

## ORIGINAL ARTICLE

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## EFFICACY OF SUBOCCIPITAL AND STERNOCLEIDOMASTOID RELEASE TECHNIQUE IN FORWARD HEAD POSTURE PATIENTS WITH NECK PAIN: A RANDOMIZED CONTROL TRIAL

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## ABSTRACT

**Background:** Neck pain in forward head posture has a high prevalence. Suboccipital and SCM release technique has been reported effective in releasing shortened muscles, but no evidence is reported of its effectiveness in neck pain patients with or without forward head posture (FHP). This study is undertaken to find out if suboccipital and SCM myofascial release (MFR) have any effect in neck pain and FHP.

**Methods:** Study design, A Randomized control trial 60 subjects between age 20-30 having FHP and neck pain were randomly divided into 2 groups Experimental group (n=30), control group (n=30), number of male patients (n=10) and female (n= 43), Intervention given for experimental group was MFR for suboccipital and SCM muscle and control received resisted chin tucks, Neck isometrics, Scapular sets, Hot packs, ergonomic advice (2 weeks/ 3 sessions). Outcome measures were the Craniovertebral angle (CVA), shoulder angle, NPRS, NDI, Cervical ROM assessed at baseline, post-treatment, 3rd and 4th week follow up.

**Results:** The repeated measures ANOVA revealed a significant group by time interaction for changes in CVA angle (p<0.01), shoulder angle (p > 0.005), NPRS(p<0.01), NDI(p<0.01), Cervical ROM (p<0.01), in both the experimental and control group.

**Conclusion:** This study concludes that Myofascial release for suboccipitals and Sternocleidomastoid is more effective than conventional therapy in improving Forward head posture and reducing neck pain.

**Keywords:** Myofascial release technique, neck pain, craniovertebral angle, suboccipital, Sternocleidomastoid, Thixotropy.

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## INTRODUCTION

According to the International Association for the study of annual pain incidence of neck pain is 30-50% [1] though multifactorial in etiology but incorrect posture is a major causal factor [2]. Forward head posture (FHP) is a postural deviation reported in neck pain patients [3]. Maintenance of incorrect posture for a long period presents as the Anterior positioning of head [4]. FHP causes biomechanical changes not only around cervical but thoracic and scapula position also [5]. It is represented by an increase in anterior cervical convexity, a decrease of craniovertebral angle(CVA) and rounded shoulders [6]. Abnormal shortening of muscles such as Levator Scapulae, suboccipital, sternocleidomastoid, and Upper trapezius along with weakness of longus capitis exists [7].

In general, Sub occipital muscles control head rotation over the cervical area and Sternocleidomastoid assists with neck flexion [7-9]. With Forward head posture, sub occipital muscles are in a state of hypertonicity to maintain the level of the eye with horizon the Longus Capitis, which is neck flexor is weakened, Sternocleidomastoid Will fire first, but the mastoid insertion of Sternocleidomastoid results in head extension. As Sternocleidomastoid receives overactive tension, tone, and fatigues, this influences disability and neck pain in patients [2,10]. This will increase the load around neck structures [11]. Through observation and palpation, the degree of fibrosis, shortening and trigger point activity in Sternocleidomastoid is identified [12]. Physiotherapy is the first approach of FHP with neck pain. Interventions such as modalities, manipulations, and ergonomics are followed traditionally [13]. MFR is a manual therapy approach that causes the release of the chain between fascia, muscle, and bones and stretches the fascia [14]. Application of relaxation treatment in soft tissue causes reduction of tone and pain intensity. Kim et.al (2016) [16] treated with sub occipital release technique in forward head posture patients and found that there was improvement in posture and reduction of neck pain.

Sub occipital and sternocleidomastoid release technique has been reported effective in relaxing and releasing shortened muscles, but no evidence is reported of its effectiveness in neck pain patients with or without FHP [12]. This study is undertaken to find if sub occipital and Sternocleidomastoid MFR have any effect in neck pain and FHP.

## METHODOLOGY

A Randomized control trial was conducted from March 2017 to December 2017. The participants were randomly assigned to a 4week intervention to either experimental or control group. 74 subjects from Dr D.Y Patil College of Physiotherapy, Pimpri, Pune and Dr D.Y Patil College of Physiotherapy, Pimpri, Pune (OPD) received a screening containing inclusion criteria (Both genders aged 20-30 years with primary complaint of neck pain for more than 3 months, NDI score  $\geq 5$  and FHP with CVA angle less than  $48^\circ$ ). Exclusion criteria (Recent history of trauma, fall or injury to cervical, Operated case of the cervical or

thoracic spine, Cervical radiculopathy, herniation or stenosis, Malignancy, Thoracic outlet syndrome, Dizziness, vertigo, cervicogenic headache, Vertebral-basilar artery syndrome).

In total 60 subjects meet the above criteria, the 60 subjects were randomized using a chit method based upon numbers. All odd numbers were assigned to the control group, and even numbers were assigned to an experimental group, where 53 subjects participated in the study, seven subjects were dropped out of the study. All participants were informed content and purpose of the study and gave their written informed consent to participants in the study. The overall flow of participant's enrolment in intervention trial is shown in Figure 1.

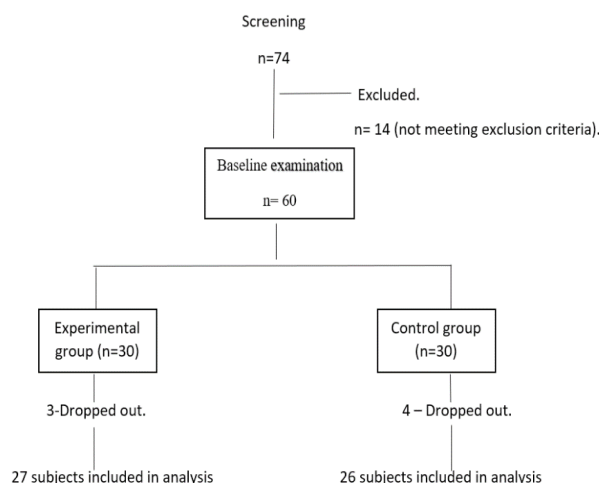


Figure 1: Flowchart of Participants

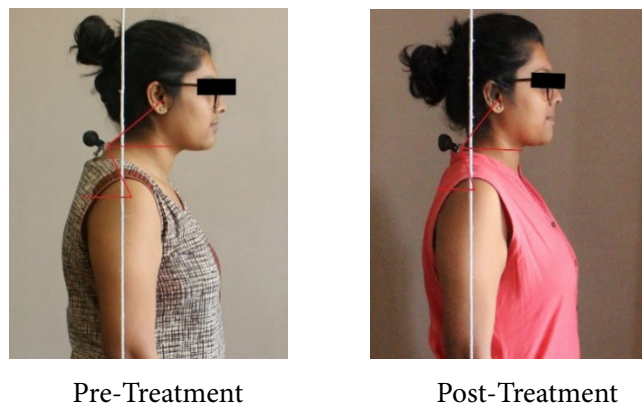


Figure 2: Photographic analysis of CVA and Shoulder angle Pre and Post-treatment.

The examiners were not blinded to group allocation. Participants in each group were allocated to a 2-week intervention period, receiving 20-25 min of treatment in either group and 3<sup>rd</sup> and 4<sup>th</sup>-week participants were asked to come for follow-up. The interventions are summarized below.

### Therapy protocol for Experimental group

Participants randomized to the experimental group (n=30) received MFR to suboccipital and Sternocleidomastoid. For myofascial release to suboccipital muscle subjects were placed in supine position, therapist was in seated position by resting hands on the table and placing edge of fingers on subjects' inferior nuchal line, palms were initially supporting under occiput, then shoulders are slowly abducted

to remove palmar support, when tissues are completely relaxed long axis distraction is applied for 2-5 min. For Myofascial release to sternocleidomastoid muscle, the tendon of sternocleidomastoid muscle is grasped as close to the mastoid process; the head is rotated towards the side being treated to rotate the SCM away from the carotid artery. Sternocleidomastoid muscle is compressed for 8-12 seconds at a 1inch interval from mastoid process to sternal and clavicular attachments. Head is Supported at 45 °of flexion and rotated away from the side being treated then a caudal glide is given on the upper 1 inch of the mastoid attachment of the SCM. Thumb is placed posteriorly to the SCM tendon at the mastoid process and displaced anteriorly while simultaneously pressing onto the mastoid attachment. Duration of treatment is 5-8 min. The treatment was for two weeks (3 sessions per week). Post-treatment in 3<sup>rd</sup> and 4<sup>th</sup>-week participants were asked to come for follow up, and all outcome measures were evaluated.

### Therapy protocol for Control group

Participants randomized to control group (n=30) received Hydro collator packs 8-10 min, resisted chin tucks, Neck isometrics, Scapular sets five sets, three repetitions, ergonomic advice and postural care. The treatment was for two weeks (3 sessions per week) duration of treatment 20-25 min. Post-treatment in 3<sup>rd</sup> and 4<sup>th</sup>-week participants were asked to come for follow up, and all outcome measures were evaluated.

### Outcome variables

The physical testing of participants included CVA and shoulder angle (SA). It is measured by Photographic analysis of posture. A plumb-rope was suspended from the ceiling a digital camera (Canon Eos 700D) was placed at a distance of 1.5 m from patient's shoulder on a fixed tripod base without any rotation or tilt, camera's height was adjusted at the level of the subject's shoulder and subjects were asked to maintain a balanced position and move their neck into flexion and extension in the full range and then gradually decrease its range till a natural position is maintained. Then two photographs were taken.

The tragus of the ear, spinous process of the C7 and mid-point of the shoulder were marked with a black marker, and ECG vacuum cup was placed on C7 so that it can be visible on the photograph. Once the picture was obtained, it was used for measuring the cranio vertebral angle and shoulder angle using MB ruler software 5.3. CVA is measured as the angle between the line from external auditory meatus to seventh cervical vertebrae and a horizontal line through seventh cervical vertebrae [17]. SA is measured as the angle between the line joining mid-point of shoulder and C7 and a horizontal line through the mid-point of the shoulder [18].

The Disability of patients were measured by Neck disability index (NDI), Pain intensity was rated using Numerical pain rating scale (NPRS), the Cervical range of motion (ROM) was measured by using universal goniometer. The subjects were evaluated at baseline, post-treatment, 3<sup>rd</sup> and 4<sup>th</sup> week follow up for all outcome measures.

### Statistical analysis

The data were analyzed using SPSS statistical software version 21.0. The change in CVA, SA NDI, NPRS, Cervical ROM from baseline to follow-up were evaluated using repeated-measures ANOVA with the group, time and group by time variables. The results were accepted as significant for p<0.05.

## RESULTS

### Study Participants

There were 53 participants in the study, 20 females and seven males in the experimental group and 23 females and three males in the control group.

### Changes in CVA

CVA scores increased significantly with time in both groups (p<0.001), though the increase was more in 1<sup>st</sup> and 2<sup>nd</sup> week of treatment. The change in CVA was more in the experimental group as compared to the control group. The change between the group was found to be statistically significant (p<0.001). Table 1 shows the results of the two groups.

Parameters	(CVA) Experimental group	P value	(CVA) Control group	P value
CVA	Mean ±SD		Mean ±SD	
Pre	43.6063± 2.5459	p<0.001	45.0565± 3.2344	P<0.001
Post	49.9052± 2.49137		49.2262± 2.29523	
3 <sup>rd</sup> Week follow-up	49.3989± 2.32185		47.5669± 2.89339	
4 <sup>th</sup> Week follow-up	49.0256± 3.19749		46.8277± 3.05116	

Table 1: CVA results.

### Changes in Shoulder angle (SA)

SA scores decreased significantly with time in both groups (p< 0.011). The change in SA was more in the control group as compared to the experimental group. The change between the group was found to be statistically not significant (p>0.05). Table 2 shows the results of the two groups.

Parameters	(SA) Experimental group	P value	(SA) Control group	P value
SA	Mean ±SD		Mean ±SD	
Pre	52.7470± 9.33242	P>0.05	51.2196± 6.47766	P >0.05
Post	52.2204± 11.15538		49.6735± 7.41292	
3 <sup>rd</sup> Week follow-up	50.2904± 11.68955		48.1742± 7.14778	
4 <sup>th</sup> Week follow-up	49.2419± 9.27819		50.2546± 6.67023	

Table2: Shoulder angle results.

### Changes in NDI.

NDI scores increased significantly with time in both groups ( $p < 0.001$ ), though the increase was more in 1<sup>st</sup> and 2<sup>nd</sup> week of treatment. The change in NDI was more in the experimental group as compared to the control group. The change between the group was found to be statistically significant ( $p < 0.001$ ). Table 3 shows the results of the two groups.

Parameters	(NDI) Experimental group	P value	(NDI) Control group	P value
NDI	Mean $\pm$ SD		Mean $\pm$ SD	
Pre	15.519 $\pm$ 1.9089	P<0.001	16.269 $\pm$ 1.9299	P <0.001
Post	3.333 $\pm$ .6202		6.769 $\pm$ 1.3945	
3 <sup>rd</sup> Week follow-up	5.111 $\pm$ .9337		9.462 $\pm$ 2.4038	
4 <sup>th</sup> Week follow-up	5.630 $\pm$ .6293		10.577 $\pm$ 2.0430	

**Table 3:** Neck disability index (NDI) results.

### Changes in NPRS

NPRS scores increased significantly with time in both groups ( $p < 0.001$ ), though the increase was more in 1<sup>st</sup> and 2<sup>nd</sup> week of treatment. The change in NPRS was more in the experimental group as compared to the control group. The change between the group was found to be statistically significant ( $p < 0.001$ ). Table 4 shows the results of the two groups.

Parameters	(NPRS) Experimental group	P value	(NPRS) Control group	P value
NPRS	Mean $\pm$ SD		Mean $\pm$ SD	
Pre	7.074 $\pm$ 0.7808	P<0.001	7.038 $\pm$ 0.7736	P <0.001
Post	2.370 $\pm$ 0.7917		3.885 $\pm$ 0.8638	
3 <sup>rd</sup> Week follow-up	3.333 $\pm$ 0.8771		4.885 $\pm$ 0.9047	
4 <sup>th</sup> Week follow-up	4.296 $\pm$ 0.8234		6.346 $\pm$ 0.9047	

**Table 4:** Numerical pain rating scale (NPRS) result

### Changes in Cervical ROM- Flexion, extension, (Rt and Lt).

Cervical ROM- Flexion scores increased significantly with time in both groups ( $p < 0.001$ ), though the increase was more in 1<sup>st</sup> and 2<sup>nd</sup> week of treatment. The change in Cervical ROM- Flexion was more in the experimental group as compared to the control group. The change between the group was found to be statistically significant ( $p < 0.001$ ). Cervical ROM- Extension scores increased significantly with time in both groups ( $p < 0.001$ ), though the increase was more in 1<sup>st</sup> and 2<sup>nd</sup> week of treatment. The change in

Cervical ROM- Extension was more in the experimental group as compared to the control group. The change between the group was found to be statistically significant ( $p < 0.001$ ). Table 5 shows the results of both groups.

	C-ROM - Flexion Mean $\pm$ SD	P value	C-ROM -Extension Mean $\pm$ SD	P value
Experimental group.				
Pre	32.963 $\pm$ 3.1802	p<0.001	33.889 $\pm$ 3.4899	p<0.001
Post	43.519 $\pm$ 2.3266		44.074 $\pm$ 1.979	
3 <sup>rd</sup> Week follow-up	43.519 $\pm$ 2.3266		44.074 $\pm$ 1.972	
4 <sup>th</sup> Week follow-up	41.111 $\pm$ 2.1183		40.741 $\pm$ 2.2802	
Control group.				
Pre	33.654 $\pm$ 2.6675	p<0.001	32.692 $\pm$ 2.5420	p<0.001
Post	38.654 $\pm$ 2.6675		40.000 $\pm$ 3.7417	
3 <sup>rd</sup> Week follow-up	37.308 $\pm$ 3.2344		38.269 $\pm$ 3.1440	
4 <sup>th</sup> Week follow-up	35.577 $\pm$ 3.5572		35.962 $\pm$ 4.4764	
C-ROM-Cervical range of motion Flexion and extension.				

**Table 5:** Cervical ROM flexion and extension results.

### Changes in Cervical ROM- lateral flexion, rotation (Rt and Lt)

Cervical ROM- lateral flexion (Rt and Lt) scores increased significantly with time in both groups ( $p < 0.001$ ), though the increase was more in 1<sup>st</sup> and 2<sup>nd</sup> week of treatment. The change in Cervical ROM- lateral flexion (Rt and Lt) was more in the experimental group as compared to the control group. The change between the group was found to be statistically significant ( $p < 0.001$ ). Cervical ROM- rotation (Rt and Lt) scores increased significantly with time in both groups ( $p < 0.001$ ), though the increase was more in 1<sup>st</sup> and 2<sup>nd</sup> week of treatment. The change in Cervical ROM- rotation (Rt and Lt) was more in the experimental group as compared to the control group. The change between the group was found to be statistically significant ( $p < 0.001$ ). Table 6 shows the results of both the groups.

	C-ROM – Lateral Flexion(Rt) Mean ±SD	P value	C-ROM - Lateral Flexion(Lt) Mean ±SD	P value	C-ROM – Rota-tion (Rt) Mean ±SD	P value	C-ROM – Rota-tion (Lt) Mean ±SD	P value
<b>Experimental group</b>								
Pre	31.667±2.7735	p<0.001	32.593±2.5459	p<0.001	43.519±3.0429	p<0.001	45.370±4.5838	p<0.001
Post	43.333±2.4019		44.444±2.1183		54.259±3.0076		53.889±2.8868	
3 <sup>rd</sup> Week	43.519±2.3266		43.333±2.4019		54.815±2.5875		54.259±2.2802	
4 <sup>th</sup> Week	40.556±1.6013		42.037±27		51.667±2.4019		50.926±1.9792	
<b>Control group</b>								
Pre	32.692±2.9089	p<0.001	32.692±3.2344	p<0.001	43.269±2.4258	p<0.001	43.654±3.0192	p<0.001
Post	38.846±3.2581		37.885±3.2165		49.231±2.3205		48.269±3.1440	
3 <sup>rd</sup> Week	37.308± 2.9089		36.731±4.6781		45.769±3.3741		45.962±3.4696	
4 <sup>th</sup> Week	35.385±3.1379		36.154±26		45.000±2.8284		45.000±2.8284	
C-ROM-Cervical range of motion lateral flexion (Rt and Lt), rotation (Rt and Lt).								

**Table 6:** Cervical ROM lateral flexion and rotation results.

## DISCUSSION

The present study found that CVA along with disability, pain and cervical ranges have improved in both the groups with more significant changes reported for the experimental group. Suboccipital muscles in forward head posture are hypercontracted, the longus capitis becomes weak. Due to the weakness of longus capitis SCM receives overactive tension, increase in tone and fatigueness [7]. Such hyperactivity response of SCM along with surrounding neck musculature aggravates the condition. Myofascial release (MFR) helped to release the tight fascia by applying continuous pressure and breaks the inter-fiber linkage between collagen and elastin tissue and improved tissue extensibility. This also changed the soft tissue length [19-21]. This increased angulation of CVA in the experimental group.

A further change in the viscosity of matrix from solid to gel state called thixotrophy under pressure results in decreasing pressure on sensitive nerve endings [19]. As the tension is released gliding of fascia increases and pain decreases a similar study was done by Kim et al. (2016) [16] reported that sub occipital release decompresses the vagus nerve running through the jugular foramen. The traction and pressure of therapist's fingers along the posterior area of the neck and sub occipital muscles induces tissue stretching and relieve foramen tension. This can be responsible for an increased range of cervical motion along with a decrease of pain following treatment. Studies have found greater myofascial trigger points presence in sternocleidomastoid muscle [22].

The range of motion changes was seen greater with lateral flexion and rotation showing sternocleidomastoid treatment has also been effective in reducing myofascial tension.

Another theory states that Ruffini corpuscle which is a slowly adapting mechanoreceptor, respond to deep, slow, sustained pressure applied by MFR. Also, MFR produces improvement in circulatory disturbances and decreasing muscle spasm and tissue tension. It recovers functional

tasks and results in a decrease of disability [23].

Except for various Manual therapy techniques, various physiotherapy modalities and techniques such as Hydrocollator packs, Isometrics to neck muscles, Chin tucks, retraction exercise of the scapula, ergonomics are also given for FHP and neck pain. Malanga G et al. (2014) [24] reported Application of Heat by Hot packs causes neural transduction of heat that is mediated by Transient receptor potential (TRP) and vanilloid receptor 1 (TRPV1). Noxious heat activates these receptors. Activation of TRPV1 receptors within the brain modulate nociceptive descending pathways. This increases tissue temperature, stimulates vasodilation and increases tissue blood flow which is thought to promote healing by increasing the supply of nutrients and oxygen to the site of inflammation. Heat also leads to changes in the viscoelastic properties of collagenous tissues that result in elongation or lengthening of tissues improving range of movement. Also, improved angulation of CVA and pain occurs. Shinu Philip et al. (2014) [25] reported that isometric neck exercise activates muscle stretch receptors, this causes endogenous opioids release and also cause the release of beta endomorphins from the pituitary gland, these secretions decrease pain. In our study pain measured by NPRS scale decreased post-treatment in the control group.

Neck Isometrics counteracts the force of gravity to maintain head and neck in upright position. Combination of Chin tuck and scapular retraction exercise improves pain and function and leads to greater patient satisfaction [15]. In our study Patients reported Disability in postures like reading, driving and sitting for a longer period. Combination of Chin tuck and scapular retraction exercise improved disability of the patients in the control group. Chin tuck exercise is used to strengthen and activate deep neck flexor which are the longus capitis and longus colli muscles; these muscles are often weak in forward head posture [26].

Given these results, it can be said that MFR for sub occipital and Sternocleidomastoid is helpful in improving

forward head posture and decreasing neck pain, and combination treatment will be more effective in improving forward head posture and decreasing neck pain.

## CONCLUSION

In conclusion performing myofascial release to suboccipital and sternocleidomastoid is more effective than conventional physiotherapy alone, thus aiming to improve posture and pain.

## ABBREVIATIONS

FHP –Forward head posture.

SCM- Sternocleidomastoid.

MFR- Myofascial release.

CVA- Craniovertebral angle.

SA- Shoulder angle.

NDI- Neck disability index.

NPRS- Numerical pain rating scale-On activity.

## REFERENCES

- [1] Ana Cláudia Violino Cunha, Thomaz Nogueira Burke, Fabio Jorge Renovato França, Amelia Pasqual Marques. Effect of global posture re-education and static stretching on pain, range of motion, and quality of life in women with chronic neck pain. *Clinics*.2008 ;63(6):763-70.
- [2] Young Jun Shin, Won Hyo Kim, Seong Gil Kim. Correlations among visual analogue scale, neck Disability index, shoulder joint range of motion, and muscle strength in young women with forward head posture. *Journal of Exercise Rehabilitation*.2017;13(4): 413-417.
- [3] Silva AG, Paul Sharples ,Mark I. Johnson . Studies comparing surrogate measures for head posture in individuals with and without neck pain. *Physical Therapy Reviews*. 2009;15(1):12–21.
- [4] Harman K, Cheryl L. Hubley-Kozey ,Heather Butler .Effectiveness of an exercise program to improve forward head posture in normal adults: A randomized, controlled 10-week trial. *Journal Manual and Manipulative Therapy*. 2005;13(3):163-176.
- [5] Griegel Morris, Larson K, Mueller-Klaus K, Oatis CA. Incidence of common postural abnormalities in the cervical, shoulder and thoracic regions and their association with pain in two age groups of healthy subjects. *Physical Therapy*.1992; 72(6):425–431.
- [6] Levangie, P.K, and Norkin C. C. Joint structure and function: A Comprehensive Analysis, 5<sup>th</sup> ed;2011.
- [7] Eric Dalton. Strategies to improve Forward head posture. *Massage magazine*, 2006:2-9.
- [8] Jull G, Patricia Trott, Helen Potter, Guy Zito, Grad Dip, Ken Niere, et al. A randomized controlled trial of exercise and manipulative therapy for cervicogenic headache. *Spine*.2002;27(17):1835–1843.
- [9] McDonnell, Shirley A, Sahrman , Linda Van Dillen. A specific exercise program and modification of postural alignment for treatment of cervicogenic headache: a case report. *Journal of Orthopaedic Sports Physical Therapy*. 2005;35(1):3–15.
- [10] Vijay Kage, Nishita Y. Patel, Mangala P. Pai. To compare effects of deep neck flexors strengthening exercise and McKenzie neck exercise in subjects with forward neck posture. *International Journal of Physiotherapy and Research*.2016;4(2):1451-1458.
- [11] Joon-Hee Lee. Effects of forward head posture on static and dynamic balance control. *Journal of Physical Therapy Science*. 2016;28(1)274–277.
- [12] Darlene Hertling, Randolph M Kessler. Management of common musculoskeletal disorders, *Physical therapy principles and methods*, 4<sup>th</sup> ed;2006.
- [13] Javier Gonzalez-Iglesiás, Cesar Fernández-de-las-Peñas, Joshua A. Cleland, Maria del Rosario Gutiérrez-Vega. Thoracic Spine Manipulation for the Management of Patients with Neck Pain: A Randomized Clinical Trial. *Journal of orthopaedic and sports physical therapy*, 2009;39(1):20-27.
- [14] Lisa C Carlesso, Joy C MacDermid, Anita R Gross,-David M Walton, P Lina Santaguida. Treatment preferences amongst physical therapists and chiropractors for the management of neck pain: results of an international survey; *Chiropractic and manual therapy*.2014;22, 22(11):1-15.
- [15] Salvi Shah1, Akta Bhalara , Myofascial Release. *International journal of health science and research* 2012,2(2):69-77.
- [16] Kim B, Lee J, Jeong H, Cynn H, Heon-SeockCynn. Effects of suboccipital release with craniocervical flexion exercise on craniocervical alignment and extrinsic cervical muscle activity in subjects with forward head posture. *Journal of Electromyography and Kinesiology*. 2016; 30:31-37.
- [17] Shaghayegh fard B, Ahmadi A, Maroufi N, Sarrafzadeh J. Evaluation of forward head posture in sitting and standing positions. *European Spine Journal*. 2015;25(11):3577-3582.
- [18] Ruivo R, Pezarat-Correia P, Carita A. Ana I. Carita . Cervical and shoulder postural assessment of adolescents between 15 and 17 years old and association with upper quadrant pain. *Brazilian Journal of Physical Therapy*. 2014;18(4):364-371.
- [19] Alireza M. Prevalence of forward head posture and its relationship with activity of trigger points of shoulder region in high school students of shiraz. *International Journal of Physiotherapy and Research*. 2016;4(2):1451-1458.
- [20] Seffinger M, Hruby R. Evidence-based manual medicine. 7<sup>th</sup> ed,2007.
- [21] Schleip R. Fascial plasticity – a new neurobiological explanation Part 2. *Journal of Bodywork and Movement Therapies*. 2003;7(2):104-116.
- [22] Roth J. Cervicogenic Headache Caused by Myofascial Trigger Points in the Sternocleidomastoid: A Case Report. *Cephalalgia*. 2007;27(4):375-380.
- [23] Stanborough M. Direct release myofascial technique. 1<sup>st</sup> ed,2004.
- [24] Malanga G, Yan N, Stark J. Mechanisms and efficacy of heat and cold therapies for musculoskeletal injury.

- 
- Postgraduate Medicine. 2014;127(1):57-65.
- [25] Shaji John Kachanathu, Shinu Philip, Shibili Nuhmani, Mohan Natho, Ganeswararao Melam, Syamala Buragadda. A comparative study on effect of different positional isometric neck exercise training on neck pain and functional abilities in patients with neck pain. *Journal of applied medical sciences*. 2014;2(1A):91-95.
- [26] Ruivo R, Pezarat-Correia P, Carita A. Effects of a Resistance and Stretching Training Program on Forward Head and Protracted Shoulder Posture in Adolescents. *Journal of Manipulative and Physiological Therapeutics*. 2017;40(1):1-10.

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