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The Schroth Method of Treatment for a Patient Diagnosed with Scoliosis: A Case Report

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Abstract

Background/Purpose: Structural scoliosis is the lateral deviation of the spine with vertebral rotation and rib deformity. This can result in asymmetrical loading of the spine and consequentially structural instabilities and secondary impairments. Treatment will depend on symptoms and functional impairments. Conservative methods are embraced internationally. The Schroth method is three dimensional approach utilizing sensorimotor and kinesthetic principles as well as rotational angular breathing to achieve an optimal alignment. The purpose of this case report is to describe the physical therapy intervention utilizing the Schroth method approach for the treatment of a patient diagnosed with scoliosis

Case Description: The patient was a 62 year old female formally diagnosed with scoliosis as an adult. She presented with complaints of pain in the right scapula, low back and right hip which increased after prolonged activity and complained of shortness of breath with extended functional activities. According to the Schroth method, she was classified as having a left 4-curve scoliosis with left hip out. Interventions included patient education, soft tissue mobilization, positioning, stretching, Schroth exercises and a home exercise program

Outcomes: The patient completed 18 outpatient physical therapy sessions. At discharge, her right scapular, hip and low back pain was eliminated and she reported the ability to self-manage muscular soreness. Her lower extremity strength increased and she reported asymptomatic IADL's. Her maximal expiration increased from 2000 ml to 2750 ml.

Discussion: Secondary impairments resulting from structural scoliosis may result in functional limitations which may impact patients' quality of life and independence. Conservative approaches may facilitate a patients' return to functional pain free independence.

Background and Purpose

Scoliosis is defined as the abnormal lateral deviation of the spinal column with minimum Cobb angle of 10° in the coronal plane. It can be characterized as either non-structural or structural scoliosis. A non-structural scoliosis is a non-progressive curve resulting from a leg length discrepancy, herniated disc or improper posture that can be corrected by elimination of the primary causative factor. However, in a structural scoliosis, the lateral deviation results in not only a vertebral distortion, as the vertebral bodies rotate towards the convex side and the spinous processes rotate toward the concave side, but also includes rib deformity with the convex sided ribs shifting posterior and superior and the concave sided ribs shifting anterior and inferior. Upon examination, a person with scoliosis may present with unequal shoulder height, a pelvis that is not level in the transverse plane, a lumbar or thoracic hump, and asymmetrical lumbar triangle, loss of lumbar lordosis, or loss of balance in the sagittal and coronal planes [1-8].

Scoliosis, affecting 2-3% of the population, may be classified as congenital, neuromuscular, degenerative or idiopathic [1-2,4-8]. Additionally scoliosis diagnosed after skeletal maturity, ages 20-50, is known as adult scoliosis and accounts for 6%-10% of the population [4]. Adult scoliosis is divided into four types: Primary degenerative scoliosis resulting from the asymmetrical erosion of the disc, endplates and/or facet joints; progressive idiopathic scoliosis not previously treated or post-surgical; secondary adult curvature due to a pelvic obliquity; and secondary adult curvature due to metabolic bone disease [1-2,4-8].

According to Aebi [4] the clinical presentation associated with adult scoliosis which necessitates a visit to the physician include: back pain expressed as muscular soreness, muscular fatigue or mechanical instability; radicular pain and claudication symptoms during standing or walking; neurological deficits; and curve progression resulting in from axial overload or osteoporotic vertebral bodies.

Literature has established treatments for scoliosis based on surgical and non-surgical classification and is dependent on the nature and severity of the curvature and risk of progression. Surgical intervention is an option for persons that are still in the growth cycle and whose curve is above 45° or who have completed the growth cycle and whose curve is greater than 50°. Bracing and casting is utilized for people still in the growth period and whose curve is between 20°- 40°. A person who has a curve of less than 25° and is still growing or less than 40° or 50° and has completed growing can be observed throughout their lifetime for curvature progression of 5° in one year, which is considered significant [1,6-8].

Although several positive outcomes from conservative measures are noted throughout the literature, [9-25] many medical profession-

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als do not feel non-surgical treatment for scoliosis can be effective. In a study by Mooney and Brigham, [9] a progressive resistive exercise program focusing on trunk rotation exercises as well as back exercises were utilized to increase the strength in subjects with scoliosis measuring 15°- 41°. The results showed a 20% ± 23% improvement in the curvature without any form of bracing or casting.

In comparison to the United States, conservative measures are more aggressively implemented internationally [8,10-25]. Along with programs such as SEAS (Scientific Exercise Approach to Scoliosis), FITS (Functional Individual Therapy of Scoliosis), Dobosiewicz method, ASCO (Anti-Scoliosis Vibration-Decompression) method, Lyonaise method, and physio-logic®, the Schroth method is one such method which attempts to conservatively treat scoliosis by emphasizing patient specific postural analysis and corrections in a multidimensional plane. Based on the work of Katharina Schroth, this method divides the trunk into three and sometimes four vertically stacked anatomical blocks. As a result of scoliosis, these blocks deviate from the vertical line and laterally shift and rotate against each other creating areas of concavities and convexities. Based on sensorimotor and kinesthetic principles, patients utilize proprioceptive and exteroceptive stimulus (visual, tactile, verbal) to achieving optimal spinal alignment through corrective breathing patterns and postures. Three dimensional postural corrections and therapeutic exercises are utilized to achieve spinal de-rotation, de-flexion and elongation in order to open the spinal concavities, attain postural symmetry and muscular balance and for stabilization of the corrected posture through isometric and isotonic tension and reflex holding of muscles. Simultaneous performance of rotational angular breathing (RAB) assists in mobilizing ribs outward by directing inspired air into the thoracic concavities. Through their curve specific routines patients learn to actively lift themselves out of passive scoliotic alignments and sustain a corrected position throughout their daily activities [8,10,15,16,19,20]. The purpose of this case report is to describe the physical therapy interventions utilizing the Schroth three-dimensional approach for the treatment of a patient diagnosed with scoliosis.

Case Description

History

The patient was a 62 year-old Caucasian female with a medical diagnosis of scoliosis. She first noticed asymmetries of her pelvis and shoulders in high school but since she was asymptomatic did not pursue any treatment. Her medical history included a diagnosis of a "crooked back" 30 years ago with a formal diagnosis of scoliosis 6 years ago after diagnostic imaging revealed a 20° right lumbar curve, 17° left thoracic curve, and a mild right cervical curve. Her past medical history also included a minimal left C4 foraminal spur, osteoporosis, mitral valve prolapse, episodes of anxiety, and a remote motor vehicle accident. Her surgical history was unremarkable. She described an onset of various muscular pains approximately 8 years ago with varying degrees of intensity and duration. Although the patient reported independence with functional mobility including ADL's and IADL's, she stated pain and shortness of breath tended to increase with prolonged activities. She also reported occasional difficulty in ascending steps due to left hip weakness. Headaches and sleep disturbances secondary to pain were also noted. The patient's previous interventions in the last 8 years consisted of the use of a right shoe lift, chiropractic care and physical therapy, including heat and cold modalities, mechanical traction, manual therapy, and stretching. She stated the above interventions did not provide a lasting relief for pain. The patient's goals were to eliminate pain, improve her endurance with prolong activities, increase her overall strength and be independent with a home program.

Clinical Impression #1

The patient reported pain and shortness of breath with prolonged functional activity as well as headaches and sleep disturbances. She also stated ascension of stairs was problematic due to muscular weakness. Postural asymmetries from her scoliosis could account for her presenting symptoms. Differential diagnoses of other mechanical causes for back pain include spondylolysis, spondylolisthesis, compression fracture, facet arthropathy, muscular strain/sprain, muscular trigger points, spinal stenosis, disc degeneration, misaligned pelvis, leg length discrepancy, restricted range of motion of the hip and abnormal foot pronation [26,27]. Based on the results of the diagnostic imaging the first four could be ruled out; however, the remaining diagnoses could not be ruled out as they can result from scoliosis.

Clinical examination consisted primarily of a postural assessment to establish symmetry as well as the Adam's Test, range of motion, flexibility and strength of both the upper and lower extremities as well as the trunk. Spirometer readings and chest expansion measurements were taken to assess for pulmonary limitations. This patient presented as an ideal candidate to trial the Schroth method due to the ineffective prior treatment reported in her history.

Examination

Pain was assessed using a 10-point visual analogue scale with 0/10 representing no pain and 10/10 worst pain. Research has shown this method of pain assessment both reliable and valid [28]. The patient complained of constant right low back and hip pain ranging from 4-5/10, which increased with walking. She also complained of constant 4/10 right scapular pain with occasional burning episodes.

Palpation revealed tenderness in bilateral piriformis and right lumbar region and tightness in her diaphragm, abdominals (right external oblique and left internal oblique), right latissimus dorsi, right quadratus lumborum, right hip external rotators, right iliotibial band, right shoulder external rotators, bilateral sternocleidomastoid, levator scapulae and upper trapezius. No deficits were noted in either light touch sensation or patella (L4) and Achilles (S1) reflexes.

On her initial visit to physical therapy, the patient presented with postural deficits including: bilateral feet pronation, elevated left patella, laterally shifted left hip, elevated and anterior rotated left pelvis, left thoracic convexity with posterior rotated ribs, elevated and winging left scapula, elevated left shoulder, bilateral rounded shoulders, right lumbar convexity, right thoracic concavity with anterior rotated ribs,

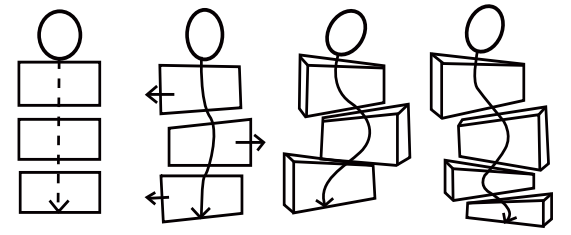


Figure 1: Schroth's Anatomical Blocks.

forward head and right laterally flexed neck. The forward bending Adams Test and scoliometer readings, which have been shown to have good to adequate reliability as screening tools, were used to assess for the degree of spinal rotation [29,30]. Along with a positive Adam's test, the patient's measurement on the scoliometer was 7° at T5 and 10° at L1. Her chest expansion was measured using a tape measure and showed the difference between inhalation and exhalation of 4 cm at the axilla and xyphoid process and 1.5 cm at the umbilicus [31]. Her maximal expiration of 2000 ml on a spirometer was utilized to assess pulmonary function. Repeated testing was incorporated to assure validity of testing [32].

Muscle strength was assessed manually using the Kendall technique which has shown both good reliability and validity [33]. The patient demonstrated 5/5 strength in bilateral shoulder flexion, abduction, internal and external rotation, elbow flexion and extension and all wrist motions; however, bilateral latissimus dorsi was 4/5 bilaterally. Her lower extremity strength deficits included bilateral hip abduction (4/5), bilateral gluteus maximus (4-/5) and right hip extension (4+/5). The patient's range of motion for her cervical and upper extremities, although tight, was within normal limits. Trunk sidebending was measured using a tape measure from third digit to floor and was 14.25 inches right and 17 inches left [34]. Leg lengths were measured using a tape measure from the distal ASIS to distal medial malleolus (left=33.75, right= 33.5) and from the umbilicus to distal medial malleolus (left=38, right=38) [34].

Clinical Impression #2

Along with the results from the x-ray, the findings from the examination supported the initial clinical impression of postural asymmetries associated with scoliosis as the causative factor in the patient's

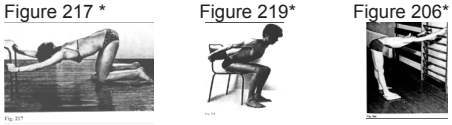
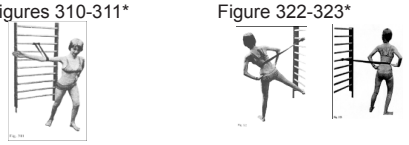
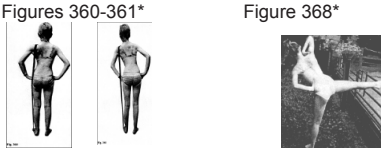
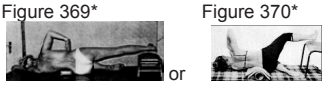
WK	Patient Education/HEP	Intervention	Manual Work
1&2	*Scoliotic blocks *5-Pelvic corrections *RAB *Cushion placement **Hooklying** 1. Below left inferior border of scapula 2. Left buttock 3. Right lumbar region **Seated** 1. Beneath right ischial tuberosity **Right Sidelying** 1. Beneath right lumbar region	Pelvic Correction in front of Mirror 1. Entire pelvis shifted posterior – Wt in bilateral heels 2. A) Rotation of femur on concave side posterior & external B) Anterior & Caudal movement of hip on convex side 3. Lateral shift of prominent hip on convex side to center 4. A) Posterior shift lumbopelvic block on convex side & anterior shift on concave side B) Frontal pelvic rim is lifted 5. Heel on convex side is pushed into the ground Figure 217 * Figure 219* Figure 206* 	Bilateral SCM, Levator Scap, traps, Diaphragm R. ITB R. Pec , Bilateral feet
3&4	Week 1&2 Figure 219 Stepping practice	Figures 310-311* Figure 322-323*  Figures 360-361* Figure 368*  Practice stepping forward and backward in corrected position	As per Weeks 1-2 R. Ext oblique, L. Int oblique, R. QL, Bilateral piriformis
5&6	Weeks 1&2 Figure 310 (Theraband anchored in door) Figure 368	Continue Figures 311,360-361 Figure 320* 	As per weeks 3-4 R. Lats Iliopsoas
7&8	Weeks 3-6	Continue Figures 360-361,368 Figure 369* Figure 370*  or Figure 349-353*  Gait on treadmill in corrected position	
9	Review above information	Review above exercises	

Table 1: Intervention.

	Initial	Final
Pain	Right low back: 4-5/10 (constant) Right hip: 4-5/10 (constant) Right scapula: 4/10 (burning)	Right low back: 0/10 Right hip: 0/10 Right scapula: 0/10
Strength	Bilateral latissimus dorsi: 4/5 Bilateral hip abduction: 4/5 Bilateral gluteus maximus: 4-/5 Right hip extension: 4+/5	Bilateral latissimus dorsi, hip abduction, gluteus maximus: 5/5 Right hip extension: 5/5
Max Expiration	2000ml	2750ml
Function	Difficulty with stair negotiation Shortness of breath with prolong activities	No difficulty with stairs Decrease and intermittent shortness of breath with prolong activities

Table 2: Outcome.

presenting symptoms. According to the Guide to Physical Therapist Practice the patient would be classified in the musculoskeletal pattern 4B: Impaired posture [35]. The Schroth method was selected for the treatment of scoliosis to address the patient's postural asymmetries, flexibility and strength deficits. Based on Schroth's anatomical blocks (Figure 1), the patient was classified as a 4-curve scoliosis with the left pelvis out. Her shoulders and lumbar blocks were deviated and rotated right and the thoracic and pelvic blocks were deviated and rotated left [15]. A six week anticipated plan of care was established with a reassessment of initial subjective and objective measurements after four weeks of intervention.

Intervention

The patient's physical therapy program was divided into two areas of emphasis: manual therapy and instruction in scoliosis exercises as described by the Schroth treatment method [8,10,15,19,20]. The Schroth exercises can be divided into three categories: 1) mobilization of the vertebrae, trunk, shoulder girdle and head; 2) shaping through rotational angular breathing to improve spinal alignment; and 3) stretching/strengthening to stabilize spinal de-rotation.

During the first six weeks soft tissue mobilization (STM) was employed at the beginning of each session. Myofascial release, trigger point release and passive stretching was incorporated to lessen tissue tightness and muscular soreness of the levator scapulae, trapezius sternocleidomastoid, pectoralis, right quadratus lumborum, right iliotibial band, bilateral piriformis and feet. STM including myofascial release was used on the diaphragm, right external and left internal obliques, right latissimus dorsi and right Iliopsoas to reduce restrictions for enhance optimal corrections and RAB. The patient was encouraged to pursue massotherapy outside of her scheduled therapy to allow additional time for therapeutic exercises during the final three weeks (Table 1).

During initial sessions significant emphasis was given to patient education regarding scoliosis, anatomical blocks/wedges, pelvic corrections, RAB and cushion placement for passive corrections in hook-lying, seated and right side lying. Once the patient was able to independently maintain her pelvic corrections, exercises with increasing difficulty were introduced. Facilitation from the therapist was given to insure proper form as well as provide tactile feedback for maximal corrections. Throughout the episode of care, wall bars, mirrors, resistive tubing, cushions, exercise balls, chairs and tables were utilized to challenge the patient and to encourage her to perform postural corrections in her daily activities (Table 1).

At the 4 week reassessment, the patient reported the pain that was present in the right scapular region on initial evaluation was now eliminated and the right low back and hip symptoms were described as soreness (0/10) versus pain. She had removed the shoe insert without any increase or return of symptoms. Her hip abduction and extension were rated 5/5 and she reported ascending and descending stairs were no longer problematic. The patient reported her shortness of breath while still present had become less frequent (Table 2).

Outcomes

The patient completed 18 sessions of physical therapy over a nine week period. Her program consisted of manual therapy, therapeutic exercises, patient education and a home exercise program. At discharge, she reported elimination of right scapula hip and low back pain as well as no sleep disturbances. Her maximal expiration improved from 2000 ml to 2750 ml and she also noted a decrease in shortness of breath episodes with the ability to correct posture and reduce the duration of the episodes when they occurred. Her strength remained a 5/5 in hip abduction and extension as did the ability to negotiate the stairs with no difficulty. The patient was independent and compliant with her daily home exercise program and corrected posture. She achieved both her short term and long term goals and was able to return to her daily activities without increase pain or shortness of breath (Table 2).

Discussion

Interventions for scoliosis are on a continuum with mildest curvatures requiring observations and the more progressive curvatures requiring surgical intervention. However, the question appears to be whether interventions between those two extremes would be beneficial and what intervention provides positive outcomes. While the United States has not embraced the concept of conservative treatment for scoliosis, internationally conservative treatment and bracing are a natural step in the complete care for individuals with scoliosis. Weiss et al. [24] compared the curve progression (>5°) of age and sex matched individuals who either received intensive in-patient rehabilitation or who left untreated. The untreated individuals progressed 1.5-2.9 times more than those who received treatment.

When a non-structural scoliosis is the cause of the curvature, treatment in one anatomical plane can achieve the desired results; however, this approach may not be advantageous when an individual presents with a structural scoliosis. Due to deformities occurring in the frontal, sagittal and transverse anatomical plane, a treatment approach which only addresses one plane may be ineffective.

Multiple articles and studies including systematic reviews, Randomised Controlled Trials (RCT), prospective matched pairs controlled, cohort studies, and case reports have reported positive clinical outcomes with the utilization of exercises specifically for patients with scoliosis [8-25]. Hawes [11] in an evidence-based review of literature, noted treatment for scoliosis either ignored exercises or stated they were ineffective. With these opinions, exercises were placed in a benign role for the treatment of scoliosis and allowed professionals to ignore their potential benefits. She noted several studies which found restoring postural balance regardless of the initiating cause of the scoliosis could improve the signs and symptoms even after it had been classified as a fixed spinal deformity [11]. The patient in this case report was referred to physical therapy due to her complaints of scapula and hip pain, which interfered with her sleep patterns as well as daily activities. After the utilization of postural exercises described by the Schroth method, her complaints of pain were eliminated. Although increasing her vital capacity was not a reason she stated for attending physical therapy, an increase in vital capacity of 750ml was noted at the time of discharge. This allowed for decreased episodes

Schroth Method, Lehnert-Schroth [19] documented an 85% reduction in pain and a 95% increase in vital capacity and Weiss [8] noted a 250 ml increase in vital capacity of adults with severe scoliosis.

The intensive inpatient program described by Schroth (4-6 weeks, 5-8 hours per day, 6 days per week, followed by a daily 30 minute home exercise routine) [8,10,15,16] was not realistic in the outpatient therapy setting however; a study by Otman et al. [25] did look at the efficacy of the Schroth method in an outpatient setting. Fifty patients completed a six week Schroth program consisting of four hours a day five days a week. After the initial six weeks of clinical intervention, the exercise routines were continued at home. Objective measurements of Cobb angle, vital capacity and muscular strength were taken at six weeks, six months and one year. The average Cobb angle initially was 26.1°, at six weeks 23.45°, at six months 19.25° and at one year 17.85°. Their vital capacity initially was 2795 ml, at six weeks 2956 ml, at six months 3125 ml and at one year 3215 ml. Their muscular strength also demonstrated increases with a decrease in postural defects. With two 45 minute to one hour weekly sessions consisting of reinforcing corrected postures and introducing more challenging postures when appropriate and our patient's compliance with her pelvic corrections throughout her daily activities and curve specific home exercise program she was able to achieved all her therapy goals.

A limitation of this case report was the limited experience in utilizing the Schroth method by two treating therapists possibly resulting in less than optimal facilitation and/or cueing for the attainment and maintenance of certain postures. Another limitation would be the lack of access to the patient's x-rays. The Schroth method requires specific corrections based on an individualized postural analysis which is enhanced by diagnostic imagining. A final limitation as previously discussed may have been time constraints based on patient's schedule and insurance restrictions. The patient was seen twice a week for forty-five to sixty minutes sessions. As demonstrated by the Schroth method, several hours a day are allotted for treatment of individuals with scoliosis. However, even with these limitations the therapists were able to educate the patient on her curve specific program and assist her in attaining her goals and objectives.

The objective of this case report was to describe one patient's conservative physical therapy intervention based on a treatment approach introduced in Germany by Katharina Schroth. By encompassing all planes of the deformity, her method appears to demonstrate positive clinical outcomes and as such may be an effective tool in the conservative treatment of patients with scoliosis who have yet to reach the criterion for surgical intervention. However, further research is needed to determine the clinical application of the Schroth method in an outpatient based facility with a limit on the number of physical therapy sessions per episode of care.

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