Effect of Corrective exercises on body indexes and some fitness factors in girls with scoliosis

Ahdiyeh Yadolazadeh[1], Mahboobeh Karbalaie[2], Mir Hamid Salehian[3]

1- Department of Physical Education, Zahedan Branch, Islamic Azad University, Zahedan, Iran
2- Department of Physical Education, Zabol branch, Islamic Azad University, Zabol, Iran
3- Department of Physical Education, Tabriz Branch, Islamic Azad University, Tabriz, Iran
Mh_salehian@yahoo.com

Abstract: The purpose of this study was to evaluate the impact of corrective exercises on body indexes (flexibility and back muscle strength) in girls (12-15 years old) with scoliosis. 40 girls (12-15 years old) with scoliosis were selected randomly from a guidance school and divided to two groups, 20 in experimental and 20 in control ones. All participants filled out the form to ensure that they had no heart and cardiovascular disease, in order to perform the required tests. After measuring the height and weight of participants, they were familiar with the tests. The pre-test consisted of the scoliosis evaluation, static strength and flexibility of back muscles and range of bending motion. Both groups practiced training programs for four weeks, each week four sessions for an hour and a half. Data were analyzed by paired t and independent t test and chi-square test (chi square). The research results demonstrated that the spinal flexibility and back muscles strength increased in the experimental group after a period of corrective movements, but there was not a significant difference between experimental and control groups. Corrective exercises had a positive impact on the level of the posterior superior iliac spine and there was significant difference between experimental and control groups. Corrective exercises had a positive impact on the shoulders surface, but there was not a significant difference between experimental and control groups. Lateral bending in the subjects of our research was asymmetrical and the results of corrective exercises did not show any significant difference in both groups.

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1. Introduction

The term scoliosis is originated from Greek word meaning crooked; it is one of the most common changes of the spinal cords that its recovery very difficult. The human spine is located in the vertical situation due to supporting muscles and balanced position and degrees of kyphosis or lordosis is normal and there is no any lateral curvature in these natural spines (Anderson, 1992). Scoliosis is consisted of the lateral deviation and rotational series of verterbrae from the midline axis, (Frymoyer, 2004; Pehrson et al, 1991; Jackson et al, 1989). Adolescent Idiopathic Scoliosis (AIS) is the most common of scoliosis and it includes more than 70% (Anthony, 2002). This change includes a three dimensional change of the spine with lateral curvature and vertebral rotation (Frymoyer, 2004). The prevalence of Scoliosis depends on the size of curvature so that the much more curvature makes its prevalence lower. There is a definite relationship between the prevalence of Idiopathic scoliosis and type. In the lowest degrees, the prevalence rate is equal in two types but how the degree of curvature becomes high, this prevalence gets high in girls (Anthony, 2002; Karol et al., 1993). The cases higher than 40, causes the related incidence in girls 10 times higher than boys (Frymoyer, 2004; Terry, 2003; Anthony, 2002). The progression rate of deformation is higher in females (Anthony, 2002). Idiopathic scoliosis is seen in 2-3 % of children under sixteen years old (Terry, 2003). Increasing the size of curvature leads to the low prevalence so that the above 40 degree angler is seen in one-tenth percent of under sixteen years old (Weinstein, 1989). One of the most considerable complications of scoliosis can be Cardiac- respiratory dysfunction. This malfunction is due to the mechanism of chest following functional inability, Cardiac – respiratory disorders and finally early death would take place (Person et al., 1991; Jackson et al., 1989). Scoliosis causes to decrease the vital capacity in the thoracic lobe and impaired exercise capacity. Given the known cases, the effect of scoliosis is easily found on individual performance. Obviously, to increase physical performance of Cardiac– respiratory, the correction of scoliosis is exercise and scoliosis corrective movements have been shown as followings: Romano (2008) showed that among several proposed programs such as massage, manual exercise and so on, people who actively participated in the exercise group showed a reduction in the size of kab angle indicating the rate of scoliosis recovery after active exercises. Negrini (2008) in a review study stated that exercising can be effective in the prevention and

progression of Scoliosis. Corrective exercises with the aim of relieving pain is recommended for the prevention of deformation, creation of beautiful appearance, improved respiratory, increased chest expansion improved mobility and increase range of spine lateral motion and reduction of mechanical stress on the spine. Barrios et al (2006) have carried out the comparison between normal subjects and Idiopathic Scoliosis in terms of respiratory functional limitations and maximal oxygen uptake; he concluded that , the limitations of respiratory function and maximal oxygen uptake test in idiopathic Scoliosis patients is higher in compare to healthy individuals. Although the emphasis of emergency correction is based on radiographically cliche or using non – aggressive methods such as chess sheet, the effects of deformation on the respiratory and Cardiovascular physiology and also the effects of flexibility deformation on the respiratory physiology has been emphasized ; The researcher will attempt to demonstrate that how these corrective exercises will be effective on improving the circulatory and respiratory systems. Accordingly and due to the high statistical anomaly scoliosis in girls, this study aims to answer this question whether the corrective exercises can effect on the posture of spinal cord and some physical fitness or not?

2. Methods

The study population is consisted of all female students ranging 12 – 15 year old of – middle school who had referred to the institute of corrective movements in Tehran education department , District 4 ; The total number of these students was 643 one ; After the diagnosis of these student by the help of the institution of – Corrective motions, it is specified 257 ones with scoliosis trauma which 84 ones were structural and 173 had situational scoliosis ; finally , Among these people with Scoliosis , 40 ones were Voluntarily taken up in two groups: 20 ones as an experimental and the rest as control group were considered.

2.3. The method of performing test

In order to Collect data, all the Subject were invited to the test location at 8:00 morning after filling the health questionnaire from and being confident of any cardiovascular disease ; the Subjects get familiar with the method of performing tests after measuring the relaxed heartbeat, age height and weight and finally they were asked to fulfill pre-test step; then, these subjects were randomly divided into two experimental and control groups participating four weeks, four sessions a week for 1.5 hr in the corrective exercise program ; After finishing the program, they were again invited and participated in the test at 8:00 morning. The t-test was used for the Comparison of data before and after corrective movements. In order to Compare two experimental and Control groups , the independent t- test was also applied ; To analyze `the descriptive data, k-z (square) test was used. The significant level of the test with 95%, $x<0.05$ and $p<0.05$ was considered.

3. Results

Table 1. The mean and standard deviation of the general profile of participants

Variable	Experimental		Control group		Sig
	mean	Criteria deviation	Mean	Std. dev	
Age	13.2	1.0	13.3	0.9	0.7
Weight	45.7	10.0	46.1	8.6	0.8
Height	157.6	6.2	157.4	6.1	0.9

The results of descriptive Statistics showed that the participants in these three characteristics in terms of- age weight in and height are homogeneous and no differences were found (P> 0.05).

Table 2. The results of paired variable t-test Of spinal flexibility and the power of back Muscles in experimental group

Variable	Pretest	Post test	Df	T	Sig
	Std. dev	Std. dev			
Spinal cord flexibility	24.4± 7.3	25.6 ±6.9	19	5.533	0.000
Power of back opening muscles	25.8±9.4	30.2±8.0	19	-5.03	0.000

The results of Table 3 show no any significant differences between two control and experimental groups in the mean variable of flexibility and back opening muscles (P > 0.05).

Table 3. The results of Independent t- test flexibility variable of spinal cords and power in both groups of Control and experimental

Variable	Control group	Experimental group	F	Sig	T	df	Sig
	Std. dev	Std. dev					
Flexibility of spine	24.7±6.0	25.6±6.0	0.057	0.8	0.450	38	0.6
Power of back opening muscles	29.0±8.0	29.0±8.0	0.002	0.9	0.452	38	0.6

The even t-test showed that the mean difference of – lateral bending movement range towards right before and after Corrective motions right before and after corrective motions is not statistically significant (P > 0.05); however, the mean difference of lateral bending moment range towards left before and after Corrective motions is statistically significant (P< 0.05).

Table 4. The results of the even t-test of lateral bending range in the experimental group

Variable	Pre –test	Post-test	Degree of freedom	T	Significance
	Stv. dev	Stv. dev			
Right bending range	19.2±3.9	20.3±5.5	19	-1.184	0.2
Left bending range	18.6±3.2	20.4±2.9	19	-5.377	0.000

T-test showing the significant difference between two control and experimental groups in terms of bending towards sides (P>05).

Table 5. The results of independent t-test of lateral bending movement range variable in both control and experimental groups

Variable	Control group	Experimental group	F	Variance Sig	T	df	Sig level
Right bending range	18.8±4.8	20.3±5.5	0.019	0.8	0.765	38	0.4
Left bending range	18.3±5.0	20.4±2.9	6.158	0.01	1.548	38	0.1

The result of descriptive statistics showed that before doing corrective exercises, each 20 ones (%100) participants in each group of corrective actions had non- equal shoulder surfaces. After corrective motions done, 12 ones (%60) had equal shoulder surface but 8 ones (40%) were non- equal in this regard. Fulfilling Chi-2 or k_2 square test showed that the difference between two control and experimental group was not significant in the variable of shoulders equalization.

Table 6. The results of k_2 variable of non – equalization of shoulders of non-equalization of shoulders

Group	equalization distribution	Shoulders distribution	Absolute distribution	Percentage of distribution	Total
experimental	12	60	8	40	20
Control	3	15	17	85	20

Variable	k_2	Df	Sig
Equalization of- shoulders	2.5	1	0.1

The results of- descriptive statics indicated that before doing corrective exercises , each 20 ones (%100) participants in each group of corrective movements had top posterior rib without any equalization Surfaces. After Corrective actions, 10 ones (50%) had also top posterior rib equally but 10 ones (%50) had unequal surfaces in the related areas of the Shoulders. Completing Chi_2 or K_2 square test showed that the difference between control and experimental group in the variable of equalization in top posterior hip rib was significant (P>0.05).

Table 7. The results of k_2 variable of Equalization in top posterior hip rib of non-equalization of shoulders

Group	equalization distribution	Shoulders distribution	Absolute distribution	Percentage of distribution	Total
experimental	10	50	10	50	20
Control	2	10	18	90	20

Variable	k_2	Df	Sig
Equalization of- top posterior hip rib	6.4	1	0.1

4. Discussion

Romano (2008) among the various programs including massage, hand exercises and active sports etc. concluded that people who actively participated in active sports , their body situation reduced in the Size of kb angle but they are getting towards recovery in this regard. The results of the research is matched to ours; the corrective movements lead to recovery of body situation in the subjects participated in experimental group; one most common reasons may be the type of exercise Carrying out on the spine and bringing all shocking angles in an effective line which made influential results such as the positive effect on equalization surface of top posterior hip in the subjects participated in the experimental group. Negrini (2008) in his study concluded that exercise can prevent the progression of – idiopathic scoliosis disorder. Our results also represent the same results. The corrective movements have positive impact on the equalization surface of top posterior hip in the subject participated in the experiment group. Negrini (2008) in his study concluded that exercise can prevent the progression of idiopathic scoliosis disorder. Our results also represent the same results. The corrective movements have positive impact on the equalization surface of top posterior hip so that about 50% of people with this disorder were complete recovered and 50 % were left with the lack synergy. The reason of- this correction probably was in relation to the type of exercises Carrying out on the spine; also. The comparison of the result in terms of- top posterior surface equalization is followed by the corrective movements in both control and experimental groups indicating significant results and the recovery is governed in the experimental group. In control group, due to the lack of give corrective movement, it is not expected any synergy in the two –sided top posterior hip ; thus it can be said that the corrective movements have been effective in two sides of- spine muscles due to the increase of power recovering the balance in equalization of- two – sided top posterior hip. The results of the research on scoliotic patients showed that these corrective movements has a positive impact on the equalization of the shoulders surface and after their corrective movements, 60% of the patients were recovered of

the shoulder's synergy; but the result of the research was not significant in relation to the control and experimental groups followed by corrective movements relating to the duration of- these corrective movements. Lateral bending in the subjects of the research was non- sinergical and doing corrective movements did not show any significant results in the experimental group after and before corrective movements ; the reason can be related to the duration and type of corrective actions. According to this view that corrective actions in terms of lateral specialty on the arches could lead to negative effects, thus they were rejected but they are representing an increase in this regard. Lateral bending was not significant in control and experimental groups after corrective actions. The reason can be related to the duration and rejection of special corrective movements in rejection to lateral bending and stretching, leading to insignificance of the results, however, the experimental group was in positive direction. Katsoshi et al (2005) studied the bilateral flexibility in scoliotic patients and concluded that 58.9% of scoliotic patients have bilateral flexibility reduction in this regard. Our results is consistent with this research , because patients showed reduction be for lateral bending test and they were recovered by the corrective movements and stretching actions on shortened tissues and also the mobilitu of the spine bilaterally. In our research in the experimental group the same reduction of flexibility was observed which the3 right side 19.2 ± 3.9 and the left was 18.6 ± 3.2. The flexibility of surrounding tissues in the joint is delivering to Stretch and then relaxation. The flexibility is being changed due to some factors such as deformation and placement of the joint in a fixed status. The soft tissues may be changed in two forms influencing on the flexibility, The first one is the lowest shortening and amendable following the lowest movement limitation and the second is related to intense or severe shortening as a fixed type of shortening and it is not amendable as usual methods and surgical method is needed. The rate of muscular shortening in the scoliotic patients of our research is amendable type because the scoliosis is situation mood in this regard the completion of a periodical corrective actions leads to the recovery of- flexibility in the experimental individuals indicating the muscular reaction to the regular exercises recovering their flexibility ; in the other hand, because scoliotic patients, type situational (functional) were considered; this, the muscular Shortening is not fixed type and it seems that they respond better to corrective movements. Also, these corrective movements lead to the recovery of mobility in the spine influencing on the flexibility (Harlson and Andreas, 1991). The comparison of flexibility in experimental group with control group was not significant. All these results represented the increase of flexibility in the experimental group. Little and Adam (2009) reviewed the characteristics of soft tissue on the spinal flexibility in scoliotic patients; he concluded that about 40% spinal flexibility of scoliotic people was increased. Our results are consistent with this research. In our research, the increase of spinal flexibility in the experimental group was seen after corrective movements. One periodical corrective actions in scoliotic patients, Situational type, was significant in the remedy of back opening muscles power; According to this view that extension (rightening) of the spinal Cords is one of the most vital corrective movements in the related patients, therefore, doing Corrective actions leads to the recovery of muscles power and strength, in which it can be effective in the remedy of deformation (Atmen et al., 2005).

The results of corrective movements on the back muscles in the experimental group was not significant in Compare to control group; the reason, can be related to the duration of Corrective movements as unlimited; If the duration gets longer the result will be significant, too. All these comparisons indicate the power of back muscles after corrective movements in the experimental group than control group. Pingat et al. (2007) concluded that the power of the leg and body muscles is reduced in scoliotic patients and even this may due to the scoliosis effects. Our results is Consistent with this research; because the power of the muscles gets reduced before Corrective movements but following these Corrective actions Cause to changes in the power of back muscles influencing directly on the chest expansion and leaving flexibility there. Atmen et al. (2005) studied the effect of Corrective movements on idiopathic scoliosis treatment and concluded that these corrective movements are effective in the remedy of – Scoliosis. Our results are consistent with this study. The selected individuals were Scoliosis type idiopathic and doing corrective movements led to increase in the power of back muscles. Bayar et al (2004). Studied the effect of short- term Corrective movement on scoliotic patients with artez including stretching and strength exercises ; they conclude that these corrective movements lead to decrease the negative effects of artez on respiration system. In our research, patients never used artez all these research results on the chest expansion representing the positive results of corrective movements on the respiratory system. Also, our research results showed that doing powerful exercises in the experimental group increased the power of back muscles. Mcintive et al. (2008) indicated that

doing circular power exercises has been effective in the reduction of spinal lateral deviation and spinal fixation in scoloiosis 20-40◦ after eight months. Therefore, these circular exercises of spinal cords are recommended for correcting scoliosis. Our result is consistent with this study.

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