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Evaluating the Role of Cervicothoracic Manual Therapy in Cervicogenic Pain Management: A Randomized Controlled Trial

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Abstract

Introduction: Neck pain imposes a substantial physical, emotional, and financial burden worldwide. Although limited research supports the use of thoracic manual therapy in managing neck pain, clinicians often integrate upper thoracic techniques into treatment routines. This study aimed to compare the effectiveness of manual therapy applied solely to the cervical spine with that applied to both the cervical and upper thoracic regions in individuals with non-specific neck pain.

Methods: A randomized controlled trial was carried out at the Physical Therapy Department of Munir Medical Complex, Dir Lower. Participants aged 18–60 years with non-specific neck pain were randomly assigned to two groups. The control group received cervical manual therapy alone, while the experimental group underwent combined cervicothoracic

manual therapy over four weeks. Pain intensity and disability were measured using the Numeric Pain Rating Scale (NPRS) and the Neck Disability Index (NDI) at baseline and after treatment. Additional treatment effects were evaluated using the Treatment Effects Questionnaire (TEQ).

Results: The participants' mean age was 25.9 ± 9.6 years, with the majority being laborers (43.2%) and housewives (18.9%). The control group (n = 17) consisted of 82.4% males and 17.6% females, whereas the experimental group (n = 20) included 70.0% males and 30.0% females. Both groups were comparable in terms of demographic and baseline clinical characteristics ($P > 0.05$). Post-treatment findings revealed significant improvements in both groups; however, the experimental group demonstrated greater reductions in pain (from 5.55 ± 1.19 to 1.30 ± 0.97, $P < 0.001$) and disability (from 20.4 ± 7.78 to 7.50 ± 5.52, $P < 0.001$) compared to the control group ($P = 0.02$ and $P = 0.03$, respectively). TEQ outcomes showed no significant intergroup differences ($P > 0.05$), suggesting that manual therapy yields beneficial effects irrespective of the targeted spinal region.

Conclusion: Combining cervical and thoracic manual therapy provides superior improvement in pain and functional outcomes compared to cervical manual therapy alone in patients with non-specific neck pain.

Introduction

"Neck pain (NP) is a disturbing sensory experience around the neck region, which may or may not radiate to upper limb"(1). NP is a 4th most important musculoskeletal(MSK) problem that leads to disability in population(2). Approximately, 330 million individuals suffer from some type of NP worldwide(3). The total cost of NP is estimated to about 1.3% of total health care expenditure(4). Globally, point prevalence of NP ranged from 5.8% to 38.6%, 1 week prevalence ranged from 1.5% to 35.9%, 1 month prevalence ranged from 15.3% to 41.2%, 6 month prevalence ranged from 6.8% to 54.3%, 1 year prevalence ranged from 16.8% to 75.2% while lifetime prevalence ranged from 14.3% to 71.1%(4). In Sweden NP prevalence was 43.3%(5), in Norway NP prevalence was 27%(6) while in Canada NP prevalence was 47.9%(6). In North America, the lifetime prevalence of NP was 67% while point prevalence was 22%(7). In Hong Kong lifetime prevalence of NP was reported to be 65.4% while in same population 1 year NP prevalence was reported to be 53.6%(8). Lifetime prevalence of NP in Saskatchewan population (Canada) was 66.7%(9). NP is a major personal as well as community problem and it is reported that annually 31-51% individuals suffer from NP(7)There is little or no high-quality research available which provide information about NP relapse(10). Carroll LJ et al. explained in their study that 51% subjects again reported their NP after 1-5 years from initial onset(11). Mikkelsson M et al. reported that 48.3% school-going children's who suffered from NP more than a week, experienced NP again after 12 months(12). similarly Hill et al. reported about 46% relapse rate after 1 year(13). A research study established that merely 6.1% subjects were having non-recurrent NP after 1-year assessment(14). There are different treatment options available for treating NP patients. Different invasive and non-invasive interventions have been employed for treating NP patients(15). Non-invasive treatment options for treating NP include pharmacological treatment and PT. Though the use of medications gives short-term relief in NP yet proper management requires PT(16). David et al. stated that PT is a mainstay for managing NP(17). In clinical practice, a number of PT modalities are used for the management of NP. Myofascial release, passive stretching, neural tissue mobilization and cervical mobilization techniques are the most commonly selected

modalities for the treatment of NP(18). Other commonly used interventions for NP are cervical traction, hot packs, dry needling, ultrasound, TENS and muscle energy techniques(19).

High-quality RCT's and systematic reviews supported the effectiveness of MT techniques in NP patients(20). Hurley et al. reported that in clinical practice, 37.2% physical therapist uses MT techniques for treating NP(21). The effects produced by MT techniques are explained by different theories. The most authentic theory is that of Lederman. Lederman proposes that MT produces psychosomatic, neurological, and biomechanical effects. The psychological effects of MT are feelings of well-being and relaxation in the body. MT techniques enhance the flexibility of muscles and soft tissues and thus help in correction of biomechanical problems. Furthermore, MT enhances circulation of joint fluids, blood, and lymph. Neurological effects of MT are stimulation of descending inhibitory mechanisms, thus inducing hypo-algesia. MT also helps in diminishing spasm associated with acute injury(22). Though MT techniques are most commonly used in NP but Gross et al. reported that most of the existing evidence related to MT techniques in NP is of a poor standard. They emphasize that high-quality research projects must be carried out regarding MT techniques in NP(23). A literature review of existing evidence demonstrates that multimodal physical therapy treatment is much more efficient as compared to mobilization techniques alone in NP(23).

Cervical MT results in positive outcomes in most NP patients, however, lack of screening of patients prior to cervical MT can result in serious complications in those patients who are at risk for vertebrobasilar insufficiency (VBI)(24, 25). VBI in extreme cases can lead to infarction of brain stem and cerebellum(25). These statistics showed that cervical MT related risk factors are major concern among physical therapists(21). Symons et al. suggested that to avoid serious vascular complications associated with cervical MT, therapist must apply manual forces within limits of stability(26).Mann et al. argued that neutral cervical position is even more significant concern than the quantity of force applied during cervical MT to avoid risk associated with cervical MT. They concluded that to minimize risks associated with cervical MT; therapist must avoid extreme ranges of cervical extension and rotation. (27).It is hard to pin down exact mechanism through which thoracic MT helps in reducing NP. However, the close anatomical and biomechanical relationship of cervical and thoracic region and neural connections between cervical and thoracic spine is evident. Anatomically, the upper thoracic vertebrae's (T1-T3) are somewhat similar to lower cervical vertebrae's (C4-C7). Vertebral bodies of both upper thoracic vertebrae and lower cervical vertebrae are broad transversely and their spinous processes are long, thick and directed horizontally in contrast to other thoracic spine processes which are short, thin and directed obliquely. Articular facets of upper thoracic (T1-T3) and lower cervical (C4-C7) vertebrae are similar in sagittal plane orientation. Superior articular facets of both upper thoracic (T1-T3) and lower cervical (C4-C7) vertebrae are oriented in posterolateral direction. These anatomical similarities between upper thoracic (T1-T3) and lower cervical (C4-C7) vertebrae's imply that both these regions perform similar functions in sagittal plane(28). Furthermore, cervical part of sympathetic system arises from sympathetic trunk present in thoracic region(29).However, There is no high quality evidence available in literature which demonstrates that thoracic mobilization has an effect on sympathetic outflow.

Norlander et al. proposed that due to biomechanical relationship between cervical and thoracic spine there is considerable association between hypo-mobility in thoracic spine and NP(30). As head position is mainly maintained by lower cervical and upper thoracic region that's why muscular tightness or abnormal joint forces distribution in

cervico-thoracic junction is common cause of NP(31).Some authors reported that thoracic spine hypo-mobility impair activity of cervical spine which in turn causes tightness of muscles, fascia and other surrounding structures in cervico-thoracic junction which eventually leads to NP(32). Furthermore, it is also reported that postural abnormalities in one region of the vertebral column have adverse affects on whole spine. Changes in thoracic spinal curvatures have negative consequences on muscle activity of cervical spine which can lead to NP(33). Longissimus cervicus and Iliocostalis cervicus muscles which are primarily concerned with neck movements arise from ribs in thoracic region and insert in the cervical region(29). Thoracic MT lower mechanical stresses of cervical spine and improves normal distribution of joint forces, thus restoring normal biomechanics of cervical spine(24). For these reasons, it is assumed that thoracic MT in NP patients will result in positive outcomes(34).Skyba et al. explained that these effects of mobilization are due to stimulation of descending inhibitory mechanisms in CNS(35).

Despite the lack of evidence regarding use of thoracic MT in NP, physical therapists frequently apply some MT techniques to upper thoracic region in the management of NP. Hutchinson J. reported that in clinical practice, majority of physical therapists and osteopaths apply some MT techniques to thoracic region for the management of NP(36). In a survey carried out by Adams and Sim, it was reported that in UK most physical therapists use thoracic MT in NP patients as compared to cervical MT. Adam and Sim argued that though there is little evidence available regarding use of thoracic MT in NP patients, yet most physical therapist in UK use this modality because thoracic MT is less associated with serious risks e.g. VBI(37). Adverse effects associated with thoracic MT are only localized soreness and feeling of pressure in the area of spine where MT techniques are applied(24, 34, 38, 39).

it is clear from review of existing evidence that there are different views about the fact that how structure and activity of upper thoracic (T1-T3) region affects cervical region, yet there is strong anatomical, neural and biomechanical relationship between upper thoracic (T1-T3) and lower cervical (C4-C7) region. The treatment protocols considered in this research study presented information about role of MT techniques in reducing pain and disability in NP patients. In addition, it also enlarged the range of evidence- based modalities accessible to physical therapists for the management of NP.

LITERATURE REVIEW:

Literature search identified researches regarding use of thoracic MT in the management of NP but only few studies compare cervical and thoracic MT in the management of NP. In a RCT Elvey ML. compared MT to cervical and thoracic spine in management of NP. He assesses effects of MT on NP and on anxiety associated with NP. The result of his study showed significant reduction in NP and anxiety in both groups. In the group who received MT to both cervical and thoracic spine, mean pain score was marginally significant as compared to those patients who received cervical MT alone, in terms of pain reduction (P=0.08) (19, 40).In the study of Cleland et al. randomized 36 patients into thoracic manipulation group and placebo group to evaluate effectiveness of thoracic spine manipulation in NP. The results of their study demonstrated that NP patients who received thoracic spine manipulation reported immediate reduction in NP on VAS. The improvement in pain on 100 mm VAS in thoracic manipulation group was 15.6±7.6 mm while in placebo group improvement in pain was 4.1±4.6 mm. Patients in thoracic manipulation group reported no major side effects except mild soreness in cervico-thoracic junction(24).In a clinical trial Parkin et al. reported that cervical and thoracic manipulation in NP patients did not result in considerable pain reduction over those NP patients who

received cervical manipulation alone. Nevertheless, they reported that they applied massage to some NP patients. Because they didn't mention those NP patients or group of NP patients who received massage, it is not clear whether massage have manipulated outcomes of their study(41). In a RCT Lyndal sharples inspected results of thrust manipulation of upper thoracic spine on cervical ROM. Active cervical ROM was recorded before and after treatment. The results of study showed that mean increase in cervical rotation was 7.09 degrees and mean increase in cervical flexion was 4.30 degrees in those subjects who received upper thoracic spine manipulation 7.09 degrees. The results demonstrated that cervical ROM can be improved with upper thoracic manipulation(39).Kruss J et al. carried out RCT on sample size of 32 NP patients. Patients were divided into EG (n=22) and CG (n=10). EG were treated with thoracic MT while control group received no intervention. The outcome measures were cervical ROM measured with inclinometer and NP using faces pain scale (FPS). EG showed increase in cervical ROM with mean increase of 8.14 on inclinometer where CG showed decrease in cervical ROM with mean decrease of -0.6 on inclinometer. Pain was decreased 1.5 on Face pain scale in EG while in CG it was -.100 on Face pain scale(42).In a RCT Puentedura et al. compares effectiveness of thoracic spine manipulation and cervical spine manipulation in NP patients. Initially they screened 96 patients with primary complaint of NP. Only 24 patients fulfill eligibility criteria and remaining 72 were excluded. 24 patients were randomized, 10 received thoracic spine manipulation while 14 received cervical spine manipulation. 4 patients were reported as "loss to follow up" from cervical spine manipulation group. The results of their study showed greater improvement in those patients who received cervical spine manipulation. They concluded that more positive results can be achieved with manipulation directed to cervical spine in NP patients. 1 patient in cervical group reported increased NP after 1st treatment while no patient reported any side effect thereafter. After 1st treatment session, 8 patients in thoracic group reported minor side effects such as fatigue, headache, and soreness etc while after 2nd treatment session 7 patients reported minor side effects in thoracic group. Patients from both groups reported no adverse effects at 6 week follow up. No data is available regarding side effects of 4 patients of cervical group who dropped out of the study(43). In a RCT Joshua a Cleland et al. analyze effectiveness of thrust mobilization and non-thrust mobilization directed to thoracic spine in NP patients. Those NP patients who received thoracic thrust mobilization reported significant decrease in disability (difference between groups 5.3-14.7) and pain (difference between groups 1.4-2.7) as compared to those NP patients who received non thrust thoracic mobilization. Joshua A Cleland et al. concluded that in terms of pain and disability reduction, thoracic thrust mobilization is more effective as compared to non-thrust thoracic mobilization in NP patients(44).a RCT in which they evaluated thoracic manipulation in NP. One group received thoracic manipulation, exercises and infrared radiation while second group received only infrared radiations and exercises for their NP. Those NP patients who received thoracic manipulation reported significant improvement in NP and cervical ROM as compared to those NP patients who didn't receive thoracic manipulation. Herman et al. concluded that thoracic manipulation is efficient in decreasing pain and dysfunction in NP patients. Thoracic manipulation is also effective in improving cervical ROM and neck posture(45).Fernandez et al. carried out a research study to evaluate effectiveness of thoracic spine manipulation in reducing NP and improving cervical ROM. Their study was a case series in which they included 7 patients with nonspecific NP. A significant reduction in NP at rest was reported. Increase in cervical ROM was also reported but was not significant(34). In a RCT González-Iglesias J et al. evaluate effects of thoracic manipulation and physical agents on pain, disability and cervical ROM in NP patients. NP patients

(n=45) were included in the study and were randomized into CG and EG. Both groups received physical agents (TENS and hot packs). EG received thoracic manipulation along with physical agents. EG reported greater decrease in NP (between group difference of 2.3 points) and disability (between group difference of 8.5 points). González-Iglesias J et al. concluded that addition of thoracic manipulation into physical agent's protocol was more useful in NP patients(46).Flynn et al. reported that thoracic spine MT helps in reducing symptomatic NP. Nevertheless, there study fails to ascertain cause and effect relationship between NP and thoracic spine MT because of lack of control group in their study(47).Walker et al. carried out a RCT and included 94 subjects in their study. They found that MT and exercises effectively reduced NP. Walker et al, concluded that MT is one of the most effective PT technique for treating NP(48).Gross et al carried out a Cochrane review in which they review 33 RCT's related to use of MT in NP. They concluded that combination of PT exercises and MT are effective in the management of NP. They also reported that there is no considerable difference in the effects of mobilization or manipulation in NP patients(49).In a research study Pool JJ. et al concluded that NPRS is one of the most accurate and precise scale for reporting pain. They suggested that because of high validity and reliability of NPRS, it should be used for reporting pain in clinical settings as well as for research studies(50). NPRS is highly reliable in reporting both acute and chronic pain (51). In clinical settings, NPRS is a commonly used scale for measuring pain(52).The accuracy and precision of NDI in NP patients is reported by Ackelman. Ackelman suggested that because of high validity and reliability of NDI, it should be used for reporting level of disability in NP patients(53).In literature, MT is well supported in managing NP. Thoracic MT has shown promising results in preliminary studies for management of NP. However, Literature concerning use of thoracic MT in NP is not sufficiently available. In order to become clinically acceptable option for managing NP, effectiveness of thoracic MT in NP needs more research data. The only justification for use of thoracic MT techniques in NP is the anatomical, neural and biomechanical relationship between cervical and thoracic region.

Material and methods

Study design: Randomized controlled trial (RCT).

Sample size: Total 58 patients were randomly assessed during data collection and out of them 46 fulfill eligibility criteria. 5 were unwilling to participate that's why 41 patients were included in the study. Out of 41 included patients, 4 were lost to follow up and 37 patients completed the study.

Inclusion criteria

Patients were included in the study on the basis of the following inclusion criteria. Patients suffering from non-specific NP Patients from both genders having age 25 to 60 year and Patients who are willing to participate

Exclusion criteria

Acute trauma to cervical and/or thoracic region, Fractures of cervical and/or thoracic region, Surgery of cervical and/or thoracic region. History of neoplasm or malignancy, Vertebrobasilar insufficiency (VBI) and patients with Cervical radiculopathy.

Data collection tools

Numeric pain rating scale (NPRS)
NPRS was used to record pre and post treatment pain. NPRS is a 11 point scale ranging from 0, "no pain" to 10 "worst pain"(54).
Because of easy administration of NPRS and due to high responsiveness, NPRS is commonly used by researchers in research studies as well as by clinicians in clinical settings for measuring pain intensity(50). NPRS is also valuable because of its ability to identify small changes in pain intensity(55). A number of studies regarding management of NP used NPRS for measuring pain intensity(36, 51, 52, 56, 57).

Neck disability index (NDI)
NDI was used to evaluate pre and post level of disability. NDI was developed by Vernon et al. to evaluate effects of NP on ADL's(58). NDI is modified form of Oswestry Disability Index (ODI) and consist of 10 components, which include different ADL's e.g. personal care, driving, lifting etc. Each component is scored from 0 to 5, 0 represent no disability while 5 represent total disability. Higher NDI score indicate high perceived disability with NP.

Treatment Effects Questionnaire (TEQ)
TEQ was used to evaluate treatment effects. Elvey ML. developed TEQ to evaluate perceptions of NP patients regarding effects of MT directed at thoracic and cervical region(19). TEQ was constructed according to the views of the focus group of physical therapists.

Data Analysis
The data of the study was analyzed using SPSS version 16. Interventions were labeled as "independent variables" while pain (NPRS), disability (NDI) and treatment effects (TEQ) were taken as "dependent variables". Chi-Square test was used to compare demographic information, age and gender distribution between the groups. Paired-Samples T-test was used to analyze pre and post pain (NPRS) and disability (NDI) scores within groups while Independent- Samples T-test was used to analyze pain (NPRS) and disability (NDI) between groups. Statements of TEQ were compared between the groups using Chi-Square test. P value less than 0.05 was considered significant. Missing values were calculated using multiple imputations.

RESULTS
Demographic information
A total of 37 patients were included in the study. The mean age of the patients were 35.9 ± 9.6 years. Out of total 37 patients, 28 (75.7%) patients were male while 9 (24.3%) were female. By profession, most of the patients were laborer (43.2%, n=16), house wives (18.9%, n=7), teachers (8.1%, n=3) and students (5.4%, n=2) while rest of 24.4% (n=9) patients were having other professions.

Comparison of the demographic data of control and experimental group
Patients in CG ranged in age from 25 to 58 years and their mean age was 36.8±11.6. Patients in EG ranged in age from 26 to 54 years and their mean age was 35.2±7.8. The CG and EG did not differ significantly with respect to age distribution (P =0.494). The CG consisted of 17 subjects in which 14 (82.4%) were males while 3 (17.6%) were females. On the other hand, EG consisted of 20 subjects in which 14 (70.0%) were males while 6 (30.0%) were females. The CG and EG did not differ significantly in terms of gender distribution (P=0.383).

In CG 10 (58.8%) patients were laborers, 2 (11.8%) were house wives and 1 was teacher (5.9%) while rest of 4 (23.5%) patients were having other professions. In EG, 6 patients (30.0%) were laborers, 5 (25.0%) were house wives, and 2 (10.0%) were teachers while rest of 7 (35.0%) patients were having other professions.
Comparison of the demographic data of CG and EG

Variable	CG(n= 17)	EG (n= 20)	P-valve
Age (Mean ± S.D)	36.8 ± 11.6	35.2 ± 7.8	0.494
Gender			
Male	14 (82.4%)	14 (70.0%)	0.383
Female	3 (17.6%)	6 (30.0%)	
Occupation			
Laborer	10 (58.8%)	6 (30.0%)	
House wives	2 (11.8%)	5 (25.0%)	
Teachers	1 (5.9%)	2 (10.0%)	
Others	4 (23.5%)	7 (35.0%)	

Comparison of base line scores of Pain and disability between groups
Pain on NPRS, in CG ranged from 3/10 to 8/10 and mean value for pain was 5.41 ± 1.37. While in EG pain ranged from 4/10 to 8/10 on NPRS and mean valve for pain was 5.55 ± 1.19. There was no significant difference between CG and EG in terms of level of pain on NPRS (P valve = 0.125).

Comparison of post-treatment numeric pain rating scale (NPRS) scores between groups
In CG baseline mean NPRS score was 5.41 ± 1.37 while post treatment NPRS score was 2.35 ±1.61. In EG baseline mean NPRS score was 5.55 ± 1.19 while post treatment NPRS score was 1.30 ± 0.97. After 2 week of treatment, mean NPRS score for CG was 2.35 ± 1.61 while mean NPRS score for EG was 1.30 ± 0.97. The EG post-treatment mean NPRS score was significant when compared to the CG in terms of pain reduction (P valve=0.02).

Table 4. 1: Comparison between pre and post-treatment NPRS scores

	Pre-treatment (NPRS score)	Post-treatment (NPRS score)	P-Value
CG (Mean ± S.D) (n= 17)	5.41 ± 1.37	2.35 ±1.61	0.02
EG(Mean ± S.D) (n= 20)	5.55 ± 1.19	1.30 ± 0.97	

Comparison of Neck disability index (NDI) scores between groups
In CG baseline mean NDI score was 23.8 ± 9.40 while post treatment NDI score was 12.4 ± 7.05. In EG baseline mean NDI score was 20.4 ± 7.78 while post treatment NDI score was 7.50 ± 5.52. After 2 week of treatment, mean NDI score for CG was 12.4 ± 7.05 while mean NDI score for EG was 7.50 ± 5.52. The EG mean NDI score was significant when compared to the CG (P valve=0.03).
Comparison between pre and post-treatment NDI scores

	Pre-treatment (NDI score)	Post-treatment (NDI score)	P-Value
CG (Mean ± S.D) (n= 17)	23.8 ± 9.40	12.4 ± 7.05	0.03
EG(Mean ± S.D) (n= 20)	20.4 ± 7.78	7.50 ± 5.52	

Comparison of groups about increase mobility post-treatment

A simple question "I feel more mobile" was asked from patients to find out about increased spinal mobility after treatment sessions. Both study groups were compared with regard to responses about increased spinal mobility after completion of treatment sessions. The differences between CG and EG were not significant with regard to increase in spinal mobility (P-valve = 0.391). It can be deduce from analysis of results that thoracic MT along with cervical MT as well as cervical MT alone increases spinal mobility in non specific NP patients.

Table 4. 2: Comparison of groups about increase mobility post-treatment

	CG (n= 17)	EG (n= 20)	Total(n=37)	P-value
Very much so	5 (29.4%)	8 (40.0%)	13 (35.1%)	
Moderately so	7 (41.2%)	9 (45.0%)	16 (43.3%)	0.391
Somewhat	5 (29.4%)	2 (10.0%)	7 (18.9%)	
Not at all	0 (0%)	1 (5.0%)	1 (2.7%)	

Comparison of groups regarding pain relief after treatment

A simple question "I feel less pain" was asked from patients to find out whether NP had decreased after treatment or not. This was a simple statement and did not evaluate quality or amount of pain reduction. NPRS was separately used to evaluate pre and post treatment pain and to assess amount of pain reduction post treatment.

The differences between CG and EG were not significant with regard to pain reduction statement on TEQ (P-valve = 0.173), but the EG post treatment mean NPRS score was significant when compared to the CG in terms of pain reduction (P valve=0.02).

Comparison of groups regarding pain relief after treatment

	CG (n= 17)	EG (n= 20)	Total (n= 37)	P-value
Very much so	10 (58.9%)	15 (75.0%)	25 (67.6%)	
Moderately so	1 (5.9%)	3 (15.0%)	4 (10.8%)	0.173
Somewhat	3 (17.6%)	2 (10.0%)	5 (13.5%)	
Not at all	3 (17.6%)	0 (0%)	3 (8.1%)	

Comparison of groups about confidence with treatment protocol

A simple question "I feel confident with the treatment " was asked from patients to find out confidence level of patients with treatment protocol.

Comparison of groups about feelings of warmth

A simple question "I feel warm" was asked from patients to find out feelings of pleasant warmth after completion of treatment session. CG and EG were compared with regard to responses about feelings of warmth with treatment protocols. The results showed that there was no significant difference between CG and EG with regard to responses about feelings of warmth with treatment protocol (P-valve = 0.323). Consequently, it can be deduced that patients felt pleasant warmth with both treatment protocols and both treatment protocols were equivalent in this regard.

Comparison of groups about pain with treatment protocols

A simple question "I am surprised that it is painful there" was asked from patients to find out about feeling of pain in areas other than neck region with treatment protocols. CG and EG were compared with regard to responses about feeling of pain in areas other than neck region with treatment protocols. The results showed that there was marginally significant difference between CG and EG with regard to responses about feelings of pain in areas other than neck region (P-valve = 0.062). This difference can be attributed due to the reason that patients in EG received therapy to more areas (cervical as well as thoracic spine) as compared to CG (cervical spine alone). Consequently, it can be deduced that patients in EG felt pain in more areas as compared to CG.

Comparison of groups about pain with treatment protocols

	CG (n= 17)	EG (n= 20)	Total (n= 37)	P-value
Very much so	4 (23.5%)	0 (0%)	4 (10.8%)	
Moderately so	6 (35.3%)	8 (40.0%)	14 (37.9%)	0.062
Somewhat	7 (41.2%)	9 (45.0%)	16 (43.2%)	
Not at all	0 (0%)	3 (15.0%)	3 (8.1%)	

Comparison of groups about effects of education received

A simple question "effects are mainly due to the advice/education received" was asked from patients to find out view of patients about effect of the advice or education received from therapist during therapy.

CG and EG were compared with regard to responses about effect of the advice or education received from therapist during therapy. The differences between CG and EG were not significant about effect of the advice or education received from therapist during therapy (P-valve = 0.552).

Table 4. 3: Comparison of groups about effects of education received

	CG (n= 17)	EG (n= 20)	Total (n= 37)	P-value
Very much so	7 (41.2%)	6 (30.0%)	13 (35.1%)	
Moderately so	5 (29.4%)	9 (45.0%)	14 (37.8%)	0.552
Somewhat	5 (29.4%)	4 (20.0%)	9 (24.4%)	
Not at all	0 (0%)	1 (5.0%)	1 (2.7%)	

DISCUSSION

NP is associated with incredible human sufferings and financial cost and physical therapy is treatment of choice for managing NP(17). A number of PT modalities are used for the management of NP, but MT is the most commonly used technique in clinical practice(18, 20, 21). Effectiveness of Cervical MT in the management of NP is reported by previous research studies, however literature regarding thoracic MT in the management of NP is scarce(15, 20, 52, 59). The objective of current study was to compare the effectiveness of manual therapy to the cervical spine with and without manual therapy to the upper thoracic spine in the management of non-specific neck pain.The mean age of the patients in current study were 35.9 ± 9.6 years and age of subjects ranged from 25 to 58 years. Previous studies reported that due to postural problems non specific NP is high in younger age(60, 61) and that's why prevalence of non-specific NP is high between the ages of 20 to 45 years(36).In current study, MT techniques were used for the management of non-specific NP and as due to poor posture and occupational habits non specific NP is high in young people(10, 36), majority of patients in current study were young. In contrast to other studies which

reported that prevalence of NP is high in female as compared to male(60-62), majority of patients (75.7%) patients in current study were male while remaining 24.3% patients were female. This can be explained by the fact that, in the current study, patients was assessed and treated by 2 male physical therapists and 1 female physical therapist, that's why number of male are high as compared to female. Moreover, current study was conducted in a male dominant society, that's why visit of male patients to PT departments was more as compared to female. Though number of male were high as compared to female but the CG and EG did not differ significantly in terms of gender distribution (P=0.383).

Pain reduction after cervical MT in NP patients is supported by many previous studies(60, 63, 64). In accordance with the results of current, previous studies also reported effectiveness of thoracic MT in the management of NP(19, 24). Comparison of post-treatment NPRS scores between groups showed that EG post-treatment mean NPRS score was significant when compared to the CG in terms of pain reduction (P valve=0.02). Literature search identified few studies which compared cervical MT and thoracic MT in the management of NP(19, 24, 39, 43, 46, 56, 65, 66). In a research project Elvey ML. compared MT to cervical and thoracic spine in the management of NP. The result of his study showed significant reduction in pain in both groups. In the group who received MT to both cervical and thoracic spine, mean pain score was marginally significant as compared to those patients who received cervical MT alone, in terms of pain reduction (P=0.08)(19). Similarly results of RCT carried out by Cleland et al. also reported immediate reduction in NP after thoracic MT. The improvement in pain on 100 mm VAS in thoracic manipulation group was 15.6±7.6 mm while in placebo group improvement in pain was 4.1±4.6 mm(24). In contrast to results of current study, Parkin et al. reported that cervical and thoracic manipulation in NP patients did not result in considerable pain reduction over those NP patients who received cervical manipulation alone. Nevertheless, they reported that they applied massage to some NP patients. Because they didn't mention those NP patients or group of NP patients who received massage, it is not clear whether massage have manipulated outcomes of their study(41).From the results of current study, it can be concluded that though both cervical along with thoracic MT as well as cervical MT alone, is effective in reducing NP. Yet cervical along with thoracic MT is more effective in reducing NP when compared to cervical MT alone and thus patients with non-specific NP respond better in terms of pain reduction to cervical along with thoracic MT. Thoracic MT lower mechanical stresses of cervical spine and improves normal distribution of joint forces, thus restoring normal biomechanics of cervical spine (24, 34). That's why it is suggested by research studies that improvement in NP from thoracic MT can be attributed to restoration of normal biomechanics of thoracic region(67, 68).

Similar to results of current study González-Iglesias J et al. also reported that addition of thoracic MT into PT protocol is more effective in reducing disability associated with NP(46). Similar results were also provide by Cleland et al. and reported that Thoracic MT is effective in reducing disability associated with NP(24, 65, 66).

One of previous systematic review reported no evidence to support thoracic MT instead of cervical MT in reducing disability associated with NP(69). Yet results of current studies showed that as compared to GC (patient who received cervical MT alone), EG (patient who received both cervical and thoracic MT) reported significant reduction in disability. Again the discrepancy can be due to the fact that in current study patients in EG received both cervical and thoracic MT.

CONCLUSIONS

Cervicothoracic MT and cervical MT alone reduces NP and disability significantly. Yet cervical along with thoracic MT reduces pain and disability more effectively than cervical MT alone. There is no difference between cervical along with thoracic MT and cervical MT alone in terms of treatment effects as listed in the TEQ.

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