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Comparative effect of activity induced and protocol based training on forward head posture in asymptomatic individual

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Abstract

Background and Objectives: Forward head posture is anterior disposition of head relative to line of gravity in sagittal plane which results from habitual postures acquired over time. It may contribute to neck and shoulder pain, muscle imbalance, fatigue and limited motion of cervical spine. The weakened postural muscles should be strengthened and shortened muscles should be lengthened in order to improve postural alignment and alleviate FHP. Therefore this study aims to evaluate the comparative effect of protocol based training and activity induced functional exercises over craniohorizontal, craniovertebral angle, sagittal shoulder posture to correct forward head posture.

Methods: 28 subjects were recruited in the study based on inclusion and exclusion criteria. Subjects were randomly allocated in two groups. Group A received protocol based training and Group B received activity induced functional exercises. Non parametric test was used to judge the statistical difference. The level of significance was set at $p < 0.05$. All data was analysed using IBM SPSS software.

Result: Both the groups were significant but there was no statistical significant difference between the groups for 3 variables, the significant difference was seen within the groups.

Conclusion: Protocol based training and activity induced functional exercises were found equally effective in correcting Forward head posture and protracted shoulder.

Keywords: forward head posture, exercises, rehabilitation

Introduction

Skeletal and muscular structures can change into incorrect shape due to reduction in physical activity and improper posture habits in daily living¹. Forward head posture is anterior disposition of head relative to line of gravity in sagittal plane which results from habitual postures acquired over time².

Flexion of lower cervical and upper thoracic vertebrae while extension of upper cervical and occiput over C1 is observed in FHP. There is anterior translation of head with increase in lordotic curve of cervical vertebrae³. This posture is related with weakness in deep cervical short flexor muscles and mid thoracic scapular retractors (i.e. Serratus anterior, rhomboids, lower and middle fibers of trapezius) and shortening of opposing cervical extensors and pectoralis muscles (also known as UCS)⁴.

Forward head posture may contribute to neck and shoulder pain, muscle imbalance, fatigue and limited motion of cervical spine^{5, 6}. Inadequate posture consists of poor correlation between parts of body. Muscle tension and shortening are caused by these imperfect correlations, which make appropriate joint movements more difficult to achieve and may cause pain. Altered postures may accelerate degenerative changes that takes place later in life⁵. Forward head posture may cause herniated cervical intervertebral discs and adverse effects such as temporomandibular disorders and chronic low back pain⁶.

Forward head posture may also found in Asymptomatic individual². Among age groups 20 to 50 years there is an incidence of 66% for FHP among people³.

Sun-myung *et al.*, suggests that shortened muscles should be lengthened and weakened postural muscles should be strengthened and in order to improve postural alignment and alleviate FHP⁷.

For correcting forward head posture, stretching of shortened SCM, upper trapezius, suboccipital, latissimus dorsi and pectorals and strengthening of deep cervical flexors, serratus anterior and shoulder retractor muscles have been found to be effective [13]. This management approach has been recommended to improve postural alignment [2]. No study has attempted to correct posture through a training protocol involving strengthening and stretching of agonist and antagonist muscle.

Functional training is the exercise training program designed to simulate the activities and movement patterns". The goal of program is to improve individual performance in activities of daily living (ADLs). Brill (2008) defined functional fitness as emphasizing multiple muscle and joint activities and utilizing more of body in each movement [7].

Therefore, the purpose of the current study is to compare protocol based training program to activity induced functional exercises in asymptomatic individuals.

Methodology

A sample of 28 subjects were selected to take part in the study based on fulfillment of inclusion and exclusion criteria. The subjects were selected from the SRHU university, jollygrant. Convenient sampling was used in the study.

Inclusion criteria

- Asymptomatic individuals.
- Age 20-30 years.
- Posture evaluation through observation (neck and shoulder alignment etc.).
- Forward head posture and protracted shoulder.

Exclusion Criteria

- Individual with Upper crossed syndrome symptom.
- Structural deformity (scoliosis, kyphosis etc.).
- Fracture associated with cervical, shoulder and clavicle.
- >30 yrs.
- Uncooperative patients.

Design

Comparative study and Pre and Post test design was used in this study

Instrumentation

Couch, Markers, Mini ball, Theraband, sponge ball, Smartphone (ON Protractor app and Auto CAD software).

Outcome measures

The outcome measures were Craniovertebral angle, Craniohorizontal angle, Shoulder angle

Procedure

Participants meeting inclusion and exclusion criteria were recruited for the study. They were randomly assigned into two groups, Group a Protocol based exercises and Group B Activity Induced functional exercises. After randomization, intervention Group A composed of 14 participants were given a protocol based exercises for 4 weeks and Group B composed of 4 participants were given activity based functional exercises program for 4 weeks.

Testing procedure

Pre intervention posture assessment in both groups were

conducted at the beginning and after 4 weeks training period with on protractor app application and Autocad software.

By the On Protractor app CVA, CHA and Shoulder angle was measured. For testing procedure participants were made to sit on a stool and instructed to focus at a particular point on their eye level. The smartphone was positioned 50 cm away from the participant and then angle was measured using smart phone app –On Protractor app and for Auto Cad software the pictures were clicked using smartphone and then inserted into the software [12].

The angles in saggital view are as follows

Cranio vertebral angle (CVA) – Angle formed at intersection of horizontal line through a spinous process of C7 and a line joining to tragus of ear. Participant is considered to have Forward head posture, if the cervical angle is less than 50°.

Craniohorizontal angle (CHA) - Angle formed at intersection of horizontal line through tragus of ear and line joining tragus of ear and lateral canthus of eye.

Shoulder Angle (SA) – Angle formed at intersection of line between midpoint of humerus and spinous process of C7 and horizontal line through midpoint of humerus.

Intervention protocol:

After the testing procedure, subjects in the intervention group were given 4-weeks protocol based training. Exercises were performed thrice a week. The training protocol comprises of strengthening and stretching exercises. Strengthening exercises are mainly targeted to elicit activation of weak muscles longus capitis, longus colli, serratus anterior, rhomboids, lower trapezius. Stretching exercises are targeted to the tight muscles. Pectorals, upper trapezius, SCM, suboccipitals, subscapularis and latissimus dorsi. Strengthening exercises were given for 2 sets of 15 repetitions and stretching exercise, 30 sec hold for 4 sets.

Group B

Participants in this group is given intervention in random manner for 4 weeks. The training protocol comprises of four activity based functional exercise program. The activity based functional exercises include various activity such as:-

- **Face pull Y press:** The Activity begins with arms straight in standing position while holding onto theraband. Theraband is tied from middle on to a knob with both ends grasp by the participant. Next the subject will pull the arms back so that elbows are at shoulder height and forearms remain parallel to the ground. Then the subject externally rotate the shoulders, positioning the forearms at vertical with his/her elbows remaining level with the shoulders. Now participant pushes arms up, creating a Y with the arms overhead before returning to the starting position. To perform the pull with therab and the subject, assume the same starting position, but use a stance that places the torso in vertical position. Then participant perform the same shoulder movements. This activity works on external rotators of the shoulder while also stressing the phasic scapular muscles, such as the rhomboids, lower trapezius and serratus anterior. This functional exercise will be performed 2-3 sets of 10-plus repetitions [11].
- **Supine with holding the ball underneath chin-** the activity begins in supine position. The subject is asked to hold the ball underneath chin for 10 sec and then

return to its starting position. The duration of activity was 10 repetitions. Muscles involved in this activity are deep cervical flexors and extensor muscles^[9].

- **Touching markings in the wall-** The participant position is standing facing towards wall and asked to touch the markings in the wall (1,2,3,4) both arm is elevated stepwise and then back to starting position. Muscles involved in this activity are serratus anterior,

lower trapezius. The duration of activity is 15 repetitions^[10].

- **Repetitive flexing neck and hold ball with resisted scapular retraction-** in this activity participant is asked to stand facing the wall and hold ball with neck flex and roll the ball against the wall and also at the same time subject is asked to pull the theraband in order to retract the shoulder. The activity is performed for 2 minutes^[8].

Table 1: Exercise Protocol (Group A)

week	protocol	hold	Duration
0-1	Strengthen deep cervical flexors.	2 sets 15 reps	
	Stretch SCM, suboccipital	15-30 sec 2-4 repetitions	3 times per week.
1-2	Strengthen serratus anterior + 1 st week exercises continued.	2 sets, 15 reps	
	Stretch upper trapezius, pectorals + 1 st week exercises continued.	15-30 sec hold 2-4 repetitions	3 times per week
2-3	Strengthen lower trapezius, serratus anterior+ 1st and 2nd week exercises continued.	2sets, 15 reps	
	Stretch subscapularis, upper trapezius+ 1st and 2nd week exercises continued.	15-30 sec hold 2-4 repetitions	3 times per week
3-4	Strengthen lower trapezius, rhomboids+ 1st, 2nd and 3rd week exercises continued.	2 sets, 15 reps	
	Stretch latissimus dorsi+ 1st, 2nd and 3rd week exercises continued.	15-30 sec hold 2-4 repetitions	3 times per week

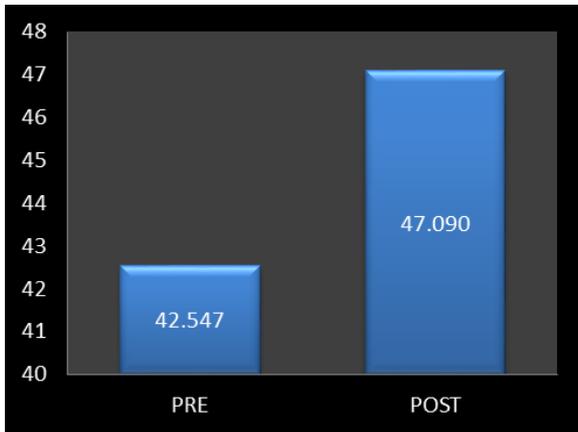
Table 2: Description of stretching and strengthening exercises used in Group A.

Exercise	Muscle	Description
Chin tucks	Longus capitis Longus colli	This exercise is done in supine lying position with the head in contact with couch. It involves holding inner range position of cranio cervical flexion that activate and train deep cervical flexor muscles
Wall slide	Serratus anterior	Patient is position standing facing towards wall. Than Arm is elevated greater than 90 degrees.
Y-I exercise	Lower trapezius	The patient retracts the scapulae with the arms abducted to 90°. As the patient advances, the shoulders are externally rotated with the elbows flexed to 90°, forming a Y. Then the patient moves into a position of full bilateral elevation with the elbow extension forming an I.
Prone horizontal abduction with external rotation	Rhomboids Lower trapezius	In a prone horizontal abduction position, the patient horizontally abducts the arm with the elbow extended and with external humeral rotation. The participant lifts the hand toward the ceiling keeping head /neck neutral and squeezing both shoulder blades together.
stetching	SCM Upper trapezius	Patient position is sitting upright. Right hand is placed on back of head near the crown. Then Pull head down toward the right and try to touch the chin as close as possible to right shoulder. then same procedure is repeated towards left.
Doorway stretch	Pectorals	The participant asked to stand upright facing towards doorway or corner and placing feet shoulder width apart with one foot slightly in front of other and With straight arms, the participant raise arms to shoulder level and place the palms on the walls or doorframe with the thumbs on top. Lean the entire body forward.
	Suboccipitals	The participant sit with chest up and looking straight ahead. Then Gently pushes his/her chin back while looking straight ahead. Then he/she is instructed to keep his/her head upright, don't look up or down. Keep eyes facing forward. While holding chin back with one hand, he/she then uses other hand to reach over the top of head. then participant is asked to stabilize chin back as gently pulling the top of head forward.
	Subscapularis	The subject position is standing near a doorway with arm placed at 45 degree angle and rest it on a wall with body in doorway. Now the subject pushes chest forward until stretch is felt around the area in which subscapularis is situated.
	Latissimus dorsi	Begin this latissimus dorsi stretch standing tall with the back straight and hands above head. Gently the paticipant lean to one side until he/she feel a mild to moderate stretch in the side of upper back and shoulder. Hold for 30 seconds and then return to the starting position. Repeat 4 times provided the exercise is pain free. Then repeat the exercise on opposite side.

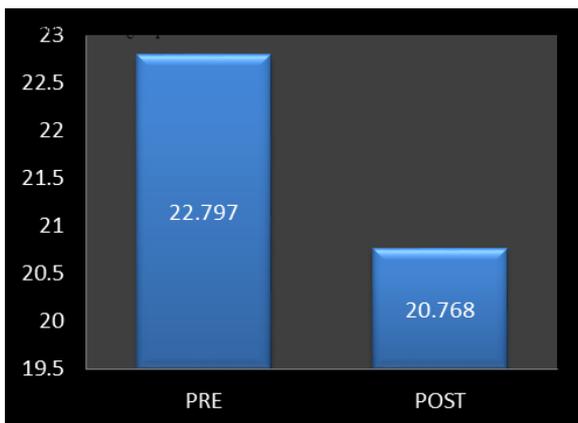
Results

28 subjects were included in the study which comprises of 14 subjects in group A and 14 subjects in group B. The comparison among group A and group B on the basis of age variables. Mean±S.D of group A (23.00±2.320) and Mean±S.D of group B (23.21±2.860) and p value is 0.963, the P value is greater than 0.05. hence no significant

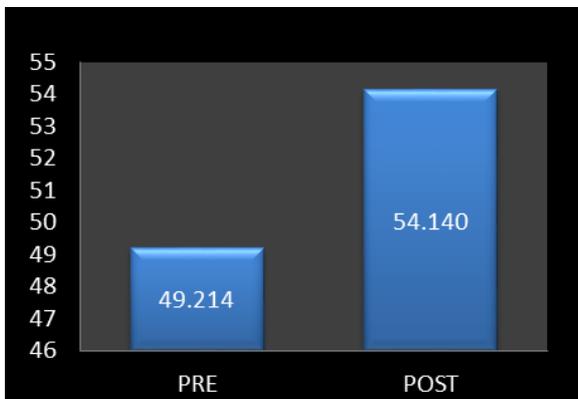
difference was found between age groups. All 3 variables following pre test and post test in intra and inter group analysis were compared with significance levels. On comparing among both groups the p value is .000, hence the result was found significant. On comparison within the groups, P=.001, P=.001, and P=.001 the result was found significant.



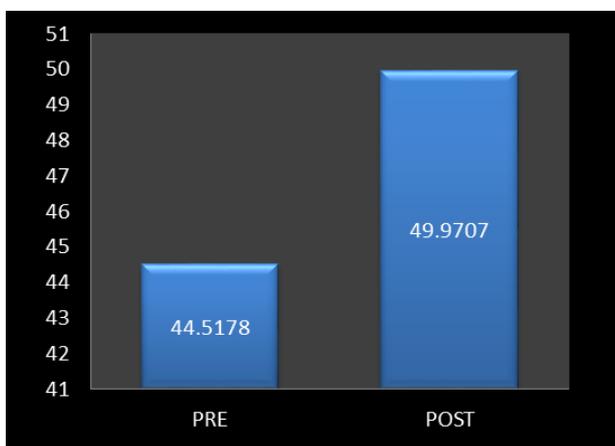
Graph 1: Comparison within group A on the basis of CVA



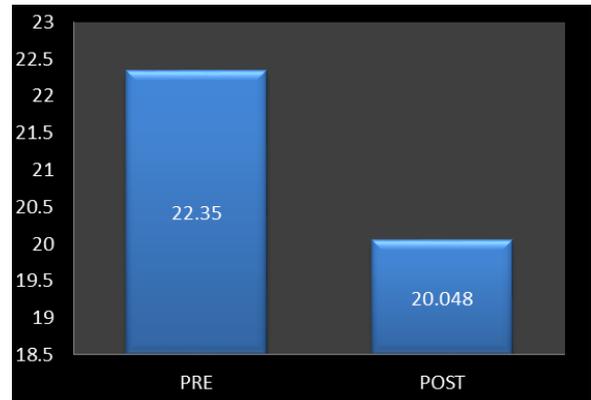
Graph 2: Comparison within group A on the basis of CHA



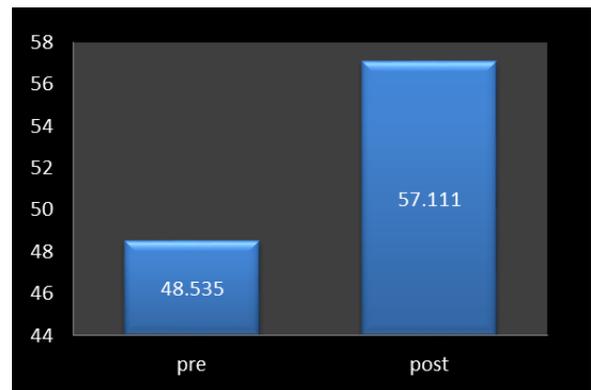
Graph 3: Comparison within group A on the basis of SA



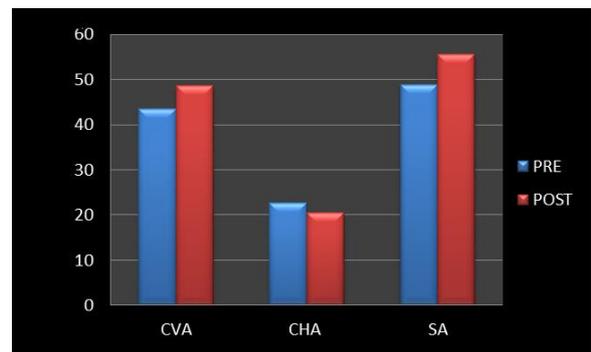
Graph 4: Comparison within group B on the basis of CVA



Graph 5: Comparison within Group B on the basis of CHA



Graph 6: Comparison within group B on the basis of SA



Graph 7: Comparison among all groups on the basis of CVA, CHA, SA Variables

Discussion

Long term use of personal computers and smartphones causes forward head posture and stiffness of muscles in neck, back and chest, shows imbalance in muscular pattern. It also reduces the epidemiological function and weakens soft tissues [14].

This study indicates that there is not much difference between activity based and protocol based training program. Both the groups are statistically significant. The result of the present study has accepted the alternate hypothesis i.e activity based and protocol based training program both will be equally effective in correcting forward head posture and protracted shoulder. Group A showed significant improvement in CVA, CHA and Shoulder Angles. In protocol based training group agonist muscles which were tight were stretched and antagonist muscles which were weak were strengthened. Thus which further leads to increased craniovertebral angle, craniohorizontal and shoulder angle and correction of forward head posture and

protracted shoulder. In this exercise program FHP can be corrected by restoring normal muscle balance between agonist and antagonist. In the present study an intervention protocol is designed which consist of four strengthening (deep neck flexors, serratus anterior, lower trapezius and rhomboids) and six stretching (sternocleidomastoid, suboccipital, upper trapezius, pectorals, subscapularis and latissimus dorsi). The duration of the program was four weeks 3 times per week. Group B also showed significant difference in correcting forward head posture and protracted shoulder with improvement in craniovertebral, craniohorizontal and shoulder angle. Four activities were designed to focus mainly on tonic and phasic muscles. Result of this study showed greater improvement of shoulder angle in activity induced functional exercises group.

Zahra and azade *et al* (2017) assessed the effects of 4 weeks corrective postural exercise on correcting forward head posture (FHP). The study included 30 female students with FHP with age group between 20 and 28 years. Intervention group performed FHP corrective exercise program in the form of stretching and strengthening exercises. The study concluded that 4- week intervention protocol improved postural alignment related to forward head posture. Thus corrective exercise program for 4 weeks is effective to decrease FHP. Limitation of this study was that only college aged female were assessed and long term exercise effects was not determined. This 4 week intervention in this study improved postural parameters such as CV angle, active neck flexion ROM and lower trapezius muscle strength.

The limitations of the study were, the study was limited to a particular age group.

Future studies can be done in other age groups.

Conclusion

The present study concluded that, the comparative study showed improvement in both groups for CVA, CHA and Shoulder angle whereas there has been found that activity based functional exercise program showed mean difference in shoulder angle which creates a need for increase in duration of study to achieve significant difference.

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