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Scoliosis Review: Introduction to an evidence based approach

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Abstract: Scoliosis is one of the most common diagnoses found in physical therapy practice with idiopathic scoliosis being the most common form found in children. Unlike adults with scoliosis those children who are identified with scoliosis have a tendency to progress, therefore, screening plays an important role in finding early scoliosis and in planning for future scoliosis management. The evidence in support of physical therapy for scoliosis management is poor. It is very important to have a thorough knowledge of clinical courses associated with scoliosis. The aims of this paper is to review and discuss the clinical pictures of scoliosis including types, prevalence, mechanism, and screening of scoliosis as well as introduction to an evidence based physical therapy intervention.

Key Words: scoliosis; idiopathic scoliosis; Schroth method

Introduction and Classification

Scoliosis is a three-dimensional deformity of spine. Scoliosis is commonly defined as a lateral deviation of the spine greater than 10 degrees[1)] . It is one of the most abnormal common conditions seen in physical therapy practice. In general, the condition of scoliosis is not painful and has normal neurological exam[2)] , therefore, it is difficult to detect until a deformity of the spine is visible. The most effective management of scoliosis is debatable. There is little evidence to support physical therapy intervention for scoliosis. It is critical for clinician to have thorough clinical knowledge about scoliosis. The purpose of this paper is to review the clinical pictures of scoliosis including types, prevalence, mechanism, and screening of scoliosis as well as introduction to evidence based physical therapy intervention.

Scoliosis can be divided into two main categories, non-structural and structural. The former has no deformity of the vertebrae and the lateral curvature disappears with lateral bending to the convex side[3)] . The contributing causes of non-structural scoliosis may be poor posture due to weakness of core muscles, or compensatory conditions such as leg length discrepancy and unilateral muscle spasm causing a lateral pelvis tilt. This type of scoliosis can be treated by addressing these underlying causes[3)] . The latter can be further categorized into non-idiopathic and idiopathic scoliosis. The non-idiopathic scoliosis is characterized by a deformity of the vertebrae, and physical examination reveals that lateral bending does not influence the deformity of the

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spine[3] .

The idiopathic scoliosis is the most common type of scoliosis found in children[4] . The causes of idiopathic scoliosis are unknown and consisting of approximately 85% of the scoliosis population[5] . Idiopathic scoliosis is classified by the age of the children. They are initially identified with scoliosis as infantile, juvenile, and adolescent types. Children diagnosed when they are younger than 3 years are called infantile idiopathic scoliosis, and when they are between 3 and 10 years, they are called juvenile idiopathic scoliosis. The patients diagnosed when they are older than 10 years are called adolescent idiopathic scoliosis[4] . Regardless of race and economical status, scoliosis affects infants, adolescents, and adults worldwide[5] .

Prevalence

The study investigated the prevalence of idiopathic scoliosis of 16,000 patients aged 6-14 years in England, of which 0.5% had idiopathic scoliosis (Cobb angle >10 degrees) .The prevalence of scoliosis was highest in the patients aged 12-14 years[6] . This, however, increased significantly to 4.5% when a smaller Cobb angle (>6 degrees) was accepted[7] . Idiopathic scoliosis is more commonly found in girls than in boys. Roach reported the following gender ratio of scoliosis in the adolescent population[7] . With small curves of less than 10 degrees, the ratio of boys to girls is equal but skews to the ratio of 1 to 10 with curves greater than 30 degrees. He recommended having girls screened more often than boys, as scoliosis in girls has a tendency to progress[7] .

The primary concern after the diagnosis is made is the underline cause of the curve and if the curve will progress. Three factors that progression of the curve may be suspected in the children that are the gender (being female), having greater growth potential, and having a higher magnitude of the curve at the time of diagnosis[4] .

Screening

The American Academy of Orthopedic Surgeons recommends screening girls at ages 11 and 13, and screening boys once at age 13 or 14[4] . Adam's forward bend test is one of a common scoliosis screening test that does not require any equipment. In the Adam's forward test, the child is instructed to bend forward at the waist until the spine becomes parallel to the horizontal plane in standing position. Detecting an asymmetry in the contour of the back while looking along the horizontal plane of the spine is a positive finding, suggesting scoliosis. Adam's forward bending test, however, does not show the quantity of the deformity[4] . To take objective measurements the examiner can utilize a scoliometer with Adam's forward bend test. Scoliometer is an inclinometer designed to measure trunk asymmetry, or axial trunk rotation[8] . In scoliosis screening, a scoliometer is positioned on the back of the child while he/she is flexing the trunk. This measures the angle of trunk rotation or degree of deformity. It is recommended to refer the child to a specialist when he or she exhibits trunk rotation >5 degrees measured by scoliometer[9] .

Mechanism of spinal movement

Scoliosis is a complexed three-dimensional deformity involving lateral bending of the spine. According to Fryette's law, when the spine is in neutral, applying side bending forces to a group of vertebrae in the thoracic and lumber regions will create the entire vertebrae to rotate toward the opposite side[10] . For example, in the case of left side bending in the thoracic region, a group of vertebrae will rotate to the right as a coupled motion resulted in concavity on the left with convexity on the right side that is a typical scoliotic configulation.

Physical therapy as a conservative scoliosis management

The primary goals of scoliosis management are to interrupt progression of the spinal curvature, to improve pulmonary function and to treat pain[11]. Treatment options for scoliosis are physical therapy, biofeedback, electric stimulation, and chiropractic care that have not been proved their efficacies to alter the curve progression[12] . In contrast, bracing and spinal surgeries have shown some evidence to alter the nature of the curve progression.

Brace intervention for scoliosis is widely accepted to manage progressive curves greater than 25 degrees of Cobb angle[13] . Fusco et al. reported that individualized physical therapy approaches, such as Schoroth method enhanced the effectiveness of brace interventions[14] . Negrini et al. reported the efficacy of Scientific Exercise Approach to Scoliosis, SEAS.02 exercise (version2), in which application of this exercises significantly improved the scoliotic curve when compared to those in subjects who performed regular core exercise in the first year[15] . It must be noted that the exercises for scoliosis mentioned above are not regular exercises but rather specific exercises to address the particular nature of spinal deformity, and application of such exercises requires therapists specifically trained and certified in those methods.

Schorth method

The Schorth method is a systematic therapeutic exercise program developed by Katharina Schroth in 1920 in Germany and further developed by her daughter, Christa Lenert-Schroth. The goals of the Schroth method are to slowdown progression of abnormal curvature and to reverse the curves if possible. It is designed to address the particular issues associate with scoliotic curvature and adapted by the certified physical therapists to specific needs of the individuals[16] .

The view of this method is that in the scoliosis condition, unlike non-scoliotic body, there is a muscle imbalance in the muscle groups of back and other parts of body. The scoliotic curvature develops due to an imbalance of some muscles on one side of body becoming stronger than those on the other side. This creates a scoliotic cycle that gradually worsens under the asymmetrical loads. Using the Schorth method the physical therapist identifies this imbalance and treats it accordingly[16] .

Schorth describes the body as having three segments: the lumber spine with pelvis, the thoracic spine with rib cage, and the cervical spine with shoulder girdle and head. For a practical purpose, in the frontal view, each segment can be represented as a rectangle block. In an individual without scoliosis these three segments are stacked in a vertical manner without deviation, creating a balance (Figure 1). When viewed laterally, due to the physiological curve, each segment becomes trapezoidal in shape. In order to describe how each trapezoid is positioned in the body in the side view, taking a trapezoid, consisting a pair of parallel sides on top (short side) and bottom (long side), rotate 90 degrees to the right. Therefore, a pair of parallel sides stands in a vertical line. Taking a longer side anteriorly and shorter side posteriorly this becomes the segments of the lumber-pelvic and cervical-shoulder blocks. The middle or thoracic-rib block sits in between the lumber and cervical blocks in which a shorter side comes anteriorly and longer side posteriorly (Figure 2). These three segments are balanced over the center of gravity[16)] .

When asymmetrical force is applied to a balanced posture due to muscle imbalance, these three segments are shifted against each other in the sagittal, frontal, and horizontal planes. As posture is collapsed, theses three segments act as wedges, in which the short side of trapezoid becomes shorter and long side increases in height leading to a shape of trapezium from trapezoid (Figure 3). The deformity of the back progresses as the angle of wedging becomes shaper. In the case of three-curve scoliosis, the top segment (cervical-shoulder block) and bottom segment (lumber spine with pelvis) are rotated in the same direction and the middle segment rotates to the opposite direction. This causes posterior rib hump on one side and anterior rib hump on the other side.

One of important aspect of the Schorth method is a breathing technique that helps to mobilize the deformed thorax. At rest individuals with scoliosis breathe with an asymmetric breathing pattern due to the scoliotic deformity. This figure leads to further rotation of the vertebrae[16)] . The diaphragm is also malfunctioning as its insertions, the ribs, are displaced. The individual with scoliosis must learn so called “right angled breathing” (RAB) to de-rotate the thorax16. In the Schroth method, the exercises consist of strengthening or lengthening asymmetrical muscles. They are subdivided into 4 groups, hanging exercises, mobilization exercises, shaping exercises, stretching and strengthening exercises. These exercises are individualized based on the unique scoliotic curve of each individual.

Figure 1: Anterior view

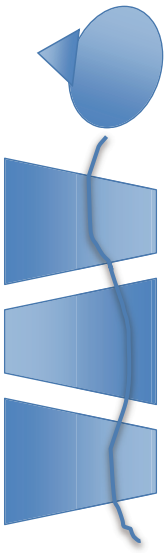

Figure 2: Lateral View

Figure 3: Posterior view

Summary

Scoliosis is a complexed three-dimensional deformity. There is evidence of active conservative management for scoliosis. The correction of scoliotic posture needs to occur not only laterally and antero-posteriorly but also caudal-cephalically. The Schroth method addresses all three dimensions: sagittal, frontal, and transverse, called three-dimensional therapy.

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