

# The Effects of Strengthening, Stretching and Comprehensive Exercises on Forward Shoulder Posture Correction

Elham Hajhosseini <sup>1\*</sup>, Aliasghar Norasteh <sup>2</sup>, Ali Shamsi <sup>3</sup>, Hassan Daneshmandi <sup>2</sup>

1. Msc Student, Department of Sports Injuries, School of Sport Sciences, University of Guilan, Guilan, Iran.

2. Associate Professor, Department of Sports Injuries, School of Sport Sciences, University of Guilan, Guilan, Iran.

3. Assistant Professor, Department of Sports Injuries, School of Sport Sciences, University of Guilan, Guilan, Iran.

Article info:

Received: 10 Feb. 2014

Accepted: 28 Jun. 2014

## ABSTRACT

**Purpose:** The forward shoulder (FS) is one of the most common deformities accounted for 60% of shoulder abnormalities. This study aimed to investigate the effects of a 6-week strength training, stretch training and comprehensive training in patients with forward shoulder abnormalities.

**Methods:** This quasi-experimental study design Pre-posttest with control group. Forty females students with excessive forward shoulder angle (FS>52) were chosen using purposive sampling method. The average of age, weight, height and body mass index of the samples were 22.22±1.77 years, 61.22±1.90 kg, 161.85±2.55 cm, and 23.37±0.9kg.m<sup>2</sup> respectively. The subjects were randomly divided into 4 groups ( each 10 subjects), 3 experimental and 1 control groups. The first experimental group performed strength training, second group stretch training and third group comprehensive training for 6 weeks. In this period, the control group did not receive any training. We used photogrammetric method to measure the angle of the forward shoulder. Shoulder angle changes of the subjects before and after 6 weeks were measured. Data were analyzed using paired T-test, One-way analysis of variance and SPSS (21) (P≤0.05).

**Results:** According to study findings, paired t-test results in the experimental group showed that the forward shoulder angle of the subjects in corrective exercises significantly decreased so that after participating in 3 types of training program, strengthening (P=0.001, t=8.63), stretching (P=0.001, t=6.78) and comprehensive (P=0.001, t=12.11), the angle dropped in the order of 6.10, 4.90 and 7.10 degrees. One-way analysis of variance (ANOVA) showed that there are significant differences (P=0.001) among the effects of different exercises on the forward shoulder angle. Based on Tukey test results, the implementation of corrective exercises, strengthening (P=0.001), stretching (P=0.001), and comprehensive (P=0.001) showed a significant difference with the control group. However, no significant differences were observed among the groups of strength, stretching and comprehensive trainings with each other.

**Conclusion:** The results demonstrated a significant decrease in the angle of forward shoulder in the experimental group. Therefore, using this program is recommended in subjects with these deformity.

### Keywords:

Forward shoulder,  
Strengthening training,  
Stretching training,  
Comprehensive training

## 1. Introduction

W

ith regard to the natural direction of the body, the position of shoulders toward the back spine has a crucial role in having proper appearance and desired

physical condition [1]. Changes in scapula and shoulder are related to each other. Any change in natural direction of scapula leads to change in local performance and movement chain. When the distance of scapulas becomes far or near to each other various physical positions such as Pigeon chest, forward shoulder posture,

\* Corresponding Author:

Elham Hajhosseini, MSc

Address: Department of Sports Injuries, School of Sport Sciences, University of Guilan, Guilan, Iran.

Phone: +98 (936)0441429

Email: Hosseinielham1988@gmail.com

kyphosis, scoliosis, or scapular winging are reported [2,3]. Some people believe that muscles that support scapula have basic and important role in the position of shoulders to each other. If the mentioned muscles lack required power, many changes will be observed in that region [4,5]. Natural performance of shoulder balances the stability and movement ability of glenohumeral and scapular thoracic joints and to the lesser amount acromioclavicular joints. When the required movement or stability in each joint encounters a difficulty, shoulder performance will be impaired [6,7,8].

Stature abnormalities have undesirable effects on the perception of the body, particularly in young people [9, 10]. Changes in scapula posture and inappropriate position of shoulder and muscular imbalance around the shoulder (for example imbalance of anterior and posterior shoulder muscles) are important factors for shoulder abnormality and chronic pain syndromes. Formation of negative compatibilities and structural deformations in peoples can be proportionate to their skill and movement patterns [11].

Scapula plays various roles in facilitating the shoulder's desired performance, as the anatomy and biomechanics of scapula have interactions with each other to make efficient movement. Dynamic stability in scapular thoracic joint depends on its muscular structure. When the muscles are weak or tired, the scapular thoracic rhythm will be deranged and shoulder performance disorder will occur. These disorders can lead to micro-trauma (little injuries) in shoulder muscles, capsule, and ligament tissue, and eventually inflammation [12]. The forward posture of shoulder is the front deviation in shoulders, which is related to the scapula protraction position and created by muscular imbalance between the shortened small pectoral muscle and stretched middle trapezius muscle. Also, the rounded shoulders have influence on the position of upper trapezius and lower trapezius muscles that will have influence on shoulder rotation negatively [12,13].

Generally, the skeletal malformations are caused by genetic and congenital disorders, diseases and injuries, type of sport, lack of movements, or inappropriate movement patterns, inappropriate habits in sitting down and standing up, body type, appearance condition and age. These malformations have undesirable effects on people's mental, social, physiological, and movement performance [14]. In a research that studied the postural abnormalities of university students in Shiraz, the incidence of round shouldered among the girls was more than the boys, i.e., where 1.1% of boys had excessive

deformation, 7.8% had mean deformation and 91.1% had normal posture, about 2.6% of girls had excessive deformation, 44% mean deformation and 53.4% normal posture [15].

Shoulders, which are rotated inward lead to shoulder protraction and this condition reduces dorsal duct space which put pressures over the neurovascular network. Finally, the person will be prone to the acromial impingement syndrome [16]. This abnormality can be the result of shoulder stretching ahead of anatomical position because of excessive exercise, repetitive movements of hands, strengthening or shortening of anterior muscles of scapula such as serratus anterior muscles, pectoralis minor, pectoralis major, and upper trapezius muscles. Also, it may be due to weakening or elongation of the muscles that pull the shoulder toward the front of the spine such as middle and inferior trapezius, rhomboids, and levator scapula muscles [17].

Continuous contraction for a long period of time, will lead to shortening of the hardened muscle, elongation or weakness of opposite posterior muscles group and muscles damage [18]. Shoulder protraction may injure the median nerve because when the shoulder has gone away or abducted and other joints move, the movement of nerve in the shoulder region will decrease. The movement of scapula abduction or is retraction results in a significant decrease in isometric elevation of scapula [19]. The above mentioned abnormality will be treated and improved through various methods that include hand treatments, postural retraining, using tapes and orthosis, and exercise therapy. Among these, exercise therapy or using the corrective and improving movements is the common method in improving or treating the forward shoulder abnormality.

In the current research the emphasis of strength training was on the weak muscles in this abnormality such as inferior and mean trapezius, serratus anterior, rhomboids muscles, and the emphasis of stretching exercises was on the shortened pectoral and inferior trapezius muscles. In this regard, Lynch et. al studied the effect of an exercise program on the amount of head and forward shoulders angles. This program included stretching and strengthening exercises and results of this research indicate that performing this exercise program had positive effect in reduction the amount of head and forward shoulder angles among the under study peoples [11].

Najafi et al studied the effect of a stretching and strengthening training program on the forward shoulder abnormality and the posture of scapula among the

female students. Analyses of the data indicated that amount of forward shoulder in the experimental group significantly decreased (about 12%) but no significant difference was observed in the control group; also the distance between shoulders significantly decreased (about 9%) and no significant difference was observed in the control group [20].

Daneshmandi et al (2006) studied the effect of training program on the scapula posture and position of forward shoulder among 80 participants. They were classified into 3 groups of abducted shoulder (more than 20 cm), normal shoulder (17-19 cm) and retracted shoulder (less than 17 cm). The Lateral Scapula Slide Test (LSST) is used to determine the strength of the shoulder and stabilizer muscles.

In addition, the Electromyography (EMG) method is used to determine the Maximum Voluntary Contraction (MVC) of levator scapulae and trapezius, (2 main muscles in scapula) before and after the training program. Results indicated that this exercise program led to change in the position of shoulders and reduction of difference in the shoulders distance and improving the forward shoulder in the practical group. Also, EMG of selected muscles indicated significant difference in amount of muscles contraction before and after the exercise and training program [21].

Klumper et. al (2006) showed that performing stretching and strengthening exercises for 6 weeks decreases the forward shoulder posture in professional swimmers [22]. Wang et. al in their study on the influence of stretching exercises for pectoral muscles and strengthening exercises for shoulder adductor and elevator muscles and as well as glenohumeral external rotators among 20 subjects with forward shoulder posture, found the increase in horizontal abduction power and internal and external rotation after exercise, also decrease in anterior deviation and deformation of the spinal column as well as increase in glenohumeral role in elevating the hand, while the stable position of shoulder did not change, However when the hand was abducted to 90 degree, the shoulder showed less upward rotation and less upper movement after the exercise program [23]. According to the research, the results confirmed the influence of stretching, strengthening, mobilizing, and stabilizing in the muscle groups improving the abnormalities.

In this study, the researcher in addition to separately schedule stretching and strengthening exercises, provided a combination of these exercises in his training and presented with different intensity, duration and

repetition to better improve the abnormalities. In the previous studies, researchers programmed their own improvement trainings on the basis of Kendall theory and this led to less than expected effectiveness of these programs. Now there are two questions: what is the influence of performing improvement exercises in the form of stretching, strengthening, and comprehensive exercises on the forward shoulder posture of female university students, and which one is more effective? Therefore, the current study aimed to compare the effects of these exercises on the forward shoulder posture by proposing three types of training programs.

## 2. Materials and Methods

This quasi-experimental study design Pre-posttest with control group. In the initial screening, out of approximately 600 people with postural see the side view, 82 people suspected of having abnormalities state simultaneously forward shoulder, forward head and kyphosis. Regarding the use of intervention variables and subjects on the basis of inclusion and exclusion criteria, the present study was a quasi-experimental one. The participants in this research consisted of non-athlete 20 to 25 years old female university students of Guilan University.

Forty eligible persons were selected purposefully and divided randomly into four groups (10 subjects in each group) of stretching exercises, strengthening exercises, comprehensive exercises and control group. The inclusion criteria were having the abnormality of forward shoulder more than 52 degree, 20-25 years age range, no pain in scapula, back, neck or upper limb and also the participants' consent form to participate in research [12,24].

- Exclusion criteria:
- Any variation and recent injury in shoulder
- Any fracture that is related to shoulder
- Any nerve injuries
- Any type of treatment or surgery in lumbar spine, back, neck or upper limbs

In the present study, the forward shoulder angle was measured by taking photo from the body profile. This method has a suitable repeatability and was used in several studies; in this research the repeatability was (ICC= 0.92). [24]. To use this method, at first 3 anatomic signs of ear tragus, the right side acromion tubercle, and spinous process of C7 vertebra must be determined and

landmarked. Then the subject was asked to stand at determined place beside the wall (with 23 cm distance) in such a manner that her left arm put toward the wall. Then a photography tripod (a digital camera) is placed at 265 cm distance from the wall and its height is adjusted at the level of the examinee's right shoulder.

At that time the subject was asked to bend forward 3 times and raise her hands over her head 3 times and then stand normally and relaxed and watched an imaginary point on the opposite wall (the eyes were in the direction of horizon). Then the examiner takes a photo from the body profile after 5 seconds pause. Finally, the photo was transferred into the computer and using AutoCAD software, the joined line angle of c7 and acromion process with vertical line (the forward shoulder angle) was measured [24], (Figure 1).

The program of special exercises for 6 weeks, 3 sessions per week and each session of 30 to 70 minutes was performed by the samples, under the supervision and control of the examiner. Each training session includes 5-10 minutes warming up, strengthening, and stretching exercises for 20–50 minutes and cooling down for 5-10 minutes. The intensity of the exercises for the subject was set on the basis of previous findings and their tolerability threshold.

In this research, the stretching exercises, were performed to stretch the shortened muscles of anterior part of the body such as minor pectoralis and increase the movement extent of scapula muscles (Figure 2). Each session of training program was performed under the direct supervision and control of examiner to be assured of doing exercises correctly. In addition, all the variables were measured with reliable tools and methods. Also during the performance process, the training

amount and volume (repetition, and duration) increased gradually during 6 weeks training program and according to the personal characteristics of each subject. The subjects were asked to do the stretching movements to the extent that feel stretch in their anterior pectoral part (chest) (until the threshold of feeling pain).

Then they kept the mentioned position for 10 to 15 seconds. Afterwards, they return to the starting position and after a pause proportionate with the keeping time, repeat that movement. It must be mentioned that, the time of keeping that position during 6 weeks of training gradually increased from 10 to 15 seconds. The number of repetition in each set gradually went up from 6 to 12. The resting time between the sets was determined based on the time of performing each set. [12, 21, 25].

In the first exercise, the person was asked to lie on the foam rolls in supine position and cross her hand over her chest. Then, put her arm and elbow muscles in 90 degree abduction and flexion form and keep this position for a minimum of 10 seconds (at the beginning of training) and maximum of 15 seconds (at the end of training) without any resistance against the gravity until she felt stretch in the anterior part of chest (to the threshold of feeling pain). Then after a pause proportionate with the time of keeping that position, the subjects were asked to repeat that action or move again.

For the next movement, the person was asked to lie on the foam in supine position and put her arm and elbow muscles in 90 degree abduction and flexion by the side of body (starting position), then slowly made her elbows near her body in parallel with the ground level and kept this position for 10 to 15 seconds while the arms were in external rotation and shoulders pressed on each other. Finally, the method of performing Chin Tuck training

**Table 1.** Description of strengthening trainings (Thera Band) used in 6 week training program.

Training	Performance method
<b>Retraction of shoulder</b>	In the first position the subject stands, shoulders are abducted, elbows are in 90 degree flexion and forearms are in horizontal position. Subjects put the training band between their hands and retracted their shoulders to each other by pulling it. The subject must keep the first position of 90 degree for shoulders and elbows and then does a controlled return to the starting position. This training is performed to strengthen the retracting muscles of shoulder such as middle and inferior trapezius, rhomboids and latissimus dorsi.
<b>External rotation</b>	In the second training, the upper part of hand is placed in 90 degree abduction of shoulder and 90 degree flexion of elbow. At first forearm has a horizontal position and then changes into a vertical position. Then the subject performs a controlled return to reach the starting position. The training band is fixed in front of the subject approximately in the height of her waist to start the training. This training is planned to strengthen the weakened muscles in scapular region such as middle trapezius, serratus anterior, and rhomboids.
<b>Flexion</b>	In the next training the subject keeps her hands at 90-degree flexion, elbows are completely straight and palms are downward, shoulders bend about 180 degree against the resistance of training band and then performs a controlled return to the starting position. The training band is fixed in front of the subject at the height about her waist to start training. This training is performed to strengthen the inferior trapezius and serratus anterior muscles.

or exercise was in such a manner that the subjects were asked to stand in a manner that their backs were against the wall and their chin was downward and back in the double chin form and kept this position for 10-15 seconds. In the third training or exercise the person stood in the corner of the wall in a manner that her arm and elbow joints were in 90 degree abduction and flexion position, hands place at two sides of the wall corner. In this position legs were placed in line with each other and one of them was ahead of other one.

Then the subject was asked to bend the knee of her forward leg and incline her body to forward. Finally, performing Chin Tuck training was in this manner that the subjects were asked that in position of sitting down on a bench put their chin to the downward and in the form double chin and kept that position for 10-15 seconds.

The aim of performing strengthening exercises was to strengthen the weakened muscles such as inferior and middle trapezius, rhomboids, and serratus anterior (Table 1). To perform strengthening trainings the elastic bands were used in 3 sets and 10 repetitions per week (Figure 3) [25]. To perform strengthening trainings the elastic bands were used in 3 sets and 10 repetitions per week [17]. In the second week, the amount of strengthening trainings changed gradually in such a manner that in every set, the number of repetitions increased to 15 and in the third week this number reached to 20 repetitions in each set. In the fourth week and according to the principle of overload and regulating strengthening trainings, the repetitions reached to 10 times and in fifth and sixth weeks they reached to 20 repetitions [22].

Comprehensive trainings were performed in the form of combination of stretching and strengthening trainings. After the end of the training program (for a period of 6 weeks), the shoulder angle was measured again. Control group was present all the time by the side of experimental groups but they did not perform any exercises. Finally, after collecting the research data, the de-

mographic information such as age, height, and weight together with research variables, were analyzed through descriptive and inferential statistics by SPSS software version 21; Also paired t-test and 1-way variance analysis were used to compare the obtained results among groups from pre-test and post-test. The significance level of all variables was considered at 0.05.

### 3. Results

Tables 2, 3, and 4 present the obtained results. In Table 2 the general characteristics of subjects and descriptive information of variables such as height, weight, body mass index, and amount of forward shoulder in the studied groups are shown.

As Table 3 indicates, according to the mean difference in pre-test and post-test, the amount of t and P value, all 3 exercises of strengthening, stretching, and comprehensive training methods have significant influence on the amount of decrease in forward shoulder angle. While no significant change was observed in the amount of average forward shoulder angle in the control group in the post-test.

Results of paired t-test in the experimental groups indicated that the forward shoulder angle among subjects after performing improvement trainings has decreased significantly. As a result after participating in 3 types of exercises of strengthening training (P=0.001, t=8.63), stretching training (P=0.001, t=6.78), and comprehensive training (P=0.001, t=12.11), the angle decreased by 6.10, 4.90, and 7.10 degrees, respectively (Table 3).

Analysis of paired variance (ANOVA) to study difference of forward shoulder amount between groups indicated that there is a significant difference (P=0.001) between the effect of various trainings on the amount of forward shoulder angle.

**Table 2.** General characteristics of the subjects and descriptive information of the research variables.

Variable	Standard deviation± Mean			
	Strengthening group	Stretching group	Comprehensive group	Control group
Age (year)	1.08±21.5	1.8±22.1	1.98± 22.8	2.07 ± 22.9
Height (cm)	2.28 ± 162.1	3.96 ± 162.1	2.13 ± 162.1	1.37 ± 161.31
Weight (kg)	2.3 ± 61.2	1.52 ± 61.1	2.09 ± 61.80	1.75 ± 60.80
Body mass index (kg/ square meter)	0.96 ± 23.29	1.02± 23.26	0.84 ±23.52	0.85 ± 23.43

**Table 3.** Comparing the mean difference of forward shoulder angle between pre-test and post-test (paired test).

Exercise type	Variable	Pre-test		Post-test		Mean difference	t	P
		Standard deviation	Mean	Standard deviation	Mean			
Strengthening	Forward shoulder angle	3.05	56.4	3.9	50.30	0.71	8.6	*0.001
Stretching	Forward shoulder angle	3.37	57.30	5.12	52.40	0.72	6.7	*0.001
Comprehensive	Forward shoulder angle	2.46	54.6	2.06	47.50	0.58	12.11	*0.001
Control	Forward shoulder angle	3.2	57.90	3.28	57.70	0.13	1.5	0.168

\*Significance level ( $P \geq 0.05$ )

PHYSICAL TREATMENTS

To compare the groups, the Tukey post-hoc test was used. It was observed that there was a significant relationship between the influence of exercises (strengthening ( $P=0.001$ ), stretching ( $P=0.001$ ) and comprehensive ( $p=0.001$ )) and the control group. Whereas no significant difference was observed among strengthening, stretching and comprehensive training groups (Table 4).

#### 4. Discussion

Forward shoulder is an abnormal position which is defined by the distance between inferior angle of scapula and spinous process of vertebra [12]. Abnormal changes in muscle balance and strength, the time consequences of using muscle, and joint movement disorder may increase the internal rotation of scapula, decrease the posterior tilt and upward rotation of scapula which leads to forward shoulder and other shoulder injuries [26,27].

This research focused on evaluating the shoulders position to determine the effect of three 6 week training program on shoulder posture. Research results indicated that performing strengthening trainings caused significant decrease of about 10% in forward shoulder angle,

performing stretching trainings caused significant decrease of about 8%, and performing comprehensive trainings caused 13% significant decrease in forward shoulder angle. According to the results of current research, there is a significant difference in performing 6 weeks strengthening, stretching, and comprehensive trainings with control group.

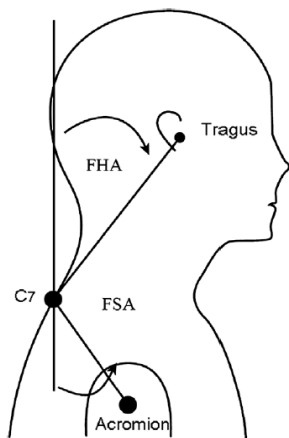
However there were no significant differences between strengthening, stretching and comprehensive training groups with each other. Although the statistical data indicated no significant differences in training programs, statistical trend and response of comprehensive training program were superior to others. Control of effective training factors in each one of training programs, particularly in comprehensive trainings, probably non-conformity of some factors which can lead to reduction of accuracy and characteristics of each program cause that effects of these 3 programs be similar to each other and don't create significant differences in the case of performance and results, its reason may be affected by difference in type of mechanisms and exercises or trainings and amount of examinee's physical fitness.

**Table 4.** Results of Tukey post-hoc test to compare changes of forward shoulder angle.

Group	Mean differences	Mean standard error	Significance level
Strengthening- stretching	-1.2	0.84	0.49
Strengthening- comprehensive	1	0.84	0.64
Strengthening-control	-5.4	0.84	0.001*
Stretching- comprehensive	2.2	0.84	0.62
Stretching-control	-4.2	0.84	0.001*
Comprehensive-control	-6.4	0.84	0.001*

\*Significance level ( $P \geq 0.05$ )

PHYSICAL TREATMENTS



PHYSICAL TREATMENTS

**Figure 1.** Calculating the angles of forward shoulder by photography method [24].

Uncontrollable factors in the present research, such as daily activities, rest, kind of diet, personal habits, manner of standing up, sitting down, and studying could be the reason for lack of differences between 3 training

groups. As it was mentioned before, this lack of significant difference among 3 training protocols can be due to the interference of unwanted and obtrusive variables. It seems that, in future similar studies, with accessing to more homogenized samples, changes in FITT (frequency, intensity, time, and type) of each program and higher control of the researcher, different results will be obtained.

Also, although the present research cant not significantly show the difference between training methods, the dominant statistical trend in combinational training (7.10 degree) compared to two other groups of stretching (4.9 degree) and stretching (6.10 degree) could be considered an important application point from operational and clinical viewpoint. It is evident that generalization of this research results was in the under study society area, that researcher was obliged to report and analyze the existed data, so more information will be dependent to the future researches.



**Figure 2.** Stretching corrective and improving exercises program **PHYSICAL TREATMENTS**

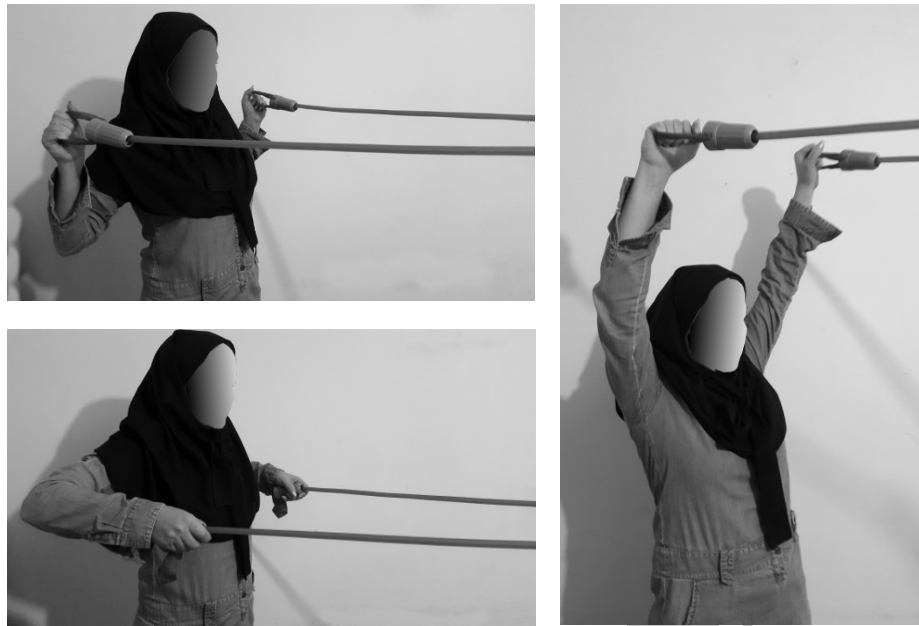


Figure 3. Strengthening corrective or improving exercises program **PHYSICAL TREATMENTS**

According to the general principles of training programs for corrective and remedial actions, strengthening of weakened muscles leads to biomechanical movement and obtaining appropriate direction of abnormal parts. In fact stretching the shortened anterior shoulder muscles (hypertrophy) together with strengthening the weakened posterior muscles has significant influence on improving the forward shoulder abnormality.

Furthermore, desirable effect of these training programs might be due to concurrent attention to the changes in one-fifth of upper part of body and considering the corrective and improvement trainings to improve abnormalities related to the face. Results of the present study conform to the results of researches conducted by Klumper et al (2006), Lynch et al (2010), Kotteswam et al (2012), Harman et al (2005), Thigpen et al (2009), Najafi et al (2006), and Daneshmandi et

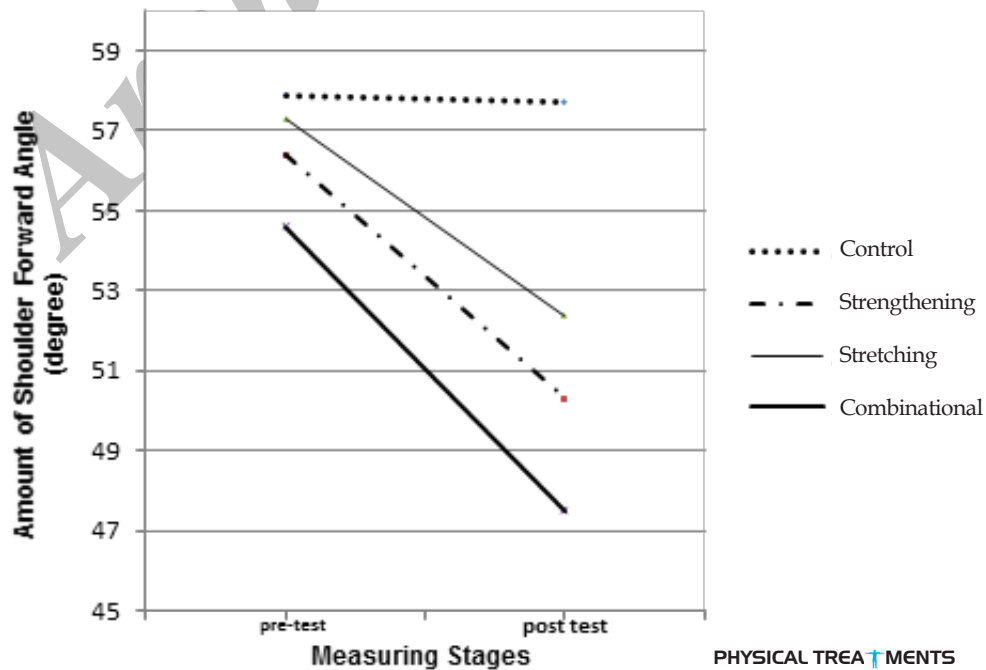


Figure 4. Average changes of forward shoulder angle in 4 research groups.



al (2006). Klumper concluded that stretching of the anterior soft tissue of shoulder, internal rotator and abductor muscles, and strengthening of shoulder posterior muscles including external and abductor rotators can decrease the forward shoulder position among athletic swimmers [22].

Kotteswarn et al studied the effect of stretching and strengthening of shoulder muscles in shoulder protraction of persons with abducted shoulder position and indicated that stretching of abducting muscles and strengthening of retracting muscles and external rotators of shoulder were effective in decreasing the shoulder protraction [12].

Lynch et al studied the influence of an 8 week period training program on the amount of forward shoulder angle among 28 professional swimmers who were 17-23 years old [11]. This program was a combination of stretching and strengthening program that was performed 3 times a week. Results of this research indicated that performing this training program had positive effect on reducing the amount of forward head and shoulder angle among the studied persons; in such a manner that the mean of forward head angle of peoples in the training group decreases from 11.29 degree in pre-test to 7.11 degree in post-test.

Also the average of forward shoulder angle among the training group decreased from 9.62 in pre-test to 8.39 degree in the post-test. Najafi et al (2012) indicated that a period of training program would strengthen the weakened muscles in the posterior part of shoulder and stretch the shortened muscles in the anterior part of shoulder. Also on the basis of the research results, the average of forward shoulder in post-test was recorded 1.46 cm less than its average in pre-test which indicated that the training program has led to a significant decrease in forward shoulder of about 12% ( $P \geq 0.05$ ) [20].

Besides, planning and performing an exact and purposeful program of corrective and improving movements of stretching, strengthening and comprehensive trainings for scapula and elbow joint performed regularly and under direct supervision and control of examiner, can have desirable effects in decreasing the angle of forward shoulder. On the basis of Vladimir Janda's chain reaction theory and modeling from Braugher's gear mechanism in spinal column, the comprehensive improvement trainings are planned and performed by the examiner [25, 26, 28].

In the combinational training program in addition to improvement of forward shoulder abnormality, the forward head and kyphosis abnormalities are studied simultaneously and regarding the fact that these 3 abnormalities are related to each other and appearance of each of them can be the reason of others' appearance, researcher tries to improve these 3 abnormalities at the same time. The weak posture of shoulder and muscular imbalance around it are important factors for forward shoulder abnormality and chronic pain syndrome. This research differed with previous researches in reducing the time of study from 8-10 weeks to 6 weeks as different researches concluded that a 6 weeks period of training program has desired effects and positive influence on improving the abnormality [12, 22, 28].

Another difference was in the sex of subjects and their number in this research when all subjects were female and their number in each training group were 10 persons and also it examined how much effective the postural suggestions were. While in the previous researches, this fact was not considered and studied. Also in this research we have used different trainings and exercised with various intensities and times of training; these exercises consisted of strengthening, stretching, and comprehensive and mobilizing trainings.

It seems that lack of exercise leads to weakening of the stabilizer muscles and muscles between the scapula as well as atrophy of scapular muscles and consequently dissymmetry of scapula and forward shoulder abnormality. Therefore, this part needs enough strengthening of weakened muscles and stretching of shortened muscles. Regarding the results of present research and based upon desired effectiveness of improvement trainings in decreasing the forward shoulder angle, we suggest that researchers and experts apply the improvement training programs used in this research by observing the mentioned principles.

Based on the present results, performing trainings in this research, particularly the combinational and comprehensive trainings is a suitable, scientific, and safe method to correct the forward shoulder position.

### Acknowledgments

Finally, we thank and appreciate all the subjects who participated in this research and also Guilan University that provided the opportunity to do our research.

## References

- [1] Mottram SL. Dynamic stability of the scapula. *Journal of Manual Therapy*. 1997; 2(3): 123-131.
- [2] Houghlum PA. Therapeutic exercise for athletic injuries. Champaign, Ill: Human Kinetics; 2001, pp: 342-369.
- [3] Borstad JD. The effect of pectoralis minor resting length variability on scapular kinematics. Minneapolis, MN: University of Minnesota; 2004, pp:166-175,
- [4] Paine RM, Voight ML. The Role of the scapula. *Journal of Sports Physical Therapy*. 1993; 18(1):386-391.
- [5] McHardy A, Hoskins W, Pollard H, Onley R, Windsham R. Chiropractic treatment of upper extremity conditions: a systematic review. *Journal of Manipulative and Physiological Therapeutics*. 2008; 31(2): 146-159.
- [6] Kibler W, McMullen J. Scapular dyskinesia and its relation to shoulder pain. *Journal of the American Academy of Orthopaedic Surgeons*. 2003; 11(2),142-151.
- [7] Martine AM, Johansson FR, Cambier DC, Velde AV, Palmans T, Witvroum EE. Descriptive profile of scapulothoracic position, Strength and flexibility variables in adolescent elite tennis players. *British Journal of Sports Medicine*. 2010; 44, 678-684.
- [8] McClure PW, Michener LA, Karduna AR. Shoulder function and 3-dimensional scapular kinematics in people with and without shoulder impingement syndrome. *Journal of Physical Therapy*. 2006; 86(8):1075-1090.
- [9] Diab AA, Moustafa IM. The efficacy of forward head correction on nerve root function and pain in cervical spondylotic radiculopathy: a randomized trial. *Clinical Rehabilitation*. 2012; 26(4): 351-361.
- [10] McAviney J, Schulz D, Bock R, Harrison DE, Holland B. Determining the relationship between cervical lordosis and neck complaints. *Journal of Manipulative and Physiological Therapeutics*. 2005; 28(3):187-93.
- [11] Lynch S, Thighpen CA, Mihalik JP, Prentice WE, Padua D. The effects of an exercise intervention forward head and rounded shoulder posture in elite swimmers. *Journal of Sport Medicine*. 2010; 44:376-381.
- [12] Kotteeswaran K, Rekha K, Vaiyapuri Anandh. Effect of stretching and strengthening shoulder muscles in protracted shoulder in healthy individuals. *International Journal of Computer Application*. 2012; 2 Issn: 2250-1797.
- [13] Kibler WB, Sciascia AD, Uhi TL. Electromyographic analysis of specific exercises for scapular control in early phases of shoulder rehabilitation. *American Journal of Sports Medicine*. 2008;36:1789-98.
- [14] Daneshmandi H, Alizadeh MH, Shademan B. [The effect of an exercise program during scapular position (Persian)] *Journal of Research in Rehabilitation Sciences*. 2006; 11: 93-107.
- [15] Rahimi S. Evaluation of postural abnormalities, male and female students of Shiraz University. *Journal of Social Science & Humanities of Shiraz University*. 2011; 21(5): 22-219.
- [16] Oyama S. Profiling physical characteristics of the swimmers shoulders: Comparison to baseball pitchers and non-overhead athletes. [Ph.D], BS, Oregon state University, School of health and rehabilitation science, Pittsburgh University; 2006; pp: 18-22.
- [17] Savadatti R, Gaude GS. Effect of forward shoulder posture on forced vital capacity- A correlational study. *Indian Journal of Physical Therapy and Occupational Therapy*. 2011;5(2); 119-123.
- [18] Kendall FP, McCreary EK, Provance PG. *Muscles: Testing and function*. 4th ed. Baltimore, Md: Williams & Wilkins; 1993, pp. .
- [19] Smith J, Kotajarvi BR, Padgett DJ, Eischen JJ. Effect of scapular protraction and retraction on isometric shoulder, elevation strength. *Archives of Physical Medicine and Rehabilitation*. 2002; 83(3):367-370.
- [20] Najafi M, Behpoor N. [Effects of corrective exercise program on scapula and shoulder joint in women with rounded shoulders abnormalities (Persian)]. *Journal of Sport Medicine*. 2012; 9(4): 31- 47.
- [21] Klumper M, Uhi T, Hazelrigg H. Effect of stretching and strengthening shoulder muscles on forward shoulder on forward shoulder posture in competitive swimmers. *Journal of Sport Rehabilitation*. 2006; 15:58-70.
- [22] Wang CH, McClure P, Partt NE, Nobilini R. Stretching and strengthening exercises: their effect on three dimensional scapular kinematics. *Archives of Physical Medicine and Rehabilitation*. 1999; 80(8):923-9.
- [23] Charles A, Thigpen N, Darin A, Padua Lori A, Michener K. Head and shoulder posture affect scapular mechanics and muscle activity in overhead tasks. *Journal of Electromyography and Kinesiology*. 2010; 20:701-709.
- [24] Seidi F, Rajabi R, Ebrahimi I, Alizadeh MH, Minoonejad H. The efficiency of corrective exercise interventions on thoracic hyper-kyphosis angle. *Journal of Back and Musculoskeletal Rehabilitation*. 2013;27(1):7-16. doi: 10.3233/BMR-130411.
- [25] Sahrmann SA. *Diagnosis and treatment of movement impairment syndromes*. St Louis Mo: Mosby; 2002; pp:193-201.
- [26] Won-gyu Y. Comparison of shoulder muscles activation for shoulder abduction between forward shoulder posture and asymptomatic. *Journal of Physical Therapy Science*. 2013; 25(7): 815-816.
- [27] Page P, Frank CC, Lardner R. *Assessment and treatment of muscle imbalance: The Janda Approach*. Champaign, Human Kinetics; 2010, pp. 27-42.