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Effect of One-period of SEAS exercises on Some Spinal Biomechanical and Postural Parameters in the Students with Idiopathic Scoliosis

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ABSTRACT: The academics paid more attention to individual health given the thriving machine lifestyle and increasing tendency toward this lifestyle. Identification of these abnormalities in various organs sometimes leads to corrective exercises in order to improve these abnormalities. Spinal scoliosis can be cited as one abnormality. There are two types of scoliosis in terms of etiology; one with a known cause and the other one with an unknown cause. SEAS exercises are one of the most widely used treatments for these patients. The present study aimed to examine the effect of one-period of SEAS exercises on some postural and biomechanical spinal parameters in the students with idiopathic scoliosis. Materials and methods: This was an applied and semi-experimental survey. The statistical population consisted of the students with idiopathic scoliosis in Tehran Province among which 30 students were selected using convenience sampling method. They were divided into two control and SEAS exercises groups. To test the hypotheses, Kolmogorov Smirnov statistical models was used to determine data normality and t-test was used to examine the effectiveness with SPSS 21. The results showed that SEAS exercises significantly affects the measured dependent variables (the length of spine at normal posture, hyper extension of spine, the differences in lateral flexion of the spine). Thus, SEAS exercises can be used to improve idiopathic scoliosis in the students based on the obtained results.

Keywords: SEAS exercises, idiopathic scoliosis, hyper extension of the spine, side flexion of the spine

INTRODUCTION

Nowadays, the academics pay more attention to individual health given the thriving machine lifestyle affecting physical organs. Research on healthy organs is the topic of many studies whether from the mechanical or physiological aspects (Fusco *et al.,* 2011). Reviewing and identifying weaknesses in different organs sometimes leads to corrective exercises in order to improve these weaknesses. The physical disorders in childhood and adolescence not properly addressed will cause many acute and chronic pains in adulthood (Maruyama *et al.*, 2002). Spinal scoliosis can be cited as one anomaly in this regard. There are two types of scoliosis in terms of etiology; one with a known cause and the other one with an unknown cause. The one with an unknown cause is called idiopathic scoliosis. The incidence of this complication is from 75% to 85% (Alizadeh, 2012). SEAS exercises can be used to treat this anomaly. These exercises reduce asymmetrical forces imposed on the spine curve. These exercises also reduce the risk of development of scoliosis by dealing with this vicious cycle. These exercises effectively treat scoliosis from biomechanical perspective. Scoliosis is three-dimensional deformity of the spine with lateral curvature and rotation of the vertebral bodies. Idiopathic scoliosis is a three-dimensional deformity of the spine with an unknown cause. This anomaly is defines as a curve more than 10 degrees at coronal plate with concordant apical rotation. Idiopathic scoliosis is most common in adults, which occurs in adults above 10 years old. The prevalence of this type of scoliosis with an angle above 10 degrees is between 0.5% and 30% among public population. The incidence of this disorder is twice in women than men. Almost 30% of the adults with idiopathic scoliosis had a history of this disorder among their relatives. This suggests that genetic factors may be involved in incidence of this disease. The physicians attempt to treat a patient with scoliosis who is growing (e.g. at puberty) or has less than 25-20 degrees of scoliosis. This is because scoliosis can eventually be corrected at puberty. The scoliosis cases with less than 25-20 degrees remain asymptomatic in absence of progress of the disorder and an increase in degree of coverture (Weiss and Weiss 2002, Alizadeh, 2012, Weiss and Weiss 2002).

Based on the above discussions, SEAS exercises are very useful for reducing thoracic scoliosis. These exercises are used as a rehabilitative approach to scoliosis treatment for 30 years. These exercises are constantly updated during this period. So these are not old-fashioned exercises.

Careful consideration is necessary to understand biomechanical role of SEAS in scoliosis treatment (Negrini *et al.,* 2006, Lenssinck *et al.,* 2005, Negrini *et al.,* 2006, Negrini *et al.,* 2006, Negrini *et al.,* 1992, Weiss *et al.,* 2006).

and to decipher unique features of SEAS exercises compared to other types of exercises. SEAS were selected as an important scoliosis treatment approach considering in terms of biomechanics. These exercises are even approved by International Society on Scoliosis Orthopaedic and Rehabilitation Treatment. Scoliosis causes functional disorders at neuromotor, biomechanical, organic and psychological levels. SEAS can reduce the severity of scoliosis progress. These exercises even terminate development of scoliosis in some cases with mild scoliosis. Proper walking, seating, standing not only leads to beautiful individual movements, but also higher functionality and less fatigue. This is because the least muscular energy is consumed at ideal posture. In proper physical condition, head and shoulders are aligned over hips, thighs and ankles and curvature of the spine is normal. However, in improper physical condition, curvature of the spine is disturbed and the shoulders move towards the pelvis. According to the above-mentioned materials, using these exercises and their effectiveness in various body organs were addressed in this study, especially the "spine" (Tahmasebi and Hamidreza 2012, Negrini *et al.,* 2002, Mollon *et al.,* 2006, Bagó *et al.,* 2006).

Chang *et al.* (2012) conducted a study entitled as assessment of idiopathic scoliosis with bracing treatment in case of SEAS training and referred to an instance of the exercises to reduce scoliosis. They addressed the significant influence of these exercises with bracing treatment on scoliosis (Michele, 2011). Stefano Negrini (2011) conducted a study entitled as "Scoliosis treatment with SEAS exercises" and addressed the impact of one period of these practices on the individuals with these disorders. Accordingly, SEAS exercises reduced curvature of the spine up to 60%. Vis and Gedal (2010) conducted a study entitled as "Rehabilitation of scoliosis" and defined idiopathic scoliosis abnormality and treatment methods. They found out that SEAS Exercises are very useful and affect the shoulders and even angle of the legs for proper posture of the spine (Weiss and Seibel 2010, Negrini *et al.,* 2011).

In all relevant studies, appropriate training exercises on lateral spinal muscles were not implemented. It can be one of the shortcomings of previous research. Rehabilitation exercises need to be modified more than ever. For this purpose, SEAS exercises can be fully linked with these shortcomings. On the other hand, previous studies have not specifically addressed the predictor variables in scoliosis with regard to SEAS exercises. This study was performed for the first time in Iran. The study sought to answer that whether a 12-week SEAS program affected the intended factor in the students or not (The spine length at normal posture, hyper extension of the spine, and the differences in lateral flexion of the spine).

MATERIALS AND METHODS

The statistical population consisted of the students with idiopathic scoliosis among which 30 individuals were selected using a convenience sampling method. The participants were divided into experimental (n = 15) and control (n = 15) groups. Only laboratory method was used to collect information on the participants. This study was conducted in the fourth district in Tehran in 2014. In this study, the patients with scoliosis were selected with diagnosis and consent of the physician for implementation of the exercises. Miter square and a tape were used to measure lateral flexion and the spinal length at normal and hyper extension postures. The exercise group underwent the SEAS trainings for 12 weeks. The exercises were performed three times a week for 40 minutes. The exercises were performed both actively and passively. In this study, all patients participating in the test were examined with an interval of 12 weeks. Then, 15 participants were taught the exercises after the first test (pretest). Twelve weeks later, these were retested (posttest) but the remaining 15 individuals in the control group were not given any training. Twelve weeks later, these were also retested. In the following, two examples of SEAS exercises are noted.

First practice: the individual sits on a chair while pressing his hands under the table and keeps his back in a straight upright (vertical) position. This exercise should be performed for 10 seconds (isometric exercise-strength and endurance in a sitting position). It should be noted that this exercise was done for five times per day at first and continued up to 8 times per day. Meanwhile, the exercise was repeated one more time every three days as follows (5, 5, 5, 6, 6, 6, 7, 7, 7, 8, 8, 8)

Second practice: the individual pushes the wall upwards while his hands are on his knees and keeps his spine in a flat position. In addition, the individual may be asked to separate his hands from the wall to strengthen the muscles while keeping the former situation. This exercise should be done for 30 seconds (strengthening muscle strength). It should be noted that this exercise was performed three times per day at first and continued up to 6 times per day. Meanwhile, the exercise was repeated one more time every three days.

(3, 3, 3, 4, 4, 4, 5, 5, 5, 6, 6, 6)

It should be noted that exclusion criteria were as follows: musculoskeletal pain, fracture history and recent surgery on the spine, presence of Sprengel disease. The study inclusion criteria were as follows: uneven shoulders, unequal iliac crest of the pelvis on both sides, asymmetric ribs on both sides, asymmetric muscles around the trunk, shortness of one leg, any obvious deformity or structural abnormality

In this study, descriptive statistics (mean and standard deviation) and inferential statistics (Kolmogorov Smirnov test to determine normal data distribution and t-test) were used to analyze the collected data. All of the above operations were performed with SPSS version 21.

RESULTS

The participants were 30 individuals divided into two experimental (n = 15) and control (n = 15) groups. Table (1) shows descriptive statistics in the control group and Table 2 shows descriptive statistics in the experimental group.

Table 1: Descriptive statistics in the control group.

Stages of the experiment variables	Pretest Mean ± standard deviation	Posttest Mean ± standard deviation
Spine length at normal posture	35.06 ± 3.06	36.20 ± 2.78
Spinal hyper extension	32 ± 3.34	36.86 ± 3.57
Spinal flexion to the right side from the midline	25.06 ± 6.57	30.06 ± 6.01
Spinal flexion to the left side from the midline	25.13 ± 9	31.73 ± 8.13

Table 2: Descriptive statistics in the experimental group.

Stages of the experiment Variables	Pretest Mean ± standard deviation	Posttest Mean ± standard deviation
Spine length at normal posture	35.83 ± 2.78	35.90 ± 2.58
Spinal hyper extension	34 ± 2.67	33.86 ± 3.20
Spinal flexion to the right side from the midline	27.80 ± 7.47	27.66 ± 6.94
Spinal flexion to the left side from the midline	27.96 ± 6.20	27.96 ± 5.91

In this study, the dependent variables were length of the spine at normal posture, hyperextension of the spine, flexion of the spine from the midline to the right side, flexion of the spine from the midline to the left). The effect of presence and absence of SEAS exercises was examined on the dependent variables. Factors within the groups were two tests as before and after the training period. Factors between the groups were classification based on exercise performance. The study had two experimental (n = 15) and control groups (n = 15). For each dependent variable of the study, an ANOVA test for repeated measurement was performed.

The length of the spine at normal posture: The analysis aimed to examine the effect of classification on length of the spine at normal posture. The effects within the groups were insignificant ($p=0.000$ and $F(1, 28) = 22.127$). The effects between the groups were insignificant ($p = 0.825$ and $F(1, 16) = 0.05$), the interaction were also insignificant ($p = 0.000$ and $F(1, 28) = 17.483$). In other words, with regard to the distinction between changes in scores in each group, changes within the group were significantly different. SEAS exercises had significant effect on length of the spine at normal posture.

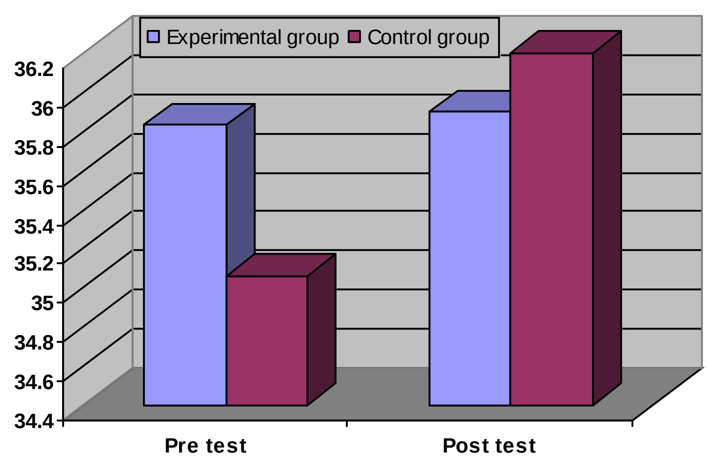

Fig. 1. Spine length at normal posture.

Hyper-extension of the spine: this analysis examined the effect of classification on hyper-extension of the spine. The effects within the groups were significant (p = 0.000 and F (1, 28) = 22.127), the effects between the groups were insignificant (p = 0.665 and F (1, 28) 0.192), and the interactions were significant (p = 0.000 and F (1, 28) = 17.483). In other words, with regard to the distinction between changes in scores in each group, changes within the groups were significantly different. The SEAS exercises had a significant effect on hyper extension of the spine (Fig. 1).

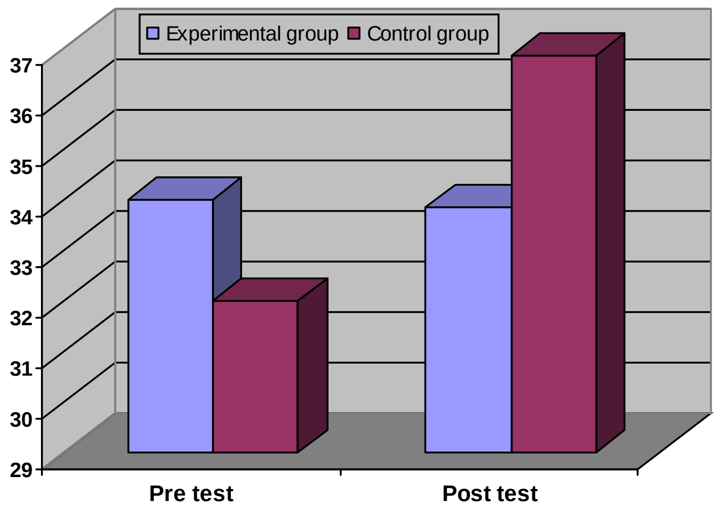

Fig. 2. Openness of spine when bending backwards.

The analysis aimed to examine the effect of classification on differences in lateral flexion of the spine from the midline to the right side. The effects within the groups were significant (p = 0.000 and F (1, 28) 29.303), the effects between the groups were insignificant (p = 0. 946 and F (1, 16) = 0.05) and the interactions were significant (p = 0.000 and F (1, 28) = 32.603). In other words, with regard to the distinction between changes in scores in each group, changes within the groups were significantly different. Thus, the SEAS exercises had significant effects on the differences in lateral flexion of the spine to the right side from the midline (Fig. 2).

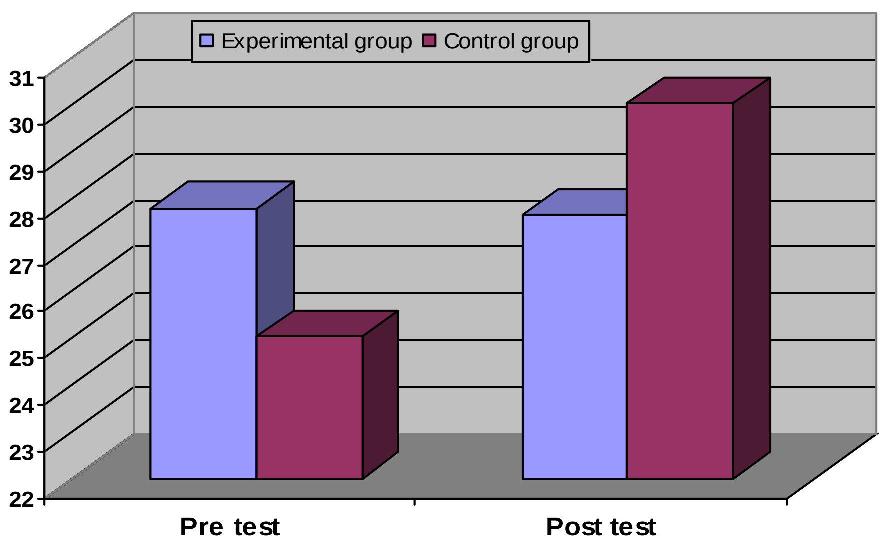

Fig. 3. Lateral flexion of the spine from the midline to the right.

The analysis aimed to examine the effect of classification on differences in side flexion of the spine to the left from the midline. The effects within the groups were significant (p = 0.000 and F (1, 28) = 53.308), the effects between the groups were insignificant (p = 0.864 and F (1, 16) = 0.03), the interactions were significant (p = 0.000 and F (1, 28) = 53.308). In other words, with regard to the distinction between changes in scores in each groups, changes within the groups were significantly different. SEAS exercises had significant effects on differences in lateral flexion of the spine from the midline to the left (Fig. 3).

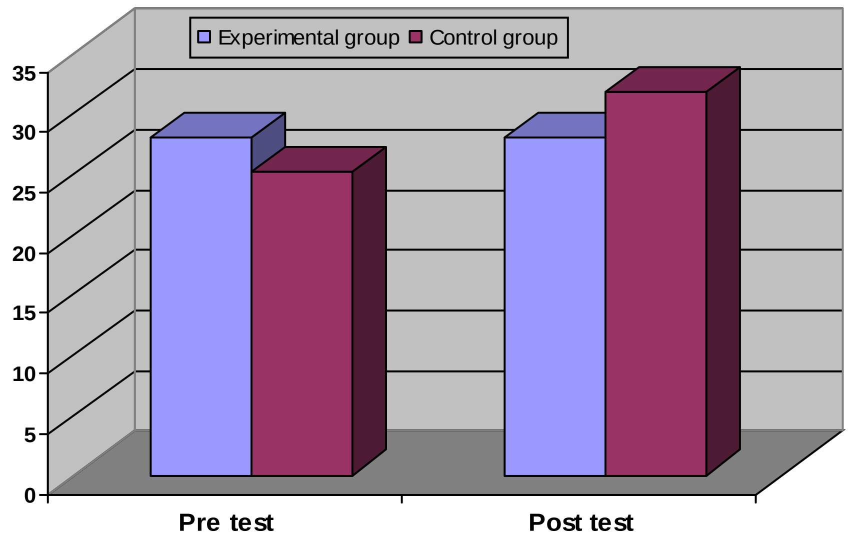

Fig. 4. Lateral flexion of the spine to the left from the midline.

The results showed that SEAS exercises had significant effects on the dependent variables (length of the spine at normal posture, hyper extension of the spine, the differences in lateral flexion of the spine from the midline to the right side, the differences in lateral flexion of the spine from the midline to the left side).

DISCUSSION

In this study, the dependent variables (length of the spine at normal posture, spinal hyper extension, the difference in spinal flexion from the midline to the right side, the difference in spinal flexion from the midline to the left side). The effect of presence and absence of SEAS exercises was examined on the dependent variables. Active movements in SEAS exercises lead to additional stress on spinal muscles on both sides and gradually improve muscular asymmetric mode. According to the sagittal plane, the individuals are affected by neuropsychological aspects of these exercises at lateral positions and the side of the chest is less concave at one side of the spine and more bulged at other side of the spine. Increased thoracic kyphosis and improved lumbar lordosis might be due to mild influence of SEAS exercise on these two factors in order to improve condition of the patients. On the other hand, stretching exercises, which are one of the basic principles of SEAS trainings may lead to higher flexibility of spinal muscles on both sides. SEAS exercises even lead to flexibility of upper parallelogram back muscles or rhomboid major muscle, which affect left and right lateral flexion. SEAS exercises create stability in the spine and gradually lead to individual rehabilitation, which decrease structural deformity in the individuals with scoliosis. The research hypotheses tested the effect of SEAS exercises on hyper extension, length and lateral change on both sides of the spine. In all these cases, the effects of exercises were significant. These results are in line with those obtained by Gedal and Weiss (2010) while inconsistent with those obtained by Stefano Negrini (2011) [20]. The effect of exercise on vertebral bodies was also approved in this study. In this regard, the exercises effectively fixate the spine or control the postures at first. Furthermore, the exercises affect the vertebral bodies at standing position in Lat Shift Corrective Exercises.

CONCLUSION

The results showed that SEAS exercises use the muscles involved in patients with idiopathic scoliosis and effectively improve postural and biomechanical parameters. Studies indicated physical deformation of the student. These deformations are usually severe and can be reformed with a series of corrective exercises.

The issues relevant to correct posture among school children are considered in the developed world. Nowadays, many students suffer from mild lateral abnormalities in spine. Familiarity with SEAS exercises and correct application of these exercises can reduce severity of deformity or cure the disorder. Thus, these exercises can prevent incidence of other complications related to spinal disorders and their impacts on individual functionality or other joints. Familiarity with SEAS exercises in the field of scoliosis can be useful for sport teachers and physical education specialists.

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