

# Improvement in the Lumbo-Pelvic Rhythm by the Correction of Forward Head Posture

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## ABSTRACT

**Introduction:** Forward head posture (FHP) is one of the commonest postural abnormality in collegiate students due to improper sitting, heavy backpack load and prolong use of cell phones. In FHP, the head protrudes forward from sagittal plane and appears to be in front of the body with rounded shoulders and kyphotic posture. The main reason for FHP is tucked pelvis and poor abdominal tone. Biomechanically, the FHP is indirectly related to lumbo-pelvic rhythm. This study focused on positive relationship between FHP and lumbo-pelvic rhythm in collegiate students.

**Materials and Methods:** Quasi-Experimental study was done by simple random sampling on 40 collegiate students, both males and females were recruited in the age group between 18 to 25 years having FHP. The experimental group was given the exercise protocol and the control group performed no exercise. The protocol for experimental group was cervico-thoracic fascia release, chin tucks and chin drops, stretches for pectoral, trapezius and levator scapulae for both left and right side and Maitland's mobilization for cervico-thoracic vertebra. Duration of the study was for 4 weeks (3times/week). Kinovea software was used for evaluating FHP by measuring the cranio-vertebral angle (CVA) and Schober's test for evaluating lumbar-flexion and extension.

**Results:** The results showed significant changes in intragroup comparison between pre and post treatment value of CVA and lumbar-flexion and extension with p value <0.05.

**Conclusion:** The study was found to be effective in improving the lumbo-pelvic rhythm by the correction of FHP.

**Keywords:** Forward head posture, lumbo-pelvic rhythm, Kinovea software, abnormal posture, rounded shoulders, goniometer.

## INTRODUCTION

Forward head posture is one of the most common postural alterations in students with or without obvious presence of disease, due to improper sitting habits at the desk or computer or prolong use of mobiles - can alter the biomechanics likewise rounded shoulders and hunch back. Use of desk and chairs that are inappropriate for the physique, excessive learning activities and heavy school bags, where a bag carries approximately 10 to 15% of body's weight in high school students, and

undergraduates-experience a period of accelerated burden over the skeletal and soft tissue. Biomechanically seen, if there is alteration at one place then there shall be change in the other.

Forward head posture was prevalent in 66% of population and had an increased incidence of cervical and intra-scapular pain<sup>1</sup>. Posture due to all of these can be affected by both internal and external influences, which may make them more susceptible to injury, gradually<sup>2</sup>. In forward head posture, the head protrudes forward

from sagittal plane and appears to be positioned in front of the body, and this condition is considered as the most common postural deformity. The sub-occipital muscles-rectus capitis posterior major may be fatigued as a result of its prolonged extension activity required to level the head and eyes over time increased muscular stress throughout the entire cranio-cervical region can lead to localized and painful muscle spasm<sup>3</sup>.

Forward head posture throws off a number of key relationships in the body and for us the main culprits for forward head posture are a tucked pelvis and poor abdominal tone; and in return opening a new gateway for more abnormalities<sup>4</sup>. Therefore, the aim of this study was to find the improvement in lumbo-pelvic rhythm by the correction of forward head posture.

The head and neck are flexed about 4 degrees during the anterior pelvic tilt and extended about 4 degrees during posterior pelvic tilt<sup>5</sup>. Typical lumbo-pelvic rhythm consists of about 40 degrees of lumbar flexion and 70 degrees of flexion at the hip (pelvis on femur). Extension of trunk with knees extended is normally initiated by extension of hips followed by extension of lumbar spine<sup>6</sup>. The objective was to see the inter-relationship between head forward posture and pelvic tilt by the correction of one and improvement of the other.

In general, if seen, not only the flexion/extension in the lumbar spine and the hip joint comes into account but also the thoracic and cervical region as well the upper extremity comes into the rescue. Manual techniques have been found to reduce pain, improve circulation, correct spinal alignment, facilitate joint movements, stretch the shortened muscles and release the adhesions around the joints<sup>7</sup>. Previous studies showed that if the restricted joint is mobilized, strength is regained by removing the inhibitory effects. In this connection some authors hypothesized that increased muscle strength or spinal extension mobility can lead to postural improvement soon<sup>8</sup>.

So, the purpose of this study was to find the relationship between the forward head posture and the lumbo-pelvic rhythm.

## **MATERIALS AND METHODS**

It was a Quasi-Experimental study with pre-test and post-test measurements. The study setting was MGM Physiotherapy OPD, Aurangabad. The study duration was of 4 weeks with the sample size of 40 college going students among which 20 were in experimental and 20 were in control group. In the study 40 participants aged 18 to 25yrs with forward head posture were recruited by simple random sampling from the physiotherapy college. The inclusion and exclusion criteria were as follows:

### **Inclusion criteria:**

- Both males and females
- Age – 18 to 25yrs.
- Students with forward head posture. CVA Angle of less than 52<sup>0</sup> on Kinovea software<sup>9</sup>.
- Collegiate students

### **Exclusion criteria:**

- Any Musculo-skeletal and neurological disorders viz.-Congenital cervical deformities
- Any structural impairments- Scoliosis, Torticollis
- Any Pathological conditions of the spine, hip, knee and pelvis that may affect the outcome of the study.
- Any traumatic conditions in past 6months.
- Pregnant women.
- Hearing impairment and Balance impairment.

### **Procedure:**

An explanation on study was given and informed consent was taken from each individual after the screening of the subjects as per the exclusion and inclusion criteria. The forward head posture was evaluated with the use of Kinovea software (pre-test measurement) and lumbopelvic rhythm was evaluated with the use of Schober's test and goniometer. After the screening of the baseline measurements, the subjects were

randomly allocated into two groups- experimental group (group 1) and control group (group 2).

For the correction of forward head posture, the experimental group was given the exercise protocol such as cervicothoracic fascia release, neck exercises like chin tucks, chin drops and pectoral, trapezius, levator scapulae stretch (10 repetitions, 6 sec hold) for both right and left side and Maitland mobilization<sup>10</sup> for cervico-thoracic vertebra (2-3 oscillations/sec, 3-4 glides) for 3 times/week<sup>11</sup> for 4 consecutive weeks<sup>12</sup>. The control group was given no exercise for 4 weeks of duration. After 4 weeks each individual was again assessed for forward head posture and lumbo-pelvic rhythm. (post-test measurement).

#### **Forward head posture measurement:**

Subject preparation:

Position of subject: Sitting.

Adhesive markers were placed at tragus of the ear and 7<sup>th</sup> cervical vertebra. The plumb line was hung freely lateral to the subject to represent the true vertical line. The subjects were instructed prior to photo capturing to assume a relaxed resting posture while looking forward at the target with arm rested beside the body.

Photograph capturing:

The camera was put 100 cm away from the subject's lateral foot at level of subject's tragus. Three sagittal plane photos were taken to minimize the error like postural sway.

Assessment of forward head posture:

To assess forward head posture, the postural angle was measured by cranio-vertebral angle (CVA). The CVA was measured as the angle between an imaginary line extending from 7<sup>th</sup> cervical vertebra through the tragus and the horizontal line. The values for CVA are indicative of the position of the head relative to the trunk. The smaller the CVA, the greater the forward head posture.

#### **Lumbo-pelvic rhythm measurement:**

First of all, students with no pelvic squaring were selected. Schober's test<sup>13</sup> was used to assess the lumbo-pelvic rhythm. In this test a point is marked midway between the 2 PSIS which is the level of 2<sup>nd</sup> sacral vertebra. Then points 5 cm below and 10 cm above that level were marked. The distance between the 3 points was measured, patient was asked to flex forward and the distance was re-measured. The difference between the 2 measurements indicates the amount of flexion occurring in the lumbar spine. After this manoeuvre, hip flexion and hip extension was measured with the help of goniometer. The patient position was supine lying, the centre fulcrum of goniometer was placed on greater trochanter of femur, proximal arm was aligned with lateral midline of pelvis and distal arm with lateral midline of femur. Measurement was taken 3 times to eliminate error.

#### **Statistical analysis-**

Statistical analysis was done using graph pad-instat 3 software. A paired t-test was used for pre- and post-treatment measurement between inter and intra-group comparison.

## **RESULTS**

After statistical analysis results showed that student's age ranging from 21-23 having more tendency toward FHP, while females are more prone to have FHP, see Table 1a and 1b.

Changes in CVA-Intragroup comparison of mean CVA in group 1 showed more significant changes in pre versus post treatment values than group 2. See table 1.1

Changes in hip flexion and hip extension-Intragroup comparison between pre versus post treatment values of both group 1 and 2 reveals significant changes. Table 1.2. and 1.3

Changes in lumbar flexion and lumbar extension- Comparison between pre versus post treatment values of both group 1 and 2 reveals significant changes. Table 1.4 and 1.5

**Table 1a: Distribution of participants according to age.**

AGE	GROUP 1		GROUP 2		TOTAL	
	NO.	%	NO.	%	NO.	%
18-20	0	0	5	25	5	12.5
21-23	15	75	15	75	30	75
24-25	5	25	0	0	5	12.5
TOTAL	20	100	20	100	40	100

The above table showed patients ageing from 21 to 23 years (75%) in both groups (experimental and control) are more prone to have forward head posture.

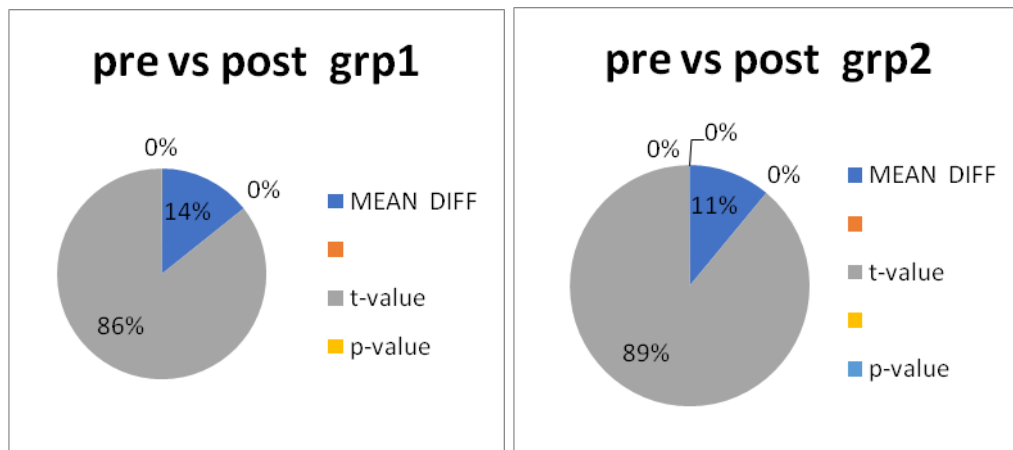
**Table 1b: Distribution of participants according to gender.**

GENDER	GROUP 1		GROUP 2	
	NO.	%	NO.	%
MALE	2	10	3	15
FEMALE	18	90	17	85
TOTAL	20	100	20	100

As revealed from above table females showed more tendency towards forward head posture.

**Table 1.1: Intragroup comparison of mean CVA:**

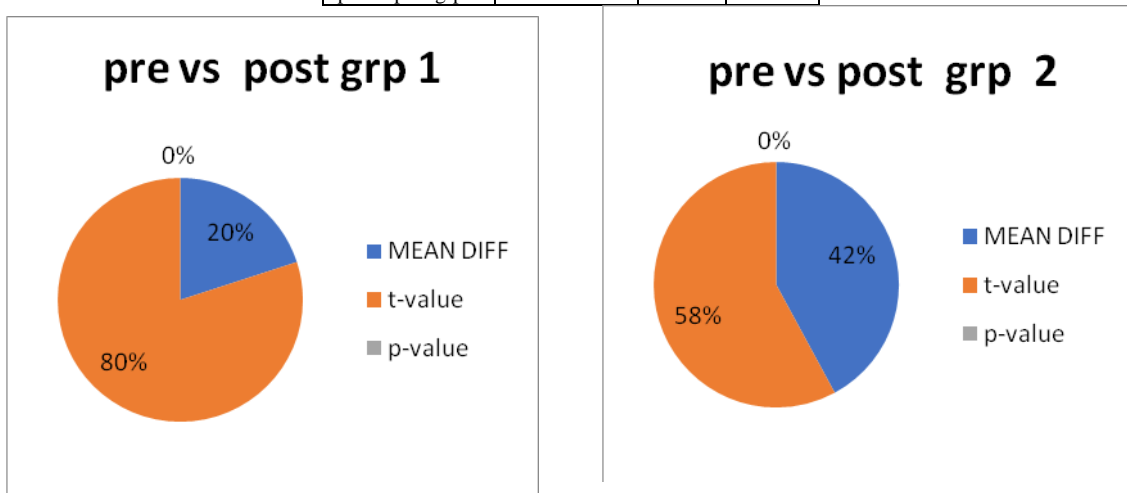
	MEAN DIFF	t-value	p-value
pre vs post grp1	1.15	6.902	0.007
pre vs post grp2	0.1	0.8094	0.001



There was more significant change in pre vs post treatment values of CVA in group 1 than compared to group 2.

**Table 1.2: Intragroup comparison of mean hip flexion.**

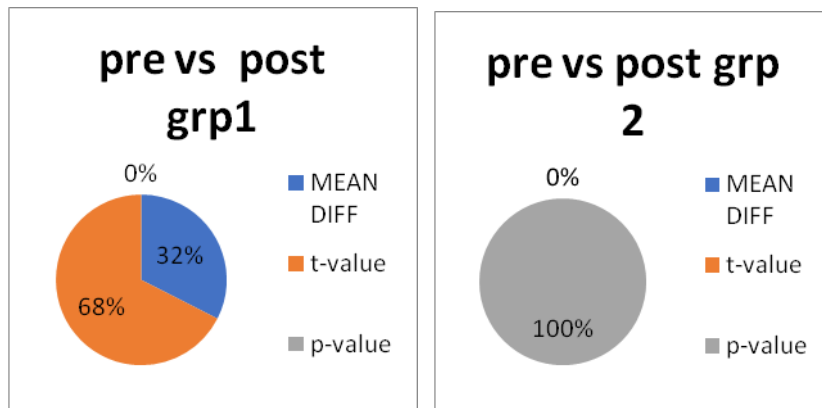
	MEAN DIFF	t-value	p-value
pre vs post grp 1	0.25	1	0.0001
pre vs post grp 2	0.4	0.5503	0.0001



Intragroup comparison between pre vs post treatment values of group 1 and 2 revealed significant change in hip flexion.

**Table 1.3: Intragroup comparison of mean hip extension.**

	MEAN DIFF	t-value	p-value
pre vs post grp1	1	2.078	0.0001
pre vs post grp 2	0	0	0.0001



Intragroup comparison between pre vs post treatment values of group 1 and 2 showed significant change in hip extension.

**Table 1.4: Intragroup comparison of mean lumbar flexion.**

	mean diff	t-value	p-value
pre vs post grp 1	0.5	2.517	0.0001
pre vs post grp 2	0.15	0.9002	0.0001

**Table 1.5: Intragroup comparison of mean lumbar extension.**

	MEAN DIFF	t-value	p-value
pre vs post grp 1	0.8	4.292	0.0001
pre vs post grp 2	0.1	1.453	0.0001

Intragroup comparison between pre vs post treatment values of lumbar flexion and extension in group 1 and 2 showed significant change.



(a) pre-treatment CVA (b) post-treatment CVA  
**Figure 1: Shows the pre- and post-treatment CVA angle in an individual.**

**DISCUSSION**

In experimental group, after giving the cervicothoracic fascia release, Maitland mobilization for cervico-thoracic vertebra,

pectoral, trapezius, levator scapulae stretch and neck exercises like chin tucks ,chin drops for 3 times/week for 4 consecutive weeks, there was significant change in pre-

treatment and post -treatment values of CVA with p value of 0.007.

In group 2 (control) after 4 weeks there was also a significant change (with p value of 0.001) but it was very less as compared to group 1. Thus, in the present study, it was found that after giving cervical manipulations, cervico-thoracic fascia release, stretches and neck exercises like chin tucks and chin drops helps in correcting forward head posture.

Our study revealed that students age ranging from 21-23 years, showed more than 75% tendency towards forward head posture. As per previous studies, students are more prone to have forward head posture because of carrying heavy back pack. CVA was selected as one of the outcome measures to evaluate difference between study and control group. CVA has a good reliability (ICC ranged from 0.85 to 0.91) and validity (ICC ranged from 0.86 to 0.94)<sup>14</sup>

A restriction of motion at either lumbar spine or at hip joint may change the lumbo-pelvic rhythm. That's the reason we included hip flexion & extension measurements by goniometry as well as lumbar flexion & extension by using Schober's test. Schober's has moderate validity ( $r=0.67$ ;95% CI 0.44-0.84) and excellent reliability (ICC -0.91;95%CI 0.83-0.96)<sup>15</sup>. Goniometry have good validity ( $r=0.97-0.98$ ; ICC- 0.98-0.99) and reliability ( $r=0.98$ ; ICC- 0.99)<sup>16</sup>.

When comparison within group was done there was significant change in pre versus post treatment values of hip flexion and hip extension but comparison within 2 groups (experimental and control) showed no significant change. This may be due to several limitations in our study like there was absolutely no treatment given to students in control group, so most values remained same after 4 weeks. Schober's test showed significant change in intragroup pre versus post treatment values in both lumbar flexion and extension. These results were similar to a previous study of Kathleen M Black et al. who proved that, head

orientation is maintained by compensatory adjustments in both the upper and lower cervical spine and changes in lumbar posture were associated with compensatory changes in overall cervical position. Hence, lumbar and pelvic position should be considered when control of cervical posture is desired.

Previous study of Esola MA, et al. spine (1996) which showed direct correlation between hip flexion-lumbar flexion and hip extension-lumbar extension which was much similar to our results obtained by statistical analysis.

Thus,our study showed improvement in the lumbo-pelvic rhythm by the correction of forward head posture.

## **CONCLUSION**

This study showed clinical significance in improvement of lumbopelvic rhythm by forward head posture correction given for 4 weeks of treatment. That includes cervicothoracic fascia release, Maitland mobilization for cervicothoracic vertebra, stretching for trapezius, pectorals, levator scapulae and neck exercises like chin tucks, chin drops.

## **Limitations:**

Sample size was small for better prediction of the study. Selection of the sample size needed to be more precise and prompter. X-ray can also be used as an outcome measure to check forward head posture. Same therapist should give the treatment to impart similar technique throughout the duration for beneficial effect. The discontinuation of subjects was inevitable due to their feasibility.

## **Future Scope-**

In future same study can be carried in different population for longer duration of period. Large sample size can give much better results. By correction of forward head posture kinetic chain of the body can be improved.

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