

# THE IMPORTANCE OF CORRECTIVE EXERCISES IN THE TREATMENT OF SCOLIOSIS IN SCHOOL-AGE CHILDREN

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## SUMMARY

Scoliosis is the most common orthopedic deformity in children, characterized by a three-dimensional curvature of the spine; lateral inclination in the frontal plane, rotation in the transvesical plane and alteration in the sagittal plane (anterior or posterior). The problem of improper posture in children is one of the significant problems of the modern way of life, and it appears at an increasingly early age. It is estimated that there are around 10.5 million scoliosis sufferers on the planet. About 60% to 80% of all cases are detected in women, and they are five to eight times more likely to progress and require treatment. Progression occurs during the years of growth, from the age of 7 the growth is 36%, and from the age of 10 even 52%.

Specific exercises are the main instrument of conservative treatment of scoliosis. They have been used since 500 BC, when Hippocrates, followed by Galen, introduced their use as a means of maintaining the flexibility of the chest wall.

Over the years, various methods have been developed, the most famous of which is Schroth (Germany), then Bspts (Spain), Seas (Italy), Dopomed (Poland). The exercise program consists of strengthening certain muscle groups and of performing respiratory exercises and it contains: breathing exercises, stretching exercises for shortened muscles, exercises for strengthening the paravertebral musculature, and posture exercises. A good and effective kinesiotherapy program should be based on a kinesiological analysis of selected kinesiological operators.

**Key words:** treatment, scoliosis, kinesiotherapy, exercise, child

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## INTRODUCTION

Scoliosis is one of the oldest known human deformities (1). It is also probably the most common orthopedic deformity in children. According to the definition of the Scoliosis Research Society (SRS), scoliosis is a lateral curvature of the spine that is 10 or more Cobb degrees as measured on an x-ray taken in a standing position. (2). According to research results, it is now considered to be caused by several biomechanical and genetic factors, and it occurs in women more often than men (3). We distinguish the following types of scoliosis:

Idiopathic scoliosis - the cause is unknown and it is considered a diagnosis of exclusion, which means it is diagnosed after all other potential causes have been excluded (4). Congenital scoliosis - means being born with this condition. This type of scoliosis begins with the formation of the spine before birth (pathologically formed vertebrae present at birth). It can be associated with other health problems, such as heart and kidney problems (2). Neuromuscular scoliosis - Any medical condition that affects the nerves and muscles can lead to scoliosis. It can occur as part of cerebral paralysis, muscular dystrophies and myopathies, as a result of spinal cord injury, spinal tumors or spinal cord cleft. Syndromic scoliosis - They occur as part of various syndromes, for example Marfan syndrome, neurofibromatosis, Ehlers-Danlos syndrome, Prader-Willi syndrome, brittle bone disease (lat. osteogenesis imperfecta) and various bone dysplasias (5). Thoracogenic scoliosis - They occur as a result of surgical opening of the chest cavity (thoracotomy) at an early age. Children undergoing this procedure have a 20% higher risk of developing scoliosis during their lifetime, which is a significant increase compared to the relative risk of scoliosis in healthy children. (4). The degree of severity of scoliosis is determined according to Cobb degrees measured on an X-ray taken in a standing position, taking into account the remaining growth time (3). Depending on the degree of spinal curvature

according to Cobb, scoliosis can be divided into four groups, namely:

1. from 0 to 20° – conservative treatment - kinesiotherapy, sports with antiparamorphic effect and lifestyle adjustment
2. from 25 to 35° – conservative treatment - brace and kinesiotherapy
3. from 35 to 50° – application of braces, exercises and plaster correction
4. from 50 to 90° – operative treatment (6).

In this paper, we looked at the definition and division of scoliosis, and we will present the pathogenesis, progression and treatment of the mentioned disease. The aim of this paper is to see the importance of conservative treatment with kinesiotherapy.

## PATHOGENESIS AND PROGRESSION

In early childhood, scoliosis occurs equally in both sexes. However, as children enter adolescence, scoliosis is diagnosed in about 4% of all children between the ages of 10 and 14. It is more common in girls than in boys (7). About 60% to 80% of all cases are detected in women, and they are five to eight times more likely to grow and require treatment. Progression is most common during the years of growth, from 7 years of age it is 36%, and from 10 years of age even 52%. Severe curves may, however, progress during adulthood. Scoliosis appears in about 4% of the world's population, 75-90% of which is actually idiopathic scoliosis (7, 8). The prevalence of scoliosis depends on the size of the deformation in degrees (9). Namely, the prevalence of scoliosis with more than 10 degrees of Cobb curve is 2-3%, from 21 to 30 degrees it is much less common and is found in 0.3-0.5% of the population, scoliosis from 31 to up to 40 degrees is even rarer, found in only 0.2% of the population, and scoliosis with more than 40 degrees of curvature occurs in less than 0.1% of the world's population (10). In the general population, idiopathic scoliosis occurs in 2-3%, in most cases it appears during the growth

spurt phase, from the ages of 5-8 or 11-14 (11). The Scoliosis Research Society recommends that girls be screened twice, at ages 10 and 12 (5<sup>th</sup> and 7<sup>th</sup> grade), and boys once at age of 12 or 13 (8<sup>th</sup> or 9<sup>th</sup> grade). There is much controversy about the benefits of school screening (12). Some of the risk factors that are considered to favor the development of scoliosis are: genetic, biomechanical and a combination of metabolic and growth factors (13). When we talk about congenital defects, the number of cases can rise to 75%, and the rest is caused by poliomyelitis, cerebral paralysis, juvenile osteoporosis and other diseases. (8). The literature provides information that inheritance is multifactorial or autonomously dominant (14). Abnormalities of the building protein collagen and related metalloproteinase enzymes are mentioned as biological factors (15). Although we do not know for sure what causes most cases of scoliosis, it should be noted that the family history is positive in almost 30% of patients. Some studies indicate that the excessive growth of the spine in adolescence is a key factor in the pathogenesis of scoliosis. Progression is more likely in women, subsequently, the younger the chronological and bone age, the more severe the scoliosis. (9). The fact is that approximately 1 in 3 children whose parents have scoliosis will develop it. Doctors do not yet know exactly which gene causes this (12). Of the genetic risk factors, female gender and height stand out the most. Also, the appearance of scoliosis is often associated with Turner syndrome, one of the most common chromosomal abnormalities in women. As many as 10% of patients with Turner syndrome develop scoliosis (16).

## **TREATMENT OF SCOLIOSIS**

Children and youth with mild scoliosis should be monitored regularly to monitor possible worsening of the disease, various sports activities, stretching exercises and specific exercises for the treatment of scoliosis should be recommended. (3). The prognosis depends on

where the curvature is located, how severe it is, the age at the time of the first menstruation, the gender, the age of the patient and when the symptoms began. Half of the children with detected scoliosis require treatment and evaluation. Early detection and treatment can stop further distortion (8). The treatment of scoliosis is usually divided into conservative and surgical treatment, whereby physical therapy together with plastering and orthotic treatment belongs to the conservative type of treatment. According to the degree of riveting, about 10% of patients need conservative treatment, and 0.1-0.3% require surgery. (3, 17). The first method we will mention in treatment is observation and evaluation. Regular check-ups are recommended every six months using the Adams bending test with the use of a scoliometer or a similar instrument to measure possible worsening of the rib hump. (18). Follow-up is reserved for patients who have reached skeletal maturity and have non-progressive scoliotic curves (16). In the case of medium-severe scoliosis, more frequent controls, more intensive practice of specific exercises for scoliosis along with physical activity and wearing an orthosis are required. An orthosis is a brace that is custom-made for each patient. By pressing on the appropriate points, it corrects the position of the spine and prevents the worsening of scoliosis (3). When the diagnosis in an adolescent with scoliosis is of 25 to 40 degrees according to Cobb, treatment with an orthosis - brace is indicated. The goal of brace treatment is to prevent the worsening of scoliosis and avoid surgery (18). Children with severe scoliosis often need surgical treatment. These are demanding operations that carry a certain risk of complications, which is why they are performed when all methods of conservative treatment have been exhausted (3). Surgical treatment is reserved for curves that are generally greater than 50 degrees in adolescents and adults. The goals of surgical treatment are to achieve correction of the curve and prevent the

progression of the curve by fusing the spine at an optimal level of safe correction of the deformity. (12). This type of treatment will not reduce morbidity or improve the quality of life of an adolescent patient when he reaches adulthood, which is why the prevailing opinion is that surgical treatment is not justified on the basis of medical indication (19). Scoliosis and its treatment can cause psychological problems. Wearing a collar or trough can cause anxiety about looking different from your peers, and hospitalization and surgical treatment bring their own difficulties. However, there is no alternative because without treatment the deformity can progress. Conversation and encouraging the child can be helpful (8). That physical deformity can also have a psychological effect on the patient was shown by the research of Payne and colleagues, who confirmed on 685 patients that scoliosis among adolescents is a significant risk factor for psychosocial issues and behavior that can compromise health (20).

### **WHAT ARE THE SPECIFIC EXERCISES FOR THE TREATMENT OF SCOLIOSIS?**

Considering that the treatment of idiopathic scoliosis can be conservative or operative, the main forms of conservative treatment are: therapeutic exercises, electrostimulation and spinal orthosis. Conservative treatment of scoliosis includes: a) Lyonaise, Side-Shift, Dobosiewicz, Schroth and other kinesiotherapy methods (21). From a kinesiological viewpoint, the real subject of interest are the so-called small (minor) scoliosis, and the most commonly used method is the Schroth (6). It is maintained by exercises, strengthening certain muscle groups and performing respiratory exercises. The program contains: 1. breathing exercises 2. stretching exercises for shortened muscles 3. exercises for strengthening the paravertebral musculature 4. posture exercises. Exercising is on average 60 minutes long (22). The results of conservative treatment of children with progressive scoliosis treated while the angulation

was still below 30 degrees showed that proper conservative treatment stops the progression and changes the natural course of scoliosis (23). Kinesiology research shows that systematic exercise can have a positive impact on the prevention and treatment of scoliotic bad posture and on scoliosis itself. Specific exercises have been proven to reduce back pain and slow down the progression of the disease. Kinesiotherapy is already applied in cases of early detected scoliosis and lateral curvatures as low as 10° according to Cobb. Regardless of how kinesiotherapy is applied, it must be planned and programmed specifically for each child (22). Conservative treatment of idiopathic scoliosis, especially kinesiotherapy, is not widely appreciated due to suspicions of low efficiency compared to surgical treatment. A conservative method of treatment has been developed, asymmetric mobilization of the trunk in strictly symmetrical positions, and it makes it possible to stop the progression of scoliosis, or even reduce the lateral curvature of the spine and the angle of rotation, assuming adequate cooperation of the patient and his family (24). Today, we can talk about the successful application of kinesiotherapy based on the experience of an increasing number of individuals and specialized institutions in the world, but most often when it comes to the treatment of scoliotic bad posture and scoliosis with a curvature angle of up to 20°(25). In Croatia, Katarina Schroth's exercises are mostly applied. These are specific exercises that treat the spine three-dimensionally. They consist of stretching exercises, trunk derotation and controlled breathing exercises. They require cooperation and motivation, which is why they are not suitable for younger children, while exercises according to Vojta's method are practiced for children younger than 7-8. (3). Schroth exercises may be more beneficial for patients with scoliosis who have a Cobb angle of 10 to 30° than for those with a Cobb angle greater than 30°. Patients should exercise for at least a month to have a better effect. Therefore,

therapists should consider the patient's initial curve status and exercise duration before prescribing a Schroth exercise program. Through research, it has been established that it has the greatest effect on the strength of the core muscles, and after the Schroth exercise, the structural deformity also changes (26). In their research, Schreiber et al. compared the group in which observation or the placement of a corset was included to the group in which the Schroth method was also applied. The results showed that there was a statistically significant improvement in the group that applied the Schroth method (27). Non-specific exercises cannot be considered as effective as exercises that use a well-defined corrective routine specific to the scoliosis pattern (28). According to the kinesiotherapy program based on elements of self-correction, stretching of weakened muscles and stimulation of the central nervous system, which was applied 3 times per week for 45 minutes, improvement was recorded in 63% and 13% of patients, respectively (29). When we speak of more severe cases of scoliosis, possible rotation of the vertebra or the entire spine around the longitudinal axis should be determined. In such cases, in the first phase of rehabilitation, de-rotation exercises are applied, followed by stretching and strengthening of the laterally twisted spine. In the case of double or multiple curvature, rehabilitation should be focused on the so-called primary distortion. Tribastone believes that in all uncertain cases it is better to intervene with symmetrical action, than to risk with asymmetrical action of doubtful effectiveness. Milder forms of scoliosis are treated with symmetrical exercises and procedures, while more severe scoliosis requires a combination of symmetrical and asymmetrical exercises in order to stop possible further progression, i.e. to reduce the existing condition (24,22). A retrospective study of children with idiopathic thoracic dextroscoliosis with a magnitude of thoracic curve between 20 and 35 degrees proved that the inclusion of

kinesiotherapy in the comprehensive treatment of idiopathic scoliosis varied in the improvement of muscle strength (satisfactory and moderate) in almost 80% of children, while the correction of the curve was small in approximately 42.1% of cases (30). In modern medicine, swimming is often recommended as a useful preventive or corrective tool in children and youth with improper posture and damage to the movement system. Breaststroke and backstroke are the best functional trainings for postural impairment. Breaststroke in scoliosis relieves tight paravertebral tension of the back musculature and strengthens trunk muscles (31). Conservative forms of scoliosis treatment can often lead to the needlessness of surgery (32).

## CONCLUSION

Movement therapy is an important part of some therapy as a procedure to treat or alleviate a condition with the goal of restoring normal functioning. Every therapy, including kinesiotherapy for children with disorders and diseases of the movement system, should be adapted to the individual. For this reason, physiotherapists have the task of organizing movement and physical activity as movement therapy in order to have its own purpose, direction and goal. Analogously to the development of technology and a sedentary lifestyle, scoliosis is becoming more and more common in children, therefore early detection and the inclusion of specific exercises are of great importance in order to prevent the progression of the deformity and then correct it. A good and effective kinesiotherapy program for scoliosis should be based on a kinesiological analysis of selected kinesiological operators and a desirable combination of isotonic and isometric contractions, accompanied by breathing techniques. Conservative measures such as specific exercises, casts and braces can delay the (frequent) need for surgery or even make surgery unnecessary, especially in early childhood idiopathic types of scoliosis.

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## ZNAČAJ KOREKTIVNIH VJEŽBI U LIJEČENJU SKOLIOZE U DJECE ŠKOLSKE DOBI

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### SAŽETAK

Skolioza je najčešća ortopedska deformacija kod djece, karakterizira je trodimenzionalna iskrivljenost kralježnice; lateralna inklinacija u frontalnoj ravnini, rotacija u tranzvezalnoj ravnini i alteracija u sagitalnoj ravnini (anteriorna ili posteriorna). Problem nepravilnog držanja u djece, jedan je od značajnih problema suvremenog načina življenja, javlja se u sve ranijoj životnoj dobi. Procjenjuje se da na planeti imamo oko 10,5 milijuna oboljelih od skolioze. Oko 60% do 80% svih slučajeva otkriva se u ženskog spola te je pet do osam puta veća vjerojatnost da će se povećati i zahtijevati liječenje. Progresija se događa tijekom godina rasta, od 7 godina je 36%, a od 10 godina čak 52%.

Specifične vježbe predstavljaju glavni instrument konzervativnog liječenja skolioze.

Koriste se još od 500. godine prije Krista, kada je Hipokrat, a za njim Galen, uveo njihovu upotrebu kao sredstva za održavanje fleksibilnosti stijenke prsnog koša.

Tijekom godina razvile su se različite metode, od kojih je najpoznatija Schroth (Njemačka), zatim Bspts (Španjolska), Seas (Italija), Dopomed (Poljska). Program vježbi sastoji se od jačanja određenih mišićnih skupina i provođenjem respiratornih vježbi, sadržava: vježbe disanja, vježbe istezanja skraćenih mišića, vježbe za jačanje paravertebralne muskulature, te vježbe stava. Dobar i učinkovit kineziterapijski program treba biti zasnovan na kineziološkoj analizi odabranih kinezioloških operatora.

**Ključne riječi:** liječenje, skolioza, kineziterapija, vježba, dijete

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