DOI: 10.7860/JCDR/2019/41917.13355

Original Article

Physiotherapy Section

Comparing the Efficacy of First Rib Maitland Mobilisation and Muscle Energy Technique on Pain, Disability and Head Position Sense in Patients with Chronic Mechanical Neck Pain

SHAIL SACHDEVA[1], JOGINDER YADAV[2], MOHIT GULATI[3]

ABSTRACT

Introduction: Mechanical neck pain is the most common musculoskeletal disorders. Muscle Energy Technique (MET) and Maitland mobilisation may provide a useful intervention for treating such disorder.

Aim: To compare the effect of MET with Maitland mobilisation on pain, functional disability and head position sense in people with chronic mechanical neck pain.

Materials and Methods: An experimental comparative study including 40 patients with mechanical neck pain of age group 25-40 years were undertaken from March 2018 to June 2018. Patients were randomly allocated to either the MET group or mobilisation group with 20 patients in each group. The former group received MET (group A) which is a form of active stretching techniques used as manipulative treatments and the latter (group B) received Maitland mobilisation manual therapy intervention, a type of passive movement of a skeletal joint. Both groups received conventional therapy in the form of proprioceptive training and hot fomentation. Treatment was given three times per week for four weeks. A Mc Gill pain questionnaire was used to measure the intensity of pain, functional disability was assessed using the Neck Disability Index (NDI) and head position sense was assessed by using cervical joint position error device using laser tracker immediately before treatment at 2nd week and again on the last day of 4th week intervention, ANOVA and student's t-test was used to compare the intergroup analysis for all variables at baseline, 2nd and 4th week of intervention.

Results: Both groups improved significantly at the end of 4th week but group A showed highly significant difference for pain, disability and head position sense in comparison to group B ($p<0.005$).

Conclusion: MET has shown better improvement than Maitland mobilisation on pain, functional disability and head position sense in patients with chronic mechanical neck pain.

Keywords: Cervical joint position error, Occupational stress, Postural imbalance, Proprioception deficits

INTRODUCTION

Neck pain is the most common occupational stress throughout the globe. According to estimates from International Burden of Diseases 2010 study, neck pain was graded fourth highest in terms of disability as measured by Years Lived with Disability (YLD'S) and 21st in terms of overall burden in which the point prevalence starting from 5.9% to 38.7% [1]. Annual prevalence ranges from 16% and 75.1% [2]. While lifetime prevalence ranges from 14.2 to 70% [3].

Neck pain is a condition marked with a course of remission and exacerbation which can be disabling in some people. Most of people don't get complete resolution of the neck pain and experience incidental disability [4].

Neck pain is a sensation or discomfort, which a person experiences within the neck or originating from different components of body like stress, upper cross syndrome in which the back muscles of the neck and shoulder muscles (upper trapezius and levator scapula) muscles become overused and strained while the muscles of the chest become shortened and tight. This results in counter muscles to become underused or weakened, which are neck flexors and thus cause headache [5].

Classification and diagnostic criteria of the Neck pain Task force 2000-2010 describes four grades that are: grade I is the pain in neck without any major structural pathology symptoms and no minor interference of the activity of the daily living, grade II is neck pain without any structural deficits but majorly affecting the activity of daily living, grade III is with no signs and symptoms of structural abnormality but presence of nerve compression signs, and grade IV is structural pathology [6].

Any condition or event (e.g., incorrect posture, acute injury, ageing, inherent or developmental defects) resulting in altered cervical joint mechanics or muscle structure and performance, that may end up in mechanical neck pain. Bergmann DC et al., represented five diagnostic criteria for joint dysfunction in the mechanical neck [7].

a) Pain/tenderness which is present on the affected area and its associated muscles.

b) Imbalance of the motion when symmetrical motions are compared bilaterally.

c) Presence of motion abnormality which differentiates the degree or quality of motion that is compromised inside the involved joint.

d) Any sign of inflammatory reaction such as altered tissue tone, texture and/or temperature.

e) Acceptable positive special orthopaedic tests such as cervical flexion and rotation test which is referred to as Kemps test which is a provocative test to detect pain which can be local or radicular in nature [7].

The importance of the primary rib which is also called as true ribs that attaches directly to the sternum (vertebro-sternal) arises from the fact that it's in relationship to the cervico-thoracic spine which leads to spondylotic changes, and therefore the proven fact that it is positioned across the cervico-brachial junction where other vital structures such as brachial plexus are also present [8].

Scalene muscle involvement related to a primary rib dysfunction is related to cervical spine path-mechanics, this argument was supported by the previous discussions who expressed that the primary costo-transverse joint is that the only level that lacks

ligamentous support superiorly, making these joint prone to mechanical dysfunctions [9].

First rib dysfunction with tight scalene muscle involvement additionally affects the lower cervical spine due to its attachment on cervico-thoracic junction. It may be common that patients with a primary rib dysfunction will also report cervical involvement with a resultant motion restriction and pain radiating up the trapezius muscle and scalene muscles [10].

Signs and symptoms of a first rib dysfunction include pain on the costo-sternal or costo-vertebral joints of the primary rib; pain within the head, neck, shoulder, or arm; and restrictions or pain throughout exhalation or inhalation. Swelling, tenderness, or sensitivity of the primary rib might also be present throughout palpation [11].

The fixated first rib syndrome in which the first rib is unable to move and smooth cervical spine flexion and rotations are altered. Mechanically scalene contracts on one side flex neck same side and elevate the first rib includes rounded shoulders, kyphotic t-spine, jutted chin, hyper extended (OA) atlanto-occipital joint, and internally revolved arms, pain deeply hidden inside the higher crossed pattern [12].

Spinal Mobilisation therapy may be a skillful technique of passive movement of a spinal section or region. It's typically performed with the aim of achieving therapeutic impact. They are represented as mild, usually periodic, passive movement given to a spinal region or segment which gently enhances the passive vary of motion of that region [13].

MET uses the muscle's energy with mild isometric contractions to loosen the muscles by using autogenic or reciprocal-inhibition therapy, and enhances the compliance of the muscle. As compared to static stretching that is a passive technique during which the patient force is less in comparison to MET, MET is an energetic technique in which patient uses their muscles and perform actively [14].

Similar study identifies the effect of first rib mobilisation in mechanical neck pain with radiculopathy by Sattar A et al., but did not compare with MET to identify which technique is most effective and did not mention the exact cause of first rib restriction neither they checked the involvement of head position sense alteration in chronic mechanical neck pain [15].

Therefore, the aim of the study was to check the impact of first rib Maitland mobilisation and MET on pain, disability and head position sense in patients with chronic mechanical neck pain, which will additionally enlighten the relation between first rib restriction and mechanical neck pain because of activity stresses and bad posture.

MATERIALS AND METHODS

Type of Study

This was an experimental comparative study which included 40 patients, with mechanical neck pain of age group 25-40 years.

Participants

After receiving Ethical Clearance from the Institutional Committee of Shree Gurugobind Singh University. Ref. No. SGTU/FOP/2018/37, the study was carried out at Sir Ganga Ram Hospital, Delhi. The sample size of 40 patients was calculated using G power (power of the study is 0.95) with chronic mechanical neck pain evaluated from March 2018 to June 2018 and the data analysis writing took around five months (till November 2018). Patients who fulfilled the inclusion criteria:

(1) Male and female patients with chronic neck pain of duration three weeks to six months.

(2) Age group 25-45 years.

(3) Hypertonic scalene muscle which was determined via regional examination and by asking the patient to laterally flex and rotate the neck to tuck in sternocleidomastoid muscle and palpating the scalene belly.

(4) Pain was measured by Mc gill Pain Questionnaire (MPQ) (ANNEXURE 1): The MPQ was scored by counting the number of words selected to obtain a number of chosen words score (0-20). Pain Rating Index scoring range from 0-78 build on the rank values of the chosen words. The score accompanying with each descriptor is centred on its position or rank order in the word such that the first word is given a value of 1, the next given a value of 2 and so on. Rank values are added within each subcategory. Scores on the Present Pain Intensity scale ranges from 0-5. A greater score on the MPQ determines worse pain. The Pain Rating Index is given both in terms of quantity of pain, by the number of words used and the rank values of the words, as well as the quality of pain, by the particular words that are selected. The normative mean scores across painful conditions ranged from 24-50% of the maximum score were included in the study [16].

(5) Neck Disability Index (NDI) (ANNEXURE 2): Moderate disability greater than or equal to 15 were included in the study. NDI can be scored as a raw score or double or expressed as percentage and rated from 0-5 where 0-No pain and 5 mean worst pain. All points are summed and taken as total score where 0-4 points refers to (0-8%) no disability, 5-14 points refers to (10-28%) mild disability, 15-24 points refers to (30-48%) moderate disability, 25-34 points refers to (50-64%) severe disability, 35-50 points refers to (70-100%) complete disability [17].

(6) Head position sense relocation (ANNEXURE 3) of equal to or greater than 2 inches from starting point, aberrant motion were included in the study. This device uses a laser pointer fixed to helmet or headband. Targets were 40 cm of diameter with concentric circles in 1 cm increments, divided into 4 quadrants which intersect at zero [18].

Patients with who did not met the inclusion criteria were excluded from the study:

1. Congenital anomalies of cervical spine or first rib.
2. Posterior ponticle or cervical rib.
3. Thoracic outlet syndrome.
4. Contraindications to mobilisation to any person that were currently taking either anti-inflammatory or pain relieving medication at that time. The whole procedure was explained and written consent was taken from all the patients participated in the study.

RANDOMISATION

Subjects who matched the inclusion criteria were randomly assigned to both the groups A and B using chit method of randomisation. The allocation was conducted by the primary investigator at the baseline. Group A was given MET along with Proprioceptive Training (n-20) and Group B was given First Rib Maitland Mobilisation along with Proprioceptive Training (n-20). Measurements were taken for age, height, Body Mass Index (BMI) for all subjects. All patients underwent baseline measurement for pain, disability and head position sense.

PROCEDURE

Group A- MET: [Table/Fig-1] shows patients were given post-isometric relaxation for restricted first rib in sitting position and therefore the affected elevated first rib, opposite foot of therapist was placed on the table and patient non affected arm is 'dropped' on the therapist flexed knee. The practitioner's conjointly flexes the elbow on the non-affected side placed anterior to shoulder with the hand supporting the patient facet of head. Then therapist makes contact with the tubercle of the first rib with fingers or thumb of affected side (patient) disposing of available soft tissue

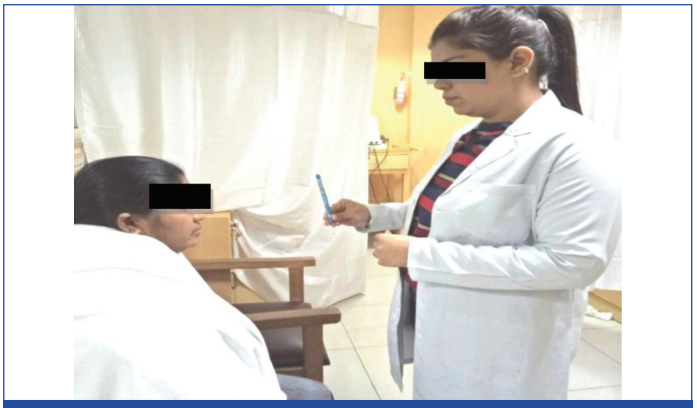
slack as steady force is applied in inferior direction. The therapist eases his flexed leg and uses his supported hand to encourage patient's neck into a side flexion and rotation to affected side thus unloading the scalene tension thereon side and encourage the first rib to move anteriorly and inferiorly. The contact thumb or fingers on the rib tubercle/shaft takeout there slack, and therefore the patient was asked to inhale and hold breath for few seconds and at a similar time gently presses your head towards non affected side against hand. This 5-7 second contraction can activate the scalene muscle. On releasing the breath, restriction barrier is taken out of soft tissues as all the movements that were done before the contractions were repeated and 2 or 3 repetitions usually results in greater rib stabilisation and functional balance [19].

[Table/Fig-1]: Muscle energy technique.

Group B-Maitland Mobilisation: [Table/Fig-2] shows first rib Maitland Mobilisation, the physiotherapists placed her thumbs anterior to muscle belly of the trapezius muscle and therefore the direction of pressure will be inclined a bit towards the feet yet as being postero-anteriorly directed. Patient lies supine whereas physiotherapists standing at the facet being treated and apply the pressure in the oscillating anterior posterior and caudal movement on all components of the primary rib that are palpable [20].

[Table/Fig-2]: Maitland mobilisation.

Both groups were given proprioceptive training as shown in [Table/Fig-3] which incorporates head relocation practice, gaze stability, eye follow, eye head coordination. All active movements of the cervical spine (flexion, extension, rotation, and lateral flexion) were used. Occulomotor adaptation exercises were used to maintain postural stability which was carried out through various stages by asking the patient to perform eye movement with head neutral in both directions then visually focusing on a target while rotating the head in both directions horizontal as well as vertical. Head eye coordination with rotation of both the eyes and head in opposite directions. Exercises were progressed by increasing vary of movements, speed and alteration of visual targets [21].



[Table/Fig-3]: Occulomotor adaptation exercise.

Hot fomentation was given in the form of commercially available hydro collator packs over the painful area in cervical region before the treatment whereas the temperature of the hydro collator unit was set at 71°C and six to eight layers of the towel were set and was given for 10-20 minutes [22]. The treatment protocol was given for three sessions per week for four weeks [23].

STATISTICAL ANALYSIS

Data were analysed using SPSS 21 version (SPSS Inc., Chicago, IL, USA). Mean and standard deviation of all the variables were measured. The level of significance was set at $p<0.05$. ANOVA and student's t-test was used to compare the intergroup difference in analysing the data collected for all variables.

RESULTS

A total of 67 patients were assessed and 40 patients who fulfilled the inclusion criteria were randomly allocated to either group. Two participants from Group A left the study out due to personal reasons and two participants from Group B withdrew because they could not comply with the treatment and assessment schedule for which 4 new patients were treated for the analysis of 40 participants.

Mean comparison of age, weight and BMI was done for both the groups. Intergroup analysis showed no significant difference in both group, $p>0.05$ [Table/Fig-4].

Variables	Mean±SD Group A (Muscle energy technique)	Mean±SD Group B (Maitland mobilisation)	t-value	p-value
Age	37.50±8.88	38.10±9.06	0.212	0.834^{NS}
Weight	69.95±5.48	68.50±7.07	0.725	0.473^{NS}
BMI	25.51±2.31	26.24±2.69	0.920	0.363^{NS}

[Table/Fig-4]: Mean comparison of age, weight and BMI.
p-value <0.05 or .001 (significant or highly significant respectively)
p-value >0.05 (non-significant)
NS: Non-significant

The result of the study showed that group A had 70.9% of improvement at the end of 4th week and group B had 28.47% of improvement. Group A Experimental group showed highly significant improvement by 42.43% in comparison to group B $p<0.001$ [Table/Fig-5].

Pain	Groups	Mean±SD	t-value	p-value
Baseline	MET (Group A) Mobilisation (Group B)	44.65±3.90 43.90±3.34	0.654	0.517
2nd week	MET (Group A) Mobilisation (Group B)	32.00±4.24 36.55±4.81	3.17	0.003
4th week	MET (Group A) Mobilisation (Group B)	12.95±4.06 31.40±5.63	11.89	<0.001^{**HS}

[Table/Fig-5]: Mean comparison for both groups on pain.
p-value <0.05 or .001 (significant or highly significant respectively)
p-value >0.05 (non-significant)
NS: Non-significant

[Table/Fig-6] shows the intragroup analysis for pain variable of MET group A and their p values showed highly significant difference at end of 4th week p<0.05.

MET group	Pain	Mean±SD	t-value	p-value
Pair 1 (Difference of means from baseline to 2nd week)	Baseline 2nd week	44.65±3.89 32.00±4.24	18.773	0.028
Pair 2 (Difference of means from 2nd week to 4th week)	2nd week 4th week	32.00±4.24 12.95±4.06	19.767	0.019
Pair 3 (Difference of means from baseline to 4th week)	Baseline 4th week	44.65±3.89 12.95±4.06	34.973	0.001**

[Table/Fig-6]: Intragroup analysis for pain variable of MET group A.
If p-value <0.05 or .001 (significant or highly significant respectively)
If p-value >0.05 (not significant)

[Table/Fig-7] shows the intragroup analysis for pain variable of Mobilisation group and their p-values showed significant difference at end of 4th week p<0.05.

Mobilisation group	Pain	Mean±SD	t-value	p-value
Pair 1 (Difference of means from baseline to 2 week)	Baseline 2nd week	43.90±3.34 36.55±4.81	11.17	0.046
Pair 2 (Difference of means from 2nd to 4th week)	2nd week 4th week	36.55±4.81 31.40±5.63	8.66	0.044
Pair 3 (Difference of means from baseline to 4th week)	Baseline 4th week	43.90±3.34 31.40±5.63	13.60	0.021*

[Table/Fig-7]: Intragroup analysis for pain variable of mobilisation group.

The intergroup analysis for neck disability measured by NDI showed that there was a highly significant improvement seen in MET group A as compared to group B at 4th week, p<0.001 [Table/Fig-8].

Disability	Groups	Mean±SD	t-value	p-value
Baseline	MET (Group A) Mobilisation (Group B)	17.60±2.68 17.25±1.71	0.492	0.626
2nd week	MET (Group A) Mobilisation (Group B)	12.60±2.41 14.75±1.99	3.07	0.004*
4th week	MET (Group A) Mobilisation (Group B)	6.45±2.33 12.60±1.67	9.61	<0.001**HS

[Table/Fig-8]: Mean comparison for both groups on Neck disability.
p-value <0.05 or .001 (significant or highly significant respectively)
p-value >0.05 (non-significant)
NS: Non-significant

[Table/Fig-9] shows the intragroup analysis for disability component for MET group A showed highly significant difference at the end of 4th week p<0.05.

MET group	Disability	Mean±SD	t-value	p-value
Pair 1 (Difference of means from baseline to 2 week)	Baseline 2nd week	17.60±2.68 12.60±2.42	12.583	0.020
Pair 2 (Difference of means from 2nd week to 4th week)	2nd week 4th week	12.60±2.42 6.45±2.33	11.725	0.009
Pair 3 (Difference of means from baseline to 4th week)	Baseline 4th week	17.60±2.68 6.45±2.33	17.714	0.001**

[Table/Fig-9]: Intragroup analysis for disability component for MET group A.
If p-value <.05 or .001 (significant or highly significant respectively)
If p-value >0.05 (not significant)

[Table/Fig-10] shows the intragroup analysis for disability component for Mobilisation group B showed significant difference at the end of 4th week p<0.05.

Mobilisation group	Disability	Mean±SD	t-value	p-value
Pair 1 (Difference of means from baseline to 2 week)	Baseline 2nd week	17.25±1.71 14.75±1.99	8.483	0.039
Pair 2 (Difference of means from 2nd week to 4th week)	2nd week 4th week	14.75±1.99 12.60±1.67	11.831	0.021
Pair 3 (Difference of means from baseline to 4th week)	Baseline 4th week	17.25±1.71 12.60±1.67	14.235	0.010*

[Table/Fig-10]: Intragroup analysis for disability component for Mobilisation group B.
If p-value <0.05 or .001 (significant or highly significant respectively)
If p-value >0.05 (not significant)

The result of our study also revealed that head position sense in group A showed 67% improvement at the end of 4th week and group B showed 28% improvement at the end of 4th week. But group A showed highly significant improvement by 39% in comparison to group B [Table/Fig-11].

Head position sense	Groups	Mean±SD	t-value	p-value
Baseline	MET Mobilisation	12.00±1.62 11.35±1.62	1.52	0.137
2nd week	MET Mobilisation	8.55±1.47 9.15 ±1.68	1.05	0.303
4th week	MET Mobilisation	4.60±1.57 8.03±1.63	6.53	<0.001**HS

[Table/Fig-11]: Mean comparison for both groups on Head position sense.
p-value <0.05 or .001 (significant or highly significant respectively)
p-value >0.05 (non-significant)
NS: Non significant

[Table/Fig-12] shows the intragroup analysis for head position sense for MET group A showed highly significant difference at the end of 4th week p<0.05.

MET group	Head position sense right	Mean±SD	t-value	p-value
Pair 1 (Difference of means from baseline to 2nd week)	Baseline 2nd week	12.00±1.62 8.55±1.47	17.39	0.041
Pair 2 (Difference of means from 2nd to 4th week)	2nd week 4th week	8.55±1.47 4.60±1.57	12.67	0.023
Pair 3 (Difference of means from baseline to 4th week)	Baseline 4th week	12.00±1.62 4.60±1.57	17.39	0.001**

[Table/Fig-12]: Intragroup analysis for head position sense for MET group A.
If p-value <0.05 or .001 (significant or highly significant respectively)
If p-value >0.05 (not significant)

[Table/Fig-13] shows the intragroup analysis of head position sense for Mobilisation group B showed significant difference at the end of 4th week p<0.05.

Mobilisation group	Head position sense right	Mean±SD	t-value	p-value
Pair 1 (Difference of means from baseline to 2nd week)	Baseline 2nd week	11.35±1.62 9.15±1.68	8.904	0.040
Pair 2 (Difference of means from 2nd to 4th week)	2nd week 4th week	9.15±1.68 8.03±1.63	4.682	0.021
Pair 3 (Difference of means from baseline to 4th week)	Baseline 4th week	11.35±1.62 8.03±1.63	12.801	0.015*

[Table/Fig-13]: Intragroup analysis of head position sense for Mobilisation group B.
If p-value <0.05 or .001 (significant or highly significant respectively)
If p-value >0.05 (not significant)

The intergroup analysis for pain, neck disability and head position sense using unpaired t-test showed that there was a significant improvement in MET group A as compared to group B p<0.001.

DISCUSSION

Mechanical neck pain is most commonly seen in people involved in occupation like computer sitting, desk job, students and administrative tasks with sedentary life style [24], occupational stress, heavy lifting and prolonged demanding work [25]. In a sitting working position, neck extensor muscles would be stretched while flexors muscles are tend to become weak during long working hours of sustained forward position of head and neck [26].

The study was done to compare the effectiveness of the two techniques that is First Rib Muscle Energy Technique in group A and Maitland Mobilisation in group B in chronic mechanical neck pain patients. The subjects of this study had similar baseline values for all dependent variables which indicate that all groups had homogenous distribution of patients.

The results of this study revealed that both the groups improved significantly at the end of the 4th week. Whereas the group A had

shown better results in reducing pain, disability and improving head position sense than group B.

In this study the within group analysis of group A, the Mc gill pain questionnaire showed that there was a significant improvement in pain of 42.43% at the last day of 4th week of treatment. The results acquired for pain decrease in the MET group could be similar to pilot study by Sachdeva S et al., where pain intensity reduced MET over the neck and showed the conceivable mechanism for decrease in pain intensity in MET group which can be attributed to hypoalgesic effect. It also leads to reduction of pain by the inhibitory Golgi tendon reflex, initiated and isometric contraction that prompts reflex relaxation of the muscle and activation of muscle and joint mechanoreceptors prompts sympathatic excitation evoked by somatic efferent's and localised activation of peri aqueductal gray matter that assume job in diminishing modulation of pain. Nociceptive inhibition at that point happens at the dorsal horn of the spinal cord, as simultaneous gating of nociceptive impulses in the dorsal horn, due to mechano-receptor stimulation [27].

The after effect of the study led by Selkow NM et al., found that momentary effects of MET on pain in individuals with non explicit lumbopelvic pain which concluded that the effects of MET over past 24 hours seems to be most significant [28].

However, in comparison between group A and group B, the group B shows 28% improvement in pain by the Mc gill pain questionnaire at the end of 4th week of treatment. The relative improvement in group B was due to the growing evidence of the hypoalgesic effect of a number of manual therapy techniques. Fryer G et al., also revealed that both spinal manipulation and mobilisation has decreased the thoracic pain sensitivity to pressure, but with mobilisation it is more effective [29].

Both the groups, group A and group B, showed statistically significant improvement in functional disability of 63.3% and 36.9%, respectively at the end of the last day of 4th week. The possible mechanism for improving NDI could be any form of physical therapy intervention brought about significant decrease in neck disability and increase in functional status of the neck supported by Ylinen J et al., [30].

The relatively additional improvement of functional disability in group A was also supported by Colloca L et al., that it may be also be due to the biomechanical effects on the restoration of mobility. Biomechanical effects have been found to be associated with manual therapy in both the groups [31].

Similar results were obtained by Phadke A et al., in a RCT which investigated the effect of MET and static stretching on pain and functional disability of mechanical neck pain patients. It was concluded that MET is better than static stretching for variables VAS and NDI [32].

The study also showed improved head position sense in Group A of 67% at the end of 4th week treatment whereas Group B showed only 28% of improvement. The mechanism of improved proprioception in MET applied to the spine involves various specific leverages and localisation to spinal articulations, which is controlled, purposeful isometric muscle contraction done by the patient. This has been explained to stimulate joint proprioceptors, which focuses on different pattern of afferent activity in proprioceptive impaired region, and initiates the CNS to normalise the proprioceptive and motor coordination from that area.

MET might also produce changes in proprioception, motor programming, and control. Spinal pain disturbs proprioception and motor control, causing decreased awareness of spinal motion and position and cutaneous touch perception [33].

LIMITATION

This study did not have a control group. There may be a possible interaction between the treatment effects of both groups. Therefore, the results could only explain the relative effectiveness of these two techniques. To find out whether each technique was actually effective in treating mechanical neck pain, additional studies are still required. The long-term effects of the treatment were not explained. The outcome assessor was not blinded, which might have led to measurement bias in the study. Future studies should assess the long-term effects of the interventions and there effects with the presence of control group.

CONCLUSION

Both groups were found to be effective in reducing pain, disability but the effects of MET was highly significant in response to Maitland Mobilisation. Results of the study also revealed that addition of proprioceptive training along with MET added the efficacy of improving head position sense, and reducing pain and disability in comparison to Maitland Mobilisation. This may also enlighten the relation between first rib restriction and mechanical neck pain due to occupational stresses and bad posture which can be treated by breaking the restriction barrier.

The effects of first rib MET along with proprioceptive training is an effective form of manual therapy in treating patients with chronic mechanical neck pain patients associated with first rib restriction, which proves MET is more effective form of manual therapy in mobilising restricted joints.

REFERENCES

[1] Wang H, Naghavi M, Allen C, Barber RM, Bhutta ZA, Carter A, et al. Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980-2015: A systematic analysis for the Global Burden of Disease Study 2015. The Lancet. 2016;388(10053):1459-544.

[2] Cohen SP. Epidemiology, diagnosis, and treatment of neck pain. In Mayo Clinic Proceedings. 2015;90(2):284-99. Elsevier.

[3] Childs JD, Cleland JA, Elliott JM, Teyhen DS, Wainner RS, Whitman JM, et al. Neck pain: Clinical practice guidelines linked to the International Classification of Functioning, Disability, and Health from the Orthopaedic Section of the American Physical Therapy Association. Journal of Orthopaedic & Sports Physical Therapy. 2008;38(9):A1-34.

[4] Côté P, Cassidy JD, Carroll LJ, Kristman V. The annual incidence and course of neck pain in the general population: a population-based cohort study. Pain. 2004;112(3):267-73.

[5] Thacker D, Jameson J, Baker J, Divine J, Unfried A. Management of upper cross syndrome through the use of active release technique and prescribed exercises. Logan College of Chiropractic. 2011 Apr.

[6] Guzman J, Haldeman S, Carroll LJ, Carragee EJ, Hurwitz EL, Peloso P, et al. Clinical practice implications of the bone and joint decade 2000-2010 task force on neck pain and its associated disorders: from concepts and findings to recommendations. Spine. 2008;33[4S]:S199-213.

[7] Bergmann DC, Thomas F, Peterson D. The Spine: anatomy, biomechanics, assessment, and adjustive techniques. Chiropractic Technique. 1993. https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=Bergmann+DC%2C+Thomas+F.+%2C+Peterson+D.+The+Spine%3A+anatomy%2C+biomechanics%2C+assessment%2C+and+adjustive+techniques.+Chiropractic+Technique.+1993.+&btnG=.

[8] Michael A. First rib function and the thoracic outlet syndrome. Journal of Orthopaedic Medicine. 1995;17(2):56-61.

[9] Lindgren KA, Leino E. Subluxation of the first rib: A possible thoracic outlet syndrome mechanism. Archives of Physical Medicine and Rehabilitation. 1988;69(9):692-95.

[10] Johnson HH. Thoracocostal subluxation syndrome: an often overlooked cause of chest and arm pain. Chiropractic Technique. 1995;7:134-38. Available from https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=Johnson+HH.+Thoracocostal+subluxation+syndrome%3A+an+often+overlooked+cause+of+chest+and+arm+pain.+Chiropractic+Technique.+1995%3B7%3A134-8.+&btnG=.

[11] Feuerherd R, Saliba S. Manual therapy for first-rib dysfunction. Athletic Training and Sports Health Care. 2013;5(1):05-06.

[12] Kamkar A, Cardi-Laurent C, Whitney SL. Conservative management of superior subluxation of the first rib. Journal of Sport Rehabilitation. 1992;1(4):300-16.

[13] Gibson W, Palsson TS, Coopes E, Wand BM, Travers MJ. Thrust manipulation may not decrease the intensity of chronic low back pain. Letter to the editor regarding "Manipulation and mobilization for treating chronic low back pain: a systematic review and meta-analysis" by Coulter et al. The spine journal: official journal of the North American Spine Society. 2018;18(10):1961.

[14] Chaitow L, Crenshaw K. Muscle energy techniques. Elsevier Health Sciences; 2006.

[15] Sattar A, Waqas S, Asim HM. Effect of First Rib Mobilization in Mechanical Neck Pain with Radiculopathy for Pain Relief. Annals of King Edward Medical University. 2018;24(2):768-70.

[16] Hawker GA, Mian S, Kendzerska T, French M. Measures of adult pain: Visual

analog scale for pain (vas pain), numeric rating scale for pain (nrs pain), mcgill pain questionnaire (mpq), short-form mcgill pain questionnaire (sf-mpq), chronic pain grade scale (cpgs), short form-36 bodily pain scale (sf-36 bps), and measure of intermittent and constant osteoarthritis pain (icoap). Journal of Arthritis Care and Research. 2011;63(S11):S240-52.
[17] Vernon H, Mior S. The Neck Disability Index: A study of reliability and validity. Journal of Manipulative and Physiological Therapeutics. 1991 Sep.
[18] Kristjansson E, Treleaven J. Sensorimotor function and dizziness in neck pain: implications for assessment and management. Journal of Orthopaedic & Sports Physical Therapy. 2009;39(5):364-77.
[19] Leon Chaitow, Ken Crenshaw, Sandy Fritz BS 'Advanced soft tissue techniques-muscle energy techniques' Churchill Livingstone Elsevier 3rd edition chapter 6 Pg no. 228-30.
[20] Tuttle N. Posteroanterior movements of the cervical spine (Doctoral dissertation, School of Physiotherapy and Exercise Science, Faculty of Health, Griffith University).
[21] Jull G, Falla D, Treleaven J, Hodges P, Vicenzino B. Retraining cervical joint position sense: the effect of two exercise regimes. Journal of Orthopaedic Research. 2007;25(3):404-12.
[22] Games KE, Sefton JM, Wilson AE. Whole-body vibration and blood flow and muscle oxygenation: A meta-analysis. Journal of Athletic Training. 2015;50(5):542-49.
[23] Kumar GY, Sneha P, Sivajyothi N. Effectiveness of muscle energy technique, Ischaemic compression and strain counterstrain on upper trapezius trigger points: A comparative study. International Journal of Physical Education, Sports and Health. 2015;1(3):22-26.
[24] Barton PM, Hayes KC. Neck flexor muscle strength, efficiency, and relaxation times in normal subjects and subjects with unilateral neck pain and headache. Archives of Physical Medicine and Rehabilitation. 1996;77(7):680-87.
[25] Rezasoltani A, Khaleghifar M, Tavakoli A, Ahmadi A, Minoonejad H. The effect of a proprioceptive neuromuscular facilitation program to increase neck muscle strength in patients with chronic non-specific neck pain. World Journ of Sport Sci. 2010;3(1):59-63.
[26] Mayoux-Benhamou MA, Revel M. Influence of head position on dorsal neck muscle efficiency. Electromyography and Clinical Neurophysiology. 1993;33(3):161-66.
[27] Sachdeva S, Yadav J, Gulati M, Pawaria S. To see the effect of first rib muscle energy technique on pain in chronic mechanical neck pain patients-A randomized controlled pilot study. International Journal of Medical Science and Diagnostic Research. 2019;32(1):75-80.
[28] Selkow NM, Grindstaff TL, Cross KM, Pugh K, Hertel J, Saliba S. Short-term effect of muscle energy technique on pain in individuals with non-specific lumbopelvic pain: A pilot study. Journal of Manual & Manipulative Therapy. 2009;17(1):E14-E18.
[29] Fryer G, Morris T, Gibbons P. Paraspinal muscles and intervertebral dysfunction: part one. Journal of Manipulative and Physiological Therapeutics. 2004;27(4):267-74.
[30] Ylinen J, Takala EP, Nykänen M, Häkkinen A, Mälkiä E, Pohjolainen T, et al. Active neck muscle training in the treatment of chronic neck pain in women: a randomized controlled trial. JAMA. 2003;289(19):2509-16.
[31] Colloca L, Benedetti F. How prior experience shapes placebo analgesia. Pain. 2006;124(1-2):126-33.
[32] Phadke A, Bedekar N, Shyam A, Sancheti P. Effect of muscle energy technique and static stretching on pain and functional disability in patients with mechanical neck pain: A randomized controlled trial. Hong Kong Physiotherapy Journal. 2016; 35:05-11.
[33] Fryer G, Morris T, Gibbons P. Paraspinal muscles and intervertebral dysfunction: part two. Journal of Manipulative and Physiological Therapeutics. 2004;27(5):348-57.

PARTICULARS OF CONTRIBUTORS:
1. Student, Department of Physiotherapy, SGT University, Haryana, India.
2. Dean, Department of Physiotherapy, SGT University, Haryana, India.
3. Assistant Professor, Department of Physiotherapy, SGT University, Haryana, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Mr. Shail Sachdeva,
New Delhi, India.
E-mail: shailsachdeva94@gmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: May 20, 2019
- Manual Googling: Oct 10, 2019
- iThenticate Software: Nov 20, 2019 (18%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:
- Financial or Other Competing Interests: No
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **May 19, 2019**
Date of Peer Review: **Jun 14, 2019**
Date of Acceptance: **Oct 10, 2019**
Date of Publishing: **Dec 01, 2019**

ANNEXURE 1

MC GILL PAIN QUESTIONNARE

Overview: The McGill Pain Questionnaire can be used to evaluate a person experiencing significant pain. It can be used to monitor the pain over time and to determine the effectiveness of any intervention. It was developed at by Dr. Melzack at McGill University in Montreal Canada and has been translated into several languages.

Sections:

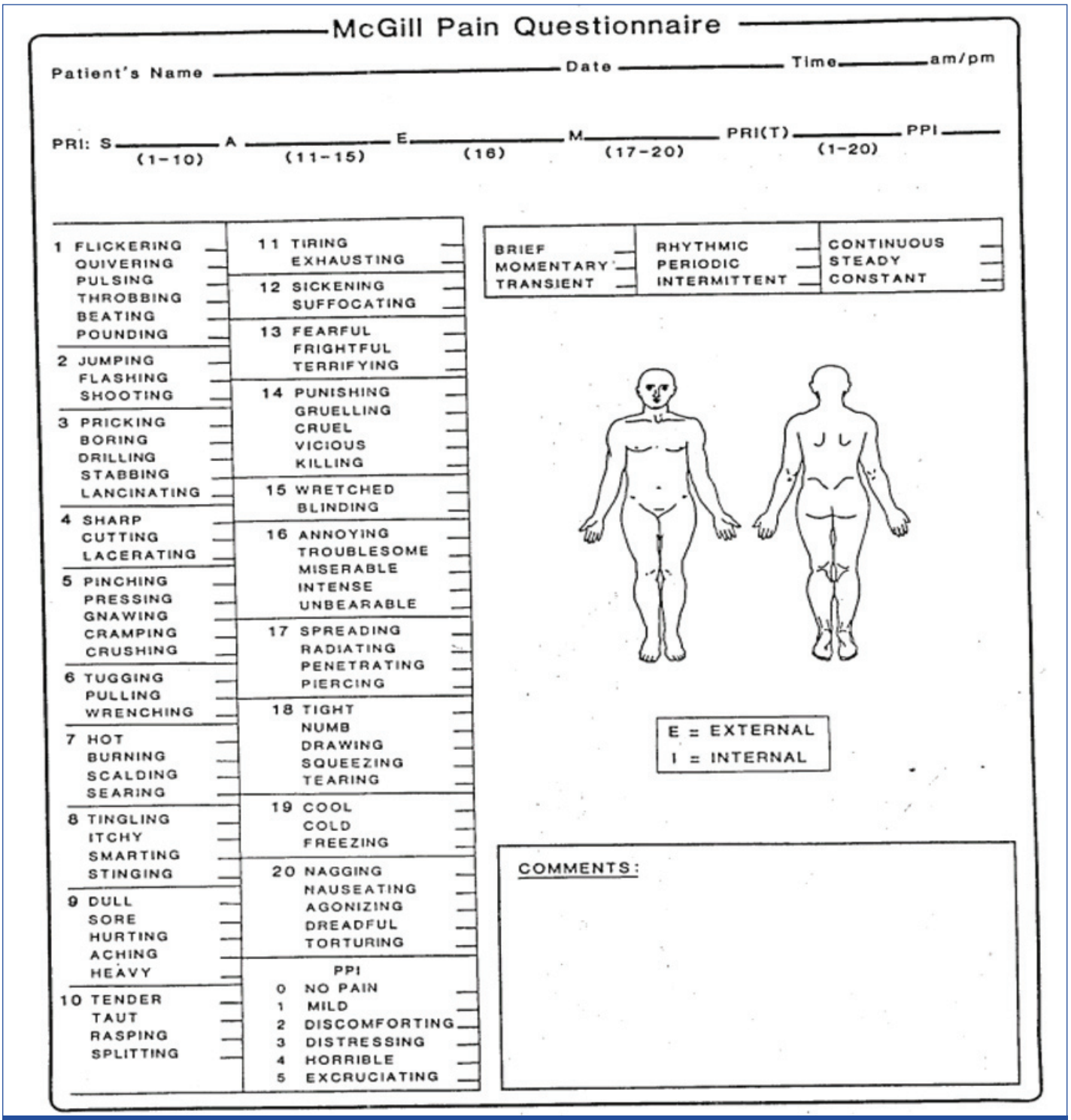
(1) What Does Your Pain Feel Like?

(2) How Does Your Pain Change with Time?

(3) How Strong is Your Pain?

What Does Your Pain Feel Like?

Statement: Some of the following words below describe your present pain. Circle ONLY those words that best describe it. Leave out any category that is not suitable. Use only a single Word in each appropriate category- the one that applies best.



McGill Pain Questionnaire. The descriptors fall into four major groups: sensory, 1 to 10; affective, 11 to 15; evaluative, 16; and miscellaneous, 17 to 20. The rank value for each descriptor is based on its position in the word set. The sum of the rank values is the pain rating index (PRI). The present pain intensity (PPI) is based on a scale of 0 to 5. Copyright 1970 Ronald Melzack.

ANNEXURE 2

NECK DISABILITY INDEX

This questionnaire has been designed to give us information as to how your neck pain has affected your ability to manage in everyday life. Please answer every section and mark in each section only the one box that applies to you. We realise you may consider that two or more statements in any one section relate to you, but please just mark the box that most closely describes your problem.

Section 1: Pain Intensity

I have no pain at the moment

The pain is very mild at the moment

The pain is moderate at the moment

The pain is fairly severe at the moment

The pain is very severe at the moment

The pain is the worst imaginable at the moment

Section 2: Personal Care (Washing, Dressing, etc.)

I can look after myself normally without causing extra pain

I can look after myself normally but it causes extra pain

It is painful to look after myself and I am slow and careful

I need some help but can manage most of my personal care

I need help every day in most aspects of self-care

I do not get dressed, I wash with difficulty and stay in bed

Section 3: Lifting

I can lift heavy weights without extra pain

I can lift heavy weights but it gives extra pain

Pain prevents me lifting heavy weights off the floor, but I can manage if they are conveniently placed, for example on a table

Pain prevents me from lifting heavy weights but I can manage light to medium weights if they are conveniently positioned

I can only lift very light weights

I cannot lift or carry anything

Section 4: Reading

I can read as much as I want to with no pain in my neck

I can read as much as I want to with slight pain in my neck

I can read as much as I want with moderate pain in my neck

I can't read as much as I want because of moderate pain in my neck

I can hardly read at all because of severe pain in my neck

I cannot read at all

Section 5: Headaches

I have no headaches at all

I have slight headaches, which come infrequently

I have moderate headaches, which come infrequently

I have moderate headaches, which come frequently

I have severe headaches, which come frequently

I have headaches almost all the time

Section 6: Concentration

I can concentrate fully when I want to with no difficulty

I can concentrate fully when I want to with slight difficulty

I have a fair degree of difficulty in concentrating when I want to

I have a lot of difficulty in concentrating when I want to

I have a great deal of difficulty in concentrating when I want to

I cannot concentrate at all

Section 7: Work

I can do as much work as I want to

I can only do my usual work, but no more

I can do most of my usual work, but no more

I cannot do my usual work

I can hardly do any work at all

I can't do any work at all

Section 8: Driving

I can drive my car without any neck pain

I can drive my car as long as I want with slight pain in my neck

I can drive my car as long as I want with moderate pain in my neck

I can't drive my car as long as I want because of moderate pain in my neck

I can hardly drive at all because of severe pain in my neck

I can't drive my car at all.

Section 9: Sleeping

I have no trouble sleeping

My sleep is slightly disturbed (less than 1 hr sleepless)

My sleep is mildly disturbed (1-2 hrs sleepless)

My sleep is moderately disturbed (2-3 hrs sleepless)

My sleep is greatly disturbed (3-5 hrs sleepless)

My sleep is completely disturbed (5-7 hrs sleepless)

Section 10: Recreation

I am able to engage in all my recreation activities with no neck pain at all

I am able to engage in all my recreation activities, with some pain in my neck

I am able to engage in most, but not all of my usual recreation activities because of pain in my neck

I am able to engage in a few of my usual recreation activities because of pain in my neck

I can hardly do any recreation activities because of pain in my neck

I can't do any recreational activities at all.

ANNEXURE 3

HEAD POSITION SENSE LASER TRACKER DEVICE

PURPOSE

The cervical joint position error test is used to assess cervicocephalic proprioception and neck reposition sense.

AREA OF ASSESSMENT

Pain

Range of motion

Vestibular

ABOUT

Its one's ability to relocate the head back to centre after maximal or submaximal rotation in transverse and sagittal planes. Patient should be seated in a chair that has a backrest with vision occluded with a blindfold or eyes closed. The target should be placed 90 cm in front of the patient and able to be adjusted to patient neutral head position this is the zero point or centre of the target. The patient is fitted with a laser pointer or similar targeting device to measure magnitude of head displacement from starting position.

The patient is instructed to perform an active head rotation to one side, after which he or she should return back to normal or neutral starting position. The point where this lands indicates error related to centre of the target.

EQUIPMENT REQUIRED

Common practice uses laser pointer fixed to a helmet or headband. Targets are typically 40 cm in diameter with concentric circles in 1 cm increments, divided into 4 quadrants intersecting at the zero.

PROCEDURE

The Head position sense was evaluated using the cervical joint position error testing using LASER tracker;

- Patient seated 90 cm from wall with tracker laser placed on head.
- With the patient eye closed, centre the laser on the bull's eye by manipulating the band to the right and left and the laser up and down.
- Instruct the patient "keeping your eyes closed, rotate the head all the way to right, left and return to the centre." Patient may open their eyes between trials.
- Perform three trials in each direction: right, left rotation, flexion, and extension.
- Make note of distance from start point, overshoot, quantity, speed of movement.

Equipment Required

Common clinical practice uses a laser pointer fixed to a helmet or headband and a mobile target. Targets are 40 cm in diameter with concentric circles in 1 cm increments, divided into 4 quadrants intersecting at the zero.