Research Paper: Effect of Corrective Exercise vs Corrective Games on Upper Crossed Syndrome in Female Students

Abdolrasoul Daneshjoo[1*], Seyed Kazem Mousavi Sadati[1], Fahimeh Pourahmad[1]

1. Department of Sport Science and Physical Education, East Tehran Branch, Islamic Azad University, Tehran, Iran.

Use your device to scan and read the article online

Citation Daneshjoo A, Mousavi Sadati SK, Pourahmad F. Effect of Corrective Exercise vs Corrective Games on Upper Crossed Syndrome in Female Students. Physical Treatments. 2021; 11(1):13-24. http://dx.doi.org/10.32598/ptj.11.1.412.3

doi: http://dx.doi.org/10.32598/ptj.11.1.412.3

CC BY NC

Article info:
Received: 19 May 2020
Accepted: 17 Nov 2020
Available Online: 01 Jan 2021

Keywords:
Therapy exercise, Experimental games, Upper limb deformities, Students

ABSTRACT

Purpose: This study aimed to compare the effect of corrective exercise and corrective games on upper crossed syndrome in female students.

Methods: This was a quasi-experimental study performed with the pre-test and post-test method. The study sample consisted of 60 people who were selected purposely, based on inclusion and exclusion criteria and the rate of the disorder. In the study sample, the Mean±SD of age, height, and weight were 14.16±1.08 years, 133.49±5.59 cm, and 44.73±8.24 kg, respectively. The study samples were randomly assigned into three groups: corrective exercises group (n=20), corrective games group (n=20), and control group (n=20). Students with upper extremity syndrome were first identified through checkered screening and the New York test. Then, the subjects of both intervention groups performed the selected training programs for eight weeks, based on the defined protocols. Finally, the one-way ANOVA, paired t-test, and Bonferroni post hoc test were used to compare the between-group differences. Also, the significance level was considered as P<0.05.

Results: After eight weeks of exercise, the intra-group changes in head forward, kyphosis, and shoulder angle were significant in the corrective exercises group (P=0.001) and the corrective games group (P=0.001). Also, the three study groups significantly differed in frontal angle, kyphosis, and shoulder angle (P=0.001).

Conclusion: According to the findings, the corrective exercises and corrective games can effectively reduce the angle of head forward, kyphosis, and shoulder in affected persons. Therefore, researchers and specialists should plan these programs. Moreover, it is recommended to use the corrective exercises used in this study with the mentioned principles and have direct and accurate supervision of their implementation to ensure the correctness of the movements.

* **Corresponding Author:**
Abdolrasoul Daneshjoo, PhD.
Address: *Department of Sport Science and Physical Education, East Tehran Branch, Islamic Azad University, Tehran, Iran.*
Phone: *+98 (21) 33585905*
E-mail: *mail:phdanesh@yahoo.com*

Highlights

- Eight weeks of corrective exercise and corrective games also can improve head forward, kyphosis and shoulder angle.

Plain Language Summary

The spine is the support of the upper body part and plays a fundamental role in performing the functions of the body. Excessive pressure or inactivity in this part of the body not only endangers the internal organs of the body but also unbalances the skeletal and muscular structure of the upper body and negatively affects the process of human movements and activities. Nowadays, advanced societies use games to correct children's postural abnormalities. In this regard, several cross-sectional and local studies have been conducted so far. These studies have shown the positive effects of the game on the correction of abnormalities. However, it seems that no research has specifically compared the effect of the two methods of corrective exercises and corrective games on the rate of upper extremity syndrome abnormality in female students. The contradictory results of some studies and the lack of research in this field arise the fundamental question that which method (corrective exercises or corrective games) is more effective on the rate of upper extremity syndrome abnormality in female students? Therefore, this study aimed to compare the effect of the two methods of corrective exercises and games on the rate of upper extremity syndrome abnormality in female students.

1. Introduction

The spine is the support of the upper body and plays a fundamental role in performing the functions of the body. Excessive pressure or inactivity in this part of the body not only endangers the internal organs of the body but also unbalances the skeletal and muscular structure of the upper body and negatively affects the process of human movements and activities [1]. The causes of these problems are not fully identified. However, the main postural abnormalities of students are caused by factors, such as inadequate tables and benches, inappropriate habits, muscle weakness, sedentary lifestyle, obesity, machine life, inactivity, and not playing games in leisure time [2]. Thus, it seems necessary to use effective and age-appropriate methods to eliminate abnormalities and find the importance of methods for prevention and treatment that have a positive effect on human stature [2].

Upper crossed syndrome is a disorder that mainly occurs in the neck and shoulder girdle and tonically shortens the posterior, upper, and anterior neck muscles. Besides, the disorder phasically restrains and weakens the anterior muscles of the spine, neck, and lower back muscles of the shoulder girdle [3]. This syndrome extensively changes the upper quarter of the body. Researchers have often associated this complication with head forward, shoulder forward, scapula protraction, and increased chest kyphosis [4]. In this regard, Janda pointed to the interrelationship between the musculoskeletal and nervous systems: the occurrence of any defects and disorders in the joints and muscles of the body can also affect the quality and function of other joints and muscles. In other words, the occurrence of the disorder in one position and the subsequent changes in the joints and muscles of that area transmit to the other parts of the body through a chain reaction and affect different joints and muscles [5]. In this regard, Janda states that the presence of an abnormality of the head forward changes the resting position of the lower jaw, thus, breathing becomes difficult owing to the increase in the activity of the respiratory auxiliary muscles. In such a situation, oral respiration is altered by the displacement of the resting position of the tongue, also, the temporomandibular joint may be impaired, leading to chronic neck pain [6]. Also, since the scapula communicates with the spine through both the muscles and the ribs, any change in the position of the spine to a change in the position of the scapula will disrupt the scapulohumeral rhythm. It impedes the normal functioning of the shoulder joint and ultimately leads to the instability of the glenohumeral joint. Therefore, these abnormalities in the form of a situational chain reaction are closely related to each other and the individual correction of each of them alone and locally has no proper scientific justification.

These abnormalities are treated and corrected through various methods, such as exercise therapy, manual therapies, postural reeducation, and the positional retraining of tapes and orthoses [3]. Exercise therapy or the use of corrective movements is one of the common methods in correcting forward head and shoulder disorders and kyphosis and is investigated by numerous studies in this field [3, 5]. Generally, research in this field indicates that

the use of corrective movements significantly reduces the angle of forward head and shoulder abnormalities and kyphosis, however, there are contradictory results in the meantime. So that, Seidi et al. showed that despite a significant reduction in the subjects' kyphosis angle, the outcome of the corrective exercises for six weeks was insignificant [4]. Besides, the corrective methods used to correct physical abnormalities seem to be limited or not suitable for individuals, especially children and adolescents [7]. Also, the correctional exercise programs are usually monotonous and tedious, and people (especially children and adolescents) do not want to do them even if they are aware of their physical abnormalities [8].

Nowadays, advanced societies use games to correct children's postural abnormalities. In this regard, several cross-sectional and local studies have been conducted so far. These studies have shown the positive effects of the game on the correction of the abnormalities [9]. However, it seems that no research has specifically compared the effect of the two methods of corrective exercises and corrective games on the rate of upper extremity syndrome abnormality in female students. The contradictory results of some studies and the lack of research in this field arise the fundamental question that which method (corrective exercises or corrective games) is more effective on the rate of upper extremity syndrome abnormality in female students? Therefore, this study aimed to compare the effect of the two methods of corrective exercises and games on the rate of upper extremity syndrome abnormality in female students.

2. Materials and Methods

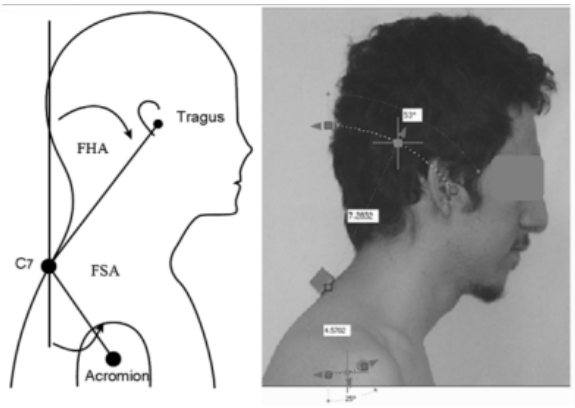
The present study was performed on human samples where all research conditions are not controllable. Thus, the method of the study is semi-experimental and applied in terms of results, also, it was conducted using a pre-test-post-test design. Before conducting the research, it received the code of ethics with the registration number of IR.IAUETB.08107. The statistical population of this study was all female students with an age range of 13 to 15 years in Sama school (district 5 of Tehran), in the academic year of 2018-2019. The statistical sample of 60 people was determined by available sampling using G×Power software and selected purposefully based on inclusion and exclusion criteria and the incidence of this disorder (upper crossed syndrome). Then, the samples were divided into three groups of corrective exercises (n=20), corrective games (n=20), and the control (n=20). Students with upper extremity syndrome were first identified through checkered screening and the New York test. Then, their physical health was measured by the questionnaires of sports injuries and sports history, also, the demographic information was gathered by valid instruments [3]. The subjects did not simultaneously participate in any other correctional program and were in the age range of 13 to 15 years. Also, they were excluded from the investigation, in case of any damage or unwillingness to continue working.

After measuring the subjects' demographic indicators, head angle, shoulder forward, and kyphosis, we identified all the students who simultaneously had a head forward of greater than 46 degrees, a kyphosis of greater than 42 degrees, and a shoulder forward of greater than 52 degrees [3]. Then, they were divided into three groups of 20 people (correction exercises, correction games, and control), based on the amount of head forward, shoulder forward, and kyphosis angles, 24 hours before the start of the training protocols (evaluation method by checkerboard). At the pre-test, we performed the measurement methods of the kyphosis, head forward, and shoulder forward angles; the obtained data were recorded. Then, the participants of both intervention groups performed the selected training programs for eight weeks, based on the defined protocols (correction game training protocol, correction training protocol) [3]. After eight weeks of retraining, the post-test was taken from all the participants.

Descriptive and inferential statistics were used to statistically analyze the obtained data. Besides, descriptive statistics were used to calculate central indicators, the dispersion of quantitative scales, charts, and tables. After checking the normality of the data with the Shapiro-Wilk test, statistical tests, such as one-way ANOVA and dependent t-test were used to evaluate the hypotheses. All analyses were performed using SPSS V. 21 at a significance level of 0.05.

Evaluation Method by Checkerboard

The checkerboard is a 2m × 1m metal or wooden frame meshed by 5 cm apart ropes in 5cm × 5cm dimensions. This is a good tool for assessing body abnormalities but includes some drawbacks. Using the checkerboard, deformation is determined as the distance the head and neck vertebrae are placed in front of the center of gravity or the vertical line. Also, the vertical line or the starting line of the checkered plane from the side view is considered to determine the kyphosis. When the vertical line passes through the index points divides the chest into two equal parts of the anterior and posterior, by crossing the midline of the armpit. If the percentage of the chest area behind the vertical line is higher than the front area, the person has around back. For example, a ratio of 70%



PHYSICAL TREATMENTS

Figure 1. Measuring the angle of the head and shoulder forward

in the back and 30% in the front, or 80% in the back and 20% in the front. To measure with a checkerboard, we first placed it in a fixed place. Then, a + sign was marked about 45cm behind the plate, the length of which should be perpendicular to the center of gravity of the plate. This sign indicated the location of the line of gravity of the examination. The distance between the inner ankles of the test legs and the + sign was considered to be four centimeters. The location of the examiner was about 3m to 4m away from the checkerboard; the examiner's location should be exactly in line with (perpendicular to) the center of gravity of the screen and the subject. While facing the screen, the examiner asked subjects to adjust their bodies in all three positions by gravity with the examiner's command. At this time, observations were made from different views (frontal, sagittal, and vertical), also, the measurements were reviewed and recorded to select individuals with head forward abnormalities and kyphosis to identify individuals with upper crossed syndrome (Figure 1) [8].

Measuring the kyphosis angle

Initially, the subjects were asked to stand in a normal position and bend their head down. In this position, two protrusions were identified at the lower end of the neck area, two index and thumb fingers were placed on the protrusions, and the subject's head was returned to its original position. It is then identified using a fourth vertebra count. Besides, the Youdas method was used to find the thorny appendage of the twelfth vertebra [7]. So that, the examiner stood up behind the subject, simultaneously touched the lower edge of the twelfth gear in both sides of the body using the thumbs, pointed them upwards and inside, and continued until they disappeared beneath the soft tissue. At this point, the paths of the two fingers were horizontally connected to reach the spiny appendages of the vertebrae. This is the site of the thorny appendage of the twelfth vertebra. These two points were then marked using a dark color, which could be easily removed from the skin (to reassure, the seventh vertebral appendage of the neck was counted again to the twelfth dorsal vertebra). Next, the person stood in the position indicated for him; a normal position with the legs shoulder-width apart, facing forward, and without movement. The flexible ruler was placed on the spine at the specified distance. Then, without making any changes on the paper, it was slowly transferred from the ductility, and with the arc shape pencil it was transferred from the edge of the ruler, which was in contact with the skin on the AS paper, and each measurement was repeated three times. The origin point of the drawn arc was connected with a straight line to its endpoint and was connected as "el" and from the deepest point in the distance from the origin point to the endpoint as a width from the shape of the arc to the longitudinal line and considered as "h". Finally, the amount of kyphosis angle was determined using the trigonometric formula [10]: $\theta = 4 \arctan(2h/l)$.

Measuring the angle of the head forward and shoulder forward

In the present study, the angles of the head and shoulders were measured using the lateral view imaging method. Moreover, we identified three anatomical signs of ear tragus, acromion protrusion, and the spinous process of the seventh cervical vertebra to measure the angle of the head and shoulder forward. The subject stood profile to the examiner at a distance of 23 cm from the wall and was photographed from the side with a digital camera at a distance of 265 cm. Then, the photo was transferred to the computer, and using the AutoCAD software, the angle of the line connecting the tragus and the seventh cervical vertebra with the vertical line (head forward angle) and the angle between the line connecting the seventh cervical vertebra and the acromion appendage using the vertical line (shoulder forward angle) was calculated. This method has a good reliability and has been used in several studies with a reproducibility of Intraclass Correlation Coefficient (ICC)= 0.92 [10].

Training protocol of corrective game

Table 1 shows the corrective game protocol. Since these games are designed for kyphosis anomaly, the students were asked to keep their necks in the right position (keep head and chest in a straight line) to cover the head forward abnormality correction while playing the game. Based on the principles of practice, to make the game more difficult, we considered the following conditions:

Table 1. Corrective game protocol

Training Week (Duration)	Game Title
First (45 min)	Wooden house Traying to get up Airplane
Second and third (45 min)	Pull-pull Broken knee Traying to get up Airplane
Fourth (45 min)	Carrying a tennis ball Judging a blackboard Pull-pull Broken knee
Fifth and sixth (45 min)	Station Crab walk Carrying a tennis ball Judging a blackboard Pull-pull Broken knee
Seventh (45 min)	Cat and mouse Station Crab walk Carrying a tennis ball Judging a blackboard Pull-pull
Eighth (45 min)	Wooden house Traying to get up Airplane Cat and mouse station Crab walk Carrying a tennis ball Judging a blackboard Pull-pull

PHYSICAL TREATMENTS

playing with more players, reducing the duration or considering a fixed period for music, using heavier balls, increasing the duration of the game, increasing distances, and using larger balls [11].

Training protocol of corrective exercise

The first exercise was the scapular retraction with a bandage. It was performed in such a way that the subject in the first week performed the scapular retraction movement for the first session in five turns with four repetitions. Table 2 represents the other exercises with the number of turns and repetitions. The second exercise was the Chin Vine that was performed with a stick to stretch the chest muscles and bring the scapula closer to the chin vine. Furthermore, the third exercise was performed to stabilize the neck and chest muscles, the fourth exercise to mobilize the spine. The fifth exercise was stretching the chest muscles and the resistance movement of the neck on a training foam roll. The sixth exercise was strengthening the back muscles with a rubber band and creasing. Table 2 shows the progress of the exercises. The exercises were performed three sessions per week, also, the time of each exercise was adopted, based on the time that the subject was able to do it [12, 13].

3. Results

The Shapiro-Wilk test was used to check the default normality of the data; Table 3 reports the results of this test. None of the data was equal to or less than the confidence level of 0.05, which indicates their normal distribution in the three groups. Table 4 shows the descriptive data related to the mean weight, Body Mass Index (BMI), height, and age of the subjects in the three groups. In the post-test, the one-way ANOVA showed no significant difference between weight, BMI, height, and age of the subjects.

A correlated t-test was used to investigate the differences between the research variables in the pre-test and post-test; Table 5 presents the results. The result of one-way ANOVA in post-test showed no significant difference between the groups in head forward (P=0.324, F=1.149, Df=2), kyphosis (P=0.464, F=0.778, Df=2), and shoulder forward (P=0.446, F=0.787, Df=2). Also, considering the results of Table 5, the one-way ANOVA showed

Table 2. Correction Exercise Protocol

Week	Training Session	Turns × Repetitions					
		Exercise 1	Exercise 2	Exercise 3	Exercise 4	Exercise 5	Exercise 6
First	First	5×4	5×4	5×5			
	Second	5×4	5×4	5×5			
	Third	5×4	5×4	5×5			
Second	First	6×5	6×5	6×6	5×4		
	Second	6×5	6×5	6×6	5×4		
	Third	6×5	6×5	6×6	5×4		
Third	First	7×6	7×6	7×7	5×4	4×3	4×3
	Second	7×6	7×6	7×7	5×4	4×3	4×3
	Third	7×6	7×6	7×7	5×4	4×3	4×3
Fourth	First	8×7	8×7	8×8	6×5	5×4	5×4
	Second	8×7	8×7	8×8	6×5	5×4	5×4
	Third	8×7	8×7	8×8	6×5	5×4	5×4
Fifth	First	9×8	9×8	9×9	6×5	6×5	6×5
	Second	9×8	9×8	9×9	6×5	6×5	6×5
	Third	9×8	9×8	9×9	6×5	6×5	6×5
Sixth	First	10×9	10×9	10×10	7×6	7×6	7×6
	Second	10×9	10×9	10×10	7×6	7×6	7×6
	Third	10×9	10×9	10×10	7×6	7×6	7×6
Seventh	First	11×10	11×10	11×11	8×7	8×7	8×7
	Second	11×10	11×10	11×11	8×7	8×7	8×7
	Third	11×10	11×10	11×11	8×7	8×7	8×7
Eighth	First	12×11	12×11	12×12	9×8	9×8	9×8
	Second	12×11	12×11	12×12	9×8	9×8	9×8
	Third	12×11	12×11	12×12	9×8	9×8	9×8

PHYSICAL TREATMENTS

a significant difference between the mean head forward angle, kyphosis angle, and shoulder forward angle of the subjects in the three research groups, in the post-test. Then, the Bonferroni test was used to compare the pairs of groups in the post-test of head forward angle, kyphosis, and shoulder forward; Table 6 shows the results.

According to Table 6, the results of the paired t-test showed a significant difference between the mean head forward angle, kyphosis angle, and shoulder forward angle of the subjects in the three groups, in the post-test. Also, the comparison of pairs in the post hoc test showed a significant difference between the mean head forward angle, kyphosis angle, and the shoulder forward angle in the groups of corrective exercises and corrective games, compared with the control group.

Table 3. Normality of data distribution analyzed by Shapiro-Wilk test in study groups

Variables	Groups	P
Head forward	Corrective exercises	0.902
	Corrective games	0.460
	Control	0.857
Kyphosis	Corrective exercises	0.465
	Corrective games	0.466
	Control	0.534
Shoulder forward	Corrective exercises	0.766
	Corrective games	0.466
	Control	0.234

PHYSICAL TREATMENTS

Table 4. Demographic indicators of the research samples by groups

Variable	Groups	Mean±SD	
		Pre-test	Post-test
Weight (kg)	Corrective exercises	53.40±2.89	53.750±3.14
	Corrective games	53.20±4.04	51.750±4.68
	Control	52.40±4.59	52.850±1.84
Height (cm)	Corrective exercises	153.05±3.41	-
	Corrective games	152.90±3.38	-
	Control	152.70±4.04	-
Age (years)	Corrective exercises	13.65±0.74	-
	Corrective games	13.76±0.95	-
	Control	14.15±0.87	-
BMI (kg/m^2)	Corrective exercises	22.81±1.30	22.96±1.54
	Corrective games	22.75±1.55	22.19±2.45
	Control	22.54±2.60	22.71±1.52

PHYSICAL TREATMENTS

4. Discussion

The head and shoulder forward angles and the thoracic kyphosis angle of the experimental groups significantly reduced after participating in the correction program and correction games. Thus, it can be concluded that the corrective exercises program used in the present study had a favorable effect. This finding is in line with the results of studies, such as Harman et al. [6] and Lynch et al. [14]. Moreover, the findings of the present study are in line with the results of a 2010 study by Lynch et al. which doubts the optimal effectiveness of corrective exercises in reducing head and shoulder forward angles in patients. Therefore, designing and executing a precise and purposeful program of corrective movements, including stretching, resistance, and mobilization exercises for the neck, shoulder girdle, and arm joint, which is performed regularly and under the direct supervision of the exam-

Table 5. Comparing the means values of the pre-test and post-test in three groups, using the dependent t-test

Variables	Group	Means Difference	t	Degrees of Freedom	P
Head forward	Corrective exercises	11.10	22.342	19	0.001
	Corrective games	10.25	11.427	19	0.001
	Control	1.75	0.580	19	0.406
Angle of kyphosis	Corrective exercises	9.60	16.877	19	0.001
	Corrective games	8.05	4.276	19	0.001
	Control	0.10	0.191	19	0.850
Shoulder forward	Corrective exercises	10.10	16.652	19	0.001
	Corrective games	10.45	17.158	19	0.001
	Control	1.00	2.517	19	0.210

PHYSICAL TREATMENTS

iner, can effectively reduce the angles of the head and shoulder forward of the affected person [15]. Such features can be seen in the corrective exercises program of the present study. The program was designed so that as much as possible in all exercises. On the one hand, the muscles of the upper extensor and lower flexors of the neck, as well as the pectoral and internal muscles of the arm rotators were stretched at the same time. Besides, the exercises increased the tensile stress on the muscles, reduced the lower extensor and deep-upper flexors of the neck as well as the scapula adductor muscles and the external arm rotators, and enhanced the ability to maintain proper posture.

Mirzaei et al. showed that the use of exercises significantly improved spinal postural abnormalities in students [10]. Shoulder forward angles may lead to shoulder extension, the shortness and stiffness of the anterior shoulder girdle muscles, and the weakness and elongation of the posterior muscles. Also, it seems to cause the shoulder position forward, anterior scapular deviation, and the incomplete rotation of the scapula upwards during the shoulder lift as well as pain in the shoulder area. Therefore, doing exercises supports the spine because of strengthening the muscles, also, leads to the improved static and dynamic balance of people [7]. In the head forward complication, the center of gravity of the head is moved forward and the flexural torque increases, and in general, the length and amount of muscle activity changes in the head and neck areas. Normally, the interaction between the four main muscles on both the anterior and posterior sides of the head and neck area maintains the desired balance and posture. But in anterior head deformity, the balance between these muscles is disturbed and a lot of stress is applied to them. It seems that the present training protocol (training and corrective games) increased the length of the shortened muscles of the upper neck muscles in the back and strengthened the muscles of the front of the neck. Hence, balancing the upper muscle groups, the protocols led to the correction of the head forward complication. The results showed significant changes in the curvature of kyphosis in the experimental group, after the training program (training and corrective games); the curvature was reduced. However, the changes in the control group were not significant. Findings in the present study are consistent with the results of Seidi et al. [4] and Hajihosseini et al. [3].

The abnormalities of patients can be effectively corrected by designing and executing a precise and purposeful program of corrective movements, including stretching and strength exercises for the areas involved in the deformity, the combination of these exercises, and whole-body mobility exercises. These trainings should be performed regularly and under the direct supervision of the examiner. Seidi et al. [4] examined the effect of local and comprehensive corrective exercise programs on kyphosis angle and concluded that comprehensive exercises had a greater effect on kyphosis curvature than local exercises. Also, Hajihosseini et al. [3] in a study entitled "Comparison of the Effect of Three Strength, Stretching and Combined Training Programs on Upper Cross Syndrome" concluded that combined training had a better effect on kyphosis and crossed syndrome, compared with stretching and strength training separately. The findings of the present study showed the optimal effectiveness of corrective exercises and corrective games in reducing the head forward angle, kyphosis, and for-

Table 6. Comparing the paired t-test results with the Bonferroni post hoc test in post-test

Group	Level	Inferential Statistics Source of Variance	Average of Squares	Degrees of Freedom	Average of Squares	F	P
Head forward	Pre-test	Between-group	59.433	2	29.717	1.149	0.324
		Intergroup	1474.750	57	25.873	-	-
		Total	1534.183	549	-	-	-
	Post-test	Between-group	1630.233	2	815.117	134.769	0.001
		Intergroup	344.750	57	6.048	-	-
		Total	166.733	549	-	-	-
Angle of kyphosis	Pre-test	Between-group	4.433	2	2.217	0.778	0.464
		Intergroup	162.300	57	2.847	-	-
		Total	166.733	549	-	-	-
	Post-test	Between-group	1136.133	2	568.067	20.906	0.001
		Intergroup	1548.750	57	27.173	-	-
		Total	2684.983	59	-	-	-
Shoulder forward	Pre-test	Between-group	0.433	2	0.217	0.778	0.464
		Intergroup	141.300	57	2.479	-	-
		Total	141.300	549	-	-	-
	Post-test	Between-group	1192.300	2	596.150	152.687	0.001
		Intergroup	222.550	57	3.904	-	-
		Total	1414.850	59	-	-	-

PHYSICAL TREATMENTS

ward shoulder of patients. On the other hand, Ahmadinejad and Ahangari [11] used corrective games to correct the abnormality.

The subjects and training protocol of this study differ from the mentioned studies in terms of gender and physical health and the number of games and their duration, respectively. However, they obtained the same results, because of the common mechanism that corrective exercises and games have in correcting abnormalities, indicating that the exercises in this study are following the principles of correction abnormalities (shortened muscle tension and weakened muscles). Besides, muscle mechanisms have been designed and implemented with the same results as the present study [16]. Consistent with the present study, the mentioned studies simultaneously included the comprehensive, stretching, and strengthening exercises, which affected the strength and activity of the muscles [4, 11]. However, in a study that used only extension exercises (although these exercises are used to correct kyphosis), opposite effects emerged on kyphosis correction; these results may be caused by the incorrect execution of exercises [5]. In the present study, the training program of the corrective games group included movements, such as wooden houses, trying to get up, airplanes, and mice and cats, the aim of which was to stretch the shortened muscles. Also, movements, such as carrying a tennis ball, judging a blackboard, pull-pull, broken knee, and trying to get up were used to strengthen the muscles. These movements effectively improved the complication of kyphosis. One of the most effective mechanisms of corrective games is the nature of the game and the group performances that motivate individuals to do the exercises. Also, the duration of the training program was long which made it more effective in the present study.

According to the present results, compared with common corrective exercises, corrective games are a more suitable and easy approach to improve kyphosis. Also, corrective games include motivational aspects due to their fun, thus,

it is suitable to perform these exercises especially in adolescence to eliminate kyphosis. Therefore, it is possible to use corrective games to correct kyphosis in younger ages. One of the limitations of this study is the impossibility of controlling the activity of the subjects outside the research hours and the lack of control over motivation and the psychological pressure of the subjects during the tests and exercises. Other studies should use a proper tool in the treatment of other complications and abnormalities, such as genu valgum and Varuna and Pes cavus in.

5. Conclusion

Corrective exercises and games significantly improve the angles of the head forward and shoulder forward of children. According to the results of the present study, it seems that for elementary students, the use of movements, such as carrying a tennis ball, judging a blackboard, pull-kill, broken knee, and trying to get up to strengthen muscles are effective in improving kyphosis. On the other hand, careful planning must be done in time, because children get tired very quickly. Games as one of the most widely used correctional methods can play a key role in correcting postural abnormalities.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the Ethics Committee of the University of East Tehran Branch, Islamic Azad University, Tehran (Code: IR.IAUETB.08107).

Funding

This research did not receive any grant from funding agencies in the public, commercial, or non-profit sectors.

Authors' contributions

All authors equally contributed to preparing this article.

Conflict of interest

The authors declared no conflict of interest.

References

[1] Rahnama N, Bambaeichi E, Taghian F, Nazarian AB, Abdollahi M. [Effect of 8 weeks regular corrective exercise on spinal columns deformities in girl students (Persian)]. Journal of Isfahan Medical School (I.U.M.S). 2010; 27(101):676-86. http://jims.mui.ac.ir/index.php/jims/article/view/338

[2] Penha PJ, Amado João SM, Casarotto RA, Amino CJ, Penteado DC. Postural assessment of girls between 7 and 10 years of age. Clinics (Sao Paulo). 2005; 60(1):9-16. [DOI:10.1590/S1807-59322005000100004] [PMID]

[3] Hajihosseini E, Norasteh A, Shamsi A, Daneshmandi H. [The comparison of effect of three programs of strengthening, stretching and comprehensive on upper crossed syndrome (Persian)]. Journal of Research in Rehabilitation Science. 2015; 11(1):51-61. http://jrrs.mui.ac.ir/index.php/jrrs/article/view/2149

[4] Seidi F, Rajabi R, Ebrahimi R, Alizadeh MH, Miniinejad H. The efficiency of corrective exercise interventions on thoracic hyper-kyphosis angle. Journal of Back and Musculoskeletal Rehabilitation. 2014; 27(1):7-16. [DOI:10.3233/BMR-130411] [PMID]

[5] Daneshmandi H, Alizadeh MH, Shadman B. [Assessing the effects of a training program on position of scapulae by EMG (Persian)]. Research on Sports Science. 2006; 4(11):107-93. https://www.sid.ir/fa/journal/ViewPaper.aspx?ID=63004

[6] Harman K, Hubley-Kozey CL, Butler H. Effectiveness of an exercise program to improve forward head posture in normal adults: A randomized, controlled 10-week trial. Journal of Manual & Manipulative Therapy. 2005; 13(3):163-76. [DOI:10.1179/106698105790824888]

[7] Shavandi N, Shahrjerdi S, Heidarpor R, Sheikh-Hoseini R. [The effect of 7 weeks corrective exercise on thoracic kyphosis in hyper-kyphotic students (Persian)]. Journal of Shahrekord University of Medical Science. 2011; 13(4):42-50. http://journal.skums.ac.ir/article-1-818-fa.html

[8] Najafi M, Behpoor N. [The effects of a selective corrective program on the scapula and shoulder joint posture in girls with rounded shoulder (Persian)]. Journal of Exercise Science and Medicine. 2013; 4(2):31-47. [DOI:10.22059/JSMED.2013.30058]

[9] Mirzaei A, Sayvand Z, Sokhanguei Y, Rahimi A. The effect of 8-week routine and foam training exercises on some physiological variables in girls with postural kyphosis, International Conference on New Research Findings in Sports Science [Internet]. 2016 [Updated 2016 March 9-10]. Available from: https://www.sid.ir/Fa/Seminar/ViewPaper.aspx?ID=27216

[10] Yousefi M, Ilbeigi S, Mehrshad N, Afzalpour M. [Diagnosis of spinal column abnormalities by image processing of reflective markers set on spinus process (Persian)]. Journal of Exercise Science and Medicine. 2012; 2(4):1-73. https://www.magiran.com/paper/942853.

[11] Ahmadnezhad L, Ebrahimi- Atri A, Khoshraftar-Yazdi N, Sokhangoei Y. [Effect of eight weeks corrective games on kyphosis curve and strengths of trunk muscle in kyphotic mentally retarded children (Persian)]. Archive of Rehabilitation. 2016; 17(2) 178-87. [DOI:10.21859/jrehab-1702178]

[12] Thigpen CA, Padua DA, Michener LA, Guskiewicz K, Giuliani C, Keener JD, et al. Head and shoulder posture affect scapular mechanics and muscle activity in overhead tasks. Journal of Electromyography and Kinesiology. 2010; 20(4):701-9. [DOI:10.1016/j.jelekin.2009.12.003] [PMID]

[13] Hrysomallis C, Goodman C. A review of resistance exercise and posture realignment. The Journal of Strength & Conditioning Research. 2001; 15(3):385-90. [PMID]

[14] Lynch SS, Thigpen CA, Mihalik JP, Prentice WE, Padua D. The effects of an exercise intervention on forward head and rounded shoulder postures in elite swimmers. British Journal of Sports Medicine. 2010; 44(5):376-81. [DOI:10.1136/bjsm.2009.066837] [PMID]

[15] Yazici AG, Momhammadi M. The effect of corrective exercises on the thoracic kyphosis and lumbar lordosis of boy students. Turkish Journal of Sport and Exercise. 2017; 19(2):177-81. [DOI:10.15314/tsed.293311]

[16] Yoo W-g. Effect of thoracic stretching, thoracic extension exercise and exercises for cervical and scapular posture on thoracic kyphosis angle and upper thoracic pain. Journal of Physical Therapy Science. 2013; 25(11):1509-10. [DOI:10.1589/jpts.25.1509] [PMID] [PMCID]