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# Effect of strain-counter strain technique on the Craniovertebral angle in subjects with forward head posture: An experimental study

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## Abstract

**Background:** Forward head posture (FHP) is the anterior positioning of the cervical spine. It is the most common deviation from the normal curvature of the cervical spine. It involves an excessive anterior position of the head in relation to the theoretical plumb line perpendicular to the body's centre of gravity. In forward head posture there is extension of upper cervical spine, flattening and flexion of lower cervical spine with an increase in lordosis and rounding of the upper back and elevation and protraction of the shoulders. Every inch of your neck goes forward there is an extra 10 lbs (4.5kg) of weight on your neck which cause forward neck posture. Since the strain- counter strain technique is always being used by many therapists, to evaluate the effect of the technique on forward head it has to be studied. Hence this study evaluates the effect of strain-counter strain technique on the craniovertebral angle in forward head posture.

**Materials and methods:** 30 individuals having forward head posture were assessed for craniovertebral angle using the photograph method and the cervical range of motion using the universal goniometer.

**Results:** The pre-post values showed statistically significant changes in the improvement of range of motion in flexion, extension, side flexion. There were no significant changes in bilateral cervical rotation range of motion and the craniovertebral angle.

**Conclusion:** Our study shows that the strain-counter strain technique is not effective in improving forward head posture, but appears to increase range of motion in these subjects.

**Keywords:** Strain-counter strain, forward head posture, craniovertebral angle, cervical range of motion

## Introduction

Forward head posture (FHP) is the anterior positioning of the cervical spine (Weon, JS Oh, 2010). It is the most common deviation from the normal curvature of the cervical spine (Grob and Frauenfelder, 2007). It involves an excessive anterior position of the head in relation to the theoretical plumb line perpendicular to the body's centre of gravity (Yoo and An, 2009). In forward head posture there is extension of upper cervical spine, flattening and flexion of lower cervical spine with an increase in lordosis and rounding of the upper back and elevation and protraction of the shoulders (Duttons, 2016).

A forward head posture can be a result of injuries like sprains and strains of the neck, weak neck muscles and poor posture (Cailliet R, 1977) and altered muscle activity of the neck protractors and retractors[8]. The muscles that become tight and inhibited are pectorals, upper trapezius, levator scapulae, sternocleidomastoid, suboccipitals, subscapularis, latissimus dorsi and arm flexors. The muscles that become weak and facilitated are longuscapitis, longuscolli, hyoids, serratus anterior, rhomboids, lower trapezius, posterior rotator cuff and arm extensors (Gore and sepic, 1986). When the pressure on the neck and shoulder is present, the neck and shoulders have to carry the added weight all day in an isometric contraction.

Posture is the alignment of body segments in certain positions such as standing, sitting and lying. Each activity of daily living needs certain form of posture to be maintained. Any deflections from the normal postural pattern, would unfavourably affect the adjacent joint muscles, resulting in pathological conditions. It has been studied and proved that sustaining one posture for a long period leads to shortening or lengthening of the respective muscles. The muscles that undergo shortening become tight and strong while the opposing muscles go into lengthening and weakness. It has also been proved that postural muscle shortening may occur due to muscle overuse. This is the mechanism which leads to postural deviations (Con and craig).

Forward Head Posture causes compression of posterior zygopophyseal joints, posterior intervertebral disk and narrowing of intervertebral foramina leading to nerve root compression (Sami and Mohammad, 2000). The posterior capsule of zygopophyseal joints becomes shortened (Janda approach, 2010). Constant forward head posture can cause ischemia of cervical extensor muscles (Carolyn and Sharon, 2000). Forward head posture is found to cause shoulder impingement syndrome (Jeremy and Christine, 2005). It can also lead to cervicogenic headaches, neck pain, and reduced neck proprioception (Wrisley and Patrick, 2000). There is an incidence of 66% for forward head posture among people in age group of 20 to 50 yrs (Edmonton, 2008; Greigel, 1992; Lennon, 1994). Children with mouth breathing habit and people with upper airway obstruction are also found to have forward head posture (Cristina and Tatiana, 2010).

In Forward head where anteriorly placed LOG requires steady isometrics muscle tendon to support head and suprahyoid muscle stretch pulls mandible into retrusion .In long term it can cause pain, fatigue, muscle ischemia and possibilities of protrusion of nucleus pulposus. Mandible retrusion can compress and irritate retrodiscal pad causing inflammation and pain (Norkin, 2012).

Various methods for assessing forward head posture: Cervical range of motion, Universal goniometer, Plumb line and Inclinometer. Various software are also available to measure the cranio -vertebral angle (CVA). The ideal way of measuring the CVA is by finding the angle between the tragus and C7 spinous process. The normal angle is $54^{o}$. Therefore the angle less than $54^{o}$ suggested as having forward head posture (Garrett and Youdas, 1993).

Positional Release Therapy is based on Counter strain, developed by Lawrence Jones and several innovations developed by George Roth, co author, Kerry D'Ambrogio (PT), and numerous pioneers in advanced musculoskeletal assessment and treatment strategies. Body posture and the position of the body parts has been a subject of intense speculation (Kerry and George).

Simons et. al define a trigger point ( TrP) as a hyperirritable spot associated with a taut band of a skeletal muscle that is painful on compression, palpation, and/or stretch, and that usually gives rise to a typical referred

pain pattern (Travell and Simons, 1990). The three major characteristics of Positional Release Therapy are: body positioning, the use of tender points, and indirect nature of therapy. Effects of Positional Release Therapy: normalisation of muscle hypertonicity, normalisation of fascial tension, reduction of joint hypo mobility, increased circulation and reduced swelling, decreased pain, increased strength (Travell and Simons, 1999).

A study done on forward neck posture to check the effectiveness of an exercise programme which included neck extensor and pectoralis stretch and deep neck flexor and shoulder retractor strengthening exercise for 10 week period. The study concluded that there was significant difference and interaction between range of motion and on postural measurement and resulted that this exercises can improve posture alignment in subjects with forward neck posture (Harman and Hubley, 2005).

A study was to compare the effects of therapeutic exercise with or without strain - counter strain technique in subjects with low back pain. The group which received a combination of both treatments showed to produce greater improvement in pain and range of motion (Mohamed and Shiwi, 2014).

Hence this study evaluates the effect of strain-counter strain. The aim of this study is to evaluate the effect strain-counter strain on the craniovertebral angle in subjects with forward head posture.

## Materials and methods

The study with a pre post experimental study design was conducted on 30 individuals through non-probability sampling design for a period of 6 months.

Males and females between the ages of 18 to 30 years, having forward head posture were included in the study.

Individuals who had a history of any neck or shoulder injuries in the past 6 months, neck pain with neurological symptoms, any psychological disorders and congenital anomalies of the cervical spine were excluded.

### Outcome measures

### Craniovertebral angle

This was measured using the photographic method. The digital camera that was used for taking photographs of the participants was mounted 1.5 m away from the subjects. To maintain the same distance between the camera and the subjects, a spot on the ground was marked for the subjects to stand on and spot was taped on to the floor where camera was held. The subjects stood barefoot and in a standing position, the photos were taken from the subject's right hand side upon which the CV angle was calculated by measuring the angle found at the intersection of a line drawn from the tragus of the ear through the spinous process of C7 and a horizontal line through C7 (Grimmer-Somers, 2008; Hazar and Karabicak, 2015).

### Cervical range of motion

This was assessed using the universal gonimeter (UG).

For measuring cervical flexion and extension, the starting position for both cervical flexion and extension was assumed after the examiner manually adjusted the subject's neck so that the external acoustic meatus-to-base of nares reference line was parallel to the floor. The UG's axis was centred over the external acoustic meatus; the fixed arm was held vertical, while the movable arm was aligned with the meatus-to-base of nares reference line as the subject actively flexed and extended the neck.

For measuring cervical lateral flexion, each subject bent his or her head and cervical spine first left and then right without elevating his or her shoulder. The examiner aligned the fixed arm of the UG parallel with a horizontal reference line between the

patient's sternal notch and acromion process; the movable arm was aligned with the midline of the patient's nose. The starting or neutral position was with the arms of the UG perpendicular.

For measuring cervical rotation, each subject rotated his or her head first left and then right. The UG axis was centred on the top of the subject's head; the fixed arm was aligned parallel to an imaginary line between the subject's acromion processes, and the movable arm was aligned with the subject's nose (Amr and Amira, 2016).

**Procedure**

An approval for the study was obtained from the Institutional Ethical Committee. Subjects were screened for inclusion and exclusion criteria. After obtaining consent from the participants, all the subjects were included in the following experimental study. The subjects were evaluated for the craniovertebral angle using the photograph method and the cervical range of motion using universal goniometer. The participants received the conventional treatment of thermotherapy in the form of hydro collator pack for 15 minutes followed by the strain-counter strain technique.

**Strain- Counter Strain technique**

This technique is also called as the "Exaggeration of distortion". The patient is in supine position and will be asked to lie down on his/her unaffected side i.e., treatment side will be on top. So as to increase a score of 10, therapist will lightly pinch the pain area and try to alter the position of the arm, by taking it up and over the subject head to slack the muscle or by altering neck position making it bent to side which is painful on the thick cushion. This position will be held for 90 sec. After the release the subject will be bought back into normal position (Singh and Chauhan, 2014).

**Statistical analysis**

Statistical analysis of the present study was done using manually as well as statistical package of social science prism 4 software or SPSS version 21 for statistical measures. For the purpose, all the data collected was entered into an excel sheet, tabulated and subjected to statistical analysis. Several statistical analysis were used such as mean, standard deviation of mean, test of significance paired 't' test, ANOVA test, Kolmogorov Smirnov. Data from subject's demographic details i.e., age was analyzed using by one way ANOVA test and normality of all variables was analysed by Kolmogorov Smirnov test. Probability values less than 0.0001 were considered highly significant.

**Results**

The present study titled "Effect of Strain-Counter Strain technique on the Craniovertebral Angle in subjects with Forward Head Posture - An Experimental Study" which comprised of 30 participants from age 18-30 years were included in the study.

**Demographic profile**

1. Gender distribution

In the present study 30 participants were included. The gender distribution was 25 females (83.33%) males and 5 males (16.66%).

2. Age distribution

In this study, the mean age of participants included was 22.733±1.484.

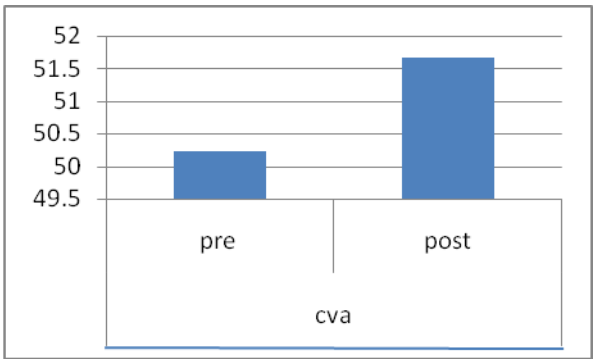
**Table 1: Demographic Data.**

| Gender | N | Age |
|---|---|---|
| F+M | 30 | 22.733±1.484 |

**Outcome measures**

**Craniovertebral angle**

In the current study, craniovertebral angle executed a mean of 51.666±0.922, with a percentage change of 2.709% and p-value being 0.641 which did not show any significance (Table no. 2) and (Graph 1).




**Graph 1: Craniovertebral angle.**

**Cervical range of motion**

Cervical range of motion, the mean for flexion was 44.566±0.727, with a percentage change of 10.625 and a p-value 0.0001 which was considered extremely significant (Graph 2). The mean extension was 44.366±0.808, with a percentage of change of 9.768 and p-value 0.0001 was considered extremely significant (Graph 3). The mean for right and left side flexion was 44.3±0.569, percentage of change 9.932%, p-value 0.0001 and 44.466±1.042, percentage of change was 9.519% and p-value 0.0001 respectively which was considered extremely significant (Graph 4a and 4b). The mean executed for right and left rotation was 78.733±1.311, with a percentage of change 10.28%, p-value 0.0036 and mean of 78.966±1.245, percentage of change 9.159% and p-value of 0.0036 respectively which did not show any statistical significance (Graph 5a and 5b). (Table no. 3).

**Table no. 2: Craniovertebral angle.**

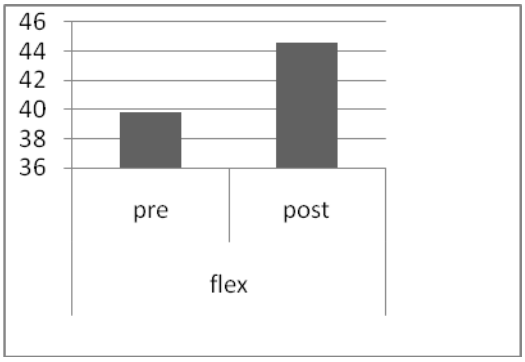
| | Time | Mean±SD | Mean Diff.±SD Diff. | % of change | Paired t | p value |
|---|---|---|---|---|---|---|
| CVA | Pretest | 50.023±1.006 | 1.433±0.0837 | 2.709% | 5.751 | 0.641 |
| | Posttest | 51.666±0.922 | | | | |

P-value<0.0001

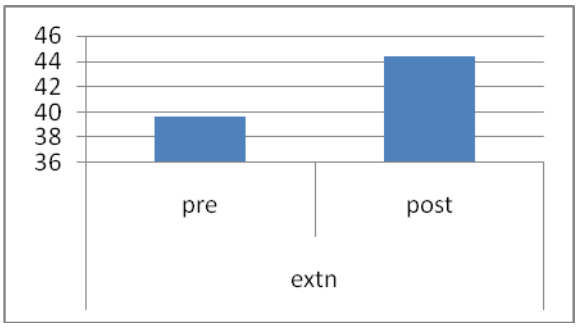
**Table no. 3: Cervical range of motion.**

| Cervical range of motion | Time | Mean±SD | Mean Diff.±SD Diff. | % of change | Paired t | p value |
|---|---|---|---|---|---|---|
| Flexion | Pretest | 39.833±1.510 | 4.733±0.782 | 10.62% | 15.462 | 0.0001* |
| | Posttest | 44.566±0.727 | | | | |
| Extension | Pretest | 39.633±0.889 | 4.334±0.081 | 9.768% | 21.560 | 0.0001* |
| | Posttest | 44.366±0.808 | | | | |
| Right Rotation | Pretest | 70.633±2.266 | 8.1±0.955 | 10.28% | 16.943 | 0.0001* |
| | Posttest | 78.733±1.311 | | | | |
| Left Rotation | Pretest | 71.5±2.177 | 7.233±0.932 | 9.159% | 16.304 | 0.0001* |
| | Posttest | 78.966±1.245 | | | | |
| Right Lateral Flexion | Pretest | 39.9±2.234 | 4.4±1.66 | 9.932% | 8.946 | 0.0001* |
| | Posttest | 44.3±0.569 | | | | |
| Left Lateral Flexion | Pretest | 40.238±1.042 | 4.233±1.33 | 9.519% | 10.424 | 0.0001* |
| | Posttest | 44.466±1.042 | | | | |

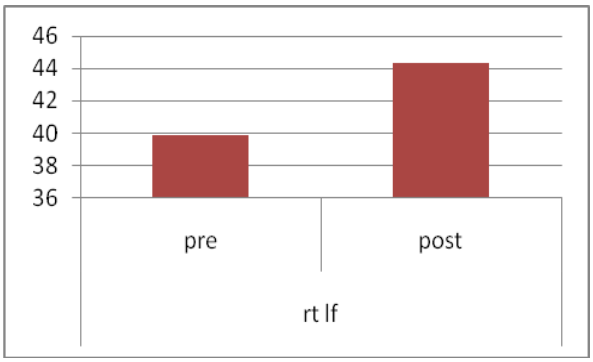
Pre-post values for cervical range of motion. P-value<0.0001



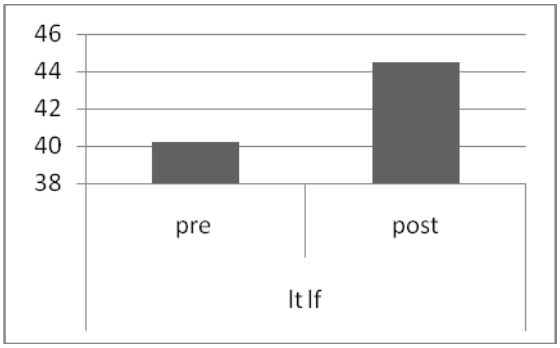

**Graph 2: pre-post flexion range of motion.**



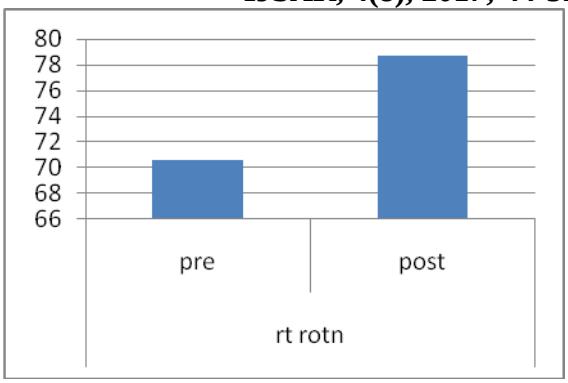

**Graph 3: pre-post extension range of motion.**



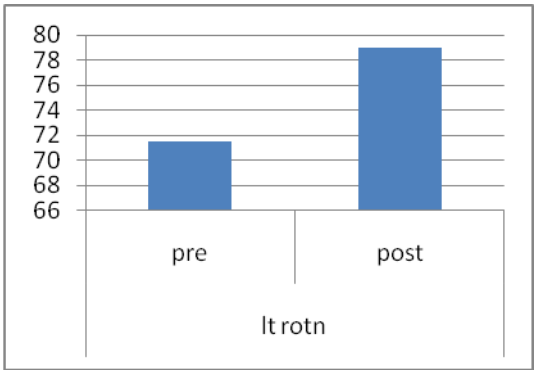

**Graph 4a: pre-post lateral flexion (right).**




**Graph 4b: pre-post lateral flexion (left).**




**Graph 5a: pre-post cervical rotation (right).**




**Graph 5b: pre-post cervical rotation (left).**

**Discussion**

The present experimental study was aimed to find the effect of strain-counter strain technique on the Craniovertebral angle in subjects with Forward Head Posture.

Gender distribution in the present study indicates that the FHP occurrence is more in females (86.67) when compared to males (13.33).This matched the findings of other studies which demonstrated increased occurrence in females than in males (Chiuu, 2002; Briggs, 2004; Cho, 2008). The age group between 18 to 30 years was taken as an inclusion criteria as several studies have shown the occurrence of FHP in the above mentioned age group (Lee and Han, 2015).Reviews have stated that forward head posture increases in individuals during the work, which involves an excessive anterior positioning of the head in relation to the theoretical plumb line perpendicular to

the body's centre of gravity. This must be a reason why FHP is the common type of posture in sedentary workers (Yoo, 2015). Studies also reveal that FHP can be a result of sprains and strains of the neck, imbalance in the neck muscles and the poor posture.

Usually long duration workers, working on computers are more susceptible to having neck pain and forward head because of hours spent studying and working on computers (Kang and Park, 2012). All these activities are done in static sitting position with the head bent forward, where during computer processing the keyboard and monitors are held close together resulting in neck pain and slouched posture.

In our study, the outcome measures taken were the craniovertebral angle and active cervical range of motion. Study done on school children by M.H. Kim et al in 2008, revealed that there was a reduction in the mean sagittal plane head posture angle that is the craniovertebral angle in subjects with forward head posture.

Another study done by Takashi et al in 2014 has concluded that there is an association between anterior translation of the cervical spine and active cervical range of motion. The individuals with forward head posture have reduced active movements of the neck which occurs due to the bony alterations and the muscular imbalance.

In the present study the strain-counter strain technique was applied on trapezius and the sternocleidomastoid muscles, a study was done by Jong et al in 2009, which proved that individuals with forward head posture have sustained activity of the upper and lower trapezius, serratus anterior and the sternocleidomastoid therefore having multiple tender points.

A study done by Mohammad et al, proved that strain-counter strain technique in combination with therapeutic exercise when applied in individuals with back pain, there was a significant reduction in pain and improvement in the lumbar range of motion than those who received strain-counter strain alone which favours the present study in terms of cervical range of motion.

In a study done by Perrault et al in 2009, proved that strain counter strain may reduce upper trapezius pain and tenderness but may not improve the disability, this holds good for the conclusion of the study suggests that strain-counter strain technique does not improve disability.

Hence, in the present study strain-counter strain technique demonstrated statistically significant improvement in the cervical range of motion but did not show any improvement in the craniovertebral angle. The primary limitation in this study was small sample size and occupation relevance was not included. Functional limitation was not assessed. The therapy intervention time can be increased. Electro therapeutic modalities can be used for relieving pain. Stretching and strengthening exercises which have proven to b effective in the management of forward head posture would have been included with strain-counter strain technique as a control group.

## Conclusion

Findings of this study conclude that the effect of strain-counter strain technique in subjects with forward head posture is not effective in increasing the craniovertebral angle.

## Acknowledgment

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**Conflicts of interest:** None.

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