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Research

Comparison of Upper and Lower Extremity Normal Joint Spaces of Patients with Adolescent Idiopatic Scoliosis with their Healthy Contemporary

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Abstract

Objective: This study was conducted to compare the normal range of motion of the shoulder and elbow in the upper extremity, hip and knee in the lower extremity of patients with a diagnosis of adolescent idiopathic scoliosis (AIS) with their healthy peers.

Method: Socio-demographic and physical characteristics of all individuals participating in the study were recorded. Only subjects with Lenke type 1 curve were included in the study and all included subjects had right thoracic curves. The hip, knee, shoulder and elbow flexion and extension normal range of motion of the participants were evaluated using a universal goniometer.

Results: A total of 56 adolescents, 20 girls and 8 boys in the AIS group, and 20 girls and 8 boys in the control group, participated in the study. The thoracic curve of the group with scoliosis was calculated as 19.61±4.16. Among the cases included in the study, the mean age of the AIS group was calculated as 14.2±1.26 years, and the mean age of the control group as 13.84±0.62 years. When we look at the findings, it was seen that the shoulder, hip and knee flexion normal range of motion values of children with right thoracic adolescent idiopathic scoliosis were statistically lower than the flexion normal range of motion values of healthy children. ($p<0.05$)

Conclusion: According to the findings of the study, the decrease in flexion and normal joint range of motion in the extremities should also be considered in the treatment of adolescent idiopathic scoliosis.

Keywords: *Scoliosis, Movement, Hip, shoulder, knee*

Introduction

Idiopathic scoliosis is defined as a complex three-dimensional deformity of the spine, including the pelvis. It causes lateral curvature in the frontal plane, axial rotation in the horizontal plane and causes deterioration of physiological sagittal curvatures. Its origin is unknown and has a multifactorial etiology. (1)

Treatment for idiopathic scoliosis is based on age, curve size, and risk of progression. Considering these conditions in the treatment, observation, bracing treatment and surgical correction with fusion are used. Generally, spinal deformity or thorax and back asymmetry are seen in these patients. The risk of progression, treatment and prognosis of the curvature in idiopathic scoliosis depend on spinal growth. The most reliable and simple method of monitoring growth is by monitoring the patients' regular height measurements. It is also important to look for other signs of growth and maturity in the assessment, including signs of puberty, onset of menarche, and breast development. This condition, which has a higher incidence in siblings (seven times) and children (three times) of patients with scoliosis, has a genetic component, so adults with idiopathic scoliosis should know that their children should be screened carefully. (2)

While examining the patient's back, the shoulders and hips are examined for asymmetry. The forward bending test, which is the classical screening test in scoliosis, is performed by bending forward from the waist with the patient's knees straight. On examination, it should be checked whether there is an asymmetry in the scapulae caused by the rotational deformity of the spine. In thoracic scoliosis with the apex of the curve to the right, the right side of the patient is prominent. Although this result is most easily seen in the thoracic spine, it is important to look at the lumbar region in the evaluation. (2)

Adolescent idiopathic scoliosis (AIS) is the most common type of idiopathic scoliosis in children. AIS occurs around 11-18 years of age and is defined as rotational deformity in the coronal plane and abnormal lateral curvature of the spine with a Cobb angle greater than 10 degrees. (3,4) The prevalence of AIS is 0.47%-5.20% worldwide. (4) AIS is determined by the forward bend test and is confirmed by scoliometer measurement. Mild scoliosis is usually asymptomatic. Patients with severe scoliosis (40 degrees or greater Cobb angle) may experience physical pain, cosmetic deformity, psychosocial distress, or pulmonary disorders.(3)

As the severity of the scoliosis curve increased, rotation increased in the spine, while lateral flexion range of motion decreased. (5) Considering these results, the stabilization and mobilization of the spine may be affected in patients with AIS, resulting in limitations in the normal range of motion of the extremities. This study was conducted to compare the normal range of motion of the shoulders and elbows in the upper extremities, and the hip and knee ranges in the lower extremities of patients diagnosed with AIS with their healthy peers.

Materials and Methods

Participants

The participants of this study are adolescents who were diagnosed with AIS according to the Lenke criteria and referred to Kırşehir Ahi Evran University School of Physical Therapy and Rehabilitation. A total of 56 adolescents, 20 girls and 8 boys in the AIS group, and 20 girls and 8 boys in the control group, participated in the study. Socio-demographic and physical characteristics of all participating individuals were recorded. When the dominant sides of the individuals were questioned, it was determined that each of them was right dominant. At the same time, all included cases were found to have a right thoracic curve. The inclusion criteria of this study were as follows: Patients diagnosed with AIS, aged 10-18 years, with Lenke type 1 curvature, Risser stage ≤ 3, and a Cobb angle of 10-30°. Patients with a history of neuromuscular, cardiovascular, pulmonary, vestibular or rheumatological diseases, who were prescribed brace treatment, who had non-idiopathic scoliosis, who used drugs periodically, who had undergone any previous spinal surgery, and who received conservative treatment were excluded from the study. This study was approved by the local ethics committee and was conducted in accordance with the Declaration of Helsinki. Written and verbal consent was obtained from all participants and their families before starting the study. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Range of Motion Measurement

The participants' hip, knee, shoulder and elbow flexion and extension normal range of motion were evaluated by the same researcher using a two-armed universal goniometer. For the evaluation to be made before all measurements, the pivot point of the joint, the fixed arm and the movable arm of the goniometer were determined. The correct movement required for the assessment was shown to the participant before the measurement. During the measurement, the two arms of the goniometer were placed at the necessary points, and after all the movements, the degree between the two arms was calculated for the joint range of motion and noted. (5)

Range of motion of hip flexion was evaluated with the participant lying in the supine position and knee flexed. In this measurement, the pivot point of the joint was aligned on the trochanter major, the fixed arm of the goniometer was aligned on the horizontal axis of the body, and the movable arm of the goniometer was aligned on the lateral midline of the femur. During the evaluation of hip extension range of motion, the position of the goniometer was adjusted to the same as the hip joint flexion measurement, but this time the participant was evaluated in the prone position. (5)

Range of motion of knee flexion was evaluated while the participant was lying in the prone position. In this measurement, the pivot point of the joint was aligned on the lateral condyle of the femur, the fixed arm of the goniometer was aligned parallel to the body, and the movable arm of the goniometer was aligned parallel to the longitudinal axis of the fibula. During the evaluation of the range of motion of knee extension, the position of the goniometer was adjusted to the same as the measurement of the knee flexion movement. (6)

Range of motion of shoulder flexion was evaluated while the participant was lying in the supine position. In this measurement, the pivot point of the joint was aligned on the greater tubercle of the humerus, the fixed arm of the goniometer was aligned parallel to the body, and the movable arm of the goniometer was aligned on the lateral line of the humerus.

During the evaluation of the range of motion of the shoulder extension, the position of the goniometer was adjusted to the same as the measurement of the shoulder flexion movement, but this time the participant was evaluated in the prone position. [7]

Range of motion of elbow flexion was evaluated while the participant was lying in the supine position. In this measurement, the pivot point of the joint was aligned on the lateral epicondyle, the fixed arm of the goniometer was aligned parallel to the body, and the movable arm of the goniometer was aligned towards the styloid process of the radius. During the evaluation of the range of motion of the elbow extension, the position of the goniometer was adjusted to the same as the measurement of the elbow flexion motion.

Both right and left normal joint movements of the individuals were measured three times by the same researcher and their arithmetic averages were recorded.

Statistical Analysis

For statistical analysis, statistical package programs of SPSS (Statistical Package for Social Sciences) were used. Descriptive statistics were presented as mean ± standard deviation and percentage. In this study, independent samples t -test was used to determine the statistical difference between the groups. Statistical significance value was accepted as $p<0.05$.

Results

The thoracic curve of the group with scoliosis was calculated as 19.61±4.16. Among the cases included in the study, the mean age of the AIS group was calculated as 14.2±1.26 years, and the mean age of the control group as 13.84±0.62 years.

Table 1. Mean age and gender of the cases.

Variable		AIS (n=28)	Control (n=28)
Average Age (years)		14,2±1,26	13,84±0,62
Gender			
	Female	20	20
	Male	8	8

Table 2. Scores of the cases from the measurements made.

Variable	AIS (n=28)	Control (n=28)	p*
Shoulder Flexion	168,86±2,72	$179,21^0$±0,04	**0,01**
Knee Flexion	129,21±0,63	135,00±00	**0,038**
Hip Flexion	118,76±2,32	125,00±00	**0,041**
Elbow Flexion	144,11±0,02	145,00±00	0,056

There was no difference between the shoulder, knee, hip and elbow extension measurements of the cases.

Discussion

When we look at the most important results of our study, it is seen that the shoulder, hip and knee flexion normal range of motion values of children with right thoracic adolescent idiopathic scoliosis are statistically lower than the flexion normal range of motion values of healthy children. The fact that individuals spend more time in the flexor direction in their daily life activities and their movements are more in the direction of flexion movements may be related to the decrease in normal joint range of motion in shoulder, hip and knee flexion. The fact that the extension movements are less in daily living activities may also be related to the lack of a significant difference in the extension measurement results.

Recently, the most commonly used classification system for idiopathic scoliosis, described by King et al., has faced significant criticism indicating poor interobserver reliability. In contrast, a new classification system presented by Lenke et al has proven to have better reliability and reproducibility than the King classification. This new classification system was developed with the aim of designing a comprehensive, practical, three-dimensional and computational system. The Lenke classification system divides idiopathic scoliosis curves into 6 types. Type 1 primary thoracic scoliosis, Type 2 double thoracic scoliosis, Type 3 double major scoliosis, Type 4 major triple scoliosis, Type 5 nonstructural primary thoracolumbar/lumbar scoliosis, Type 6 thoracic curve and structural thoracic curve define primary thoracolumbar/ lumbar scoliosis. [8] Our study included only cases with Lenke type 1 curvature. The reason why only the cases with Lenke type 1 curve were found in our study is that the most common type was Lenke type 1 and this type of curve was found in all participating patients.

It has been reported in the literature that trunk range of motion may be impaired in patients with AIS due to body asymmetries involving the pelvis and lower extremities. Coordinated functional trunk movements should be combined with normal range of motion for sustained movement in the upper and lower thorax as well as the lumbar spine. More limited range of motion values were found in patients with AIS, especially in the trunk-pelvis-hip complex, compared to patients without AIS. [9] Hip abduction movement in idiopathic scoliosis differs according to the existing curve. There is asymmetry in left and right hip extension movement in idiopathic scoliosis. These results show that the normal range of motion of the extremities may change in the presence of scoliosis. [10] With these conditions, the decrease in the normal joint movement of the spine may affect the stability and mobility of the spine and cause a decrease in the normal range of motion in the extremities, and the results of our study support this idea.

Conclusion

According to the results of this study, the decrease in flexion and normal joint range of motion in the extremities should also be considered in the treatment of adolescent idiopathic scoliosis. In treatment, the patient should be taught proper posture techniques and joint protection principles. Appropriate exercises should be planned and performed to correct the decrease in the range of motion in the flexion direction.

Conflict of Interest

The authors declare no conflict of interest.

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