shift (United Kingdom), and FITS (Poland). Among all these institutes, Schroth has been paid the highest attention and lots of studies have been conducted based on this method (5,21).

In recent years, the Schroth method has attracted the attention of therapists especially physiotherapists in Iran. The objective of the present study is to evaluate the effectiveness of this method and the three-dimensional exercises as a method using PSSE in the treatment of scoliosis, on the improvement of the Cobb angle, pain reduction, improvement of lumbar muscle endurance, improvement of respiratory function, improvement of appearance, decrease or inhibition of arch progression, and finally, the improvement of QOL in individuals with idiopathic scoliosis. According to statistics published, idiopathic scoliosis is more prevalent in adolescent girls (1). Based on the present study, physiotherapists

get acquainted with the general effects of the Schroth method on different aspects of the physical and mental health of adolescents with idiopathic scoliosis.

Materials and Methods

In this review study, the keywords including Schroth AND Scoliosis AND (Quality of life/Muscle endurance/Cobb angle / Respiration/Respiratory function), PSSE AND Scoliosis, 3 dimensional exercises AND Scoliosis, and Scoliosis specific exercises were searched in the studies published between 2009 and 2019 in the PubMed, PEDro, Trip, ScienceDirect, and Google Scholar databases. It is worth noting that the English-language studies were used in the present study. Besides, the studies that had not used the 3-dimensional exercises and the Schroth method as well, as the desired variables, were excluded. Initially (considering the time limit), 31 studies were found of which 16 ones were extracted and finally, 15 studies were reviewed.

Results

In the present review study, the effect of Schroth exercises, as well as 3-dimensional (3-D) spine exercise, was examined as part of PSSE in AIS treatment in the short term.

In recent years, several methods have been introduced for the scoliosis treatment (21). Pilates (22-24), yoga (25,26), respiratory exercises (12), and other scoliosis specific exercises (not necessarily the Schroth method) (12,21) are treatments recently prescribed to patients. The results indicated a significant superiority of the Schroth method in terms of improvement of the Cobb angle, weight the distribution between legs, and psychological parameters over Pilates and other two-dimensional exercises (23,24). This is because the primary goal of this method is to correct the pelvic block. Correction of the pelvic tilt and shift (if any) normalizes the weight distribution on the two legs, hence preventing further progression of scoliosis.

The samples investigated in most studies had a Risser grade of 0 to 20. The Risser sign is a measure of skeletal maturity in which the degree of ossification of the iliac apophysis is examined by the x-ray evaluation. The Risser sign is scored from 0 to 5, with 0 and 5 indicating the lowest and highest degree of skeletal maturity, respectively (27). The higher the degree of the skeletal maturity in the scoliosis treatment, the less likely effectiveness of the physiotherapy interventions

Definition of the Schroth method in scoliosis treatment: This method involves specific sensory-

motor exercises for scoliosis, as well as postural and respiratory exercises (28). One of the most important bases of the Schroth exercises is the ability to auto-correction, meaning that the patient actively helps reduce his/her spinal deformity performing three-dimensional postural correction exercises (28,29). Auto-correction by self-elongation exercises and postural correction specific to any type of scoliosis (according to Schroth classification) will finally become a habit in the daily life of the individual (21,28). The findings of several cohort studies suggested that the Schroth method has desirable effects on the lumbar muscle endurance, respiratory function (30), decreased arch progression (19), improved Cobb angle (19,30), and reduced likelihood of surgery (31).

Since the Scoliosis Research Society (SRS) has introduced the Cobb angle measurement as the main measurement in the scoliosis diagnosis (7), the effects of Schroth exercises and 3-dimensional spine exercises on this angle have been measured in numerous studies, reporting that these exercises had a positive effect on the Cobb angle, so that the 5° or higher improvement of the Cobb angle or its staying fixed due to the short-term application of the Schroth method (six months on average) has been reported (12,23,32-37).

One of the important basics of the Schroth exercises is rotational angular breathing (RAB) (28). In this perspective, both diaphragmatic and chest breathing are needed to correct the trunk posture and prevent respiratory disorders. The breathing exercises in the Schroth method emphasize its lack of symmetry, i.e. the individual should more use the less used parts of the diaphragm and respiratory muscles during exercise (28). According to Lehnert-Schroth et al., patients with scoliosis have an asymmetric respiratory pattern, in whom regular breathing exacerbates deformity. Therefore, the respiratory pattern trained to these individuals should be different from that of the healthy ones (28). Given the effect on the respiratory muscles and subtle rib and postural movements, the Schroth exercises improve chest expansion and pulmonary function [forced vital capacity (FVC), peak expiratory flow (PEF), forced expiratory volume (FEV1) and FVC/FEV1] among the patients, and subsequently improve their respiratory capacity (21,30,36,37).

Effect of brace: Based on the SOSORT clinical guidelines, the use of braces (different types for different treatment periods and specific to each individual) in the scoliosis treatment accounts for the

highest number of studies among all non-surgical treatments, which should be further discussed given the recommendations of this clinical guideline (1). In some studies, the Schroth method has been applied along with standard treatments and braces (5,32,33,35,38). Some studies have not pointed to the use of braces in their study population (36,37). In general, the simultaneous use of a brace and Schroth exercises seems to have a more desirable effect than the brace alone. However, in the Schroth method as well as other physiotherapeutic scoliosis exercises (e.g. Lyon), braces are designed and used separately for each individual, and in case of necessity (21).

Psychological and mental effects: Various studies have noted the beneficial effects of the Schroth exercise on improving the appearance and self-esteem of individuals (5) and also its psychological effect by reducing the trunk rotation angle and the trunk asymmetry in the short term (23); Because this method emphasizes the visual feedback by the patient, and thus the patient helps the treatment by seeing and performing postures that make the trunk smoother (28). This motivates the patient to continue the treatment because they learn that they can help to reduce deformity by performing the exercises. In this regard, Wibmer et al. used computer games to provide feedback during the Schroth exercises, reporting the desirable effect of this technic (35).

Effect on spinal pains: In addition to stretching and breathing exercises, the Schroth method emphasizes balancing the trunk muscles including abdominal muscles, paraspinal muscles, iliacus muscles, quadratus lumborum muscles, latissimus dorsi muscles, etc. and suggests specific exercises in this regard (28) which reduce spinal pain and improves lumbar muscle endurance (5).

Finally, in the studies examined, the effect of the three-dimensional and Schroth exercises on other physical aspects such as plantar pressure (23,39), back symmetry angle (34), trunk rotation angle (34,37), balance (39) and improved QOL of the individual (5,12,33,34,39,40), which is the main goal of rehabilitation, was evaluated to be more positive compared to other treatment methods.

Discussion

Scoliosis is a form of extensive orthopedic deformity, and involving the axial spine, not only causes the trunk deformity, but also affect the shape and mechanics of other organs (28). The individuals suffering from scoliosis deal with various problems ranging from

orthopedic to psychological disorders (23,28,41). In addition to experiencing apparent dissonance, these patients may suffer from dysfunction of important organs such as the lungs (28,42) and back pain due to the non-symmetry in the trunk muscles (not a single muscle group) as well as reduced back muscle endurance (43). Most of the patients lose self-confidence due to their inability to accept their own appearance and isolate themselves from society (44). Sometimes due to scoliosis, some patients avoid participating in specific programs and many jobs in the community. All of these issues can cause a decrease in the QOL of individuals with scoliosis (44).

Although surgery is a method of quickly treating deformities, post-operative disorders and the prohibition of performing most of the post-operative scoliosis specific exercises should not be neglected. In most cases after the scoliosis surgery, the patient loses a great amount of the spinal motor range; this can cause pain and other deformities by affecting the mechanics of other parts of the body in the long run (5,32,45). Therefore, it is necessary to reduce the need for surgery as much as possible by presenting an effective method.

The short-term effects of the Schroth method (a few weeks to a few months) were reported in all studies reviewed. Based on the findings of the studies, the Schroth exercises improve several indicators including pain, back muscle endurance, individual's appearance self-image (5) and psychological factors (23), Cobb angle (12,25,32-35,37), spine rotation and trunk symmetry (34), decrease arch progression (38), improve neuromotor control (5), improve respiratory function and lung volume (36,37), balance (24) and, ultimately, improve QOL of the patients (5,12,33,34).

Given the results, the claim by Borysov and Mogilantseva that the Schroth method is the most effective PSSE treatment, can be verified (46). It should be noted based on the findings of the studies, regular exercise in the presence of a physiotherapist is very effective and it should not be delegated to the individual alone (34).

Overall, it can be declared that the Schroth three-dimensional exercises desirably influence all physical and psychological aspects of the patients with scoliosis. The main goal of the long-term therapeutic exercise is to improve the QOL in these subjects, which, given the results of the studies, the three-dimensional exercises

seem to be effective in this regard (1). Thus, specific therapeutic exercises should be followed more seriously in individuals with scoliosis.

Limitations

All studies conducted on a specific group of patients with scoliosis (AIS), the unclear type of brace and its use in some studies, and the lack of a specific protocol for PSSE in some studies were among the limitations of the studies. Besides, the inaccessibility of the full text, the non-English language, and the poor quality of some of the studies included some of the limitations of the present review study.

Recommendations

Most of the studies had short follow-up time; in addition, they had not specified the percentage of the need of the patients with AIS to surgery in the long term after the Schroth and 3 dimensional exercises. It is recommended that more patients be examined in future studies. Moreover, it is recommended to determine the effect of the Schroth and three-dimensional vertebral exercises on the types of arcs by the Schroth classification. Most investigations have been carried out on individuals with AIS given the importance of puberty and rapid growth of the individuals at that time; however, older people also refer to physiotherapy clinics to treat scoliosis. The effect of Schroth exercises on other age groups and higher Risser degrees also needs to be examined to test the Schroth's claim regarding the effectiveness of this method for improving scoliosis at any age.

Conclusion

The Schroth method exercises are among the most specific and complete exercises in the treatment of scoliosis. Performing the scoliosis-specific exercises recommended in the SOSORT clinical guidelines such as the Schroth 3-dimensional exercises along with standard treatments is more effective in improving the Cobb angle, reducing pain, enhancing muscle endurance, increasing chest expansion, improving individual appearance and satisfaction, reducing trunk deformities, weight distribution and, ultimately, QOL of patients with AIS compared to the standard treatments alone.

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Authors' Contribution

Farnaz Jokar: Study design and ideation, data collection, analysis and interpretation of results, manuscript preparation, responsibility for maintaining the integrity of the study process from beginning to publishing and responding to the referees' comments; Javid Mostamand: Attracting funding for the study, performing the study support, executional, and scientific services, specialized evaluation of the manuscript in scientific terms, confirmation the final manuscript

for submission to the journal office.

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Conflict of Interests

The authors declare no conflict of interest. Dr. Javid Mostamand has been an Associate Professor, School of Rehabilitation Sciences, Isfahan University of Medical Sciences, Isfahan, Iran, since 2014 and attracted funding for this study. Farnaz Jokar has been a MSc student of physiotherapy in the School of Rehabilitation Sciences, Isfahan University of Medical Sciences since 2018.

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