INTERNATIONAL JOURNAL OF RESEARCH CULTURE SOCIETY ISSN: 2456-6683 Volume - 4, Issue - 5, May – 2020
Monthly, Peer-Reviewed, Refereed, Indexed Journal Scientific Journal Impact Factor: 5.245
Received on : 04/05/2020 Accepted on : 18/05/2020 Publication Date: 31/05/2020

# Effectiveness of proprioceptive neuromuscular facilitation on forward head posture among computer operators at a tertiary care hospital

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***Abstract:*** *The study conducted on forward head posture in computer operators at tertiary care hospital. This study was to find out the effect of proprioceptive neuromuscular fascilitation on forward head posture and neck disability among computer operators at a tertiary care hospital. The research design used for the study was prospective comparative study. Both male and female from Pravara institute of medical sciences, Tertiary care Centre, Loni The materials used for the study were Consent form, Patient information form, Screening form, Data collection sheet.39 Subjects clinically diagnosed with FHP meeting the inclusion criteria were randomly assigned into two groups. Group A (Experimental Group) received Proprioceptive Neuromuscular Fascilitation, Group B (Control Group) received Conventional Exercises and both the groups commonly went for Neck isometrics respectively for 3 times a week for 4 week. The instruments were used in the study was craniovertebral angle on protractor smart phone application version 6.0 and neck disability index. Implication of the study to treat Forward head posture various conventional physiotherapeutic treatments are used but the use of Proprioceptive Neuromuscular Facilitation is rare. Now days, when everybody wants to improve there posture and quick relief from pain. Proprioceptive Neuromuscular Facilitation and conventional exercises can be considered as an effective, safe and simple option to improve posture and reduce the pain, to improve range of motion and to reduce functional disability. Hence, Proprioceptive Neuromuscular Facilitation and conventional exercises must be used in clinical practice to improve posture and reduce pain, to increase the ROM and to reduce functional disability.*

***Keywords:*** *Forward Head Posture, Proprioceptive Neuromuscular Facilitation, Neck isometric exercises Craniovertebral Angle.*

## 1. INTRODUCTION:

The body posture is known as proper alignment of the body in a particular position for a specific duration while a state of maintenance of a balance in the body using less amount of musculoskeletal work without causing pain or discomfort is an ideal posture(1).Optimal head and neck posture is important to lessen the need for muscular activity and the stress apply on the cervical tissues(2).The person who uses a personal computer or smartphone for a longer time is increasing as the percentage of the population. It leads to improper postures, such as a rounded shoulder or forward head posture. This can cause change between the spine and the line of force, causing an overload on muscles and connective tissues. Musculoskeletal dysfunctions like Neck pain or neck dysfunction is caused by improper posture with physical impairment and functional limitation (1).Bad posture is a serious health issue that causes more musculoskeletal dysfunctions with age. Forward bending head posture is known as the bump of the head in the sagittal plane so that the head is located anterior to the trunk. This change can occur because of lower cervical flexion, anterior translation of the head or it is associated with an increase in upper cervical extension (3).This misalignment has been suggested to increase load on the posterior cervical elements, affect the length-tension relationship in the cervical spine muscles, increase muscular activity, restricted neck movement(2).It is correlated with shortening of the upper trapezius, the posterior cervical extensor muscles, the sternocleidomastoid muscle, and the levator scapulae muscle(3).Nowadays Smartphones have become a staple in our society. They are essential for our day-to-day lives as well as a healthcare tool for measuring joint ROM. Mobile technologies, and in particular mobile applications (apps), are the ones making a most profound impact on both patients and healthcare practitioners. Recently, however, a range of smartphone applications that offers an alternative means for measuring joint range of motions have become available. Recently Smartphone application developers have created mobile applications that are intended to Work like Universal Goniometer (4). Measurement of the craniovertebral angle is from the C7 Spinous process to the tragus of the ear. A normal craniovertebral angle is 49.9 degrees (5). The Proprioceptive Neuromuscular Facilitation treatment method is an important treatment to increase flexibility, stability, and muscle strength (6). The Proprioceptive Neuromuscular Facilitation developed by Knott and Kabat in 1940 (7). Proprioceptive Neuromuscular Facilitation is a stretching method used to improve muscle elasticity

and should be given to have an accurate effect on active and passive range of motions (8, 9). Isometric exercise is a static form of exercise that occurs when a muscle contracts without an appreciable change in the length of the muscle or without visible joint motion (10).

## 2. LITRATURE REVIEW:

**Hyun-Ju Oh-Gui-Bin Song (2016)** A study was to investigate the effect of proprioceptive neuromuscular facilitation (PNF) for neck movement and the neck disability index (NDI) among adults with forward head posture. There were significant effects for the NDI, PNFG, pre- and post-intervention, in ARA, AWB, and RFEM. There were significant differences, the CG is compared with ARA, AWB, RFEM, and NDI the results of this study suggest the PNF neck pattern could be beneficial for adults with forward head posture (16).

**Esther Liyanage et al. (2014)** A randomized control trail to find if ergonomic intervention with isometric exercises and stretching for neck proves more effective than ergonomics alone for neck pain in computer professionals. The Result showed that Neck exercises and stretching along with ergonomic intervention combining both these interventions to explore if exercises together with ergonomic intervention proved to be more beneficial than ergonomics alone for neck pain in computer professionals proved more beneficial than ergonomics alone for neck pain in computer professionals ($p<0.001$).study concluded that combining both these interventions to explore if exercises together with ergonomic intervention proved to be more beneficial than ergonomics alone for neck pain in computer professionals(20).

**Pil Neo Hcvangbo et al. (2016)** A study on to know the effect of proprioceptive neuromuscular facilitation neck pattern exercise on the ability to control the trunk and maintain balance in chronic stroke patients , in the study 30 subjects were selected and included outcome measures trunk impairment scale and berg balance scale. There is statistically significant changes in all the items of the Trunk Impairment Scale, the Trunk Impairment Scale total score and the Berg Balance Scale were observed in both the groups. Significant differences in both the groups were found and the study concluded the proprioceptive neuromuscular facilitation neck pattern was shown to have an effect on increasing the ability to control the trunk and maintain balance in the chronic stroke patients(22).

## 3. MATERIALS: The materials used for the study were:

- Consent form
- Patient information form
- Screening form
- Data collection sheet

## 4. METHOD:

**4.1. Participants:** In Present study 53 samples were screened, 40 subjects selected for this study,39 subjects were completed the study with 1 drop out. Randomization was done with simple random sampling method with 39 participants with forward Head posture in computer operators. Both male and female from Pravara institute of medical sciences, Tertiary care Centre, Loni.

### 4.2. Inclusion Criteria:

- Both Male and female
- Age group 25-60 yrs
- Computer oprators with forward head posture ( CV angle<50 degrees)

### 4.3. Exclusion criteria:

- Previous history of whiplash injury
- Previous history of injury to cervical spine
- Malignancy or other spinal infection
- Patients on medication for neck pain

### 4.4. Outcome measures

**Craniovertebral Angle:** CV angle < 50 degrees measuring with the use of ON protractor smart phone application A measured the craniovertebral and cranio-horizontal angle using *ON Protractor* app. Two markers were used: one placed on C7, the second on tragus of ear. The angle between the line joining C7 to tragus was measured and photographs were taken.

**Neck disability index:** NDI score 14/50 – this questionnaire has been designed to give us information as to how your neck pain has affected your ability to manage everyday life. Please answer every section and mark in each section only the ONE box which applies to you at this time. We realize you may consider two of the statements in any section may relate to you, but please mark the box which most closely describes your problem today. For each question, there is a possible 5 points; 0 for the first answer, 1 for the second answer, etc. Add up the total for the 10 questions and rate them on the scale at right.

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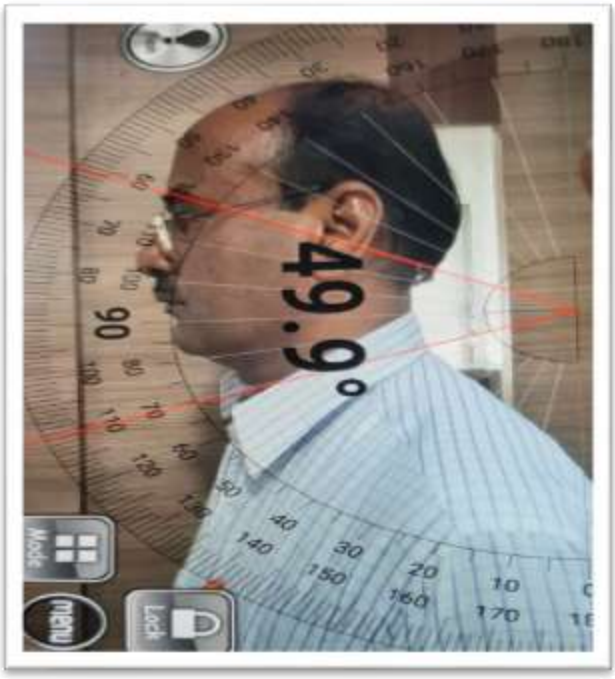


**Figure 1** was taken on protractor smart phone application version 6.0

**Procedure:** The two groups were treated as follows: Group A was given proprioceptive neuromuscular fascilitation (PNF) neck pattern.
To perform a bend-right bend-right turn pattern.

The patient stretches his back on the chair and posture was kept sitting. Researcher left the patient After standing diagonally behind the side, the right hand is the right forehead of the patient Located at the top, the left hand stops with the index finger at the lower part of the chin Put the end of. To complete the neck bending exercise. After giving enough direction to the right diagonal, Rotate the patient's neck in the diagonal direction opposite to the direction of movement Stretch your body and prepare for exercise. To the patient 'in the jaw Pull it and move it to see the right pelvis. 'After two commands, bend-right bend-turn right and the pattern was implemented. Same bending motion in opposite direction. The intervention was given for the duration 20 minutes 3 times a week for 4 weeks (16).

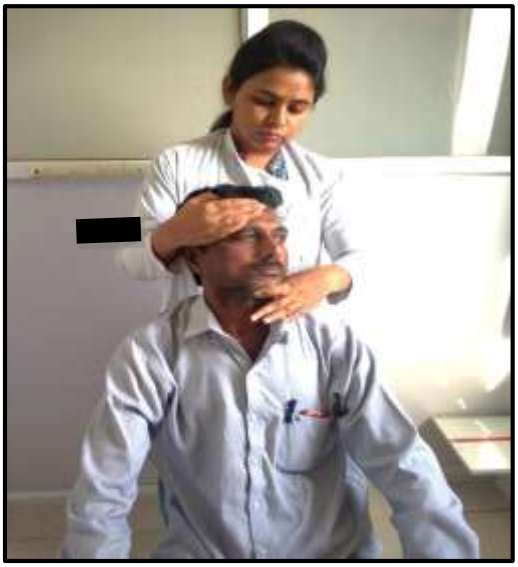

**Figure 2:** PNF Neck Pattern (Left Side)

**Figure 3:** PNF Neck Pattern (Right Side)

And neck isometrics these included Isometrics exercises for neck including flexors, extensors, and lateral flexors hold for 5 seconds and were told to repeat 5 times. And Group B was given neck isometrics and hot water fermentation was given by applying cervical hot pack over the area in prone lying position for 15 minutes followed by conventional exercises.

**Figure 4** Hot water fermentation for cervical spine

These included Isometrics exercises for neck including flexors, extensors, and lateral flexors.

**Isometric flexion** - They were taught to place their dominant hand flat on the forehead. Next, they were told to firmly push forehead against the right hand and hold for 5 seconds and were told to repeat 5 times.

**Figure 5** Isometric flexion

**Isometric extension** – Patients were taught to place their dominant hand behind their head, over the occiput. Next, they were told to firmly push the head backwards against the hand, and hold for 5 seconds and repeat 5 times.

**Figure 6** Isometric extension

**Isometric side flexion** – Patients were taught to place the right hand flat on the right side of the head. Next, they were told to firmly push the head against right hand and hold for 5 seconds and repeat 5 times. Same exercise was repeated with the left hand against the left side of the head.

**Figure7** Isometric side flexion (Right side)

**Figure 8** Isometric side flexion (Left side)

**Isometric neck rotation** – Patients were taught to place the right hand on the right cheek. Next, they were told to firmly turn the face against the right hand and hold for 5 seconds and repeat 5 times. Same exercise was repeated with the left hand on the left cheek.

**Figure 9 Isometric neck rotation (Left side)**

**Figure 10 Isometric neck rotation (Right side)**

**5. Analysis:** Data was analyzed using SYSTAT version 12. Descriptive statistics for all outcome measures were expressed as mean, standard deviations and test of significance such as paired "t" test used for comparing the data within each group and unpaired "t" test for comparing the data between the groups.

**6. RESULTS:**

**Table 1: Age and Gender wise distribution in Group A-(Experimental Group) and in Group B – (Control Group)**

| **Demographic data** | **Group-A** | **Group-B** |
|---|---|---|
| | Mean±SD | Mean±SD |
| **Age** | 37.8±7.25 | 42.78±6.45 |
| **Weight** | 61.7±8.70 | 64.47±11.03 |
| **Height** | 167.2±6.84 | 165.7±5.06 |
| **BMI** | 22.08±2.88 | 23.41±3.30 |

**Table 2: Distribution of mean values and SD value of all parameters in Group A – Experimental Group**

| **Group A** | Pre | Post | t-value | P-value |
|---|---|---|---|---|
| | Mean ± SD | Mean± SD | | |
| **Craniovertebral Angle** | 46.22±2.16 | 51.31±1.47 | 17.51 | P=0.001 |
| **Neck Disability Index** | 11.95±1.79 | 9.35±2.20 | 5.57 | P=0.001 |

**Table 3 Distribution of mean and SD values of all parameters in Group B –Control Group**

| Group B | Pre | Post | t-value | P-value | Significance |
|---|---|---|---|---|---|
| | Mean ± SD | Mean± SD | | | |
| **Craniovertebral Angle** | 46.24±4.054 | 48.45±4.057 | 18.25 | P=0.0001 | Significant |
| **Neck Disability Index** | 12.94±1.17 | 9.57±1.12 | 16.40 | P=0.0001 | Significant |

**Table 4 Comparison of mean difference of values of all parameters in Group A – (Experimental Group) and in Group B –(Control Group) (n=39)**

| Parameters | Group A | Group B | Unpaired t value test | P value | Significance |
|---|---|---|---|---|---|
| | Mean± SD | Mean ±SD | | | |
| **Craniovertebral Value** | 5.09±1.30 | 2.20±0.52 | t=8.978 | 0.0001 | Significant |
| **Neck Disability Index** | 3.2±0.83 | 3.36±0.89 | t=0.608 | 0.2733 | Not significant |

## 7. DISCUSSION:

In the study, both techniques showed improvement in the Craniovertebral angle and neck disability index in participants with Forward head posture. Proprioceptive Neuromuscular Facilitation (PNF) is aimed at relaxing tense muscles and restricted joints to make quick gains in ROM. Kayla (2012) stated that PNF stretching is effective in improving and maintaining range of motion and increasing athletic performance, especially after exercise. However, proper protocol and consistency must be followed to attain and maintain the benefits of the PNF technique (11). Probable causes for Proprioceptive Neuromuscular Facilitation are, PNF technique involves different patterns of movements that are rotational, multi-axial, and multidirectional which provides proper neuromuscular function via the stimulation of proprioceptive function. These movements are more effective and are used to decrease pain, increase the range of motion, and improve the function. PNF position renders a greater amount of sensory input coming from the periphery than that in the neutral position. This induces changes in the excitability of the pyramidal tract, the final motor pathway leading to stronger excitation of the cortical area leading to better recruitment of the muscle (12, 13). The level of pain decreased by isometric exercises due to increased level endorphins which occur usually after training. The strong muscle contractions occur which activates muscles stretch receptor which causes endogenous opioids to be released and also causes the release of beta-endorphins from the pituitary gland, these secretions may cause decrease pain (12). The decrease in the pain following stretching produces inhibitory effects of Golgi tendon organ (which causes dampening effects on the motor neuronal discharges, through causing relaxation of the musculotendinous unit by resetting its resting length) and Pacinian corpuscle adjustment. These reflexes will permit relaxation in musculotendinous unit tension and reduced pain perception and increase in range of motion (12). Therapeutic heat widely used for the relief of pain. Anecdotally heat ranks highly among patients, after analgesics, as a way of controlling pain or managing pain. Heat may reduce muscle spasm by reducing the level of ischemia associated with prolonged contraction in affected muscles. The temperature changes the output of both the muscle spindle and the type 1b Golgi tendon organ afferent fibers. The net result is an inhibition of the motor neuron pool and a reduced level of muscle excitation. It gives a sedative effect, during and after heat treatments patients have been found to sleep more readily. While this might be simply a consequence of pain relief it has been noted that skin temperatures rise just before the onset of sleep so that the sedative effect of superficial heat could be a reflex phenomenon. The analgesic effect of heat allows greater tolerance of stretching, a comparison of the effects of heat, stretch or heating and stretching on increasing joint range of motion (14).

The PNF neck pattern could be beneficial for adults with forward head posture. Mechanism of Proprioceptive neuromuscular facilitation is a condition in which the patient Actively using and reinforcing what is available As a positive treatment, the primary goal of treatment is to help them reach their highest level. This therapy accepts stimuli into body tissues It is the body structure that is associated with nerves, muscles, Palpation or suppression of the patient's pain It is a treatment that restores the performance of a specific muscle group. Advantages of selectively acting on relaxation and relaxation (16). The effect of Proprioceptive Neuromuscular Facilitation neck pattern exercise on cervical ROM and Quality of life in 21 post-operative head and neck cancer patients for 7 days while their stay in the hospital. Proprioceptive Neuromuscular Facilitation may be utilized as a therapeutic exercise to reduce pain, improve cervical ROM, and Quality of life for patients who have experienced head and neck cancer surgery following reconstruction in each clinical service of the Indian scenario. There was a significant reduction mentioned in both the VAS and NDI scores post-intervention which proves to be effective in reducing cervical pain and disability (17). The PNF exercises are more effective in improving in flexibility. The findings indicate that it is possible to significantly increase range of motion in people with chronic low back pain by use of a 4-week intensive PNF exercise program. Such exercises take advantage of the body's inhibitory reflexes to improve muscle relaxation. This muscle relaxation allows a greater stretch

magnitude during stretch training, which should result in superior gains in flexibility. In that study proprioceptive neuromuscular fascilitation shows more effect than conventional exercises (18). The increase in functional activities found in their study occurred because the exercise program performed with PNF techniques stimulated both the myoreceptors and the exteroceptors, promoted motor-skill memory, and triggered neurophysiological changes. In addition, the neurophysiological changes must have increased functional activities by more accurate control of muscle activities and surrounding structures. They prove that exercise programs that apply PNF techniques can be said to be effective at improving the function of myofascial pain syndrome patients (6). Pain and disability significantly reduced in both the groups (on within group analysis).However, forward head posture showed significant improvement in experimental group only. All the other dependent variables showed improvements significantly in experimental group on analysis between groups. They proved Deep cervical flexor training is more effective than conventional isometric training for improving forward head posture, decreasing pain and disability in dentists suffering from chronic neck pain(19). Efficacy of Isometric Neck exercises and stretching with ergonomics over ergonomics alone in Computer Professionals Observing the efficacy of exercises and ergonomic intervention in reducing neck pain, the present study aimed at combining both these interventions to explore if exercises together with ergonomic intervention proved to be more beneficial than ergonomics alone for neck pain in computer professionals (20). The Efficacy of Muscle Energy Technique As Compared to Proprioceptive Neuromuscular Facilitation Technique in Chronic Mechanical Neck Pain. PNF technique involves different patterns of movements that are rotational, multi-axial, and multidirectional and provide proper neuromuscular function via the stimulation of proprioceptive function. These movements are more effective and are used to decrease pain, increase the range of motion and improve the function. PNF position renders greater amount of sensory input coming from the periphery than that in the neutral position. This induces changes in the excitability of the pyramidal tract, the final motor pathway leading to stronger excitation of the cortical area leading to better recruitment of the muscle. It has also been indicated that proper function of proprioceptive system has an important role in the maintenance of correct head and neck posture, and improve the ability to maintain a correct posture. The effect of PNF for increase in ROM, according to (Alter 1996), PNF is a technique involving combinations of alternating contraction and stretches. Whose goal is facilitation of agonist muscle thereby increase the recruitment of additional motor neurons or increase the excitability of the motor neurons. In the present study Muscle Energy Technique and Proprioceptive Neuromuscular Facilitation Technique are both equally effective in reducing pain, improving ROM and function in subjects with chronic mechanical neck pain (21). Comparison between the two groups revealed that there were faster improvement in the group A than group B which proved Proprioceptive Neuromuscular Facilitation is effective than conventional exercises .There was a significant difference between mean values of parameters of Craniovertebral angle and Neck Disability Index at Post treatment, when Group A was compared with Group B. Based on the results of this both study, the Conventional exercises and Proprioceptive Neuromuscular Facilitation are effective methods to increase craniovertebral angle and for reducing NDI score in participants with Forward head posture. But PNF stretching is more effective than the conventional exercise in increasing craniovertebral angle and reducing NDI score.

## 8. CONCLUSION:

The study concluded that Proprioceptive Neuromuscular Facilitation (PNF) along with neck isometrics more effective in increasing craniovertebral angle and reducing NDI score than only conventional exercises in participants with forward head posture in computer operators at a tertiary care hospital.

**9. RECOMMENDATIONS:** The study can be conducted on larger samples and longer intervention duration.

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