SPORT TK-EuroAmerican Journal of Sport Sciences

https://revistas.um.es/sportk Online ISSN: 2340-8812

Received: **11/02/2023.** Accepted: **25/06/2023.** Published: **31/12/2023**

# Effect of two different manual therapy techniques for treatment of forward head posture: A comparative study

# Efecto de dos técnicas diferentes de terapia manual para el tratamiento de la postura de la cabeza adelantada: Un estudio comparativo

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## ABSTRACT

**Background**: Forward head posture (FHP) is a misalignment of the head on trunk that makes the external moment longer by shifting the gravitational center in front of the load bearing axis causing stress on the suboccipital muscles with functional movement limitations and formation of myofascial trigger points (MTrPs). **Objectives:** To compare between suboccipital muscle inhibition technique (SMIT) and progressive pressure release technique (PPRT) on craniovertebral angle (CVA) and neck range of motion (ROM) in individuals with FHP and active suboccipital MTrPs. **Methods:** Forty-five subjects were randomly assigned in three groups. Group A was given postural correction exercise, group B received SMIT and postural correction exercise, and group C received suboccipital PPRT and postural correction exercise. **Results**: Statistical significance was found within and between groups in respect to ROM in all directions *($P < 0.05$)* except for right and left side bending between groups A and B, which was $P = 0.54$ and $P = 0.67$, respectively. CVA had shown significant results for within and between groups *($P < 0.05$)* except for group A versus group B ($P = 0.41$). **Conclusion:** Both techniques work to increase CVA and improve ROM in individuals with FHP. However, suboccipital PPRT has shown to be more effective.

## KEYWORDS

Forward head posture (FHP); suboccipital muscle inhibition technique (SMIT); progressive pressure release technique (PPRT); neck range of motion (ROM).

## RESUMEN

**Antecedentes:** La postura de la cabeza hacia adelante (FHP, por sus siglas en inglés) es una desalineación de la cabeza sobre el tronco que prolonga el momento externo al desplazar el centro gravitacional frente al eje que soporta la carga, causando estrés en los músculos suboccipitales con limitaciones de movimiento funcional y formación de puntos gatillo miofasciales (PGM). **Objetivos:** Comparar entre la técnica de inhibición del músculo suboccipital (SMIT) y la técnica de liberación progresiva de presión (PPRT) en el ángulo craneovertebral (CVA) y el rango de movimiento del cuello (ROM) en individuos con FHP y PGM suboccipitales activos. **Métodos:** Cuarenta y cinco sujetos fueron asignados aleatoriamente en tres grupos. El grupo A recibió ejercicio de corrección postural, el grupo B recibió SMIT y ejercicio de corrección postural, y el grupo C recibió PPRT suboccipital y ejercicio de corrección postural. **Resultados:** Se encontró significación estadística dentro y entre los grupos con respecto al ROM en todas las direcciones ($P < 0{,}05$) excepto para la flexión del lado derecho e izquierdo entre los grupos A y B, que fue $P = 0{,}54$ y $P = 0{,}67$, respectivamente. CVA había mostrado resultados significativos dentro y entre los grupos ($P < 0{,}05$), excepto para el grupo A versus el grupo B ($P = 0{,}41$). **Conclusión:** Ambas técnicas funcionan para aumentar el CVA y mejorar el ROM en individuos con FHP. Sin embargo, la PPRT suboccipital ha demostrado ser más eficaz.



## PALABRAS CLAVE

Postura de la cabeza hacia adelante; técnica de inhibición del músculo suboccipital; técnica de liberación progresiva de presión; rango de movimiento del cuello.


## 1. INTRODUCTION

The musculoskeletal system is a group of interconnected and mechanistically integrated components in the human body (Donatelli and Wooden, 2009). The cervical spine is one of the most common targets for checking for postural changes. For example, forward head posture (FHP) makes the deep cervical flexors weaker and the opposite muscles in the cervical extensors shorter (Contractor et al., 2019). This abnormality is caused by an increase in the curvature of the lower cervical spine which causes the lower cervical spine to flex abnormally and the upper cervical spine to extend. The suboccipital muscles, posterior ligaments, and membranes connected to the atlanto-axial and atlanto-occipital joints all become less flexible over time as a result of this posture (Ramieri et al., 2022).

A valid and reliable clinical method for obtaining an objective measurement of FHP is through the assessment of the craniovertebral angle (CVA) which can be obtained using a photograph of the sagittal view of an individual's head and neck and is formed by measuring the angle between two lines that go through certain points on the body meet. A first line is drawn from the tragus of the ear to the spinous process of the seventh cervical vertebrae. The second line goes horizontally through the spinous process of the C7 vertebrae (Molaeifar et al., 2021). CVA cutoff values used as criterion to classify head posture vary among research studies. "Normal" head posture has been reported to begin at CVA values > 53° (Kong et al., 2017), while other researchers have designated values of ≥ 49.9° (Ramalingam & Subramaniam, 2019).

Simons et al. (1999) suggested that hyperirritable points along with tense bands of muscle, known as myofascial trigger points (MTrPs), may be activated by postural deviations in the cervical spine. During palpation, compression or during stretch, it produces pain which refers to remote areas. When the trigger point produces spontaneous referred pain that is typically radiating, it is known as active trigger point. Whereas trigger points with no immediate pain is called latent trigger points.

The human fascia is an elastic collagenous connective tissue that runs throughout the body giving, nutrition and flexibility to body structures. Skeletal muscles throughout the body are linked indirectly to each other by fascial tissue forming a network with some specific pattern. Thus, when undue stress is applied over one part causing fascial restrictions, other body parts will also get involved. Suboccipital muscles, dura mater, and C2 vertebrae are connected to each other through the same fascia. Fascial restriction can cause the inadequate movement of the muscles and limited range of motion (ROM) (Ramezani and Arab, 2017).

To reduce myofascial restriction in the suboccipital area and relieve tension in the suboccipital muscles, a manual technique known as suboccipital muscular inhibition technique (SMIT) is implemented through the application of sustained pressure to release facial restrictions, tightness, and adhesions in any plane responsible for causing pain and reduced ROM (Molaeifar et al., 2021). Previous studies have reported that SMIT increases the range of motion in patients with several pathologic conditions (Jeong et al., 2018; Antolinos-Campillo et al., 2014; Aparicio et al., 2009; Rizo et al., 2012; Oliveira-Campelo et al., 2010) and when used along with conventional treatment significantly improved neck pain, disability, and range of motion in individuals with forward head posture (Aggarwal et al., 2022).

Progressive pressure release (PPRT) technique is a manual strategy utilizing the thumbs, knuckles or four fingers of one or both hands by gradually increasing pressure on the MTrPs. It works the same way as the barrier-release technique to get rid of the muscle contraction knot (Travell and

Simons, 1992). It is thought to bring the length of the sarcomere back to normal, softening the felt knot and inactivating the MTrPs which cause tight bands and pain. This manual application causes ischemia, which is followed by reactive hyperemia (Ceballos-Laita et al., 2022).

For FHP, it is recommended to strengthen the deep cervical flexors and shoulder retractor muscles and to stretch the cervical extensors and pectoral muscles. Tissue imbalances leading to FHP can be corrected with the use of these exercises. Many studies have shown that strengthening weak postural muscles and stretching short ones is an effective way to improve postural alignment (Ruivo et al., 2017; Harman et al., 2005; Im et al., 2015; Seidi, 2014) There is strong evidence that exercise training programs improve FHP, as measured by the craniovertebral angle (Sheikhhoseini et al., 2018).

## 2. METHODS

A pretest–posttest randomized controlled experimental study design. Outcomes were measured pre- and post- the treatment period. From September 20, 2021, to February 20, 2022, the research was conducted at Badr University's physical therapy outpatient clinic in Cairo, Egypt. Before the study began, subjects were introduced to the details of the procedures, given instructions, and asked to sign a consent form. The study was approved by the Research Ethics Committee of Cairo University's Faculty of Physical Therapy, with approval no. (P.T.REC/012/002781). It was prospectively registered for Pan African Clinical Trail Registry with number PACTR202109867376877.

### 2.1. Participants

Forty-five subjects fulfilled the inclusion criteria as per the literature (Kim et al., 2018) (18–25 years, male or female, CVA< 52 and tenderness over the suboccipital region) were recruited in this study from faculty of physical therapy at Badr University in Cairo, Egypt. Subjects were excluded from the study if they couldn't make the required number of visits, complained of dizziness or radicular pain, or had had neck surgery before. Pregnant women were also excluded from the study. They were divided into three groups based on a random selection: group A (n=15; 4 males, 11 females) received posture correction exercises, twice weekly for four weeks, group B (n=15; 6 males, 9 female) received suboccipital muscle inhibition technique and the posture correction exercises, twice weekly for four weeks and group C (n=15; 6 males, 9 females) received suboccipital progressive pressure release technique and postural correction exercise, twice weekly for four weeks. Randomization was done by the therapist who did the interventions using sealed, clear envelopes.

## 2.2. Procedures

### 2.2.1. Evaluative Procedures

***Forward head posture assessment***

In order to properly evaluate FHP, two side-view images of each individual were taken in both standing and seated positions. The camera was positioned on a tripod with its base at the subject's shoulder level. A plastic pointer was taped to the skin over the seventh cervical vertebra's spinous process, and the tragus of the ear was identified (C7). Participants were asked to stand and maintain a relaxed natural position to take the first picture. For the second picture, the person who was seated on a stool, their feet firmly planted on the ground, and their hands relaxed and resting comfortably on their thighs. They were instructed to focus at a particular point on their eye level during taking measurements. The craniovertebral angle was determined by finding the angle that was formed by a horizontal line that passed through C7 and a line that went from the tragus of the ear to C7 (Figure 1) (Yip et al., 2008). Average of the two measurements was then calculated. Intra-rater and inter-rater reliability for ON protractor application showed good to excellent reliability for measuring CVA angle when compared to AutoCAD® software, with ICC values 0.879 (Mamania et al., 2017).


**Figure 1.** Craniovertebral angle (CVA) measurement

***Myofascial Trigger Point assessment***

The suboccipital muscles were used to apply the diagnostic criteria established by Simons et al. (1999) and Gerwin et al. (1997). In particular, suboccipital discomfort, referred pain, and increased referred pain on muscular contraction were seen as diagnostic criteria of TrPs in these muscles.

Participants were asked to lie supine with their cervical spines in a neutral position to evaluate the effect of muscular contraction on the degree of referred pain. After massaging the client's suboccipital area for 10 seconds, the therapist switched to the next area. A common method of eliciting referred pain involves instructing subjects to extend their necks, which results in a noticeable contraction of the posterior cervical muscles therefore, we assume, the suboccipital muscles as well. To separate the rectus capitis posterior muscles from the other suboccipital muscles, subjects were instructed to keep their necks rigid and expand solely at the cervical-occipital junction.

***Cervical range of motion (ROM) assessment***

A specialized instrument was used to measure the cervical range of motion (Performance Attainment Associates, St. Paul, MN). It comprises of two gravity goniometers and one compass goniometer, was placed on their head. Gravity goniometers in the sagittal and frontal planes are used to quantify flexion and extension, as well as lateral flexion. The rotation was determined using the compass goniometer and a magnetic yoke. For the cervical range of motion test, the subject sat up straight on a stationary chair, as if putting on a pair of glasses. All subjects were instructed to self-adjust to an upright, chin-in position before range-of-motion measurements were taken. The next step was to have the participant do extreme side-to-side cervical flexion, extension, lateral flexion, and rotation. The experiment was repeated twice on each side, and the mean was calculated. Recent studies have shown that the cervical range of motion instrument has intra- and inter-test reliabilities of 0.89 and 0.91, respectively (Fletcher et al., 2008).

**2.2.2. Treatment Procedures**

***Group A (control group)***

Fifteen participants were shown pictures and given a detailed explanation of how to do each exercise. They then had to show that they knew how to do each one right. Kendall et al (1993). 's approach called for two exercises to strengthen (deep cervical flexors and shoulder retractors) and two to stretch (cervical extensors and pectoral muscles). The exercises were (a) chin tucks while sitting (the next step was to lift the head off the floor while tucking it and hold it there for different amounts of time), (b) chin drops while sitting with a hand, (c) shoulder retraction in standing with a TheraBand and then in prone with weights, and (d) bilateral pectoralis stretches for 4 weeks. Three sets of 12 repetitions of strengthening exercises and three stretching exercises sustained for 30 seconds were performed twice a day, three times a week.

***Group B (experimental group 1)***

Fifteen participants also did postural correction exercises and suboccipital muscle inhibition technique (SMIT). The participant was in a supine position while the therapist seated at his head with his elbows resting on the table. The therapist placed both hands behind the subject's head with the palms pointing up, the fingers flexed, and the finger pads on the space between the occipital condyles and the C2 spinal process so that the occiput could rest on the palms. With the finger pads over the atlas, a force was applied in the direction of the ceiling with a little traction in the direction of the head. This was done for 2 to 3 minutes, or until the therapist saw the participant's suboccipital muscle relax. Once the tissues were loosened, the pressure was gradually removed, leaving the individual's head on the bed. During the SR, the subject was instructed to close his or her eyes to prevent eye movements that could alter the tone of the suboccipital muscles (Aparicio et al., 2009). For four weeks, the participant attended two sessions per week, for a total of eight sessions.

***Group C (experimental group 2)***

Fifteen participants received suboccipital progressive pressure release technique (PPRT) in addition to postural correction exercise. Release of the suboccipital trigger points started with the patient in the supine position, he was asked to raise his head as the therapist placed his hands underneath it, then have the patient lower his head into the therapist’s palms contacting the region just below the base of the skull or the occiput, gently turning his head to one side and being careful not to cover his ears as the trigger points lie just below the occiput and about halfway between the mastoid process and the midline of the upper neck. Using the thumb gentle, gradual increasing pressure was applied to the trigger points in a direction towards the patient’s nose. Once tissue resistance was felt, the pressure was kept up until resistance went away and the tissue felt like it was slowly letting go or "melting away." At this point, the pressure was increased again by moving inward toward the center. The amount of pressure applied was based on how much pain the patient could handle, and the patient gave constant feedback. It was used for at least 30 seconds and up to two minutes at a time, and the process was done three or four times. The patient was told to take deep, slow breaths while the pressure was slowly raised (Simons et al., 1999).

### 2.3. Data analysis

MANOVA test was done to compare the characteristics of the individuals in each group. The Chi-squared test was used to compare the number of men and women in each group. The Shapiro-Wilk test was used to make sure that all variables had a normal distribution of data. Levene's test for homogeneity of variances was used to see how similar each group was to the other. Mixed MANOVA was used to compare the effects on CVA and neck ROM both within and between groups. For multiple comparisons in the future, post-hoc tests were done with the Bonferroni correction. All statistical tests were set to have a level of significance of $p < 0.05$. The statistical software for social studies (SPSS) version 25 for Windows was used for all of the statistical analysis (IBM SPSS, Chicago, IL, USA).

## 3. RESULTS

### Subject characteristics

Table 1 showed the subject characteristics of group A, B and C. There was no substantial difference between groups in age, weight, height, BMI and gender distribution ($p > 0.05$).

**Table 1.** Basic characteristics of participants.

| | Group I | Group II | Group III | p-value |
|---|---|---|---|---|
| **Age, mean ± (SD), years** | 19.8 ± 1.14 | 20.13 ± 1.45 | 19.53 ± 1.84 | 0.55 |
| **Weight, mean ± (SD), years** | 71.4 ± 11.17 | 73.06 ± 8.15 | 69.4 ± 10.96 | 0.61 |
| **Height, mean ± (SD), years** | 167.6 ± 7.51 | 170.66 ± 8.19 | 169 ± 8.29 | 0.58 |
| **BMI, mean ± (SD), kg/m²** | 25.45 ± 3.83 | 25.16 ± 3.17 | 24.21 ± 2.54 | 0.55 |
| **Sex, n (%)** | | | | |
| **Females** | 11 (73%) | 9 (60%) | 9 (60%) | 0.67 |
| **Males** | 4 (27%) | 6 (60%) | 6 (60%) | |

SD, standard deviation; p-value, level of significance

### Effect of treatment on CVA and neck ROM

Mixed MANOVA revealed that there was a substantial interaction of treatment and time ($F = 6.85$, $p = 0.001$, Partial Eta Squared = 0.57). There was a substantial main effect of time ($F = 240.54$, $p = 0.001$, Partial Eta Squared = 0.97). There was a substantial main effect of treatment ($F = 5.51$, $p = 0.001$, Partial Eta Squared = 0.51).

### Within group comparison

There was a substantial increase in CVS in the three groups post treatment compared with that pretreatment ($p < 0.001$). The percent of change of CVA in group A, B and C was 8.65, 16.31and 25.35%% respectively. (table 2).

There was a substantial increase in neck ROM in the three groups post treatment compared with that pretreatment ($p < 0.001$). The percent of change of flexion, extension, right bending, left bending, right rotation and left rotation in group A was 22.72, 26.95, 13.71, 15.24, 19.17 and 14.39% respectively, and that in group B was 42.35, 36.53, 11.43, 18.35, 26.67 and 25.69% respectively while that in group C was 54.29, 46, 18.79, 28.58, 35.62 and 33.46% respectively. (table 3).

**Between group comparison**

Between group comparison pretreatment revealed a non-substantial difference in all parameters ($p > 0.05$). There was a substantial increase in CVA of the group C compared with that of group A and group B ($p = 0.001$). There was substantial difference in CVA between group A and B ($p = 0.41$). (Table 2).

**Table 2.** Mean CVA pre and post treatment of group A, B and C

| | Group A mean ± SD | Group B mean ± SD | Group C mean ± SD | p-value A vs B | A vs C | B vs C |
|---|---|---|---|---|---|---|
| **Pre treatment** | 31.91 ± 2.19 | 31.02 ± 3.55 | 32.42 ± 1.98 | 1 | 1 | 0.46 |
| **Post treatment** | 34.67 ± 2.21 | 36.08 ± 2.26 | 40.64 ± 3.03 | 0.41 | 0.001 | 0.001 |
| **MD (% of change)** | -2.76 (8.65%) | -5.06 (16.31%) | -8.22 (25.35%) | | | |
| | ***p = 0.001*** | ***p = 0.001*** | ***p = 0.001*** | | | |

SD, Standard deviation; p-value, Level of significance.

There was a substantial increase in flexion, extension. right and left bending, right and left rotation ROM of the group C compared with that of group A ($p = 0.001$) and group B ($p < 0.05$). There was a substantial increase in flexion, extension, right and left rotation ROM of group B compared with that of group A ($p < 0.05$). There was no substantial difference in right and left bending ROM between group A and B ($p > 0.05$). (Table 3).

**Table 3.** Mean neck pre and post treatment of group A, B and C

| ROM (degrees) | Group A mean ± SD | Group B mean ± SD | Group C mean ± SD | p-value A vs B | A vs C | B vs C |
|---|---|---|---|---|---|---|
| ***Flexion*** | | | | | | |
| **Pre treatment** | 34.6 ± 3.43 | 33.86 ± 3.56 | 35 ± 3.48 | **1** | 1 | 1 |
| **Post treatment** | 42.46 ± 8.14 | 48.2 ± 3.82 | 54 ± 2.82 | 0.01 | 0.001 | 0.01 |
| **MD (% of change)** | -7.86 (22.72%) | -14.34 (42.35%) | -19 (54.29%) | | | |
| | ***p = 0.001*** | ***p = 0.001*** | ***p = 0.001*** | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| ***Extension*** | | | | | | |
| **Pre treatment** | 37.07 ± 5.78 | 38.13 ± 4.73 | 39.13 ± 3.64 | 1 | 0.73 | 1 |
| **Post treatment** | 47.06 ± 5.25 | 52.06 ± 4.44 | 57.13 ± 4.88 | 0.02 | 0.001 | 0.02 |
| **MD (% of change)** | -9.99 (26.95%) | -13.93 (36.53%) | -18 (46%) | | | |
| | ***p = 0.001*** | ***p = 0.001*** | ***p = 0.001*** | | | |
| ***Right bending*** | | | | | | |
| **Pre treatment** | 34 ± 3.98 | 36.13 ± 4.67 | 37.26 ± 5.2 | 0.64 | 0.18 | 1 |
| **Post treatment** | 38.66 ± 4.18 | 40.26 ± 2.89 | 44.26 ± 2.28 | 0.54 | 0.001 | 0.004 |
| **MD (% of change)** | -4.66 (13.71%) | -4.13 (11.43%) | -7 (18.79%) | | | |
| | ***p = 0.001*** | ***p = 0.001*** | ***p = 0.001*** | | | |
| ***Left bending*** | | | | | | |
| **Pre treatment** | 32.8 ± 3.01 | 33.46 ± 2.87 | 33.8 ± 2.39 | 1 | 0.98 | 1 |
| **Post treatment** | 37.8 ± 4.14 | 39.6 ± 3.52 | 43.46 ± 4.29 | 0.67 | 0.001 | 0.03 |
| **MD (% of change)** | -5 (15.24%) | -6.14 (18.35%) | -9.66 (28.58%) | | | |
| | ***p = 0.001*** | ***p = 0.001*** | ***p = 0.001*** | | | |
| ***Right rotation*** | | | | | | |
| **Pre treatment** | 50.4 ± 3.35 | 51 ± 2.9 | 50.53 ± 2.47 | 1 | 1 | 1 |
| **Post treatment** | 60.06 ± 4.39 | 64.6 ± 3.41 | 68.53 ± 3.5 | 0.006 | 0.001 | 0.02 |
| **MD (% of change)** | -9.66 (19.17%) | -13.6 (26.67%) | -18 (35.62%) | | | |
| | ***p = 0.001*** | ***p = 0.001*** | ***p = 0.001*** | | | |
| ***Left rotation*** | | | | | | |
| **Pre treatment** | 52.33 ± 6.27 | 51.66 ± 6.21 | 52.6 ± 5.48 | 1 | 1 | 1 |
| **Post treatment** | 59.86 ± 4.48 | 64.93 ± 3.17 | 70.2 ± 4.09 | 0.003 | 0.001 | 0.002 |
| **MD (% of change)** | -7.53 (14.39%) | -13.27 (25.69%) | -17.6 (33.46%) | | | |
| | ***p = 0.001*** | ***p = 0.001*** | ***p = 0.001*** | | | |

SD, Standard deviation; p-value, Level of significance

## 4. DISCUSSION

This study was planned and carried out to compare between the effect of suboccipital muscle inhibition technique (SMIT) combined with postural correction exercise (group B) versus progressive pressure release technique (PPRT) combined with postural correction exercise (group C) on craniovertebral angle (CVA) and neck range of motion (ROM) on individuals with forward head posture and active suboccipital Myofascial trigger points (MTPs). Results showed a substantial increase in post-treatment CVA when compared with that of pre-treatment in all three groups with the highest significance in group C with percent of change (25.35%.), indicating that suboccipital progressive pressure release technique combined with posture correction exercise has proven to be more effective technique in treating subjects with FHP. Nonetheless, there was no statistically substantial difference between the effects of posture correction exercise (group A) and the effects of

SMI technique combined with posture correction exercise (group B) on the craniovertebral angle improvement.

This study also showed improvement of neck range of motion with respect to post treatment flexion, extension, side bending, and rotation compared with that of pre-treatment in all three groups. For between groups comparison, suboccipital progressive pressure release technique combined with posture correction exercise (group C) has also showed the greatest improvements in neck ROM in all directions, while there was no significant difference between the group who received suboccipital muscle inhibition technique (SMI) combined with postural correction exercise (group B) and who received only postural correction exercise (group A) regarding post treatment right and left side bending. However, adding suboccipital muscle inhibition technique to postural correction exercise in group B significantly increased flexion, extension and neck rotation ROM.

Postural alignment associated with FHP may be enhanced by participating in a targeted strengthening and stretching exercise program. Different exercise routines appeared to have varying degrees of effectiveness in reducing CVA and improving forward head posture. Strengthening the deep cervical flexors and shoulder retractor muscles and stretching the cervical extensors and pectoral muscles are the cornerstones of any exercise program aimed at correcting FHP (Sheikhhoseini et al., 2018 and Mylonas et al., 2021). A previous study performed by Harman et al (2005) suggested that a 10-week home-based exercise program made a significant improvement in the cervical range of motion (ROM) and CVA of asymptomatic participants. Their results back up the results of current study, which showed a decrease in FHP after the intervention training protocol. This consistency between results may be due to sharing the same goal of the training protocol as to restore the normal balance between muscle groups that work against each other (agonists and antagonists) and cooperate the elongation capacity of muscle groups which limit the range of motion of joints that they work against.

Results of this study were the same as what had been found by Aggarwal et al. (2022) who evaluated the impact of suboccipital release against conventional treatment composed of application of hydrocollator pack, scapular setting, neck isometrics, chin tucks and ergonomic advice along with postural care for treatment of forward head posture, between groups comparison showed that adding suboccipital release helps in improving neck pain intensity, disability and neck ROM. However, CVA showed significant increase only for within the suboccipital release group. Similarities between results could be due to having a near sample size and treatment protocols.

On the other hand, kim et al (2016) investigated the immediate effect of suboccipital release coupled with craniocervical flexion exercise on CVA as well as neck flexion and extension ROM on subjects with forward head posture and their results contrasted with this study showing that the CVA was significantly higher after suboccipital release was coupled with craniocervical flexion exercise than after exercise alone. However, part of their findings, aligned with results of this study, suggesting that suboccipital release could be useful for improving flexion and extension ROM.

Heintz and Hegedus (2008) stated that soft tissue mobilization, such as that achieved during the SMI method, has been hypothesized to help persons with FHP by decreasing hyperactivation and tightness in their shortened deep cervical extensors. Due to its location in the jugular foramen, the vagus nerve is supposed to benefit from SMI by having its pressure reduced. Thus, the investigator's finger pressure and traction, along with the subject's head weight, resulted in a stretch to the posterior neck fascia and the suboccipital muscles. By lengthening, these tissues, pressure on the jugular foramen is reduced. (Kwan et al. 2012). In addition, Vernon and Schneider (2009) revealed that activation of deep segmental craniocervical thoracic muscles after suboccipital relaxation facilitated free cervical mobility. Therefore, SMI may aid in restoring normal autonomic function, as well as restoring normal range of motion in the cervical flexors and extensors. Since the suboccipital muscles are a crucial component of the myofascial superficial back lines, it is thought that releasing the suboccipital muscles also led to the release of the muscles in the neck and shoulders, resulting in an improvement in forward head posture (Aparicio et al., 2009).

Takla et al. (2017) compared the effectiveness of progressive pressure release on latent trigger sites, discomfort, and range of motion in the upper trapezius to that of dry needling. According to the findings, progressive pressure release is superior to traditional treatments for raising pain pressure threshold values and enhancing active cervical lateral flexion and rotation. Sedighi et al. (2017) examined the short-term results of superficial and deep suboccipital and upper trapezius trigger point dry needling in patients with cervicogenic headaches. Patients with active suboccipital TrPs who had received deep dry needling showed improvement in all CROM measures including (flexion, lateral flexion, rotation) excluding the extension, in addition to immediate improvement in trigger point tenderness. Fryer and Hodgson (2005) Also searched upon how manual pressure release on latent upper trapezius MTrPs for 60 seconds affected cervical pain and range of motion. They found that the sensitivity of MTrPs went down right away and that cervical ROM went up a lot, their results agree with those of other authors' reports including Hanten et al. (2000) and Hou et al. (2002).

The effects of the trigger point release technique on acute myofascial pain syndrome of the upper trapezius muscle, movement dysfunction, postural misalignment (forward head posture), limited range of motion (ROM) of the cervical spine, and muscle shortening were investigated in a case report studied by Lee and You (2007). After treatment, the patient's neck pain went away completely and his movement problems were almost back to normal, including normal range of motion (ROM) without pain, proper posture, muscle length, and muscle strength in his neck and shoulders.

All these studies support results of current study suggesting that progressive pressure release was found to be a more effective technique in treating trigger points and improving limited range of motion in cervical region than other techniques used as dry needling. This research is novel since no previous studies have looked at the effectiveness of progressive pressure release on suboccipital muscles in individuals with FHP who have active TrPs, which are frequently found in these muscles.

The mechanism behind agreements between these previous studies and the current study may be explained physiologically as when a muscle fiber is damaged or even under abnormal stress, calcium is released from the sacroplasmic reticulum or through an injured sacrolemma. This causes the muscle to contract without control and speeds up the metabolism. This constant muscle contraction cuts off blood flow, which causes waste products to build up and muscles to get tired, which triggers pain-causing nociceptors. This makes a circle that keeps going on its own; when the muscle gets shorter, it loses sarcomeres. Later, an increase in the amount of collagen in the muscles makes pain and muscle stiffness worse, which leads to a decrease in active ROM (Simons, 2002). Gradual downward pressure on the affected muscle fibers tends to release and break down collagen fibers in the contracted sarcomeres. This makes all the sarcomeres the same length. After that, the palpable knot gets smaller and the length of the muscle fibers grows, which increases functional ROM.

## Limitations

The specificity of the sample (college students) in this study is one of its major limitations, making it challenging to extrapolate the findings to older populations. The palpation and the essential and confirmatory criteria of L-MTrPs by Simons et al. (1999) were also used for clinical diagnosis. Even though these are the gold standards by which MTrPs are identified and classified, they are nonetheless thought of as subjective evaluations. Thus, future studies should evaluate the efficacy of used manual therapy techniques in a variety of populations, and objective measures to quantitatively determine MTrPs tenderness as pain pressure threshold.

## Conclusion

The present study concluded that both suboccipital muscle inhibition technique and suboccipital progressive pressure release technique are effective in increasing CVA and improving ROM in subjects with FHP. However, suboccipital progressive pressure release has shown to be more effective.

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**AUTHOR CONTRIBUTIONS**

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

**CONFLICTS OF INTEREST**

The authors declare no conflict of interest.

**FUNDING**

This research received no external funding.