



The Effect of Eight Weeks of Global Postural Corrective Exercises on Kyphosis and Forward Head Angle in Elderly Women with Age-Related Hyperkyphosis

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ABSTRACT

Studies reported that, thoracic Hyperkyphosis may have negative effects in health status and postures of elderly women. The aim of current research was to evaluate the effect of eight weeks of global postural corrective exercises on kyphosis and forward head angle in elderly women with age-related hyperkyphosis. The mean age, height, and weight of the experimental group (n=16) were 68.5 years, 151.6 cm, and 55.4 kg respectively, whereas the values in the control group (n=16) were 69.1 years, 154.3 cm, and 54.6 kg, respectively, with no statistical differences between the groups. Forward head posture was measured lateral view photogrammetry and also thoracic kyphosis was measured using 2 gravity-dependent inclinometers placed over the spinal processes of T1 and T2 and over the T12 and L1 vertebrae before and after 8 weeks global postural corrective exercises. Results indicated that global postural corrective exercises significantly improved thoracic kyphosis ($p=0.002$) and forward head angle ($p=0.003$). It is concluded that the global postural corrective exercises developed in the present study can be recommended for improving the hyperkyphosis and forward head postures through specialized exercises focused on global postural corrective exercises in elderly women with age-related hyperkyphosis.

Keywords: Age-related hyperkyphosis, Corrective exercises, Forward head posture

INTRODUCTION

Averages thoracic kyphosis angle during childhood to through the third decade of life is about 20° to 29°. Thoracic kyphosis angle in women population begins to increase immediately after 40 years from 43° to 52° [1-4]. Reports of functional hyperkyphosis associated with age is a progressive malformation of the spine, and 50% of adults with an age range of 60 years and older are involved [5,6].

Hyperkyphosis can damage person's health; physical activity and quality of life. Women with hyperkyphosis have slower walking speeds. Also, it is difficult to do the climbing of the stairs and they also have a disturbance in the balance. Consequently, they are at risk of falling, resulting in fractures and, in some cases, death of the person [7].

Risk factors for hyperkyphosis include aging, bone loss, disc disease and previous spinal fractures. The patient's permanent postural posture decreases the movement of the spinal extension and reduces the strength of the back-extensor muscles, which is evidence of cause's age-related hyperkyphosis [1-8].

According to previous research reports, some exercises have had a significant effect on the correction of this abnormality [9]. Regarding the effects of hyperkyphosis on the health of individuals, physical activity and quality of life, recently it has been reconsidered by health centres as an important issue of health [10,11].

But for hyperkyphosis, there is no standard treatment. The usual novel treatment used for functional hyperkyphosis abnormalities includes physical exercises and the use of brace [4-9].

Recently, a study several randomized clinical trials have been conducted that examine the effect of exercises on kyphosis and their effect on the strength of back muscle and treatment of kyphosis. However, it is not possible to recommend a specific practice for treatment intervention, among which the small size of the sample, the heterogeneity of the participants in researches, and the inappropriate and different measurements of the kyphosis angle. Previous studies on physical performance measurements also do not determine whether exercises designed to reduce kyphosis can also improve body performance. Determining the risk factors for physical inability can lead to interventions that prevent or delay the loss of physical activity. Recently studies reported that treatment of thoracic kyphosis should be focused on regaining global flexibility and strength of body using global and progressive interventions. On the other hand, some researchers have resist on thoracic kyphosis, related muscle strength, range of motion, and physical performance measurements after an preventive and treatment interventions, and some other studies have been conducted on measurement of upper extremity and chest functions [3-11]. The aim or current research was to evaluate the effect of eight weeks of global postural corrective exercises on kyphosis and forward head angle in elderly women with age- related hyperkyphosis.

MATERIAL AND METHODS

The subjects of the study were 32 elderly hyperkyphotic women who have not used any especial modalities at least six months before the intervention (corrective exercises). The mean age, height, and weight of the experimental group (n=16) were 68.5 years, 151.6 cm, and 55.4 kg respectively, whereas the values in the control group (n=16) were 69.1 years, 154.3 cm, and 54.6 kg, respectively, with no statistical differences between the groups. Individuals who had initial conditions of entering the study completed the written informed consent form to participate in the study.

Procedure

Samples were initially selected and were then randomly (based on kyphosis angle $\geq 40^\circ$) divided into two groups (corrective exercises (n=16) and control group (n=16)). It was explained for individuals that they can opt out at any time if they do not want to cooperate anymore. During the test, individuals were initially trained using written description for testing and after a five-minute warm-up, pre-test of angle of forward head and kyphosis were carried out. Corrective exercises were carried out in 8 weeks (three days per week) under the supervision of examiner. Subjects were told two sessions of consecutive absences and three non-consecutive absences will lead to their elimination from the research program. After 8 weeks of training, measurement of post-test dependent variables was carried out in same conditions with pre-test measurements and one individual was eliminated from each group and the results were statistically analysed [11-14].

Inclusion criteria included: female gender, history of chronic neck pain for more than six months, and filling consent form and exclusion criteria included items such as: regular daily and weekly exercise, neck pain due to impact, history of spinal surgery, history of using any kind of medicine or therapeutic measures to resolve neck pain, congenital abnormalities in the cervical spine, cardiovascular and neuromuscular diseases and dizziness and special diseases associated with musculoskeletal disorders of the neck (rheumatoid arthritis, tuberculosis of the spine, head and neck cancer, tumours, etc.) and radiculopathy and neurologic deficits.

Forward head posture was measured in the present study by lateral view photogrammetry [12,13]. To measure forward head angle using the mentioned method, initially three anatomic signs of tragus of the ear and right Acromion as well as seventh cervical vertebrae spinous process were marked. Then, subjects were asked to stand in designated place next to the wall (at a distance of 23 cm) in a way that their left arm is toward the wall, then the digital camera which was on tripod was placed at distance of 265 cm to the wall and its height was set to the level of right shoulder of subject. In such conditions, the subjects were asked to lean forward three times and also move their hands above their head three times and then stand totally relaxed and natural and look at an imaginary spot on the opposite wall (eyes towards the horizon). Then, the examiner took consecutive pictures from the lateral view of body after a five-second pause. Ultimately, the mentioned pictures were transferred into a computer and filed tragus line angle and seventh cervical vertebrae (forward head angle) were measured using AutoCAD software and the average of three obtained angles was recorded as the intended angle for forward head [11-13].

In our study, thoracic kyphosis angle was measured by 2 inclinometers that put on the spinous processes of T1 and T2, and over the T12 and L1 vertebrae [12,13].

Intervention

We used Katzman et al. protocol for corrective exercises intervention program. The corrective exercise program executed in side-lying and standing with end-range thoracic extension and rotation in order to mobilize the spine during intervention [6].

Exercises includes: Supine transversus abdominis on roller, Quadruped arm and leg lift, Prone trunk lift to neutral, Side-lying thoracic rotation/extension, Side-lying hip abduction/external rotation, Marching on roller, Unilateral overhead reaching on roller, Bilateral pull-down supine on roller, Shoulder flexion/thoracic extension at wall, Wall push-ups, Single-leg stance, Chest/spine stretching supine/roller, Gluteal stretching, Supine straight-leg raise, Prone hip/quadriceps stretch, Quadruped thoracic extension stretch and Neck/chest stretch standing.

All statistical analyses were performed using SPSS version 18 statistical software (SPSS Inc., Chicago, IL, USA). Results are presented as mean \pm standard deviation (SD). The normality of the data was assessed by Shapiro-Wilk test. Sample and paired t-tests were used to examine the significance of differences for variables. The paired t-test was used to assess pain, function, movement accuracy, range of motion, and endurance before and after the treatments. The independent t-test was performed to identify differences between groups. For all tests, statistical significance threshold was set at $p < 0.05$.

RESULTS

Shapiro-Wilk test results indicated data's normality in study. Results indicated that the kyphosis ($p=0.002$) and forward head angles ($p=0.003$) improved in experimental group after 8 weeks corrective exercises (Table 1).

Table 1 Mean \pm SD for kyphosis and forward head angles in experimental and control groups

Variables	Experimental group		Control group	
	pre	post	pre	post
Kyphosis angle	55.6 \pm 4.3	49.1 \pm 2.5 ($p=0.002^*$)	56.4 \pm 2.8	56.7 \pm 3.6 ($p=0.104$)
Forward head angle	20.4 \pm 3.6	15.3 \pm 2.2 ($p=0.003^*$)	19.4 \pm 2.9	20.5 \pm 3.2 ($p=0.117$)

Values are mean and SD; *Significant differences between pre- to post-test within group at level of ($p \leq 0.05$)

DISCUSSION

The aim of current research was to evaluate the effect of eight weeks of global postural corrective exercises on kyphosis and forward head angle in elderly women with age-related hyperkyphosis. In elderly women populations, the health related outcome such as excessive thoracic kyphosis to prevention and treatment of osteoporosis needed comprehensive assessment.

Previous studies reported effectiveness of isolated and local corrective exercises programs in treatment and prevention of age related hyperkyphosis [6]. Few studies have assessed the effects of a multimodal corrective exercises program on side effects of subjects with hyperkyphosis. Our study results revealed that thoracic and head posture might be improved using mixed corrective exercise program, and this program may be effective in prevention (delay) and treatment of the physical disability associated with age related hyperkyphosis and finally led to postural improvement in this population [1-9].

In conducted studies so far, the effect of lower limb strengthening exercise on elderly population were assessed. The main focus of our study is on age related thoracic hyperkyphosis angle. Due to the positive effect of corrective exercises in our study, we can suggest basic and fundamental idea for age related thoracic hyperkyphosis treatment.

One of the side effects of age related thoracic hyperkyphosis treatment is thoracic pain and improvement of upper quarter muscle timing and activation can have positive effects this side effect. Correcting the postural faults in cervical, thoracic and scapular region is one of the aims of therapists in treatment of age related thoracic hyperkyphosis [5-9,11-13].

Generally, it is clear that forward head posture resulting in weakness of deep cervical flexor muscles and shortness of posterior neck structure such as upper trapezius, and elevator scapula muscles. Thus, improvement of strength and movement control of deep neck flexor muscles and improvement of flexibility of the posterior structures of the neck are among the aims of treating this complication. Neck flexor muscles and thus strengthening them have been considered in corrective exercise program used in this study a large number of moves [11-13]. Strengthening these muscles improves the ability to maintain the neck posture. In addition, reduction of forward head posture observed in this study might be due to improvement of strength in these muscles which has occurred during the six-week spinal extensor corrective exercise. Shortening of elevator scapula muscle in forward head posture can change the position of the scapula, reduce upper spin and change the mechanism of shoulder and also thoracic Hyperkyphosis. Thus, the

result of the present study showed that the intended corrective exercises have probably targeted tissues which have improved the forward head and thoracic hyperkyphosis postures [5-9].

This study was conducted on elderly women with thoracic kyphosis more than 45° to evaluate the effectiveness of an 8-week corrective exercises program on hyperkyphosis and forward head postures (abnormalities).

The results of present study show that the corrective exercises have effectiveness in improving the age related hyperkyphosis and forward head posture. Katzman et al. believed that postural exercises including complex flexibility and strength may decrease thoracic kyphosis up to 6° [12]. Greendale et al. revealed that exercise intervention has improvement in thoracic kyphosis [13]. Exercise interventions that designed to improve the side effects of thoracic hyperkyphosis may be conducive to improving the posture, flexibility and stiffness of the thoracic portion [14].

Regarding the results of this study and positive effect of the corrective exercises program on kyphosis correction, it is useful to use these exercises along with other therapeutic protocols to correct complications in elderly women with hyperkyphosis. Considering that in order to complete the discussion, the researcher had to use secondary factors in this study in some cases, it is suggested that the effect of these exercises on other dependent variables, such as proprioception and muscle strength were examined.

Based on the results of this study, it can be deduced that performing the corrective exercises program in hyperkyphosis elderly women improves the hyperkyphosis and forward head angles. Finally, it can be noted that definitive decision on the rejection or acceptance of the effectiveness of this exercises program is not feasible with limited research and further research is needed.

CONCLUSION

In summary, the global postural corrective exercises developed in the present study can be recommended for improving the hyperkyphosis deformity and forward head via corrective exercises focused on specific program of spinal strengthening in elderly women with hyperkyphosis.

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