COMPARATIVE EFFECTS OF MUSCLE ENERGY TECHNIQUE AND MULLIGAN MOBILIZATION ON PAIN AND FUNCTIONAL DISABILITY IN PATIENTS OF CERVICAL RADICULOPATHY

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Abstract: Cervical radiculopathy is a pathological definition of the inflammation or injury to a neural feature of a nerve root in the cervical spine. Deficits of neurology such as numbness, changed reflexes or fatigue will irradiate in the neck, arm, hand, or finger anywhere. Tingling pins and nerves and/or discomfort may also radiate in the arm and/or hand, ranging from pain to shock.

Objectives: To determine the outcome of muscle energy technique (MET) and Mulligan mobilization on pain & functional incapacity and range of motion in patients with cervical radiculopathy.

Material and Methods: The study design was single blinded randomized control trial in which patients were kept blinded. 48 patients were enrolled in the study. Randomization was done through computer generated method. Patients were classified into 2 groups, with 24 patients in each group. Group A treated with MET and Group B was treated with MWM and conventional therapy was used as a baseline treatment. Reading was recorded pre and post treatment. Session consists of 4 weeks, 3 session per weeks. NPRS, NDI and goniometer were used for pain, functional disability, and range of motion.

Results: Result revealed that there was statistically, and clinically significant difference and p-value was <0.01 which shows that both techniques were effective for managing the patients of cervical radiculopathy.

Conclusion: Both techniques were effective for managing the patients but MWM was more effective as compared to MET

Keywords: Cervical radiculopathy, muscle energy technique, mulligan mobilization, pain management, functional disability

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Introduction

Musculoskeletal disorders (MSDs) represent a broad spectrum of injuries or dysfunctions affecting bones, muscles, joints, and ligaments, and they are increasingly prevalent in modern populations. The rise in sedentary lifestyles, improper ergonomic practices, repetitive strain, and age-related degenerative changes has significantly contributed to the global burden of MSDs. These disorders not only cause localized pain and disability but also impact an individual's quality of life, work productivity, and psychological well-being. Among the various regions affected, the cervical spine is particularly vulnerable due to its complex structure and the high mobility it affords to the head and

neck.[1,2] Cervical radiculopathy is a common neurological manifestation of cervical spine pathology. It occurs when one or more nerve roots in the cervical region become compressed or inflamed, leading to symptoms that may include radiating pain, numbness, tingling sensations, and muscular weakness in the neck, shoulders, arms, or hands. These symptoms result from either mechanical compression or chemical irritation of the nerve roots and may significantly impair a person's ability to perform everyday tasks such as lifting, typing, or driving.[3,4] Several underlying pathologies can contribute to cervical radiculopathy. In older adults, degenerative changes such as foraminal stenosis, disc desiccation, and osteophyte formation are common causes. These structural alterations reduce the space available for nerve roots and predispose individuals to chronic nerve compression.[5] Conversely, in younger individuals, acute cervical disc herniation due to trauma or excessive physical exertion is a more typical cause. The herniated disc material can impinge on the adjacent nerve root, leading to acute pain and neurological symptoms. The C5 to C7 nerve roots are most frequently involved due to their anatomical vulnerability.[6,8] Clinically, cervical radiculopathy may present unilaterally and involve a combination of sensory, motor, and reflex deficits. Sensory involvement may include paresthesia or reduced sensation in a dermatomal distribution, while motor weakness and altered reflexes can compromise limb function. In severe cases, patients may experience functional disability, such as difficulty gripping objects, performing overhead activities, or maintaining proper posture for extended periods.[9–11] The management of cervical radiculopathy often begins with conservative treatment approaches, aiming to alleviate pain, improve mobility, and restore function without surgical intervention. Common non-invasive treatments include the use of analgesics, anti-inflammatory medications, cervical traction, and physical therapy.[12,13] Physiotherapeutic interventions play a central role in conservative care and are tailored to individual needs based on severity and symptomatology. Among the manual therapy techniques, Muscle Energy Technique (MET) and Mulligan's Mobilization with Movement (MWM) have gained attention due to their effectiveness in addressing musculoskeletal dysfunction.[14,15] MET is an active manual therapy technique that utilizes the patient's own muscle contractions in a specific direction against a counterforce applied by the therapist. It aims to improve joint mobility, reduce muscle hypertonicity, and enhance neuromuscular function. On the other hand, Mulligan's MWM combines sustained passive accessory mobilization with active physiological movement by the patient. It focuses on correcting joint positional faults and enhancing movement quality through pain-free mobilization.[16,18] Although both techniques are widely used in clinical practice, there remains a paucity of direct comparative evidence regarding their relative efficacy in treating cervical radiculopathy. Existing literature offers limited

insights, and further research is required to establish their effectiveness based on objective outcomes such as pain scores, functional disability indices, and range of motion improvements.

Material and Methods

This single-blinded, randomized clinical trial was conducted over a nine-month period following approval of the research synopsis by the Institutional Review Board. A total of 48 patients (24 in each group) were recruited using multistage random sampling to enhance the representativeness of the population. Data collection was carried out at various clinical settings, including Civil Hospital DHQ Sheikhupura.

Patients of both genders, aged 35 to 55 years, presenting with subacute cervical pain radiating unilaterally for more than 3 days and less than 3 weeks, were considered. Inclusion criteria included a positive Spurling and distraction test, a painful cervical facet joint at C5 on examination, and a positive upper limb nerve tension test. Ethical considerations were strictly observed throughout the study. Informed written consent was obtained from all participants after explaining the study's purpose and procedures.

Participants were randomly allocated into two groups. Group A received treatment with Muscle Energy Technique (MET), while Group B received Mulligan Mobilization with Movement (MWM). Randomization was performed using computer-generated numbers. Pre- and post-treatment data were recorded.

Each group underwent 12 treatment sessions (three sessions per week on alternate days) over four consecutive weeks. All patients received conventional physical therapy as baseline treatment, which included hot packs, ultrasound therapy, and isometric neck exercises.[19]

Intervention

Group A: MET+ conventional therapy

- **Conventional physical therapy:** - hot pack, ultrasound, isometric neck exercises (flexion, extension, side bending and rotation, 10-15 repetition, 10 sec hold).[19]
- **Muscle energy technique:** -

  For lower cervical:-Patients were taken in the supine position with a mildly flexed neck by the physiotherapist in the lower cervical area like C3-C4. The center right finger has been positioned over the right C3-C4 pillars and the neck has been brought into the full lateral movement, which is on the barrier. The left hand was put in temporal and parietal region. The patient was invited to bend and twist to the left 5 seconds, with this hand providing counter-compliance. After 5-7 seconds of moderate contraction, the neck is released afterwards and the process repeated 2 or 3 times after this, after which the neck has been carried to its current challenge.[19]

MET Lower Cervical

For Upper cervical: - Therapist instruct the patient in supine position and bent the head and neck in flexed position passively at the angle of 45 degree until the resistance felt to the therapist. For example therapist make movement at left side than rotation was make on the same side until the restriction of the movement was felt.at same time instruct the patient to move against the resistance of the therapist/ or move in opposite direction of the movement taken passively this movement was performed for 5 sec and relaxation was made then for 5 sec.[19]

Fig. 2: MET for Upper cervical vertebrae.

MET upper cervical

Group B: MWM+ Conventional Therapy

- **Conventional physical therapy:** - hot pack, ultrasound, isometric neck exercises (flexion, extension, side bending and rotation, 10-15 repetition, 10 sec hold).[19]
- **MWM: patient receives SNAG: -**

For lateral flexion and rotation: -

Patient sitting position. Head in neutral position. Therapist hand placement was on medial boundary, distal phalanx on the joint pillar of one thumb, other thumb strengthened to provide the mobilizing force. Glide was provided up toward the eyeball in the plane of the facet. Instruct the patient to do lateral flexion while at the same time slide was done by the therapist.

For Flexion and Extension: - Patient sitting position. Head in neutral position. Therapist hand placement was on medial boundary, distal phalanx on the joint pillar of one thumb, other thumb strengthened to provide the mobilizing force. Glide was provided up toward the eyeball in the plane of the facet. Instruct the patient to do extension/flexion while at the same time slide was done by the therapist.[19]

SNAG Flexion/Extension

SNAG Rotation/Lateral Flexion

The data was managed and analyzed using SPSS software version 23. Statistical significance α was set at 5%.

Descriptive-Statistics: The frequency tables, pie-charts, bar-charts and line graphs remained to show the summary of group measurements measured over time.

Difference-between-Groups: The Independent sample t-test, and paired sample t-test was applied.

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Result:

show comparison of variables between both groups. It shows that before treatment NPRS was 7.19±0.750 in group A and 7.29±0.717in Group B P=0.67 which means that there is not any substantial change between group A and B. NDI was 29.52±3.572 in group A and 29.62±3.500in Group B P=0.93 which means that there is not any substantial change between group A and B. Flexion was 26.90±2.166 in group A and 26.90±2.166 in Group B P=1.00 which means that there is not any substantial change in between group A and B. Extension was 32.19±6.809 in group A and 32.95±6.415in Group B P=0.71 which means that there is not any substantial change in between group A and B.

After four weeks of treatment NPRS was 3.48±.602 in group A and 1.48±0.512in Group B P=0.00 which means that there is significant difference between group A and B. NDI was 9.52±2.136 in group A and 3.14±0.359in Group B P=0.0 which means that there is significant difference between group A and B. Flexion was 39.71±1.793 in group A and 47.81±2.040in Group B P=0.00 which means that

there is significant difference between group A and B. Extension was 66.43± 2.839 in group A and 78.10±2.166 in Group B P=0.00 which means that there is significant difference between group A and B.

This statistical presentation shows that both groups were effective for reducing pain and functional disability and increasing range of motion, but MWM show remarkable results as associated to MET. So, reject the null-hypothesis and accept the alternative-hypothesis.

Table No.1 Mean ± standard Deviation of ages in both groups:

Mean ± standard Deviation of age				
Group	N	Minimum	Maximum	Mean ± Std. Deviation
MET (Group A)	21	35	50	40.29 ± 3.621
MWM (Group B)	21	35	52	42.67 ± 4.799
Gender Frequency rate in both groups				
Group		Frequency	Percent	
MET (Group A)	Male	9	42.9	
	Female	12	57.1	
MWM (Group B)	Male	10	42.9	
	Female	11	57.1	

Table No. 2 Comparison of Pain, ROM, and functional Disability between 2 groups

Variable	Treatment Group	Pretreatment Mean ± SD	P-value	Post-treatment Mean ± SD	P-value
NPRS	MET	7.19±0.750	0.67	3.48±.602	0.00
	MWM	7.29±0.717		1.48±0.512	
NDI	MET	29.52±3.572	0.93	9.52±2.136	0.00
	MWM	29.62±3.500		3.14±0.359	
Flexion	MET	26.90±2.166	1.00	39.71±1.793	0.00
	MWM	26.90±2.166		47.81±2.040	
Extension	MET	32.19±6.809	0.71	66.43± 2.839	0.00
	MWM	32.95±6.415		78.10±2.166	

Above table show comparison of variables between both groups. It shows that before treatment NPRS was 7.19±0.750 in group A and 7.29±0.717in Group B P=0.67 which means that there is not any substantial change between group A and B. NDI was 29.52±3.572 in group A and 29.62±3.500in Group B P=0.93 which means that there is not any substantial change between group A and B. Flexion was 26.90±2.166 in group A and 26.90±2.166 in Group B P=1.00 which means that there is not any substantial change in between group A and B. Extension was 32.19±6.809 in group A and 32.95±6.415in Group B P=0.71 which means that

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This statistical presentation shows that both groups were effective for reducing pain and functional disability and increasing range of motion, but MWM show remarkable results as associated to MET. So, reject the null-hypothesis and accept the alternative-hypothesis.

Table No. 3 Comparing Pain, ROM and Functional disability within group A (MET)

Paired-Samples-Statistics				
		N	Mean± Std. Deviation	P Value
Pair 1	Pain MET Pre Treatment	21	7.19±0.75	<0.0001
	Pain MET After Treatment	21	3.48±0.60	
Pair 2	Pain MWM Pre Treatment	21	7.28±0.71	<0.0001
	Pain MWM After Treatment	21	1.47±0.51	
Pair 3	NDI MET Pre Treatment	21	29.52±3.57	<0.0001
	NDI MET After Treatment	21	9.52±2.13	
Pair 4	NDI MWM Pre Treatment	21	29.61±3.49	<0.0001
	NDI MWM After Treatment	21	3.14±0.35	
Pair 5	Flexion MET Pre Treatment	21	26.90±2.16	<0.0001
	Flexion MET After Treatment	21	39.71±1.79	
Pair 6	Flexion MWM Pre Treatment	21	26.90±2.16	<0.0001
	Flexion MWM After Treatment	21	47.80±2.04	
Pair 7	Extension MET Pre Treatment	21	32.19±6.80	<0.0001
	Extension MET After Treatment	21	66.43±2.83	

Pair 8	Extension MWM Pre Treatment	21	32.95±6.41	<0.0001
	Extension MWM After Treatment	21	78.09±2.16	

Paired Sample T Test was applied according to which Pain in MET group Pre Treatment7.19±0.75, Pain in MET group After Treatment3.48±0.60, Pain in MWM group Pre Treatment7.28±0.71, Pain MWM after Treatment1.47±0.51, NDI in MET group Pre Treatment29.52±3.57, NDI in MET group After Treatment9.52±2.13, NDI in MWM group Pre Treatment29.61±3.49, NDI in MWM group after Treatment3.14±0.35, Flexion in MET group Pre Treatment26.90±2.16, Flexion in MET group After Treatment39.71±1.79, Flexion in MWM group Pre Treatment26.90±2.16, Flexion in MWM group after Treatment47.80±2.04, Extension in MET group Pre Treatment32.19±6.80, Extension in MET group After Treatment66.43±2.83, Extension in MWM group Pre Treatment32.95±6.41 and Extension in MWM group after Treatment78.09±2.16. P value was <0.0001 which means that there was substantial change in between the mean of muscle energy technique and mobilization with movement before treatment and after treatment.

Table No. 4 Comparing Pain, ROM, and Functional disability within group B (MWM)

Variable	Tx. Group	Pretreatment Mean ± SD	Post treatment Mean ± SD	P-value
NPRS	MWM	7.29±0.717	1.48±0.512	<0.01
NDI	MWM	29.62±3.500	3.14±0.359	<0.01
Flexion	MWM	26.90±2.166	47.81±2.040	<0.01
Extension	MWM	32.95±6.415	78.10±2.166	<0.01

Discussion

The neck is a common site for musculoskeletal disorders, including cervical radiculopathy, which involves inflammation or compression of cervical nerve roots. This condition leads to neurological deficits such as pain, numbness, and weakness radiating from the neck to the upper limbs.[20]

Although various conservative treatment protocols are available, evidence comparing the effectiveness of Muscle Energy Technique (MET) and Mulligan Mobilization with Movement (MWM) in cervical radiculopathy remains limited. This study addresses that gap by evaluating their impact on pain and functional disability.

Krupa D. Tank et al. conducted a randomized controlled trial (RCT) comparing MET and Mulligan SNAGs in patients with mechanical neck pain. Both techniques showed comparable improvements in VAS, NDI, and cervical ROM,

suggesting they are effective adjuncts to conventional therapy.[19]

Similarly, Rayudu and Alagingi compared MWM and MET in adhesive capsulitis. Both interventions were effective in reducing pain and improving function, with no significant difference between them.[21] Another RCT by Hariharasudhran and Balamurugan in lateral epicondylitis found MWM more effective than MET, highlighting condition-specific outcomes.[22]

The present study found that both MET and MWM significantly improved pain and function in cervical radiculopathy patients. Group A (MET) and Group B (MWM) both showed reduced NPRS and NDI scores and increased ROM after four weeks. However, Group B (MWM) demonstrated greater improvement across all outcome measures, with statistically significant differences ($p < 0.01$), supporting the rejection of the null hypothesis.

These findings align with studies by Baidya et al., who showed similar efficacy of MET and MWM in treating lateral ankle sprains,[23] and Solanki et al., who found MWM more effective for hip adductor tightness.[24] Conversely, Vaidya et al. reported greater effectiveness of MET in anterior innominate dysfunction, indicating that treatment efficacy may vary by condition.[25]

Conclusion

It was concluded in study that MET and MWM together were operative for treatment of the patients with cervical radiculopathy in decreasing the pain, range of motion & functional disability, on the other hand MWM was additional effective that associated to MET.

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