



Asymmetry Improvement on Core Training for Adolescent Idiopathic Scoliosis

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Dear Editor-in-Chief

The etiology of idiopathic scoliosis is not known, it mainly occurs in adolescents aged 11–18 yr with a Cobb angle of 10 degrees or greater (1), characterized by vertebral rotation and lateral curvature as a three-dimensional spinal deformity (2, 3). This is a complex spinal deformity that can cause posture imbalance, muscle weakness in the spine area, and chronic pain (4). The asymmetry in the pelvis, which serves the function of maintaining body alignment with the spine, will have a negative effect on idiopathic scoliosis (5). Therefore, active and comprehensive research is required through implementing exercise intervention programs to prevent scoliosis caused by three-dimensional deformity and to improve spinal and pelvic asymmetry. In this regard, we aimed to contribute to public health by helping adolescents with spinal healthcare and prevention of idiopathic scoliosis by implementing core training among adolescents with idiopathic scoliosis and investigating their impact on the improvement of three-dimensional spinal and pelvic deformities.

For this study, 44 elementary school teenage girls (10.00 ± 9.96 yr, 142.82 ± 8.84 cm, 38.80 ± 10.70 kg) who had orthopedic findings of idiopathic scoliosis based on asymmetric scoliosis in the spine and pelvis and had obtained parental consent for an 8-week core training participated.

Participants read and signed an informed consent approved by the Institutional Review Board of Incheon National University prior to starting the testing.

In order to analyze vertebral rotation and pelvic asymmetry, using the spinal structure analyzer (Formetric 4D, DIERS International GmbH, Germany), surface tomography using the raster stereography method was used for three-dimensional measurements with reference to C7, the left and right posterior superior iliac spine (PSIS), and the center of the PSIS on both sides. Through the measurements, the scoliosis angle, as well as the pelvic tilt angle, torsion angle, and rotation angle were measured to analyze the differences before and after participation in the core training.

The measuring instrument was non-invasive, as measurements were obtained through the contour of the body surface using a halogen lamp. This method has the advantage of no risk of radiation exposure, as well as ensuring fast and accurate measurements. In order to improve vertebral and pelvic rotation and asymmetry in adolescents with idiopathic scoliosis, an active static strength exercise and passive manual muscle exercise for posture correction were performed in parallel, comprising a regular core training of 8 weeks performed 3 times a week for 60 min. Each training consisted of a 10 min warm-up, 40

min core training, and 10 min cool-down training. The core training included pelvic tilts, cat-camel, back extension, crunches, double leg abdominal press, single leg balance, foam roller balancing, squats, and plank.

For all data processing, SPSS 25.0 (SPSS Inc., USA) was used to calculate the mean and standard deviation, and analysis was performed using the paired sample *t*-test. The significance level of all statistical analysis was set to $\alpha = .05$.

As a result of analyzing the changes observed through the 8-week core training conducted with the purpose of improving spinal and pelvic

asymmetry in adolescents using a three-dimensional vertebral structure analysis approach, statistically significant results were obtained in terms of the scoliosis angle ($P=0.000$) and pelvic rotation angle ($P=0.042$) (Table 1). In the case of scoliosis, when the core stability exercise was implemented in adolescents with moderate idiopathic scoliosis in this study, it showed similar results to those in previous studies that demonstrated improvements in the scoliosis angle and body symmetry similar to that in cases of wearing orthoses (6, 7).

Table 1: Changes of spinal and pelvic angle by core training

<i>Variables</i>	<i>Pre Exercise</i>	<i>Post Exercise</i>	<i>P-value</i>
Scoliosis Angle (°)	15.55±2.32	9.95±3.42	.000
Pelvic Tilt Angle (°)	-.18±2.81	-.37±2.90	.714
Pelvic Torsion Angle (°)	.99±2.28	.99±2.20	.998
Pelvic Rotation Angle (°)	-2.78±5.88	-.92±4.19	.042

Values are Mean±SD

Based on the aforementioned findings, periodic and scientific spinal structure analysis will help predict and prevent the onset of idiopathic scoliosis in adolescents from an early stage. In addition, it is thought that the core training can be implemented as a very effective exercise program to improve the scoliosis angle and pelvic deformities. Therefore, the implementation of continuous examinations for idiopathic scoliosis prevention and a strategic exercise program for prevalence control and functional improvements will be helpful for spinal health management in adolescents.

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Conflict of interest

The authors declare that there is no conflict of interest.

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