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**Original Research Article**

# Effectiveness of three-dimensional myofascial release on pain, disability and functional performance in physiotherapy students with forward head posture: a pre and post experimental study

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## ABSTRACT

**Background:** Forward head posture (FHP) is one of the most common postural abnormalities among young adults and physiotherapy students due to prolonged smartphone use, poor ergonomics, and sedentary lifestyle. FHP is associated with pain, neck disability, reduced mobility, and impaired functional performance. Three-dimensional myofascial release (3D-MFR) is a multidirectional fascial release technique designed to reduce fascial restrictions and improve postural alignment. The aim was to find out the effectiveness of 3D-MFR on pain, disability and function with FHP in physiotherapy students of Srinivas Institute.
**Methods:** A pre- and post-experimental study was conducted among 27 physiotherapy students aged 18-25 years with forward head posture at Srinivas University, Mangaluru. Participants underwent 3D-MFR intervention targeting suboccipital muscles, upper trapezius, levator scapulae, pectoralis major and minor, and sternocleidomastoid muscles. Outcome measures included numeric pain rating scale (NPRS), neck disability index (NDI), craniovertebral angle (CVA), tragus-to-wall test, and global rating of change (GROC) scale. Statistical analysis was performed using Wilcoxon signed-rank test and paired sample t-test.
**Results:** Significant improvements were observed in all outcome measures following intervention. NPRS ($p=0.006$), NDI ($p<0.001$), CVA ($p<0.001$), tragus-to-wall test ($p<0.001$), and GROC scores ($p<0.001$) demonstrated statistically significant improvement after 3D-MFR intervention.
**Conclusions:** Three-dimensional myofascial release was effective in reducing pain, improving disability, correcting forward head posture, and enhancing functional performance among physiotherapy students with FHP.

**Keywords:** Forward head posture, Functional performance, Neck disability, Pain, Three-dimensional myofascial release

## INTRODUCTION

Myofascial release (MFR) is a manual therapy technique used to stretch fascia and release adhesions between the skin, muscles, and bones.[1] The technique helps reduce pain, improve range of motion, and restore normal body mechanics. Fascia is described as fibrous connective tissue surrounding muscles and other structures of the body.[2] Trigger points and fascial restrictions are commonly associated with musculoskeletal pain and dysfunction.[3]

Direct, indirect, and self-myofascial release are common methods of MFR.[4] Direct MFR applies sustained pressure to restricted fascia using the therapist's hands, elbows, or knuckles to elongate tissue and improve mobility.[4] Indirect MFR uses gentle stretch and minimal pressure, allowing fascia to release naturally through the body's self-correcting mechanisms.[5] It involves minimal pressure and encourages the body's own self-correcting mechanisms to restore proper tissue function.[6]

Self-MFR is a soft object to provide MFR under the individual's pressure.[7] Self-myofascial release is technique were individuals own body weight is used and foam rollers tool to apply pressure to muscles and fascia.[7] It's a popular method which offer soft tissue restrictions and improve overall movement to enhance both fitness and rehabilitation settings.[7]

Three-dimensional(3D) release technique is a fascial release technique that focus on relieving pain and correcting postural deviation.[8] 3D-MFR, applies gentle, sustained pressure in multiple planes which encourages the fascia to soften and elongate naturally which reduces tension across the cervical and thoracic fasciae.[9] Three-dimensional myofascial release (3D-MFR) is an advanced fascial release technique that addresses restrictions in sagittal, frontal, and transverse planes.[8,10] It applies gentle multidirectional pressure and movement to improve fascial mobility, posture, and neuromuscular coordination.[10] 3DMFR approach has a significant impact on functional performance, or individual's ability to carry daily tasks efficiently. One of the primary ways of 3D MFR to enhances functional performance in increasing joint and muscle mobility in all three planes of movement.[10]

Forward head posture (FHP) is one of the most common cervical postural abnormalities among students and young adults.[11] It occurs when the head moves anteriorly relative to the body's vertical axis, increasing stress on cervical structures.[12] Prolonged smartphone use, poor ergonomics, sedentary lifestyle, and long study hours contribute significantly to FHP.[13,14] FHP is associated with shortening of cervical extensor muscles, upper trapezius, levator scapulae, and sternocleidomastoid muscles, leading to pain, disability, and muscular imbalance.[15]

Physiotherapy students are particularly vulnerable because of prolonged academic activities and sustained postural demands. Various physiotherapy interventions including strengthening exercises, postural correction, and myofascial release have been used to manage FHP.[16] However, limited evidence is available regarding the effectiveness of 3D-MFR in improving pain, disability, posture, and functional performance among physiotherapy students with FHP. Forward head posture is common in undergraduate physiotherapy students and has significant effect on level of stress but also effect on neck disability.[18] FHP is a common deviated posture in which a faulty posture adopted while driving, tightness of muscles, use of high pillows, fatigue, restricted ROM, TMJ dysfunction, teeth clenching, pinched nerves, myofascial pain syndrome, headache, migraine, numbness, tingling in arms and hands, muscle spasm, low desk height for study purpose, long sitting hours and continuous use of mobile phones, laptops, and other electronics.[19]

Therefore, the present study was undertaken to determine the effectiveness of three-dimensional myofascial release on pain, disability, and functional performance among physiotherapy students with forward head posture.

Hence, the aim of the study was to find out the effectiveness of 3D-MFR on pain, disability and function with FHP in physiotherapy students of Srinivas Institute.

## METHODS

### *Study design*

It was a pre- and post-experimental study.

### *Study population*

The study included physiotherapy students with forward head posture.

### *Sampling method*

Purposive sampling was employed for sample collection.

### *Sample size*

A total of 27 participants were included in the study.

$\alpha$=0.05

CI=95%

$\beta$=0.2/80% (power)

Effect size = 2

SD = 1

### *Study setting*

The study took place at the Institute of Physiotherapy, Srinivas University, Mangaluru.

### *Study duration*

The study took place from April 2025 to May 2026.

### *Inclusion criteria*

Both genders aged 18-25 years. Participants with forward head posture. Willing to participate in the study. Able to understand, read, and write English.

### *Exclusion criteria*

Recent cervical trauma, recent surgery, recent fracture, cervical radiculopathy.

### *Outcome measures*

*Numeric pain rating scale (NPRS)[8]*

NPRS was tool used to assess pain intensity. It is a straight-forward 11-point scale where individuals rate their pain

from 0 to 10. Here, the person is asked to rate how bad their pain on 0-10 scale, typically either verbally or in writing.

*Neck disability index (NDI)*[11]

The NDI was a questionnaire used to measure neck pain related self-related disability. It is a commonly used tool in both clinical and research setting. The NDI consists of 10 sections, each with six possible answers, scored from 0 to 5, with 5 indicating the highest level of disability and 0 indicating no disability. The total score ranges from 0 to 50, or 0 to 100 when expressed as a percentage.

*Craniovertebral angle (CVA)*[8]

CVA is a measurement used to assess head and neck posture. It's formed by the intersection of two lines: the C7 spinous process is passed through one horizontal line, and the tragus of the ear is connected to the C7 spinous process by another. CVA typically ranges from 48-52 degree. A CVA below 48-50 degree.

*Tragus-to-wall test*[19]

It is a clinical measurement used to evaluate forward head posture. It measures the horizontal distance from Targus to a wall. Here the individual stands with back, buttocks and heels flat against a wall, ensuring posture is as neutral as possible. Keep chin parallel to the floor and gently draw it backward (creating a "double chin") without tilting head up. Measure the horizontal distance using a measuring tape (in centimetres) from the back of your Targus to the wall.

*Global rating of change (GROC) scale*[20]

This outcome measures, which is patient-reported, is used to assess person's overall perception of change in their health status overtime usually before and after an intervention like physiotherapy exercise and medications.

***Procedure***

Ethical clearance was obtained from Srinivas University Ethical Committee. Participants meeting inclusion criteria were recruited after informed consent. Baseline assessment included NPRS, NDI, CVA, Tragus-to-wall test, and GROC scale. Participants underwent three-dimensional myofascial release targeting suboccipital muscles, upper trapezius, levator scapulae, pectoralis major and minor, and sternocleidomastoid muscles. Post-intervention assessment was performed using the same outcome measures (Figure 7).

***Testing procedure***

*Assessment procedure*

Pre-test assessment including NPRS: pain intensity, NDI: disability of neck, CVA: photograph of tragus-C7 landmark, Tragus-to-wall test: distance of tragus from the wall.

*Treatment procedure*

*Three-dimensional myofascial release*

*Suboccipital muscle*

The patient sitting up straight and supports their feet while the therapist stands behind them. This procedure starts with one hand below the occiput region and the other hand over the opposite upper thoracic region to create a gentle diagonal fascial stretch, gentle neck flexion with slight opposite side rotation is then added to produce rotational fascial tension, at the end range a gentle compression is applied over the suboccipital muscles, finally, assisted cervico-thoracic extension with slight rotation is performed to enhance fascial release and improve upper cervical mobility. Each position is held for 60-90 seconds and repeated 1-2 times a day (Figure 1).[20]

**Figure 1: Diagonal fascial stretch for suboccipital muscle.**

**Figure 2: Cervical extension with slight rotation and shoulder depression for upper trapezius.**

*Upper trapezius*

The therapist stands behind the patient as they sit up straight. Using one hand on the upper trapezius and the other on opposite posterior trunk, the technique begins

with a diagonal stretch. The neck region is then gently rotated to provide a rotational stretch. At the end range, a small amount of compression is applied over the upper trapezius to enhance deep fascial release. Finally, assisted cervical extension is performed with a slight rotation and gentle shoulder depression is performed to enhance myofascial release. Each position is maintained for 60 to 90 seconds and repeated 1-2 times a day (Figure 2).[20]

*Levator scapulae*

The patient is seated with a neutral spine and relaxed arms, while the therapist stands behind. In the first position, the therapist gently stabilizes the shoulder blade and applies a diagonal stretch from the upper inner angle of the scapula towards the opposite side of upper back. The patient's neck is then gently bent forward, rotated away from the treated side and slightly side flexed to increase the stretch on the levator scapulae muscle. Once the end range is reached, gentle compression is applied over the tight area near the upper angle of the scapula to release fascial tension. Finally, the therapist gently guides the neck and upper back into slight extension with controlled trunk rotation to improve fascial mobility and relaxation. Each position is held for 60-90 seconds and repeated for 1-2 times per day (Figure 3).[20]

**Figure 3: Neck forward, rotated away from treated side and slight side flexed for levator scapulae.**

*Pectoralis major and minor*

Pectoralis major- the patient is positioned sitting upright on the treatment table with back supported, feet flat, and arms relaxed. The therapist stands in front and slightly to the side being treated. Initially, one hand is placed over the upper back to create a diagonal fascial stretch across the chest muscle. The therapist then slowly moves the patient's shoulder into abduction and external rotation with slight trunk rotation to increase the fascial stretch in a three-dimensional manner. Once the end range is reached, gentle compression or increased stretch is applied to release tightness and fascial restrictions. Finally, thoracic extension with scapular retraction to improve chest mobility, posture, and muscle relaxation. Each position is held for 60-90 seconds and repeated 1-2 times per day (Figure 4).[20]

**Figure 4: Diagonal fascial stretch for pectoralis major.**

Pectoralis minor- the patient is seated upright with a neutral spine and relaxed arms, while the therapist stands behind or slightly to the side. Initially, the therapist applies a gentle diagonal stretch from the front of the shoulder near the coracoid region towards the opposite lower upper-back region to create fascial tension. The patient's trunk is then gently rotated away from the treated side with slight shoulder retraction to increase the stretch on the pectoralis minor muscle. At end range, gentle compression or increased stretch is used to release deeper fascial restrictions. Finally, the therapist guides the upper back into slight extension with mild scapular tilting and rotation to improve fascial release, chest mobility and posture. Each position is held for 60-90 second and repeated for 1-2 times per day (Figure 5).[20]

**Figure 5: Compression for sternocleidomastoid muscle.**

*Sternocleidomastoid (SCM)*

The patient is seated upright with a neutral spine and relaxed arms, while the therapist stands behind. Initially, the therapist applies a gentle diagonal fascial stretch from the area behind the ear towards the opposite upper back to create tension along the front and side of the neck. The

neck is then gently extended, rotated to the opposite side and slightly side flexed away from the treated side to increase the fascial stretch on the SCM muscle. At end range, the therapist enhances release with increased stretch or gentle compression along the SCM, avoiding sensitive neurovascular structures. Finally, cervico-thoracic extension with slight rotation is facilitated to achieve deeper myofascial elongation and to improved mobility. Each position is held for 60-90 seconds and repeated for 1-2 times per day.[20]

*Post test assessment*

Same tools repeated in same order. Global rating of change (GROC) scale additionally recorded.

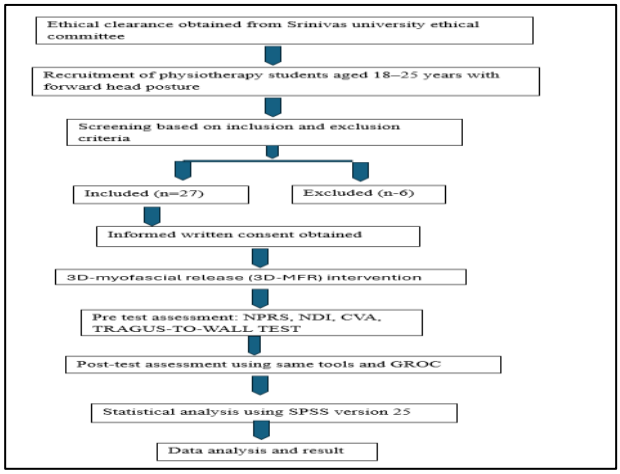


**Figure 7: Flowchart.**

***Statistical analysis***

Initially normality of distribution of the data was done by Shapiro wilk test. If the data was normally distributed then within group analysis was analysed using paired sample t-test. If the data was not normally distributed then non parametric Wilcoxon signed rank test was used. Data was analysed by using IBM SPSS, version 25.

## RESULTS

***Gender***

In gender distribution, females (59.3%) were slightly more than males (40.7%), showing a mild female predominance in the study sample (Table 1).

**Table 1: Gender distribution.**

| Gender | Frequency | Percent |
|---|---|---|
| **Female** | 16 | 59.3 |
| **Male** | 11 | 40.7 |
| **Total** | 27 | 100.0 |

***Descriptive statistics***

The mean age of participants was 22.85 years. Mean BMI was 23.32 kg/m$^2$, indicating that most participants were within normal BMI range (Table 2).

**Table 2: Descriptive statistics.**

| Statistics | | | | |
|---|---|---|---|---|
| | **Height (m)** | **Weight (kg)** | **Bmi (kg/m$^2$)** | **Age (years)** |
| **N Valid** | 27 | 27 | 27 | 27 |
| **Mean** | 1.644 | 63.259 | 23.320 | 22.852 |
| **Median** | 1.620 | 64.000 | 21.500 | 23.000 |
| **Std. deviation** | 0.111 | 14.891 | 4.535 | 0.662 |
| **Range** | 0.395 | 58 | 17.36 | 3 |
| **Minimum** | 1.500 | 42 | 17.94 | 22 |
| **Maximum** | 1.895 | 100 | 35.30 | 25 |

**Table 3: Pre- and post-intervention comparison.**

| Targus to wall test | Paired Differences | | t | |
|---|---|---|---|---|
| | **Mean** | **Std. deviation** | | **P value** |
| **Targus to wall test-Pre -Targus to wall test-Post** | 2.2259 | 1.2684 | 9.119 | <0.001 vhs |
| **Paired samples test** | **Paired differences** | | **Z** | |
| | **Mean** | **Std. deviation** | | **P value** |
| **NPRS PRE- NPRS -POST** | 1.000 | 1.664 | 2.762 | 0.006 hs |
| **NDI PRE- NDI- POST** | 3.296 | 4.093 | 3.306 | <0.001 vhs |
| **CVA PRE- CVA -POST** | -3.370 | 1.418 | 4.564 | <0.001 vhs |

***Pre- and post-intervention comparison***

Significant improvement was observed after intervention in all outcome measures: NPRS: p=0.006, NDI: p<0.001, CVA: p<0.001, Tragus-to-wall test: p<0.001, GROC scale: p<0.001.

Participants demonstrated reduced pain intensity, improved neck function, better postural alignment, and improved functional performance following 3D-MFR intervention (Table 3).

## DISCUSSION

The present study was conducted to determine the effectiveness of three-dimensional myofascial release on pain, disability, posture, and functional performance among physiotherapy students with forward head posture. The findings demonstrated statistically significant improvement in NPRS, NDI, CVA, Tragus-to-wall test, and GROC scores following intervention.

The improvement observed may be due to reduced fascial tightness, improved circulation, enhanced soft tissue mobility, and correction of muscular imbalance.[1,6] Significant improvement in craniovertebral angle indicates correction of forward head posture and improved cervical alignment.[8,14]

The findings are consistent with previous studies by Welling et al and Narulkar et al which demonstrated the effectiveness of 3D-MFR in improving posture, flexibility, and musculoskeletal dysfunctions. Similarly, Anwar et al reported significant improvement in pain and neck disability following myofascial release interventions in university students with FHP.[12]

Forward head posture is increasingly prevalent among students because of prolonged mobile phone usage, poor ergonomics, and sedentary lifestyle.[13,14] Physiotherapy students are at higher risk because of prolonged academic work and sustained postural demands.[19] Therefore, early intervention focusing on fascial restrictions and postural correction is essential. The strength of the study is 3D-MFR is a multidirectional treatment approach that addresses the fascial restrictions and postural imbalance. Most of the participants reported moderate to good improvement on the GROC scale.

The study had certain limitations including small sample size, absence of a control group, and short duration of follow-up. Long-term effectiveness of 3D-MFR was not evaluated. Future studies with larger sample size, randomized controlled design, and long-term follow-up are recommended.

## CONCLUSION

The present study concluded that three-dimensional myofascial release is effective in reducing pain, improving neck disability, correcting forward head posture, and enhancing functional performance among physiotherapy students with forward head posture. Significant improvement was observed in NPRS, NDI, CVA, Tragus-to-wall test, and GROC scores following intervention. Therefore, 3D-MFR can be considered an effective physiotherapy intervention for management of forward head posture.

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