

# Effect of McKenzie Self-Therapy Protocol on Forward Head Posture and Respiratory Functions of School Going Adolescent Girls

Shreya Joshi<sup>1</sup>, Megha Sheth<sup>2</sup>

<sup>1</sup>Intern, SBB College of Physiotherapy, Ahmedabad, Gujarat

<sup>2</sup>Lecturer, SBB college of Physiotherapy, Ahmedabad, Gujarat

Corresponding Author: Shreya Joshi

## ABSTRACT

**Background:** The McKenzie exercise is a self-therapy exercise done through repetitive motions. Objective of this study was to find effect of McKenzie self-therapy protocol on Forward Head Posture and respiratory functions of adolescent girls.

**Materials and Methods:** An experimental study was conducted on 60 school going girls randomly allocated into two groups. Group A was given McKenzie self-therapy for 12 weeks and group B was control. Forward head angle was measured by measuring craniovertebral angle (CVA). Peak expiratory flow rate (PEFR) was measured by peak expiratory flow meter.

**Results:** Difference in CVA-group A( $t=-3.77, p=0.001$ ) and PEFR( $Z=-3.97, p<0.01$ ). For group B difference in CVA ( $t=-0.289, p=0.77$ ) for PEFR( $Z=-3.886, p,0.01$ ). Between group for CVA ( $t=2.06, p=0.04$ ) and for PEFR( $Z=-0.052, p=0.962$ ) was seen.

**Conclusion:** Significant difference was seen in forward head posture and respiratory function with McKenzie self-therapy. Significant difference was seen in respiratory function in control group. Difference in CVA was more in exercise group and respiratory function was not significantly different between the groups.

**Keywords:** Forward head posture, Cranio-vertebral angle, Peak expiratory flow rate, McKenzie self-therapy

## INTRODUCTION

Postural orientation is defined as control of the relative positions of body parts by skeletal muscles with respect to each other and gravity during activity of daily living. Good postural habits in the adult are necessary to avoid postural pain syndromes and postural dysfunctions. A postural fault is a posture that deviates from normal alignment but has no structural impairments. Postural pain syndrome refers to the pain that result from the mechanical stress when a person maintains faulty posture for a prolonged period of time. Pain is usually relieved with activity and on

examination no significant impairments in flexibility and strength are found. But if the faulty posture continues it tends to result in postural dysfunction. Postural dysfunction is defined as the weakness and adaptive shortening of soft tissues. Mechanical stress, impaired postural support (stretch weakness or tight weakness because of shift in length-tension curve) and impaired muscle endurance are the major factors playing role in pain syndromes related to impaired posture. <sup>(1)(2)</sup>

Forward head posture (FHP) is defined as excessive anterior positioning of the head in relation to a vertical reference

that is plumb line (Line of Gravity) in sagittal plane. <sup>(3)</sup> A forward head involves increased flexion of the lower cervical and upper thoracic regions, increased extension of the upper cervical vertebrae and extension of the occiput on C<sub>1</sub>. The craniovertebral angle (CVA) is defined as the angle of the horizontal line running through the C7 spinous process and the line connecting the C7 spinous process to the tragus of the ear. <sup>(4)</sup> FHP in school going adolescents can be because of sitting at a desk for a long time, use of desks and chairs not appropriate for the physique, a bed not conducive to good posture, lack of exercise, excessive learning activities, and heavy school bags. <sup>(4)</sup> Increasing use of electronic screens, such as smart phones and personal computers, to an average of about 8 hours per day, has led to an increasing number of people with forward head posture. <sup>(4)</sup> Verma et al. identified the prevalence of FHP among 12–16-year-old school going students in Gujarat, India to be 63%. <sup>(5)</sup> Forward Head Posture can cause muscle ischemia and spasm, pain, fatigue, decreased range of motion of cervical spine as well as shoulder, early disc degeneration and osteophyte formation, possible protrusion of nucleus pulposus and nerve compression, tension headache, increased thoracic kyphosis, decreased vital capacity and Temporomandibular joint pain and inflammation.

Peak Expiratory Flow Rate (PEFR) can be determined by volume of the lungs, elastic properties of the lung and the power and co-ordination of expiratory muscles in healthy people. Movements of thoracic rib cage are interdependent with spinal movements and other surrounding joints. Forward head posture can aggravate thoracic kyphosis which may hamper thoracic mobility especially thoracic extension. Because of flexed thoracic spine individual may have neck pain, depression of ribs and therefore excursion will be limited and respiratory functioning will have a negative effect. <sup>(6)(7)</sup> PEFR is simple outcome measure used to determine

respiratory system functioning which can be done easily by patient using peak flow meter. <sup>(8)</sup>

McKenzie self-therapy exercises are a set of exercises which focus on flexibility of muscle groups around the cervical spine which helps to maintain normal spinal alignment and includes mobilization and manipulation. Its main focus is on stretch exercises. This self-therapy also showed effective results in reducing pain. <sup>(3)</sup> Studies on effects of McKenzie self-therapy exercises on FHP and PEFR are less so the aim of the study is to find the effect of McKenzie self-therapy on forward head posture and respiratory function of school going girls.

## MATERIALS AND METHODS

This study was done in Vadodara, Gujarat, India (Adarsh Nivasi School). Permission from the principal was taken to perform this study. The study was explained to all students. This study was done on 60 school going adolescent girls. Participants who were 13-16 years old with CVA less than 55° and who enrolled themselves willingly for participation were included. According to the school medical records, students who had neuromuscular, respiratory, musculoskeletal or cardiovascular impairments, psychological co morbidities and congenital disorders were excluded from this study. Participants were explained whole procedure thoroughly. Assent to participate was taken from the participants. Participants were randomly assigned to two different groups of 30 participants by random table. Group A was given intervention and group B was kept in waiting period. Group A girls were given McKenzie self-therapy on daily follow up basis. Outcomes were forward head angle and peak expiratory flow rate.

Forward head posture was measured by craniovertebral angle by photogrammetry. <sup>(9)</sup> A digital photograph of sagittal view was taken in standing by Nikon S3100, placed at a distance of 1.5 meter on a fixed base without rotation or tilt.

The height of the camera was adjusted to the level of the subject's shoulder. Participants were asked to have a natural head position and then instructed to assume normal resting standing position on barefoot. Neck region was sufficiently exposed, jewelries were removed and hair was tied. Colored tape was used to mark tragus of the ear and C7 spinous process. Taken image was digitalized and CVA was measured using adobe photoshop CS6 software. Which is shown in Figure 1.



Figure 1: photogrammetry method for CVA measurement

Respiratory function was measured by peak expiratory flow meter in sitting position. (10) Participants were asked to sit with back supported straight in the chair and feet flat on the floor. Participants were asked to remove any food or gum from the mouth. At the beginning, it was made sure that scale on the meter pointed at zero. Participants were asked to hold peak flow meter exact horizontally and at 90 degree angle. Mouth piece was placed in correct manner to avoid acceleration of air with the tongue. Participants were asked to inhale deeply and slowly and asked to place mouthpiece on tongue (they were asked not to put tongue in the hole) and close the lips around it to form a tight seal. The participants were asked to blow out as fast and hard as possible. They were instructed not to blow slowly. Three trials were given to each student and the maximum value was considered. Figure 2 shows how to blow air in peak flow meter.



Figure 2: PEFR measurement

Group of six exercises (McKenzie self-therapy exercises) were given to group A.

- 1) chin tucks
- 2) neck flexion extension side bending and rotation (until it has reached the full stretched point)
- 3) scapular protraction retraction (until it has reached the full stretched point)
- 4) move the head in backward direction, and turn it until it has reached the fully stretched point
- 5) Lower the head, and turn it until it has reached the maximal point

Intervention was given for 12 weeks. Participants of group A were asked to do exercises on six days per week. Each motion had to be maintained for 10 sec followed by 5 sec rest. Each subject performed 10 sets. All exercises took 30 minutes to perform. Correct method of exercises was shown to the participants and material was provided to show how to carry out correct way of exercise. Weekly follow ups were done to see whether protocol is going correctly or not. Group B participants were allowed to participate in daily sports activities in school.

#### Statistical Analysis:

Pre-intervention data and post-intervention data were collected. Dependent and Independent t-tests were used for CVA and Wilcoxon and Mann-Whitney tests for PEFR to compare data between both the groups. The data were analyzed at 5% level of significance using SPSS version 16.

## RESULTS

Table 1 shows demographic details of participants from both groups. As shown there is no difference between the groups.

**Table 1: Demographic details of participants**

Demographics	Group A	Group B	t value	p value
Age (years)	14.13±0.68	14.33±0.86	-4.79	0.07
Weight (kg)	43.98±6.36	44.18±7.58	-0.108	0.91
Height (cm)	152.37±5.15	152.78±5.33	-0.385	0.70

Table 2 shows the mean and SD of outcome measures of group A and group B.

**Table 2: Mean and SD of outcome measures of groups A and B**

Outcome measures	Group A		Group B	
	Pre	Post	Pre	Post
CVA	46.54°±4.26°	49.56°±5.16°	48.83°±7.18°	49.14°±6.69°
PEFR (L/min)	225±80.08	278±70.16	265 ±84.03	320±81.56

Difference in outcomes using paired t-test for group A was significant for CVA and using Wilcoxon was significant for PEFR. For group B difference was significant for PEFR but using paired t-test was not-significant for CVA. Table 3 shows differences in outcome measures within the groups.

Independent t-test for mean difference data of CVA between both the groups was significant and difference using Mann-Whitney for PEFR was not significant. Table 4 shows difference in outcome measures between the groups.

**Table 3: Difference in outcome measures within the groups**

OUTCOME MEASURES	t/Z Value	p value
Group A CVA	t=-3.77,	p=0.001
Group B CVA	t= -0.289,	p=0.77
Group A PEFR	Z=-3.97,	p<0.01
Group B PEFR	Z=-0.052,	p=0.01

**Table 4: Difference in outcome measures between the groups**

OUTCOME MEASURES	t/ z value	p value
CVA	t=2.06	p=0.04
PEFR	z=-0.052	p=0.962

## DISCUSSION

The present study found statistically significant difference in both CVA and PEFR by intervening McKenzie self therapy in group A. In group B there was no significant difference found in CVA but for PEFR difference was statistically significant. Mean difference for CVA in group A is significant while for group B it is not significant. So, McKenzie self-therapy protocol was beneficent for increasing craniovertebral angle and decreasing forward head postures. Mishra et al. concluded in her study that height and

weight can also affect PEFR values. (11) Difference in age, height and weight among participants of both groups was not found to be statistically significant.

Difference in mean for CVA of group A was (t=-3.77,p=0.001). In present study, physical therapy protocol was focused mainly on range of motion and flexibility of muscles and postural alignment. However this protocol had not only shown improvement in musculoskeletal dysfunctions but also improved respiratory function. Lee et al. applied three kinds of exercises to different groups i.e. McKenzie group, Kendall group, self-stretch therapy group for 8 weeks. (3) The findings of this study were consistent with the present study in which FHP reduced through McKenzie therapy. Ruivo et al. concluded in their study that FHP and rounded shoulder postural malalignment is more seen in adolescent age group. Adolescent girls are more prone to have forward head posture and related pain compared to same age group of boys. Females had reported increased degrees of neck flexion (approximately 2°-3°) with decreased CVA (46.5°-48.4°). Moreover with this, risk of neck pain in girls also tends to increase. (9) However pain was not assessed in the present study.

Difference in mean PEFR was (Z=-3.97,p<0.01)in the present study. Park et al. reported that individuals with forward head posture had decrease in their FVC and FEV<sub>1</sub> values compared to the normal individuals. They have also reported diminished muscular activation of Sternocleidomastoid, Upper trapezius and Pectorals. This can be



influenced in accordance of motor strategies to minimize the activities of muscles that are sensing pain and to adapt compensation for this. Park et al. also reported significant decrease in respiratory functioning in individuals with FHP without having pain in neck. (12) Thus in the present study decrease in FHP & changing biomechanics could lead to increase in PEFR. N. Yozbatiran et al. reported in their study that physiotherapy protocol applied on neck or back pain patients had positive effect on increasing PEFR and chest expansion. (7) He also added that weakness of erector spinae of upper back and trapezius muscles influence the postural malalignment and minimize the respiratory capacity. FHP is known to have an influence on respiratory function by weakening the respiratory muscles, thereby decreasing their function.

Similar to the present study, Kim et al. stated that McKenzie exercise, Kinesio taping, and myofascial release were effective in improving the CV angle contributing to the forward head posture. (13) Kim et. al. also reported that McKenzie self therapy causes increase in CVA and relaxation in forward head posture, (13) which can influence the proper extension of thoracic spine and increase in respiratory compliance.

For group B difference in mean for CVA was ( $t=-0.289, p=0.77$ ) and for PEFR it was ( $Z=-3.886, p=0.01$ ). In present study it was found that routine sports activities (kabbadi, kho-kho, cricket, badminton) can improve PEFR in school going adolescents, which was continued in all the girls, but does not have beneficiary effect on the neck related (musculoskeletal) pain. Cheng et al. has also reported that any type of physical activity can affect respiratory function which is similar to findings from the present study. (14)

For between the groups, CVA ( $t=2.06, p=0.04$ ) mean difference was significant and PEFR ( $Z=-0.052, p=0.962$ ) mean difference was not significant. McKenzie self-therapy had increased CVA and improved FHP in Group A compared to

group B participants. While, there was no significant difference found for PEFR in between the group comparison as there was significant difference found for PEFR in both the groups individually. McKenzie self therapy has significant effects on both outcomes i.e. CVA and PEFR. Many studies have been done to see effects of different kinds of protocol on alleviating problems related to FHP. McKenzie self therapy would be more effective in this age group which provides home exercise protocol and minimum supervision of therapist with proper instructions of how to perform.

There are few limitations in present study. CVA values were taken at rest, hence findings cannot be generalized to the activities of daily living in functional positions, CVA angle was measured of dominant side of the each subject, again for accurate findings both sides dominant and non-dominant should be taken into the account. Neck pain of individual participants was not evaluated.

Implications of the study include using McKenzie home program for school going adolescents on daily basis to improve FHP and prevent consequences related to poor neck posture and improvement of respiratory function. In future studies, protocol can be focused on the entire spine compensation attributed to the FHP. Effect of exercises on pain can be assessed and the exercises can be studied in older population.

## CONCLUSION

Significant difference was seen in forward head posture and respiratory function with McKenzie self-therapy. Significant difference was seen in respiratory function in control group. Difference in CVA was more in exercise group and respiratory function was not significantly different between the groups.

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