# MYOFASCIAL RELEASE VERSUS PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION IN CHRONIC MECHANICAL NECK PAIN: A RANDOMIZED CONTROLLED TRIAL

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## Abstract

**Objectives:** To compare the effect of myofascial release technique versus proprioceptive neuromuscular facilitation on cervical Pain, disability, pain pressure threshold and range of motion in chronic mechanical neck pain patients.

**Methods**: 60 chronic mechanical neck pain right handed patients were involved in this randomized controlled trial. They were recruited from El-Hosary family health center and randomly assigned into three groups. All groups received conventional treatment of mechanical neck pain, while group A received myofascial release in addition and group B received proprioceptive neuromuscular facilitation in addition. Pain, disability, pain pressure threshold and range of motion were measured at baseline, after six sessions, after 12 sessions and at 3months follow up.

**Results:** Concerning pain and disability group A improved significantly more than group B and C (P=0.001). Concerning pain pressure threshold there was statistical significant difference in the 4$^{th}$ measure in right upper trapezius between groups in favor to group A (P=0.023) and in the 2$^{nd}$ measure in left suboccipital between groups in favor to group B (P=0.016). Concerning range of motion group A and B improved significantly more than group C (P=0.001) in flexion and extension while in right rotation group A improved significantly more than group B and C (P=0.001). Concerning other measurements the three groups didn`t differ significantly (P>0.05).

**Conclusion**: Myofascial release is more beneficial than proprioceptive neuromuscular facilitation regarding pain and disability and right upper trapezius pain pressure threshold while in suboccipital pain pressure threshold proprioceptive neuromuscular facilitation was more effective after six sessions while after twelve sessions both techniques are equally effective. Regarding range of motion both techniques are equally effective except in right rotation myofascial release was more effective.

**Key words:** Myofascial release, proprioceptive neuromuscular facilitation, chronic mechanical neck pain.

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## Introduction

Chronic mechanical neck pain (MNP) commonly affects the population throughout their lifetime with a prevalence rate of 45% to 54%. Chronic MNP Patients commonly suffer from moderate disability that leads to poor quality of life, increased risk of depression and hyperalgesia in muscles, skin, and ligaments during motions.[2 ]

Chronic MNP can be treated pharmacologically by pain-modulating therapies and nonsteroidal anti-inflammatory drugs that have expressive adverse effects. Physical therapy modalities include electrotherapy, acupuncture, manual therapy and therapeutic exercise also can be used to manage neck pain[3]

Manual therapy includes joint techniques like manipulation and mobilization and soft tissue techniques like post isometric relaxation, deep transverse massage, and functional massage [4]

Myofascial release is a manual technique which concerns myofascial complex mobilization by applying Sustained pressure for 9 to 120 seconds over tissue restriction by force of few kilograms to the stiff overused fascia to release compression from the affected organ.[5]

Perception of joint angle and muscle tension and length is the responsibility of proprioceptive receptors located in tendon and myofibers. In rehabilitation field, proprioceptive neuromuscular facilitation (PNF) commonly used to inhibit mitotic reflex to improve joint range of motion and muscle length. [6] PNF stimulates neuromuscular activity and improves ROM by using muscle contraction. [7 ]

Although myofascial release and PNF are considered from the most beneficial techniques that decrease pain and improve range of motion and function in mechanical neck pain there is a gap in the literature concerning the comparison between myofascial release versus PNF on cervical pain in mechanical neck pain patient so this study was conducted to compare the effect of myofascial release versus PNF on patient with chronic mechanical neck pain regarding pain, disability, ROM and pain pressure threshold to determine the most beneficial technique.

## Methods

### Study Design

The present study was blind randomized controlled trial. It was conducted according to the CONSORT (consolidated standards of reporting trials).

### Ethics

This randomized controlled study was approved by an institutional Human Research Ethics Committee (reference number P.T.REC/012/002836) and was prospectively registered with the Pan Africa Trials Registry with the registration number PACTR202203614479239. All data was collected and completed between September 2020 and November2022.

### Participants

Sixty Chronic MNP right-handed patients were recruited from El-Hosary family health center, their age ranged between 20-50 years old, suffer from MNP for three months or more. Individuals were excluded if they reported history of neck surgery in the past 12 months, serious pathology like malignancy, central cervical canal stenosis, trauma of the neck, spine deformity, spinal infection, neck pain with radiation to the upper extremity, nerve root involvement, inflammatory disorders, active trigger points and treatment by analgesics.

The sample size was determined according to G*Power (version 3.1.6). Considering the type of study design, ANOVA test, type I error was 5 %( alpha level 0.005) and statistical power was 80%. The calculated minimum sample size was 42. The study increased the subjects to 60 patients assigned randomly into three groups. Group A, received MFR technique and conventional therapy (in form of static resisted exercises for neck muscles in all directions), group B, received PNF and conventional therapy, and group C (control), received conventional therapy using permuted blocks randomization.

### Assessment

Measurement procedures applied before treatment, after 6 sessions, after 12 sessions and 3 months follow up. Patients were informed about the appointment of follow up which is after the end of the treatment by three months and they reminded 5days before the appointment by a phone call.

Neck Pain intensity was measured by visual analogue scale (VAS), in which zero refers to no pain and ten refers to extreme pain. The VAS has been approved to be a valid and reliable pain measurement tool [8]

Bubble Inclinometer (Baseline 12-1056, China) was used for cervical range of motion measurement, it is approved as a valid and reliable measurement tool for measurement of flexion, extension, side bending, and rotation**.** [8]The participant was seated and the inclinometer was placed in the frontal and sagittal planes on head to measure side bending ROM and flexion and extension ROM respectively. In order to measure cervical right and left rotation the inclinometer was placed on the forehead in transverse plane while the subject was in supine position [10]

Copenhagen Neck Functional Disability Scale (Arabic version) as used as a valid and reliable tool for measurement of neck disability. Total scores ranged from 0 to 30, it contains 15 items that evaluate the level of neck disability and pain. 3 items concerned with the degree of neck pain effect on patient's future and the pain severity; 8 items evaluate the disability during activities of daily living; and 4 items assess social recreation and interaction. [11]

Pressure algometer was used for measurement of pain pressure threshold of upper trapezius and suboccipital myofascial trigger point (Baseline push pull force gauge12-0302 11LB 5KG sensitivity, United States). It has been shown as an excellent reliability**.** [12 ]Palpation technique was used to evaluate myofascial trigger points and the pressure applied on it gradually and stopped when the subject indicated pain. Three measures on each side were taken with 30 seconds rest interval and the average of the three measures was statistically analyzed**.** [13]

### Intervention

All three groups received for a month three sessions a week conventional treatment of mechanical neck pain in form of static resisted exercises for neck muscles in all directions by performing resistance for side bending on the head side, for flexion on the

forehead and for extension on the occiput. The resistance was applied for ten seconds with ten repetitions, then stretching exercises are applied for flexors, extensors, rotators and side flexors for thirty seconds with three times repetitions in every session with rest in between. [14]

Group A received conventional treatment in addition to myofascial release technique in four steps while the patient in supine position, first, the therapist applied a hand beneath the neck and the other one on the partial area till sensation of spontaneous motion that continued to maximum length, then the therapist applied suboccipital release of restricted fascia by raising atlas toward ceiling by therapist index, middle and ring fingers, after that therapist gently rotate patient`s head and placed one hand over occiput and the other on the belly of sternocleidomastoid muscle, one hand applied head rotation with slight extension and the other transversely slides the restriction zone in the muscle, finally, the therapist slowly bent the neck and applied vertical sliding to elongate the myofascial structures of the posterior cervical region. [12]

Group B received conventional treatment in addition to PNF technique in two patterns applied bilaterally while the patient is in supine position with his head outside the plinth and the therapist a hand on the occiput and the other one on the mandible, for the first pattern flexion with rotation to the right the patient started with his head and neck extended and rotated to the left then the therapist asked the patient to pull his chin up towards the sternum to do flexion with rotation to the right movement, the second pattern is extension with rotation to the left, the patient started with his head and neck flexed and rotated to the right, the therapist asked the patient to push and look to the left to do extension with rotation to the left movement. Facilitation by manual contact and appropriate verbal command in both patterns. All patterns repeated 8-12 repetitions in each session [15]

Group C is a control group received only conventional treatment of mechanical neck pain as described.

**Data analysis**

Data were represented as mean± SD. ANOVA was applied to compare between participants features of the three groups. Shapiro-Wilk and Kolmogrov-smirnov tests were used for testing normality of data distribution. MANOVA was applied to compare between and within groups' effects for parametric variables Friedman and Kruskal Wallis tests for nonparametric variables. Statistical package for the social sciences computer program (version 20 for Windows; SPSS Inc., Chicago, Illinois, USA) was used for data analysis. *P* less than or equal to 0.05 was considered significant.

**Results:**

Evaluated subjects for eligibility, involvement, exclusions, and missed patients are shown in figure 1. ANOVA revealed that the mean age and BMI of the three groups were not significantly different where $P > 0.05$. The sex distribution didn`t differ significantly between the three groups ($p = 0.392$) as shown in table 1

Table 2 shows the comparison between the four measures (before treatment, after 6 sessions, after 12 sessions and follow up at 3months after treatment) mean values of pain, disability and PPT of upper trapezius and suboccipital myofascial trigger points. There was a significant difference between all four measures in the three groups.

In the analysis of the difference between groups concerning the intensity of neck pain, the median values of the three groups didn`t differ significantly in the 1st and 2nd measurements ($p > 0.05$), while there were significant differences in the 3rd and 4th measurement group A improved significantly more than group B ($p=0.003$) and group C ($p=0.001$) while group B and C didn`t differ significantly ($p=0.3$).

In the analysis of the difference between groups concerning the neck disability, the median values of the three groups didn`t differ significantly in the 1st measurement ($p > 0.05$), while in the 2ndmeasurement group A improved significantly more than group B ($p=0.015$ while group c didn`t differ significantly from group A ($p=0.414$) and B ($p=0.560$) in the 3rd measurement in the 3rd measurement group A improved significantly more than group B and C ($p=0.001$) while group B and C didn`t differ significantly. In the 4th measurement group A improved significantly more than group B ($p=0.001$) and group C ($p=0.002$).

In the analysis of the difference between groups concerning of the upper trapezius PPT, about the right side, the median values of PPT of the three groups weren`t significantly different in the 1st, 2nd and 3rd measurements ($p > 0.05$), while in the 4th measure group A improved significantly more than group B ($p=0.021$) but group C didn`t differ significantly from group A and B ($p > 0.05$). About the left side the median values of PPT of the three groups didn`t differ significantly ($p > 0.05$).

In the analysis of the difference between groups concerning of the suboccipital PPT, about the right side, the median values of PPT of the three groups didn`t differ significantly ($p > 0.05$) in the four measurements. about the left side , the median values of PPT of the three groups didn`t differ significantly in the 1st , 3rd , and 4th measurements while in the 2nd measurement group A improved significantly more than group B (P=0.014) and

group C didn`t differ significantly from group A and B ($p > 0.05$).

Table 3 shows the comparison between the four measures (before treatment, after 6 sessions, after 12 sessions and follow up at 3months after treatment) mean values of ROM in all directions (flexion, extension, side bending and rotation). There was a significant difference between all four measures in in group A, group B except in extension but the four measurements weren`t significantly different in group C except in rotation to the right

In the between group analysis of the ROM there was no significant difference except in flexion, extension and rotation to the right.

In flexion, the mean values of cervical flexion in the three groups didn`t differ significantly in the 1st measurement ($p = 0.078$), also in the 2nd measurement group A and B were not significantly different ($P = 0.738$) While, group A improved significantly more than group C ($P = 0.001$) and group B improved significantly more than group C ($P = 0.001$). In the 3rd measurement group A wasn`t significantly different from group B ($P = 0.999$) while group A and group B improved significantly more than group C ($p=0.002$). In the 4th measurement group A and B weren`t significantly different (0.777) while group A improved significantly more than group C ($P=0.002$) and also group B improved significantly more than group C ($P=0.004$).

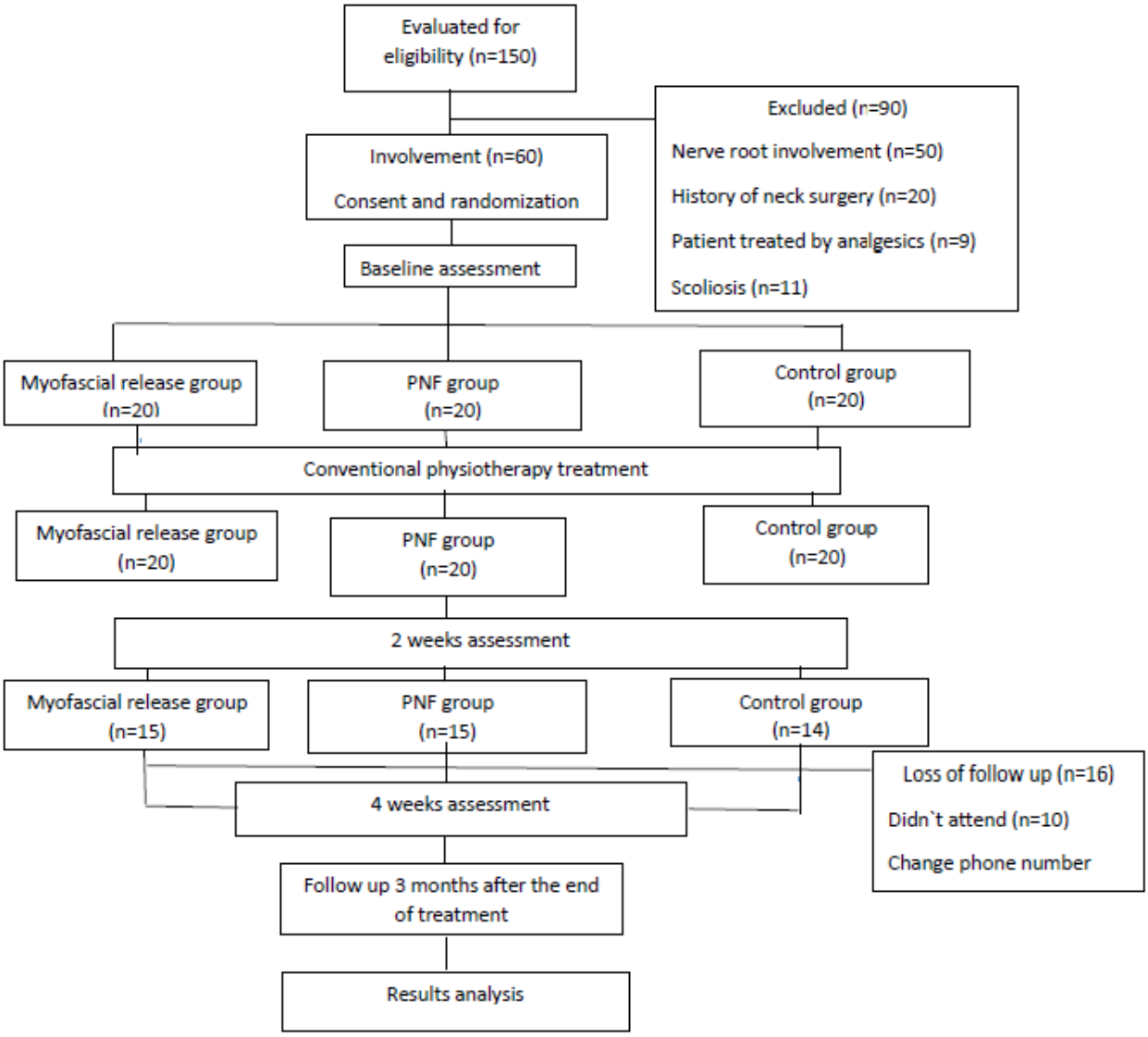


**Figure 1.** Flow chart for MFR, PNF and control group

In extension, the mean values of the three groups weren`t significantly different in the 1st, 2nd and 4th measurements ($p > 0.05$), also in the 3rd measurement group A and B didn`t differ significantly ($P = 0.229$). While, group A improved significantly more than group C ($P = 0.001$) and

group B improved significantly more than group C (P = 0.014).
About rotation to the right, group A and B weren`t significantly different (P = 0.054) and also group B and C weren`t significantly different (P = 0.148). While, group A improved significantly more than group C (P = 0.001).

**Table (1): General characteristics of subjects.**

| General features | Group A (n=20) | Group B (n=20) | Group C (n=20) | F-value | P-value | Significance |
|---|---|---|---|---|---|---|
| **Age (years)** | 38.3± 8 | 39.2± 9.5 | 41.3± 6.8 | 0.710 | 0.496 | NS |
| **BMI (kg/cm$^2$)** | 23.9 ±0.8 | 23.5±0.8 | 24± 0.6 | 2.4 | 0.096 | NS |
| **Sex Males**<br>**Females** | 6 (30%)<br>14 (70%) | 3 (15%)<br>17 (85%) | 3 (15%)<br>17 (85%) | $\chi 2$ =1.87 | 0.392 | NS |

**P, probability NS, non-significant**

**Discussion**

The significant enhancement in PNF group can be explained by the influence of PNF technique in muscle strength and flexibility enhancement and pain reduction as it involves stretching, resisted movement, traction and approximation and it facilitates the position sense of the body with nerves and muscles which results in improving ROM.[16 ]
The significant improvement in myofascial release group is due to myofascial release relaxation effect on contacted muscle by elongation of fascia which allow good blood flow to the muscle, decrease pain and normalize ROM. [17]
The results of this study regarding neck pain showed that, MFR group improved significantly more than the other two groups. It can be as a result of breaking pain muscle tension pain cycle by myofascial release technique as it relaxes the tense muscles and fascia and allow healing initiation by increasing blood flow and inflammatory cytokines to the chronic pain region. [17 ]
The results of current study come in line with Elgendy, et al [3], who compared the influence of the MFR versus multimodal approach of electrotherapy on functional disability, range of motion and pain in chronic MNP patients and found that chronic MNP can be managed effectively by both MFR technique and multimodal approach of electrotherapy.
Also the present findings are similar to previous result that have reported by Rodríguez-Huguet et al [18 ]who compared between the effects of MFR and a standard physical therapy program in neck pain patient and found that MFR is more beneficial.

**Table (2):** Pre- versus post- intervention mean values of pain, disability and upper trapezius, suboccipital PPT within and between groups

| pain | Group A | Group B | Group C | P value |
|---|---|---|---|---|
| **Pain** | | | | |
| Pre treatment | 9 (9-10) | 9 (9-10) | 8 (7.7-9.2) | 0.05 |
| After 6 sessions | 6 (5-6.25) | 6.5 (5-8) | 6 (4-8) | 0.637 |
| After 12 eassions | 1 (0-2.25) | 3 (2-4.2) | 5 (2.7-7) | 0.001* |
| 3 months follow up | 1 (0-3) | 5 (5-8.2) | 5 (3.7-7) | 0.001* |
| **(P-value)** | 0.001* | 0.001* | 0.001* | |
| **Disability** | | | | |
| Pre treatment | 20.5 (17.7-28) | 25.5 (21.5-27) | 14 (11.7-27) | 0.184 |
| After 6 sessions | 10 (8-14.25) | 20 (17.7-22) | 12.5 (9-23) | 0.020* |
| After 12 eassions | 2 (0-4.7) | 15 (10-17) | 12 (8-20) | 0.001* |
| 3 months follow up | 1.5 (1-6.2) | 21 (12.7-22) | 11.5 (9-21) | 0.001* |
| **(P-value)** | 0.001* | 0.001* | 0.061 | |

| | | | | |
|---|---|---|---|---|
| **Right upper trapezius PPT** | | | | |
| Pre treatment | 1.5 (1.3-1.7) | 1.6 (1.5-2.1) | 2 (2.1-3) | 0.051 |
| After 6 sessions | 1.9 (1.4-2.5) | 2 (1.7-2.6) | 2.4 (2-3.5) | 0.534 |
| After 12 eassions | 2.6 (2.1-3.5) | 2.6 (2.3-3.3) | 3 (2.4-3.6) | 0.774 |
| 3 months follow up | 2.7 (2.3-3.5) | 2.1 (1.8-2.5) | 2.9 (2.4-3.5) | 0.023* |
| **(P-value)** | 0.001* | 0.001* | 0.010* | |
| **Left upper trapezius PPT** | | | | |
| Pre treatment | 1.4 (1.1-1.5) | 1.5 (1.3-1.8) | 1.5 (1.3-1.9) | 0.057 |
| After 6 sessions | 2 (1.6-2.5) | 2.2 (1.7-3.4) | 2.2 (2-3) | 0.611 |
| After 12 eassions | 2 (1.6-2.9) | 2.7 (2.6-3.3) | 2 (1.3-3.5) | 0.082 |
| 3 months follow up | 3 (2.3-3.5) | 2.3 (2-2.6) | 2.5 (1.6-3.4) | 0.198 |
| **(P-value)** | 0.001* | 0.001* | 0.001* | |
| **Right suboccipital PPT** | | | | |
| Pre treatment | 1.3 (1-1.5) | 1.6 (1.5-1.7) | 1.8 (1.3-2.7) | 0.052 |
| After 6 sessions | 1.7 (1.3-2) | 2.6 (1.8-3.2) | 1.9 (1.1-2.7) | 0.064 |
| After 12 eassions | 2 (1.8-2.8) | 2.2 (1.9-3.5) | 2.3 (2-3) | 0.744 |
| 3 months follow up | 2.8 (1.9-3) | 1.9 (1.5-2.5) | 2.4 (2-3.1) | 0.085 |
| **(P-value)** | 0.001* | 0.001* | 0.007* | |
| **Left suboccipital PPT** | | | | |
| Pre treatment | 1.4 (1-1.8) | 1.5 (1.3-1.8) | 2 (1.5-2.5) | 0.051 |
| After 6 sessions | 1.6 (1.4-2) | 1.9 (1.5-2.1) | 2 (2.3-2.6) | 0.016* |
| After 12 eassions | 2.3 (1.9-3) | 2.5 (2-2.8) | 2.8 (2.1-3.2) | 0.736 |
| 3 months follow up | 2.7 (2-3.1) | 2.3 (1.9-2.5) | 2.8 (2.2-3) | 0.074 |
| **(P-value)** | 0.001* | 0.001* | 0.001* | |

P, probability; Data are expressed as median (interquartile range), *: statistical significant

**Table (3):** Pre- versus post-intervention mean values of measured variables within and between groups

| **Cervical ROM (degrees)** | Group A | Group B | Group C | **f-value** | **P value** |
|---|---|---|---|---|---|
| **Flexion** | | | | | |
| Pre treatment | 37±8.7 | 41±5.8 | 35±11.7 | 2.59 | 0.078 |
| After 6 sessions | 47.6±5 | 48.6±3 | 38±9.9 | 8.88 | 0.001* |
| After 12 eassions | 50±0.1 | 50±0.1 | 41±9.7 | 6.83 | 0.001* |
| 3 months follow up | 48.6±2.3 | 47.8±8.4 | 39.6±9.6 | 6.38 | 0.002* |
| **(P-value)** | 0.001* | 0.010* | 0.156 | | |
| **Extension** | | | | | |
| Pre treatment | 48.6±10.7 | 52.5±11.9 | 42±12.7 | 2.82 | 0.062 |
| After 6 sessions | 61.4±12.9 | 58.6±16.8 | 51±11.6 | 2.8 | 0.064 |
| After 12 eassions | 69.3±11.9 | 64±10 | 52.9±10.8 | 7.09 | 0.001* |
| 3 months follow up | 59.6±8.9 | 56.8±9.4 | 51.6±11.3 | 1.64 | 0.197 |
| **(P-value)** | 0.001* | 0.082 | 0.061 | | |
| **Right side bending** | | | | | |
| Pre treatment | 39±9.6 | 35.6±5.5 | 41.4±10 | 1.96 | 0.143 |
| After 6 sessions | 44.6±4.7 | 44.8±5.8 | 40.8±6 | 2.07 | 0.129 |
| After 12 eassions | 45±0.1 | 44.3±2.8 | 41±5 | 1.75 | 0.177 |
| 3 months follow up | 44.6±1.3 | 40.8±6 | 40±5.4 | 2.39 | 0.095 |
| **(P-value)** | 0.022* | 0.002* | 0.945 | | |
| **Left side bending** | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Pre treatment | 38.2±8 | 36.2±7.8 | 38.6±8.2 | 1.4 | 0.249 |
| After 6 sessions | 43.4±4.6 | 43.5±4.6 | 40.6±7.4 | 1.13 | 0.324 |
| After 12 eassions | 44.6±1.3 | 43.6±2.7 | 41±6.2 | 1.41 | 0.247 |
| 3 months follow up | 43.9±2.1 | 40.2±5.3 | 40.9±5.9 | 1.63 | 0.197 |
| **(P-value)** | 0.015* | 0.001* | 0.649 | | |
| **Right rotation** | | | | | |
| Pre treatment | 51±11.5 | 49.8±17.5 | 46.2±15 | 0.542 | 0.583 |
| After 6 sessions | 67.6±5.5 | 67.2±11.2 | 60.1±15.3 | 1.57 | 0.210 |
| After 12 eassions | 79.7±6.6 | 70.4±9.4 | 64±15.2 | 5.4 | 0.005* |
| 3 months follow up | 72±10.2 | 62.9±12.8 | 61.5±14.7 | 2.90 | 0.058 |
| **(P-value)** | 0.001* | 0.001* | 0.001* | | |
| **Left rotation** | | | | | |
| Pre treatment | 53.2±10.8 | 49±15.3 | 52.6±17.5 | 0.337 | 0.714 |
| After 6 sessions | 67.4±8.7 | 64.5±8.7 | 58.9±18.3 | 1.20 | 0.302 |
| After 12 eassions | 73.3±22 | 70.7±10.5 | 63.4±17.2 | 1.73 | 0.181 |
| 3 months follow up | 72.9±6 | 63±15 | 60.3±17 | 2.88 | 0.059 |
| **(P-value)** | 0.001* | 0.001* | 0.261 | | |

*, significant difference; p, probability; P-Value < 0.05 indicate statistical significance; Data are mean± SD

Stieven et al [19 ]conducted a study to investigate the immediate effect of dry needling (DN) versus MFR regarding pain pressure threshold (PPT) and neck pain intensity in chronic MNP patients and reported that both techniques are equally effective in pain reduction.

The results of this study as regards to neck disability showed that, MFR group improved significantly more than the other two groups. This could be because of the decrement of pain resulting in improvement of daily activities and reduce neck disability**.** [20]

The results of this study as respects to neck PPT of upper trapezius and suboccipital myofascial trigger point indicated that, the three groups didn`t differ significantly except in second measurement (after six sessions) there was a significant difference between myofascial release and PNF techniques in favor to PNF technique in pain pressure threshold of left suboccipital trigger point. And in fourth measurement (3months follow up) there was a significant difference between myofascial release and PNF techniques in favor to myofascial release technique in pain pressure threshold of right upper trapezius trigger points. This may be due to that the PNF technique has faster results but in long term effect myofascial release is more effective that is because the mechanism of myofascial release to decrease tenderness and increase PPT is to remove compression occurred on blood vessels due to shortened fascia which leads to good oxygen delivery by arteries and release venous congestion and allow lymph drainage and tissue return to health**.** [16 ]This is why the right upper trapezius in our sample of right handed individual are improved in the follow up measure more than the other two groups.

The significant improvement of PPT in left suboccipital muscles in PNF group may be due to the presence of abundant proprioceptors in suboccipital region in addition to mechanoreceptors occur in facet joint capsules as neck proprioception is responsible of providing necessary information about head movement in relation to the trunk. [22 ]

The gait control theory may be the mechanism of significant improvement in pain in PNF group. Both myelinated and un-myelinated peripheral afferent fibers carry impulses to the spine through the same interneurons. In PNF technique Golgi tendon organ is stimulated by muscle stretch and subject`s resistance to this stretch which results in pain inhibition by GTOs sensory inputs. [23 ]Significant improvement may be appeared in left undominant side before right dominant one as it is less affected.

This results came in line with Guo, et al [24 ]who presented a systematic review examined the MFR effect on chronic MNP patients and reported that MFR technique significantly improved PPT of

**Clinical messages**

- MFR technique is more effective than PNF technique in enhancing Pain, pain pressure threshold, and Functional Disability in Chronic MNP patient
- MFR technique and PNF technique are equally effective in improving ROM.

trapezius and suboccipital muscle in chronic MNP patients

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