

SCOLIOSIS AND TREATING SCOLIOSIS WITH SCHROTH METHOD

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Abstract

Idiopathic scoliosis is a deformity of the spinal column and is found among healthy children. Etiology of idiopathic scoliosis is unknown. Spinal shift occurs in all three planes followed by muscle disfunction and reduced vital capacity of the lungs. Asymmetric loading on the spine can be listed as one of the factors of rapid progression of scoliosis, whereby large pressure is put on the concave side of the scoliotic curvature due to the shift of standing balance of the body. Rehabilitation is based upon improvement of functionality, ability and capacity of the patient with scoliosis. The initial stage of rehabilitation rests on correct diagnosis and estimation of patient's condition in order to commence the treatment in the best possible manner. The Schroth method has a long-standing tradition and is primarily applied in correction of scoliosis. It is based on three-dimensional breathing, proper pelvic correction and specific exercises and education of patients in order to continue the treatment at home.

Keywords: the Schroth method, scoliosis, asymmetric loading, muscle disbalance

Introduction

Idiopathic scoliosis may be defined as a complex three-dimensional deformity of the spine and trunk. It occurs in healthy persons and its etiology is unknown (Rigo, M., & Grivas, T. 2010). With the aim to detect scoliosis easier, its specific name can be obtained according to the localization of the principal curvatures (thoracic, lumbar, thoracolumbar, double major, double thoracic); however, there are numerous classifications by means of which it is easier to recognize the type of idiopathic scoliosis (Weiss, H.R. et al, 2013). In addition to idiopathic scoliosis, scoliosis can be classified into two more groups according to the etiology: congenital and neuromuscular. Congenital scoliosis is gained by nurture and the process of deformation can occur even in the embryonic conception, while the other type of scoliosis comprises of neuromuscular scoliosis, whereby neuromuscular diseases occur as a result of deformity. Many authors dealt with etiology of idiopathic scoliosis and did not wind up with a concrete answer. They suggest various causes as the rea-

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sons of occurrence of this type of scoliosis; nevertheless, it is assumed that genetics and asymmetric loading represent the greatest cause. The difference in rehabilitation from congenital and neuromuscular scoliosis in comparison to idiopathic scoliosis lies in the fact that the first two deal with the causes of the deformity, while in idiopathic scoliosis consequences are ones that are addressed.

Biomechanical factors may have a significant role during the rapid progression of scoliosis in adolescence (Stokes, I. 2007). Asymmetric loading of the body, as well as the shift of standing balance of the body, may have serious consequences on the deformity of the lumbar spine. Mechanical factor becomes predominant, as compared to the initial factor, in the period of rapid growth during adolescence (Stokes, I. et al, 2006). Muscle disbalance occurs as a result of spinal column shift, thus the muscles on one side of the spinal column are less active, whereby rotation of the spinal column can be listed as the cause (Fidler, M.W. & Jowett, R.L. 1976). Patients who suffer from this condition often have problems with reduced function of respiratory muscles, and even reduced vital capacity of the lungs (Martinez-Liorens J. et al, 2010).

The Schroth method is a longstanding, traditional method applied in rehabilitation from scoliosis and it is used around the globe. It originates from Germany and it rapidly spread to other countries in Europe and worldwide due to its results. The method was launched by Katharina Schroth; later, her daughter Christa Lehnert Schroth joined her and gave a large contribution to the development of this method (Weiss, H.R. 2010). The Schroth method corrects scoliosis in all three planes, which is actually its advantage as compared to certain methods.

The history of Schroth method

The Schroth method is a non-operative treatment applied in the correction of scoliosis and has a very long tradition. One may suggest that it is a conservative type of treatment that reminds of Hippocrates' original method. Although it has been more than 2,000 years since Hippocrates' era, the conservative type of scoliotic correction retained the same approach to the problem. The fact that three therapists used to work with one patient in order to prevent mistakes during the correction shows how seriously this problem used to be approached two centuries ago. Corrective treatment based on the principles of the Schroth method is nowadays applied worldwide, precisely because of its approach to the problem, primarily based on three-dimensional breathing, which has the most significant role in treatment of scoliosis.

Development of the Schroth method rests upon professional work of three generations. The first steps were recorded back in 1921, by Katharina Schroth, who suffered from scoliosis herself. Dissatisfaction, caused by the treatment she had received in particular institutions, made her to look for the solution to her problem by herself. She started to explore her body and apply a new type of treatment. She was a teacher, so she did not know anything about anatomy, physiology and biomechanics; however, her inspiring spirit contributed to the development of something completely new, something that gave amazing results in the following years. She came to the conclusion that it is possible to achieve postural control exclusively by changing of postural perception. She was trying to make the correction of the rib cage by performing deep inhalations on the concave side. She used to do that in front of a mirror in order to be able to control the movements of the rib cage. Her primary inspiration was a balloon. While observing the balloon being inflated, she concluded that there is a possibility to make a correction of the deformity by following the same principle. She started to develop the method in *Meissen*, Eastern Germany, where she had her first small institute. During the 1930s and 1940s, Katharina received support in work and development of the method from her daughter Christa, who was born in 1924. Katharina moved with her daughter Christa to Bad Sobernheim in 1961. This is the town where they founded their insti-

tute which gradually developed into a well-established clinic, officially opened in 1983 under the name “Katharina Schroth Klinik”. After Katharina’s death in 1985, her daughter Christa Lehnert-Schroth, therapist, continued with the development of the method. Later on, her son, Hans Rudolf Weiss, orthopedic surgeon, joined her. Dr. Weiss was the director of the clinic during the period from 1995 to 2008. German health care provider, *Asklepios*, bought the clinic in 1995 with all rights and liabilities to use the name “the Schroth Method”, thus today, the clinic bears the name “Asklepios Katharina-Schroth-Klinik”.

In order to assess the influence of the Schroth method, the first research with patients was conducted in the period 1989-1991, and it was published in German in 1995 and in English in 1997. The next research also included the division of patients according to their age and gender, which brought about more valid results. Studies included the improvement of cardio-pulmonary capacity, vital capacity, muscle function monitoring, electromyography and changes in pain during the treatment. It was determined by EKG tests that there is a statistically significant reduction of cardiac exertion during the intensive treatment of 6 weeks in 794 patients. The improvement of vital capacity of the lungs and mobility of the ribs were recorded in more than 800 patients. Activity of the muscles was reduced in more than 300 patients after intensive treatment. The correction of thoracolumbar curvature, including derotation by means of muscle psoas was improved during the 1920s. The program of correction according to the principles of the Schroth method was designed so that patients continue to practice at home after being provided with proper education supervised by a Schroth therapist.

Etiology of scoliosis

Idiopathic scoliosis is a complex deformity of unknown etiology which includes morphological changes and transformation of the spinal column in all three planes. Scoliosis is a term that describes lateral deviation of the vertebrae, axillar rotation of which stimulates three-dimensional deformity of the trunk. Therapists and doctors, who deal with this problem, understand what the term “idiopathic scoliosis” is, but are speechless when etiology is concerned. Various studies who deal with etiology of the idiopathic scoliosis have not come to a direct response, but they have made certain conclusions. Thomas et al. (2008) listed several factors which cause the development of scoliosis, the first of which is genetics.

Genetic or hereditary factors are widely accepted in the development of idiopathic scoliosis (Thomas et al., 2000). Harrington’s research with women who had scoliotic curvatures of more than 15 degrees, ended with a result that showed that 27 percent of these women’s daughters have scoliosis. It was determined that 11 percent of patients (first-degree relatives are affected), 2,4 percent second-degree and 1,4 percent third-degree relatives suffer from scoliosis (Harrington, P.R. 1977). The research conducted with identical and fraternal twins who had scoliosis showed that genetics has a large influence on the development of scoliosis. The group of authors obtained the results which indicated that 73 percent of scoliosis developed in both identical twins when one of them initially had scoliosis, while the percentage was slightly less in fraternal twins, so that scoliosis developed in both of them in 36 percent of cases (Kesling, K. L., i Reinker, K.A. 2009).

Other studies show that a hormon called melatonin also has a large influence on the development of idiopathic scoliosis. In consequence, certain authors conducted numerous studies in order to prove that fact. Dubousset et al. (1998) controlled the level of melatonin in thirty adolescents in his study who had severe curvature, between 57 and 75 degrees. Patients who experienced the deterioration of the curvature of more than 10 degree had 35 percent- reduced secretion of melatonin during the night, while in the group of patients with stable scoliosis, during the

same year, melatonin secreted without any problems. Lafortune et al. (2007) conducted an experiment in which he did a research of the influence of melatonin on scoliosis in chickens. He divided the chickens into three groups. He removed the pineal gland, which secretes melatonin, from the first group, made an incision on the second group in order to simulate the removal of the gland, and the third group was the control group. All three groups had the same treatment during the experiment, 12 hours of light, 12 hours of dark, 26 degree Celsius and 78% humidity. Scoliotic curvature occurred in 55% of the chickens in the first group after two weeks and developed into a severe condition during the third and fourth week. Cases of scoliosis were not recorded in the second and third group.

Besides genetics and melatonin, some other factors, mentioned by various authors, can be listed as the cause of idiopathic scoliosis. One of these factors can be effects of connective tissue. Collagen and elastic fibers are crucial elements of the supporting structure of the spinal column and have a significant role, according to many authors who deal with the pathophysiology of idiopathic scoliosis (Thomas, L. et al. 2000). Skeletal muscle abnormalities are also one of the factors that can be claimed to have a significant role in the development of idiopathic scoliosis, as well as the Role of Growth and Development.

Nevertheless, Manuel Rigo (2010) stated that there are two types of pathogenetic factors for idiopathic scoliosis. The first group comprises the initial stage of scoliosis, where the main factors are biological, morphological, neuromuscular and biomechanical, while the main cause of rapid progression of scoliosis lies in the biomechanical factors, i.e. asymmetric loading on the spinal column.

Biomechanics of scoliosis

Understanding the etiology of scoliosis is a great challenge, but it is well known that mechanical factors have a significant role in the development of deformity. Geometry and anatomy are fundamental for understanding mechanical part of deformity. It is mentioned that scoliosis is a three-dimensional deformity; however, the entire process may include the fourth dimension as well (Bagnall et al. 2009). Deformity shifts over time and, consequently, this is the time when the fourth dimension is very important for patients because they can follow and control their own condition.

The shifting process of deformity occurs due to the shifted standing balance of the body which causes altered pressure on the spinal column (Rigo, M., Grivas, T. 2010). The concave side of the spinal column suffers a lot more pressure than the convex side, which leads to certain consequences. One of them is that vertebral body loses its natural geometry and becomes wedging vertebrae over time (Stokes, I. 2007). Scoliosis progresses rapidly during the adolescent growth. That period is considered the most critical for the development of scoliosis. Spinal column tissue and trunk tissue also suffer from the loading during everyday activities, precisely because of the asymmetric loading. In 2006, Professor Stokes introduced biomechanical modulation of spinal growth and development of scoliosis in adolescents. In the illustrated scenario of loading, he explains to what extent altered pressure actually affects the progress of scoliosis. He calculated that vertebral body suffers the pressure of 1.3 MPa on the concave side on the verge of the curvature, whereas the convex side suffers the loading of 0.7 MPa, with annual spinal growth of 3 percent (30 mm). Growth of the vertebral body at the center of the curvature on the concave side amounts 0.5 mm and 1.3 mm on the convex side, which would lead to the increase of the curvature of 6.7 degrees and forming the wedging vertebrae. The influence of gravity can be listed as one of the crucial factors in producing axial force that leads to asymmetry and torsion, because standing balance of

the body is shifted to the side of convexity of the primary curvature. In that manner, the increase of loading on the concave side, and consequently the increase of deformity, occurs (Stokes, I., et al. 2006). Scoliosis research society explains that torsion of the spinal column may be defined in two manners. The first is a mechanical torsion that influences the intervertebral disc in the vertebral body. The second type of torsion is explained as geometric and represents the movement of the spinal column in space, i.e. the change in its physiological shape in all three planes (Rigo, M., Grivas, T., 2010).

Scoliosis also has significant influence on movement. Mahaudens et al. (2008) conducted a research in which, besides muscle activation, he wanted to examine the difference in mobility of certain parts of the body during movement. Between participants with formed scoliotic curvature (exclusively lumbar and thoracolumbar) and healthy participants, those with scoliosis were divided into three groups in respect to the degree of the curvature. They concluded that statistically significant reduced mobility of certain parts of the body, as well as length of a step, in comparison to the control group, alterations mainly occurred during the movement of body segments in the frontal plane. Participants with scoliosis had shorter steps as compared to the control group. Reduction of pelvic and hip movement in the frontal plane, as well as hip movement reduction in the transversal plane occurred. Differences between the experimental groups were not recorded, regardless of the difference in the degree of the deformity.

Muscle disfunction

Besides the changes in bone structure, changes also occur in the muscles. In 1976, Fiddler and Jowett conducted a research on corpses with large scoliotic curvatures in order to determine the disbalance of the deep back muscles. They came to a conclusion that the muscle multifidus on the verge of scoliotic curvature is shorter on the convex side. That was the consequence of the rotation of the spinal column, while the erector spinae was longer on the convex side than on the concave side, which is the cause of movement in the spinal column in the frontal plane.

Long-term use of braces may have a significant role in the change of muscle structure since, due to muscular inactivity, transformation of muscle fibers may occur. In a research, during biopsy, Meier et al. (1997) discovered the transformation of muscle fibers in the muscle multifidus in patients with scoliosis who had worn braces. Considering the fact that multifidus mainly comprises of slow muscle fibers, the other author came to the conclusion that, after long use of braces, the muscles change their structure due to inactivity and slow muscle fibers become fast. The role of braces is very significant in prevention of the progression of scoliosis; however, patients have to be engaged in corrective activities in order to prevent transformation of the muscle fibers.

It can be noticed that numerous consequences occur on muscles in patients with scoliosis. Therefore, Dr. Weiss (1933) wanted to determine the effect of the Schroth treatment on muscle activation. The study included 316 scoliotic persons who were tested before and after treatment. Muscle activation was tested by electromyography having a patient extend the trunk from the prone position. Overall results indicated significant improvement in postural capacity. Results also showed significant reduction of muscle activation on the convex side of thoracic and lumbar curvatures after the treatment. Major reduction in muscle activation was recorded on lumbar scoliotic curvature in comparison to thoracic scoliotic curvature.

Conclusion

Idiopathic scoliosis is a deformity that most often occurs among adolescents and its etiology is unknown. However, rapid progression of scoliosis is assigned to biomechanical factors such as asymmetric loading where the crucial role belongs to gravity. Due to this three-dimensional deformity, numerous side effects, such as disfunction of the respiratory system, muscle disbalance, pelvic shift and shoulder girdle shift, come into play. All of them have an influence on the movement disorder. The Schroth method is applied in correction of scoliosis and it influences the deformity in all three planes. It impacts the improvement of vital capacity of the lungs and derotation of the rib cage. This method appeared to be very effective in correction of scoliotic curvature by using gravity as an aid in rehabilitation. Therefore, it can be assumed that more rapid rehabilitation from scoliosis would be achieved exactly with the increase of gravity.

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