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Effect of Proprioceptive Neuromuscular Facilitation and Myofascial Release for trigger points in Upper cross Syndrome- An Experimental study

Shivangi Dutta Jha[1], Shuaib Akhtar[2], Vajrala Krishna Reddy[3*], Chhavi Kumar Sharma[4], Jyoti Sharma[5], Mohammad Sidiq[6]

[1,2,3*,3,4,5,6]Department of Physiotherapy, School of Allied Health Sciences, Galgotias University, Greater Noida, Uttar Pradesh, India

***Corresponding Author:** Vajrala Krishna Reddy
Department of Physiotherapy, School of Allied Health Sciences, Galgotias University, Greater Noida, Uttar Pradesh, India

Abstract: In today's lifestyle, faulty postures lead to musculoskeletal changes causing symptoms like neck and upper back pain. Postures such as bent posture result in deformities like rounded shoulders, forward head posture, and restricted thoracic spine mobility. Upper Cross Syndrome (UCS) is characterized by an unbalanced posture, overactive pectoralis and trapezius muscles, and postural abnormalities with muscle tightness and weakness. These issues can be corrected through strengthening and stretching exercises. This study aimed to compare the effects of myofascial release (MFR) and proprioceptive neuromuscular facilitation (PNF) on individuals with UCS. A total of 112 subjects meeting inclusion criteria were divided into two groups. Group A received PNF and conventional physiotherapy exercises with a hot pack, while Group B received MFR and conventional physiotherapy exercises. Subjects aged 18 and above of all genders participated. Visual Analog Scale (VAS) and Neck Disability Index (NDI) were used as outcome measures for pretest and posttest evaluations. Assessments were conducted before treatment and after six weeks. Results showed a significant difference between pretest and posttest scores in both groups. A comparison of NDI and VAS post-scores between groups indicated that PNF demonstrated superior outcomes to MFR. In conclusion, the experimental group receiving PNF outperformed the control group, confirming PNF's greater effectiveness in managing UCS compared to MFR.

Key words: Upper cross syndrome, myofascial trigger point, myofascial release, proprioceptive neuromuscular facilitation

INTRODUCTION: In today's world, the lifestyle has caused people to have faulty postures that causes musculoskeletal changes in the body which leads to problems like neck pain and upper back pain. Faulty postures like bent posture causes deformities like rounded shoulders, forward head posture and restricted thoracic spine mobility(1).

The leading cause of disability among people between the ages of 20 and 50, and the predominant factor associated with their occupations, is musculoskeletal illnesses, according to WHO literature. The most typical complaints worldwide are headaches and chronic neck discomfort(2).

Due to the rapid increase in the amount of time spent doing the following tasks, such as studying, writing, or using a computer, people are more likely to sit incorrectly for extended periods of time, putting their neck, bottom of the head, and shoulders at risk(3).

Postural dysfunction or postural asymmetry with the overactive upper trapezius and pectoralis muscles is how the condition; the upper cross syndrome is described. Muscle imbalance between tonic and phasic muscles is possible. Tonic muscles tend to be tight, and phasic muscles tend to be weak due to excessive facilitation and decreased activation, respectively. Direct results of flexor-dominant postures include UCS. Clinical signs of upper crossing syndrome include forward head posture, rounded upper back, prolonged and elevated shoulders, scapular winging, and impaired cervical and thoracic spine flexibility in those who present with the condition(4).

The following factors result in an upper cross syndrome: Weak deep-neck flexors, tight sub-occipital muscles, the sternocleidomastoid, weak serratus anterior, and tight pectoralis major and minor; tight upper trapezius; weak lower and middle trapezius; tight upper trapezius and levator scapulae(2). The word "cross" was given to this illness because it can draw an "X" (a cross) over the upper body. UCS is largely characterized by muscle imbalance, which eventually affects tonic and phasic muscles. The following characteristics, which include winged scapulae, lifted and elongated shoulders, rounded upper backs, and restricted thoracic spine motion, may be present in people with upper cross syndrome(3).

The upper fibers of the trapezius muscle are crucial for maintaining proper head posture, but they can be damaged by overuse, restricted activity, or a restricted range of motion, which can result in spasms or stiffness(5)

Upper cross syndrome was the term used by Vladimir Janda to characterize the presence of forward head position and rounded shoulders simultaneously(6,7).

He claimed that upper crossed syndrome, a condition that affects people with forward head posture (FHP), happens when a slouched sitting position is maintained for an extended period. This poor posture also shortens the deep neck flexors and

scapular retractors. It weakens the lower trapezius fibers and rhomboids, as well as the upper trapezius, levator scapulae, pectoralis major, and pectoralis minor.(7).

A forward head posture (FHP) is when the head is positioned structurally away from the body's centerline, with the cervical spine's upper segment extended and the lower cervical vertebrae bent, increasing the head's weight that the neck is bearing. The head's bending moment puts pressure on the neck's joints, muscles, and suboccipital muscle's active myofascial trigger points, which may cause tension-type headaches, neck pain, and cervical headaches while limiting the neck's range of motion. The upper cervical joint and atlanto-occipital joint experience considerable extension because of the postural deformity of FHP, and the upper cervical vertebrae comparatively protrude forward as the face turns upward. Due to an imbalanced muscle pattern, a change in the curvature of the neck bone creates upper-crossed syndrome, which ultimately results in rounded shoulder posture (RSP). Rounded shoulders are caused by the acromion of the shoulder joint protruding outward from the body's center of gravity. This results in a hunched-over posture, as well as scapular elevation, protraction, and downward rotation, as well as a widened angle between the lower neck bone and upper spine (6).

Observation is the first step in UCS evaluation. The correct standing position, as seen from the side, with the greater trochanter, ear, shoulder, and somewhat anterior to the lateral malleoli in a plumb line. Patients with UCS will have a forward head and neck posture, upper cervical lordosis, extended and raised shoulders, thoracic hyper kyphosis, and scapular winging during postural examination(4)

Upper cross syndrome results in weakness in the cervical flexors, rhomboid, and lower trapezius as well as tension in the sub occipital, pectorals, upper trapezius, rhomboid, and lower trapezius. The muscular bellies develop trigger points (hypersensitive spots/knots) because of the overuse and strain of these muscles(8)

In a muscle, trigger points are highly irritated areas. As a result of trauma or myofascial overuse, trigger points are adhesions that form in the muscle. These adhesions prevent muscles from working as efficiently as they should. Muscle stiffness, soreness, and reduced range of motion are symptoms of trigger points. Almost everyone experiences trigger point without any additional problems or complaints. Trigger points also result in a rupture or obstruction in the blood flow to that region of muscle(8)

The pathology behind the development of trigger points is caused by disturbed posture or poor neck ergonomics, which may shorten the muscle fibers. The disturbed muscle now receives less oxygen and blood supply, which results in less removal of metabolic waste and it will provide low levels of nutrients to two muscle fibers(5)

latent and active trigger points are the two types of myofascial trigger points. Active myofascial trigger points are far less common than latent MTrPs. Stiffness and limited ROM may be brought on by latent MTrP. A focus of hyperirritability may exist in a muscle or fascia area that is clinically painless about spontaneous pain and that hurts only when touched.

however, Active MTrPs exhibit a region of heightened sensitivity, signaling the presence of pain in a muscle or its surrounding fascia. These active MTrPs manifest a distinct pain pattern specific to the affected muscle, which can be experienced both at rest and during movement. Later, latent MTrPs might become active. It is believed that both active and latent MTrPs might alter muscle function and expose joints to inadequate loading by causing muscle imbalances, weakness, and poor motor recruitment(9).

MTrPs present a range of symptoms, including intense sensitivity, the "jump sign" characterized by palpable snapping, pain experienced in areas beyond the expected dermatome or nerve distribution under sustained pressure, elevated skin temperature, and reduced skin impedance. Travel and Simon have extensively documented the referral patterns of MTrPs in various muscles through numerous publications(10).

The physical examination of myofascial trigger points involves a technique known as "palpation of the entire area where trigger points have developed." Using the thumbs and fingers, this technique palpates the entire taut band of muscle fiber before applying pressure to the area to help locate the trigger points quickly and effectively. The physical therapist can learn more about the bone's structure using this kind of palpation. The texture, turgidity, and temperature of the skin around the affected area can also be inferred from the tone of the affected muscle(11).

Myofascial release is a manual method that relieves pain and improves range of motion by stretching, compressing, and applying prolonged pressure to constrictive fascia in the body. The purpose of myofascial therapy is to stretch and release the fascia, restore it to its ideal length, reduce discomfort, and enhance motion-related function. Myofascial release for trigger points is another name for it. The muscle needs to be stretched out to its full length after the myofascial trigger points have been released. It aids in eliminating trigger points(4,8).

Due to the parasympathetic nervous system being stimulated by the gradual movement of constricted muscles, it reduces pain and improves blood flow and lymphatic drainage while relaxing the muscles(12).

The fascia, a form of connective tissue is composed of three layers: The superficial layer, a layer of potential space, and a deep layer make up the fascia. Fascia can move and alter with the surrounding tissues because its fibers travel in numerous directions. To create tensegrity in the body, one continuous segment of tissue is believed to be fascia that functions in interconnected "chains". As a result, stretching fascia in one area of the body might result in tightness, constriction, and pain in a different location of the body. The opposing side gets even more taut when one side is pulled tight, just like when you pull plastic wrap across a bowl. Traditional referred-pain patterns are not followed by the pain that is experienced. It might be difficult to diagnose myofascial pain because of the dynamic nature of the fascia, but once it is, manual therapy like MFR is used frequently to treat it(13)

Myofascial release is a treatment method that seeks to increase soft tissue flexibility and sliding between layers, lessen the intensity of discomfort caused by muscular activation, and enhance functional performance. After several releases, the tissue will soften and become more malleable. Myofascial tissue length and health restoration improve joint alignment and mobility while reducing pressure on pain-sensitive structures including nerves and blood vessels. To return the myofascial complex to its original length and relieve pain, this method calls for the use of an external force to weaken muscular fibrous tissue adhesion and a long-duration low-load stretch. Stretching and soft tissue release are used in this type of manual therapy to lengthen muscles, make soft tissues more flexible, and improve joint range of motion (ROM).
There have been numerous reports of the physiological advantages of myofascial release, including capillary dilatation, metabolic, and cutaneous temperature changes. Individuals experience these changes as reduced pain, muscle spasms, muscle tone, edoema, enhanced extensibility of soft tissues, increased range of motion, and improved joint biomechanics(14)
Myofascial Release is, not an evidence-based practice. MFR cannot be a neutral treatment because it depends on the contact between the physician and the patient; as a result, the subjectivity of the interaction cannot be eliminated when trying to predict its outcome. According to the previous literature, a significant portion of MFR's effectiveness depends on the clinician's skill and capacity to detect changes in the tissue. Additionally, depending on the condition of the patient or the therapist, the biological impacts of touch can alter the efficacy of the treatment. Due to this heterogeneity, interrater reliability is weak, which prevents MFR from being regarded as evidence-based(13)
Myofascial release (MFR) is thought to offer rapid relief from pain and tissue soreness when used alongside conventional treatments. Advocates of myofascial techniques assert that by restoring the length and health of restricted connective tissue, pressure on pain-sensitive structures such as nerves and blood vessels can be alleviated.
It's crucial to specify the therapy being performed since the term “myofascial release” encompasses a wide range of diverse treatment(13)
MFR involves the application of prolonged and gradual pressure (lasting from 120 to 300 seconds) either directly or indirectly to restricted fascial layers. In the direct MFR technique, practitioners apply pressure directly over the constricted fascia, using their knuckles, elbows, or specialized tools to sink into the tissue with a few kilograms of force, aiming to touch, tighten, or stretch the fascia. On the other hand, in the indirect MFR technique, a gentle stretch is applied along the line of least resistance until unrestricted movement is achieved (15)
In this type the clinician uses a graded stretch to the recipient’s soft tissue, guided solely by feedback from the recipient’s body. The feedback helps determine the appropriate stretch direction, force, and duration to target soft tissue restrictions effectively. It’s crucial to highlight that myofascial release relies on active participation from both parties. In addition to the form described earlier, active treatments require patient’s engagement in muscle contractions to induce relaxation, as well as trigger-point therapy(13)
PNF evaluates or treats neuromuscular issues using concepts of the sensory/motor system from neurophysiology. PNF is a successful treatment option for structural and neuromuscular problems(16)
PNF was defined as "methods of increasing or hastening the response of the neuromuscular system through stimulation of the proprioceptors" by Voss, Jonta, and Meyers in 1985. The core idea of the PNF philosophy is that a motor learning impact is a long-lasting response of the neuromuscular process(17)
The general exercises consist of one-plane, typical physiological joint movements such as abduction, rotation and flexion. PNF seeks to increase mobility, control of movement and joint synchronization. This can be achieved by rotating diagonal movement patterns while adhering to the therapist's directions in response to a range of stimuli. Circular movement patterns are one of the main components of PNF techniques, which are all performed by basic rules.

Numerous methods, such as rhythmic initiation, repeated contractions, rhythmic stabilization, and combinations of isotonic, dynamic reversals, hold-relax, and contract-relax, can be used to develop muscle strength and flexibility. The basis for hold-relax and contract-relax techniques is the neurophysiology of reciprocal innervation, post-isometric relaxation (autogenic inhibition), and stress-relaxation(18)
The hold-relax method is one of the PNF strategies which is frequently used in clinics to ease pain and increase joint range of motion. By strengthening the postural muscles of the trunk, shoulder girdle, and hip joint with the stabilizing reversal technique, the muscles are stabilized, which improves the stability of the relevant joints(19)
PNF techniques, particularly those incorporating the simultaneous activation of both the desired action’s agonist and antagonist muscles, hold significant promise for improving muscle function. Joint mobilization using PNF is a treatment modality that can effectively reduce pain, enhance muscle strength, and increase the range of motion.
Proper functioning of the upper extremities relies on the scapula being both mobile and stable. PNF describes specific scapula patterns that are activated through a combination of upper extremity movements and scapular motions(17).
Through increased flexibility and an increase in blood flow, PNF stretching entails moving within a range without inflicting pain, and it has grown in importance in decreasing and preventing exercise injuries. PNF stretching also enhances the precision of training and muscle action while enhancing body coordination(21)
The most often used modalities in clinical practice to treat trigger points are ultrasonography and heated packs. By generating a vasodilator called histamine, a hot pack dilates the superficial tissues and improves blood flow in the area in which it is placed. These techniques are employed to treat trigger points more effectively(11).

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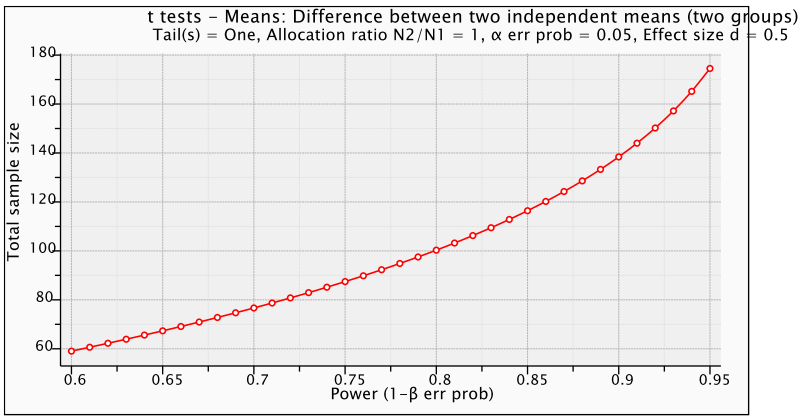
MATERIALS AND METHODS
Type of Study: A prospective comparative study
Area of Project: NOIDA
Study Setting: Galgotias university

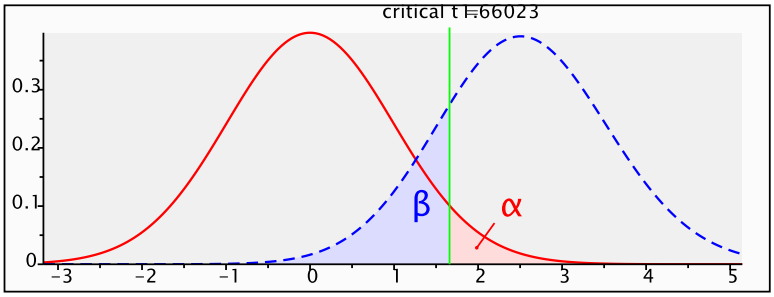
Sampling Method:
- No of Sample:112 (10% dropouts)

t tests - Means: Difference between two independent means (two groups)

Analysis:	A priori: Compute the required sample size	
Input:	Tail(s)	= One
Effect size d	=	0.5
α err prob	=	0.05
Power (1-β err prob)		= 0.8
Allocation ratio N2/N1		= 1
Output:	Non-centrality parameter δ	= 2.5248762
Critical t	=	1.6602343
Df =	100	
Sample size group 1		= 51
Sample size group 2		= 51
Total sample size		= 102
Actual power =		0.8058986

Sample size calculation:
Sample size was calculated using G Power version 3.1.9.4 in windows by assuming taking an effect size of 0.5(Cohen's D medium size effect was assumed) with the margin of error probability kept at 0.05 and (1-α) 80% βpower, confidence interval at 95%, the total sample size was 112 assuming 10% drop outs.





Inclusion Criteria:

- Male and female
- Age limit: 18 and above.

For upper cross syndrome

- Hyper-kyphosis
- Forward head posture
- Rounded shoulder
- Capacity to fulfill study questionnaires and give informed consent.

Exclusion Criteria:

- Neurological signs
- Hyper-sensitive skin
- Any previous history of surgery
- Any psychiatric disorder
- Patients who are receiving any other treatment
- Malignancy
- Acute rheumatoid arthritis
- Advanced Diabetes
- Severe osteoporosis
- Acute inflammation or infection
- Disc bulge
- Lumbar instability
- Idiopathic scoliosis
- Intervertebral disc problems
- Migraine

OUTCOME MEASURES

1. Neck disability index (NDI)

- It's a questionnaire using ten measures to assess functional status and discomfort of the neck. It is a self-assessing tool and is condition-specific. Every item is given a score between 0 and 5, which is then totaled up and expressed as a percentage. Patients who scored between 0-4 were considered to have no disability, patients with 5-14 points were considered to have a mild disability, patients who scored 15-24 points were put under moderate disability, and patients who scored 25-34 points were under severe disability, complete disability was considered when patients scored 35-50 points.
- Validity and reliability: In patients with neck discomfort, the NDI is a valid and trustworthy questionnaire with an interclass correlation range of 0.50 to 0.98(12). With an ICC of 0.96, test-retest reliability was quite high(22).

1. Visual analog scale (VAS)

- • The psychometric response scale, which measures pain intensity in millimeters or centimeters, uses numerical values to indicate pain severity (0 being "no pain" and 10 being "worst pain").

Validity and reliability: The VAS is a valid and dependable measure of pain severity, with an interclass correlation of 0.95 to 0.98(12)The intraclass correlation coefficient (ICC) for the test-retest reliability was 0.97, which is quite high.(22).

METHODOLOGY

Assessment

Evaluation of both pre-participation and post-participation was done through the outcome measures, Neck disability index (NDI), and visual analog scale (VAS). An assessment sheet was also included as a preparticipation step which included name, sex, age, and contact details. Pre-readings were taken, and NDI and VAS was filled by the subjects. Subjects were assessed before the procedure and immediately after the procedure, so that the effect of the treatment can be seen.

Procedure

In this research study, 112 Subjects were requested to fill out the consent form along with the Neck disability index and VAS forms. Then the forms were evaluated, and 102 subjects were selected given the inclusion and exclusion criteria. Subjects were divided by random sampling into two separate groups; Group A and Group B (ratio 1:1). The experimental group, designated as Group A, received treatment using PNF, traditional physiotherapy exercises, and a hot pack. The other group: group B which served as the control group was treated with myofascial release and conventional physiotherapy exercises.

Clinical intervention
Group A: experimental group
(PNF + Conventional physiotherapy + hot pack)
In this group, PNF was the intervention given along with the hot pack and conventional physiotherapy. There are many techniques that come under PNF, for this study, the hold-relax technique is used. Under which there are two principles of PNF applied: autogenic inhibition and reciprocal inhibition.
A hot pack was applied prior to the session for 10-15mins, to loosen up the muscle.

Group B: control group
(MFR + Conventional physiotherapy)
In this group, MFR was the intervention given along with conventional physiotherapy. Among the two techniques that come under the MFR technique, for this study, the direct MFR technique is applied.

Conventional physiotherapy (for both groups)
Under conventional physiotherapy, subjects were told to do self-corrective exercises. Such as levator scapulae stretch, upper trapezius stretch, pectoralis doorway stretches, scapular retractions, Brugger posture, chin tucks and serratus anterior, lower trapezius, and middle trapezius strengthening movements.

Study protocol
Both two interventions were given 3 times a week with a day break in between two sessions. Both groups received each intervention for 45 minutes. Treatment was provided for 6 weeks. Outcome measures were taken before the treatment for pre-test scores and 6 weeks immediately after the treatment for post-test scores. Subjects were aware of the objective of the study without revealing the intervention details.

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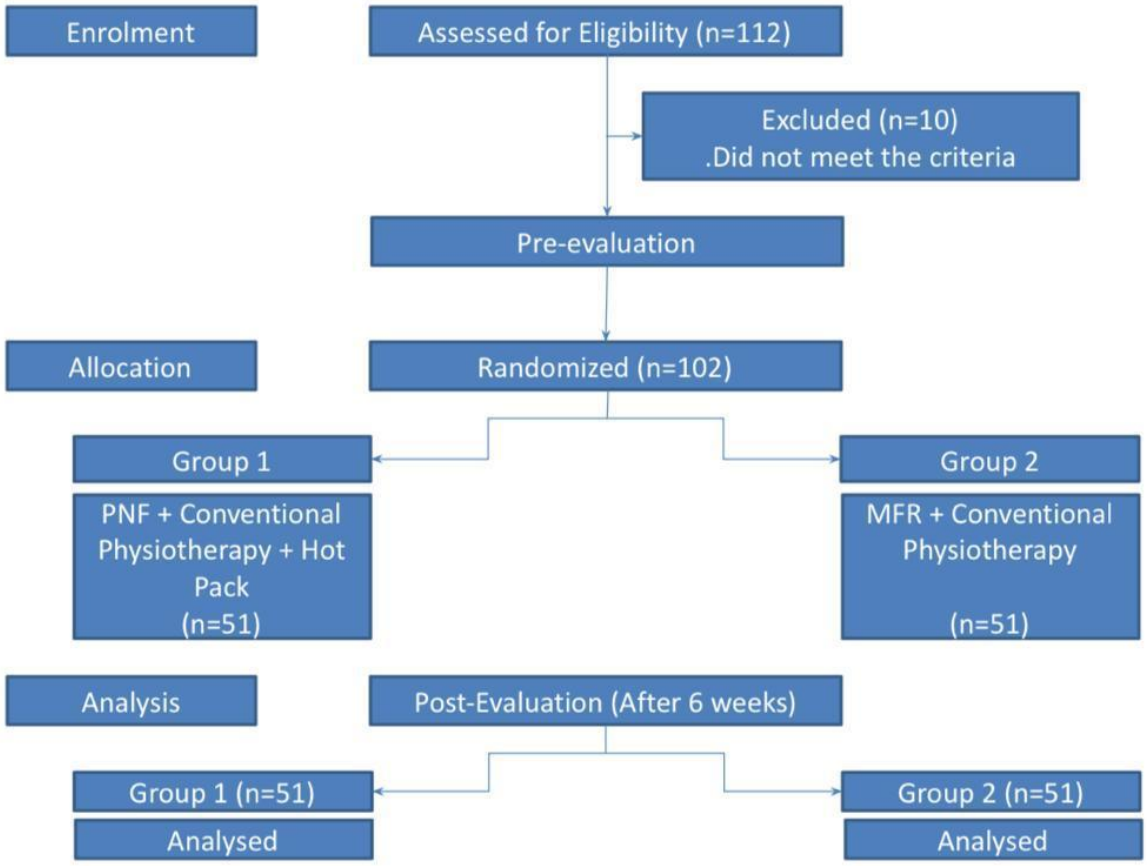

DATA ANALYSIS

1. **Descriptive Statistics:** Statistics for descriptive data are used to determine the main characteristics of the study subjects such as age, gender, and the baseline measurements of NDI and VAS.
2. **Inferential Statistics:** these statistics are used to get the conclusion about the population which is based on the data collected from the sample of the study.

it also includes the testing of hypotheses to evaluate the significant differences between the groups; based on NDI and VAS.

3. **Independent Samples t-test:** This t-test is used to compare the mean value of the individual independent groups for different variables (like pre-intervention and post-intervention)
4. **Paired Sample t-test:** The paired sample t-test compares the mean values of two related groups (such as pre and post-intervention scores within the same group). This determines the effectiveness of PNF and MFR interventions.
5. **Analysis of covariance (ANCOVA):** ANCOVA compares the effectiveness of PNF and MFR interventions, while also controlling the variables that could affect the outcomes. These variables could be age and gender. These are potential confounding variables.
6. **Effect size calculation:** to calculate the practical significance of the outcomes and to also to quantify the magnitude of the differences between the groups effect size calculation is done.

RESULTS

LIST OF TABLES:

TABEL NO 1 – variables with their descriptive statistics

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
AGE	102	19	52	27.07	8.399
Valid N (listwise)	102				

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Table no. 1 presents descriptive statistics for the variable "AGE", which is based on the sample size of 102 individuals. The data shows a diverse range of ages, spanning from a minimum of 19 years to maximum of 52 years. The mean age in this data is approximately 27.07 years. The standard deviation of approximately 8.399 suggests a moderate level of variability around the mean age.

Group Statistics

	GROUP	N	Mean	Std. Deviation	Std. Error Mean
VAS_PRE	PNF	51	4.10	.300	.042
	MFR	51	4.08	.272	.038
VAS_POST	PNF	51	.84	.367	.051
	MFR	51	1.00	.000	.000
NDI_PRE1	PNF	51	4.63	.488	.068
	MFR	51	4.53	.504	.071
NDI_POST1	PNF	51	1.94	.238	.033
	MFR	51	2.00	.000	.000

Table no. 2 represents the group statistics for various measures, categorized by two groups : PNF and MFR. Each group consists 51 participants.
For the variable VAS_PRE, participants in PNF group reported a mean pain score of 4.10 with a standard deviation of 0.300, while those in MFR group reported a slightly lower mean score of 4.08 with a standard deviation of 0.272.
After the treatment protocol was completed, there was a noticeable difference for the variable VAS_POST, pain reduction was noticed in both groups. The mean pain score for the PNF group decreased to 0.84 with a standard deviation of 0.367, while the MFR group reported a mean score of 1.00 with standard deviation of 0.000.
The table also includes statistical data for neck disability index both before and after the treatment. Before the treatment NDI_PRE, participants of the group PNF had a mean NDI score of 4.63 with a standard deviation of 0.488, while those in the MFR group had slightly lower mean score of 4.53 with a standard deviation of 0.504. After treatment, improvement was seen in both the group's NDI scores. PNF group reported a mean score of 1.94 with a standard deviation of 0.238 and the MFR group reported a mean score of 2.00 with a standard deviation of 0.000.
This provides valuable insight into the effectiveness of different treatment techniques (PNF and MFR) in reducing pain and improving neck disability scores among the participants.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
VAS_PRE	Equal variances assumed	.480	.490	.346	100	.730	.020	.057	-.093	.132
	Equal variances not assumed			.346	99.000	.730	.020	.057	-.093	.132
VAS_POST	Equal variances assumed	56.163	.000	-3.050	100	.003	-.157	.051	-.259	-.055
	Equal variances not assumed			-3.050	50.000	.004	-.157	.051	-.260	-.054
NDI_PRE1	Equal variances assumed	2.947	.089	.998	100	.321	.098	.098	-.097	.293
	Equal variances not assumed			.998	99.899	.321	.098	.098	-.097	.293

NDI_POST1	Equal variances assumed	14.222	.000	-1.768	100	.080	-.059	.033	-.125	.007
	Equal variances not assumed			-1.768	50.000	.083	-.059	.033	-.126	.008

Table no. 3 presents the results of independent samples tests conducted to compare the effectiveness of two treatment techniques, on various outcome measures.
The Levene's test checks for equality of variances between the groups. Since the sig. value is greater than the significance level of 0.05 (i.e. 0.49>0.05), we can assume equal variances between the two treatment groups. For VAS PRE and NDI PRE, the assumption of equal variances was met ($p>0.05$), this indicates that the variances of pain scores and neck disability scores did not differ between PNF and MFR groups. However, VAS POST and NDI POST, the assumption of equal variances was violated ($p<0.05$), which shows that the pain scores and neck disability scores after treatment differed between the two groups.
Subsequently, a t-test for equality of means were conducted to compare the mean scores of each outcome measure between the PNF and MFR groups, assuming equal variances and not assuming equal variances. For VAS PRE and NDI PRE, there were no significant differences seen in the mean scores between the two groups regardless of the assumption of equal variances($p>0.05$). however, for VAS POST and NDI POST, there were significant differences in the mean scores between PNF and MFR groups ($p<0.05$), this indicates that the two treatment modalities had different effects on pain and neck disability scores after treatment.
Overall, the result indicates that both interventions were effective in reducing the neck disability and pain intensity. There was a noticeable improvement in post-intervention results compared to the pre-intervention results. NDI and VAS scores were significantly improved between the pre and post-interventions, however, there was a discernible difference between the post-intervention of the groups: PNF and MFR. PNF showed better results in comparison to MFR.

DISCUSSION

The purpose of the study was to compare the efficacy of two distinct interventions; proprioceptive neuromuscular facilitation and myofascial release therapy in subjects with upper cross syndrome. 102 individuals took part in the research and were assessed on the basis of two outcome measures; Neck disability index (NDI) and Visual analogue scale (VAS) both pre-treatment and post-treatment.
The pre-intervention data, the mean scores for the NDI showed similar results for both the groups which indicates that the data is on a comparable level of neck disability at the start of this research. Additionally, the mean scores for VAS also showed similar results for both the groups making the data comparable. It suggested similarities in pain intensity between the groups before the intervention. These similarities in the baseline data between the groups enhance the reliability of the results and reduce the potential for confounding factors.
After the intervention, both groups demonstrated significantly improved results. The subjects of both groups experienced a substantial reduction in neck disability and pain intensity. This data's findings indicate that both the PNF and MFR techniques can be effective in addressing upper cross syndrome and, its associated symptoms.
When the groups were compared before any intervention was applied, the NDI scores were the same for both groups. No significant difference was seen in the pre-intervention NDI scores which indicates initial severity of neck disability between the PNF and MFR groups. Similarly, the pre-intervention results for the VAS score were compared and no discernible differences were found in pre-intervention. This makes the study reliable as the data is comparable at the same level and will reduce the potential confounding variables that can alter the outcomes.
However, after the interventions, there was a discernible difference between the groups. Both the groups showed improved results for both the outcome measures used. Post-intervention of the groups for NDI showed significant improvements compared to pre-intervention. The PNF group experienced statistically better values compared to the MFR group. The post-intervention for VAS scores showed a notable distinction between the pre-intervention and post-intervention for both the groups and between the groups. the PNF group experienced better outcomes compared to the MFR group. This suggests the impact of the PNF intervention was greater than the MFR in reducing pain intensity and neck disability in individuals with upper cross syndrome.
Raghav Bansal et.al.,2020, determined the effect of MCTE in comparison to PNF on variables like pain and neck function. Both interventions were effective in improving pain and function. There were no significant differences in improving the range of motion in post-treatment assessment that was done after 4 weeks. However, PNF group showed significant improvement at the follow-up assessment after 15 days(23)
Study findings of Arbnore Ibrahimaj Gashi. et.al.,2023, suggest that PNF combined with passive mobilization was an effective physiotherapeutic protocol for cervical radiculopathy. PNF contract-relax technique was applied to 15 subjects and outcome measures like vas and NDI were used to compare the pre and post-treatment effects(24)

Woo Kang.et.al,2018, determined the effect of PNF on neck disability among acute whiplash injury patients. PNF exercises were beneficial given the improvements in neck disability index and vas(25).
According to Sonia Pawaria .et.al.2015, MFR and muscle stretching are two techniques used in the treatment of active myofascial trigger points of the trapezius muscle. The purpose of the study was to compare the effects of MFR and stretching. SPSS software version 12 was used. Vas and NDI were the measures used for the study. There were no significant differences found in ROM between the group analysis. However, MFR was found to be a better treatment technique, which showed better results in pain reduction, functional status, and improved ROM for active myofascial trigger points(26)
According to Ana Yousuf. et.al.2024, those with cervicogenic headache can be efficiently treated with both the interventions that is PNF and MFR, Both interventions significantly reduced pain intensity and improved cervical ROM and functional disability. The study's findings suggested that MFR exhibited superior efficacy in enhancing cervical rotations and reducing NDI scores(27)
According to Manolya Acar. et.al.2021, patients with subacromial impingement syndrome showed better results with the combined application of PNF and MFR. PNF showed improvement in pain whereas, MFR was more effective in increasing functionality(28)
Although the study provides valuable insights into the effectiveness of the interventions; PNF and MFR, several limitations should be acknowledged. Limitations of this study are as follows:

LIMITATIONS OF THE STUDY

1. **Small sample size:** This study's sample size is 112 subjects, which is divided into two groups. This might be considered a relatively small sample size. more statistical power and improved generalization of the results could have been provided with a larger sample size.
2. **Sampling bias:** Since the subjects were recruited from a specific geographical area, the sample might not fully represent the diversity of the participants with the upper cross syndrome. This can reduce the findings' external validity.
3. **Limited control over confounding variables:** the subjects might have received additional interventions outside of the study protocol. These uncontrollable confounding variables could influence the outcomes. It can also make it difficult to attribute outcomes only to the interventions being studied.
4. **Short follow up period:** the study is conducted for short duration of 6 weeks and there is no follow up, which is relatively short to assess long term effects of PNF and MFR on upper cross syndrome. A longer duration could have provided insights into the sustainability of the intervention effects.
5. **Generalization to other conditions:** this study focuses on the subjects with upper cross syndrome and the effects of PNF and MFR techniques. Therefore, caution should be exercised when generalizing the results to other populations or musculoskeletal conditions.
6. **Absence of placebo control:** In this study, MFR group served as a control group but the study could have been strengthened by including a placebo control group. It could help in differentiating the true effects of the interventions from the placebo effects.
7. **Publication bias:** if no previously published research shows similar research questions and negative findings, then there is a possibility of publication bias which could affect the overall interpretation of the existing evidence. despite these limitations, the study contributes valuable insights into the impact of the PNF and MFR techniques in treating individuals with upper cross syndrome. Further research with a large sample size, and longer follow-up periods would be beneficial to address the basis of some of these limitations and strengthen the evidence base.

CONCLUSION

In conclusion, this comparative study contributes substantial evidence to the information already available on the management of upper cross syndrome. The PNF and MFR approach's ability to lessen neck discomfort and dysfunction highlights their value as effective treatment alternatives for individuals with upper cross syndrome. Both therapies can be regarded as important parts of physiotherapy treatment for upper cross syndrome despite the potential benefit of PNF in lowering pain intensity and neck disability.
Overall, the research indicates that PNF and MFR were equally helpful in lowering neck impairment (as determined by NDI scores) and discomfort/pain (as measured by VAS scores). However, the results of the VAS post and NDI POST scores suggest that the proprioceptive neuromuscular facilitation intervention may have been more successful in lowering the pain intensity and neck disability scores than the myofascial release therapy.
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REFERENCES

1. 1.Kumta S, Rayjade A, Lakkad S. Effect of a Corrective Exercise Program Using Proprioceptive Neuromuscular Facilitation on Forward Head and Rounded Shoulders with Ergonomic Intervention in Adolescent Age Group. International Journal of Physiotherapy and Research [Internet]. 2022 Dec 11;10(6):4402–8. Available from: https://www.ijmhr.org/IntJPhysiotherRes/IJPR.2022.166
2. Sasun AR, Jawade S, Chitale N. Measuring the Efficacy of Myofascial Rollers and Post-isometric Relaxation Technique in Relieving Pain Intensity and Postural Deviation Using Plumb Line Assessment for the Treatment of Upper Cross Syndrome in Dental Undergraduate (UG) Students. Cureus. 2022 Oct 3;
3. Risaldar PB, Phansopkar P, Chitale N, Wadhokar OC, Arora SP. Comprehensive rehabilitation of a patient with upper crossed syndrome. Journal of Medical Pharmaceutical and Allied Sciences. 2021 Jul 1;10(4):3179–81.
4. Mol N, Ashok A, K. U. DK. Upper Crossed Syndrome: Trends and Recent Advances in the Physiotherapy Treatment a Narrative Review. J Pharm Res Int. 2021 Dec 30;359–67.
5. Gupta M. https://www.alliedacademies.org/journal-physical-therapy-sports-medicine [Internet]. Vol. 5, J Phys Ther Sports Med. 2021. Available from: https://www.alliedacademies.org/journal-physical-therapy-sports-medicine/
6. Kim EK, Kim JS. Correlation between rounded shoulder posture, neck disability indices, and degree of forward head posture.
7. Bae WS, Lee HO, Shin JW, Lee KC. The effect of middle and lower trapezius strength exercises and levator scapulae and upper trapezius stretching exercises in upper crossed syndrome.
8. Ahmad S, Komal S, Shafique S. Comparison of effectiveness of myofascial trigger point release with manual therapy and myofascial release in combination with self stretching in upper cross syndrome. Journal of Riphah College of Rehabilitation Sciences. 2019;(0):1.
9. Ribeiro DC, Belgrave A, Naden A, Fang H, Matthews P, Parshottam S. The prevalence of myofascial trigger points in neck and shoulder-related disorders: A systematic review of the literature. Vol. 19, BMC Musculoskeletal Disorders. BioMed Central Ltd.; 2018.
10. T Gulick D. Evidence-based interventions for myofascial trigger points. Phys Med Rehabil Res. 2016;1(3).
11. Khalid A, Ahmad J, Michelle A, Nazir S, Khalid N, Jabbar F. Comparative effects of Myofascial Technique Alone and In Combination with Isometrics on Myofascial pain Syndrome Due to Excessive Smartfone Usage. Pakistan BioMedical Journal. 2022 Jul 31;212–7.
12. Khan ZK, Ahmed SI, Baig AAM, Farooqui WA. Effect of post-isometric relaxation versus myofascial release therapy on pain, functional disability, rom and qol in the management of non-specific neck pain: a randomized controlled trial. BMC Musculoskelet Disord. 2022 Dec 1;23(1).
13. McKenney K, Elder AS, Elder C, Hutchins A. Myofascial release as a treatment for orthopaedic conditions: A systematic review. Vol. 48, Journal of Athletic Training. 2013. p. 522–7.
14. Parikh RJ, Sutaria JM, Ahsan M, Nuhmani S, Alghadir AH, Khan M. Effects of myofascial release with tennis ball on spasticity and motor functions of upper limb in patients with chronic stroke: A randomized controlled trial. Medicine (United States). 2022 Aug 5;101(31):E29926.
15. Ajimsha MS, Al-Mudahka NR, Al-Madzhar JA. Effectiveness of myofascial release: Systematic review of randomized controlled trials. J Bodyw Mov Ther. 2015 Jan 1;19(1):102–12.
16. Hendra M, Nugraha S, Agung A, Angga G, Negara P, Komang N, et al. Sport and Fitness Journal THE EFFECTIVENESS OF PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION IN MECHANICAL NECK PAIN: A SYSTEMATIC REVIEW. 2021;9(2):103–8.
17. Smedes F, Heidmann M, Schäfer C, Fischer N, Stępień A. The proprioceptive neuromuscular facilitation-concept; the state of the evidence, a narrative review. Physical Therapy Reviews. 2016 Jan 2;21(1):17–31.
18. Shanker Tedla J, Rani Sangadala D. Proprioceptive neuromuscular facilitation techniques in adhesive capsulitis: a systematic review and meta-analysis [Internet]. Available from: http://www.ismni.org
19. Lee JH, Park SJ, Na SS. The Effect of Proprioceptive Neuromuscular Facilitation Therapy on Pain and Function.
20. Comuk BalCi N, oZlem yuruk Z, ZeyBek asliCaN, GulseN mustafa, aGah tekiNdal mustafa. Acute effect of scapular proprioceptive neuro-muscular facilitation (PNF) techniques and clas-sic exercises in adhesive capsulitis: a randomized controlled trial.
21. hwang O, ha kyungjin, chOi S. The Effects of PNF Techniques on Lymphoma in the Upper Limbs.
22. Shin YJ, Kim WH, Kim SG. Correlations among visual analogue scale, neck disability index, shoulder joint range of motion, and muscle strength in young women with forward head posture. J Exerc Rehabil. 2017 Aug 1;13(4):413–7.
23. Bansal R, Paul M. EFFECTIVENESS OF MOTOR CONTROL THERAPEUTIC EXERCISE VS. PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION IN SUBJECTS WITH CERVICAL SPONDYLOSIS ON PAIN AND FUNCTIONAL DISABILITY. International Journal of Physiotherapy and Research [Internet]. 2020 Oct 11;8(5):3620–7. Available from: https://www.ijmhr.org/IntJPhysiotherRes/IJPR.2020.162

24. Gashi AI, Kovačič T, Gashi F, Azemi A. The effect of proprioceptive neuromuscular facilitation technique on treating cervical radiculopathy. Journal of Physical Education and Sport. 2023 Mar 1;23(3):722–9.
25. Kang TW, Jeong WM, Kim BR. Effects of Proprioceptive Neuromuscular Facilitation Exercises on the Neck Disability Index and Deep Neck Flexor Endurance of Patients with Acute Whiplash Injury. PNF and Movement. 2018;16(2):217-27.
26. Pawaria S, Kalra S. Comparing Effectiveness of Myofascial Release and Muscle Stretching on Pain, Disability and Cervical Range of Motion in Patients with Trapezius Myofascial Trigger Points. Indian Journal of Health Sciences and Care. 2015;2(1):8.
27. Yousuf A, Qazi D, Sandeela KA, Rasheed A, Mushtaq MU. Effectiveness of Myofacial Release versus Proprioceptive Neuro Facilitation Technique on Pain and Range of Motion in Patients with Cervicogenic Headache. Journal of Health and Rehabilitation Research [Internet]. 2024 Feb 20;4(1):780–7. Available from: https://jhrlmc.com/index.php/home/article/view/510
28. Çelik MS, Sönmezer E, Acar M. Effectiveness of proprioceptive neuromuscular facilitation and myofascial release techniques in patients with subacromial impingement syndrome. Somatosens Mot Res [Internet]. 2022 Oct 2;39(2–4):97–105. Available from: https://doi.org/10.1080/08990220.2021.2018293