THORACIC MANUAL THERAPY IN THE MANAGEMENT OF NECK PAIN: REVIEW OF THE LITERATURE

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ABSTRACT

Neck pain is associated with incredible human sufferings and financial costs. Different non-invasive interventions including physical therapy have been employed for treating neck pain patients. Manual therapy is the most commonly applied physical therapy intervention for managing neck pain.

Considering risk factors associated with cervical manual therapy, literature suggests that thoracic manual therapy should be used to avoid risks associated with cervical manual therapy and attain same therapeutic goals as achieved with cervical manual therapy. It is hard to pin down exact mechanism through which thoracic manual therapy helps in reducing neck pain. 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 current article aims to review the existing literature regarding thoracic manual therapy in the management of neck pain.

KEY WORDS: Cervical, Manual therapy, Neck pain, Thoracic

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BACKGROUND

Neck pain is a 4th most important musculoskeletal(MSK) problem that leads to disability in population(1).About, 330 million individuals suffer from some type of Neck pain worldwide(2). The total cost of Neck pain is estimated to about 1.3% of total health care expenditure(3). Globally, point prevalence of Neck pain 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%(3).

There are different treatment options available for treating neck pain patients. Different invasive and non-invasive interventions have been employed for treating neck pain patients(4). Non-invasive treatment options for treating neck pain include pharmacological treatment and physical therapy. Though the use of medications gives short-term relief in neck pain yet proper management requires physical therapy T(5). David et al. stated that physical therapy is a mainstay for managing neck pain (6). In clinical practice, a number of physical therapy modalities are used for the management of neck pain. Myofascial release, passive stretching, neural tissue mobilization and cervical mobilization techniques are the

most commonly selected modalities for the treatment of neck pain(7). Other commonly used interventions for neck pain are cervical traction, hot packs, dry needling, ultrasound, TENS and muscle energy techniques(8).

CERVICAL MANUAL THERAPY IN THE MANAGEMENT OF NECK PAIN

High-quality RCT's and systematic reviews supported the effectiveness of manual therapy techniques in neck pain patients(9). Hurley et al. reported that in clinical practice, 37.2% physical therapist uses manual therapy techniques for treating neck pain(10). The effects produced by manual therapy techniques are explained by different theories. The most authentic theory is that of Lederman. Lederman proposes that manual therapy produces psychosomatic, neurological, and biomechanical effects. The psychological effects of manual therapy are feelings of well-being and relaxation in the body. Manual therapy techniques enhance the flexibility of muscles and soft tissues and thus help in correction of biomechanical problems. Furthermore, manual therapy enhances circulation of joint fluids, blood, and lymph. Neurological effects of manual therapy are stimulation of descending inhibitory mechanisms, thus inducing hypo-algesia. manual therapy also helps in diminishing spasm associated with acute injury(11). A literature review of existing evidence demonstrates that multimodal physical therapy treatment is much more efficient as compared to mobilization techniques alone in neck pain (12).

Cervical manual therapy results in positive outcomes in most neck pain patients, however, lack of screening of patients prior to cervical manual therapy can result in serious complications in those patients who are at risk for vertebrobasilar insufficiency (VBI)(13, 14). VBI in extreme cases can lead to infarction of brain stem and cerebellum(14). Haldeman et al.

argued that because most of the screening tools used for neck pain patients in physical therapy practice are not good enough to identify patients at risk, that's why cervical manual therapy especially manipulation techniques should be used with caution(15). In a cross sectional survey 88.2% (n=118) Canadian physical therapist suggested that before cervical manual therapy, screening tests should be thoroughly applied. These statistics showed that cervical manual therapy related risk factors are major concern among physical therapists(10). Symons et al. suggested that to avoid serious vascular complications associated with cervical manual therapy, therapist must apply manual forces within limits of stability(16).Mann et al. argued that neutral cervical position is even more significant concern than the quantity of force applied during cervical manual therapy to avoid risk associated with cervical manual therapy. They concluded that to minimize risks associated with cervical manual therapy; therapist must avoid extreme ranges of cervical extension and rotation. (17).

THORACIC MANUAL THERAPY IN THE MANAGEMENT OF NECK PAIN

Considering risk factors associated with cervical manual therapy, Erhard et al. suggested that thoracic manual therapy should be used to avoid risks associated with cervical manual therapy and attain same therapeutic goals as achieved with cervical manual therapy(18). Some authors argued that clinically it is important to assess thoracic spine thoroughly in neck pain patients because structural, neural or biomechanical problems in thoracic spine can lead to neck pain(19). There is limited evidence available about use of thoracic spine manual therapy in neck pain. Cleland et al. in their research article states that because high quality evidence is available regarding effectiveness of cervical manual therapy in neck pain, that's why we do not suggest avoiding cervical manual therapy in neck pain. However, thoracic manual therapy is a reasonable alternative in those neck pain patients who are at risk for VBI. Moreover, thoracic manual therapy in neck pain patients act as supplement to therapeutic modalities applied to cervical spine(13).

It is hard to pin down exact mechanism through which thoracic manual therapy helps in reducing neck pain. 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's and lower cervical vertebrae's 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's are similar in sagittal plane orientation. Superior articular facets of both upper thoracic (T1-T3) and lower cervical (C4-C7) vertebrae's 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(20). Furthermore, cervical part of sympathetic system arises from sympathetic trunk present in thoracic region(21).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 neck pain(22). 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 neck pain(23).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 neck pain(24). 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 neck pain(25). 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(21). Thoracic manual therapy lower mechanical stresses of cervical spine and improves normal distribution of joint forces, thus restoring normal biomechanics of cervical spine(13). For these reasons, it is assumed that thoracic manual therapy in neck pain patients will result in positive outcomes(26).

Besides anatomical and biomechanical relationship, therapeutic effects of thoracic manual therapy in neck pain patients are due to reflexive responses as well as mechanical effects on shortened muscles. Moreover, manual therapy results in release of natural analgesics (e.g. endorphins) which helps in reducing neck pain. In addition to this, effects of thoracic manual therapy in neck pain can be explained by the fact that mobilization at location other than the area of the pain can induce hypo-algesia(27). Skyba et al. explained that these effects of mobilization are due to stimulation of descending inhibitory mechanisms in CNS(28).

Despite the lack of evidence regarding use of thoracic manual therapy in neck pain, physical therapists frequently apply some manual therapy techniques to upper thoracic region in the management of neck pain. Hutchinson J. reported that in clinical practice, majority of physical therapists and osteopaths apply some manual therapy techniques to thoracic region for the management of neck pain(29). In a survey carried out by Adams and Sim, it was reported that in UK most physical therapists use thoracic manual therapy in neck pain patients as compared to cervical manual therapy. Adam and Sim argued that though there is little evidence available regarding use of thoracic manual therapy in neck pain patients, yet most physical therapist in UK use this modality because thoracic manual therapy is less associated with serious risks e.g. VBI(30). Adverse effects associated with thoracic manual therapy are only localized soreness and feeling of pressure in the area of spine where manual therapy techniques are applied(31).

In clinical practice, physical therapist commonly measure cervical range of motion (ROM) to assess neck pain

patients. Thoracic manual therapy is efficient modality for restoring ROM while minimal risks are associated with it(31). Cervical ROM is frequently applied functional outcome measure in physical therapy practice. It is reported that normal or near normal cervical ROM is necessary for prevention of neck pain(32).Assessment of cervical ROM along with assessment of quality, nature and area of neck pain guides physical therapists in diagnosis and treatment of neck pain and are considered necessary for clinical decision making. Documentation of these assessment tools help clinicians to assess treatment outcomes in neck pain patients(26). Effectiveness of thoracic manual therapy in improving cervical ROM is reported by previous studies(13, 26, 33).

Previous researches demonstrate that application of myofacial release of cervical and upper thoracic region in neck pain patient's results in considerable decrease in neck pain(8).Hence it can be assumed that manual therapy techniques to cervical and thoracic region offer more positive outcomes in neck pain(34). These positive outcomes include decrease in pain and anxiety, increase ROM and feelings of relaxation in neck pain patients(13). In a RCT Cleland et al. observed effects of thrust techniques at cervico-thoracic junction in neck pain patients. Their study illustrated significant decrease in neck pain as compared to placebo manipulation. Cleland et al. hypothesize that joint mobility deficits in thoracic region are a causal contributor to neck pain(13). Flynn et al. reported that thoracic spine manual therapy helps in reducing symptomatic neck pain. Nevertheless, there study fails to ascertain cause and effect relationship between neck pain and thoracic spine manual therapy because of lack of control group in their study(35).

To sum up, 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.

EXISTING LITERATURE REGARDING THORACIC MANUAL THERAPY IN THE MANAGEMENT OF NECK PAIN

In a Randomized controlled trial (RCT), Cleland et al. randomized 36 patients into thoracic manipulation group and placebo group to evaluate effectiveness of thoracic spine manipulation in neck pain. The results of their study demonstrated that neck pain patients who received thoracic spine manipulation reported immediate reduction in neck pain 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(13).

In a RCT Joshua a Cleland et al. analyze effectiveness of thrust mobilization and non thrust mobilization directed to thoracic spine in neck pain patients. Those neck pain 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 neck pain 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 neck pain patients(36).

In a RCT González-Iglesias J et al. evaluate effects of thoracic manipulation and physical agents on pain, disability and cervical ROM in neck pain patients. Neck pain patients (n=45) were included in the study and were randomized into control group and experimental group. Both groups received physical agents (TENS and hot packs). Experimental group received thoracic manipulation along with physical agents. Experimental group reported greater decrease in neck pain (between group differences of 2.3 points) and disability (between group differences of 8.5 points). González-Iglesias J et al. concluded that addition of thoracic manipulation into physical agent's protocol was more useful in neck pain patients(37).

Lau et al. carried out a RCT in which they evaluated thoracic manipulation in neck pain. One group received thoracic manipulation, exercises and infrared radiation while second group received only infrared radiations and exercises for their neck pain. Those neck pain patients who received thoracic manipulation reported significant improvement in neck pain and cervical ROM as compared to those neck pain patients who didn't received thoracic manipulation. Herman et al. concluded that thoracic manipulation is efficient in decreasing pain and dysfunction in neck pain patients. Thoracic manipulation is also effective in improving cervical ROM and neck posture(38).

In a RCT Puentedura et al. compares effectiveness of thoracic spine manipulation and cervical spine manipulation in neck pain patients. Initially they screened 96 patients with primary complaint of neck pain. 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 neck pain patients. 1 patient in cervical group reported increased neck pain 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(39).

Kruss J et al. carried out RCT on sample size of 32 neck pain patients. Patients were divided into EG (n=22) and CG

(n=10). EG were treated with thoracic manual therapy while control group received no intervention. The outcome measures were cervical ROM measured with inclinometer and neck pain 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(32).

Table 1: Existing literature regarding thoracic manual therapy in the management of neck pain

Author	Experimental group	Control group	Follow up	Outcome Measures	Findings
Cleland et al 2005	Thoracic manual therapy	Placebo	Immediately following thoracic manual therapy	VAS	Experimental group demonstrated significant improvement in pain
Cleland et al 2007	Thrust mobilization to thoracic spine	Non thrust mobilization to thoracic spine	2–4 days	NPRS NDI GROC	Experimental group demonstrated significant improvement in pain and disability
Gonzalez-Iglesias et al 2009	Thoracic manual therapy along with electrotherapy	Electrotherapy	1 week	NPRS NPQ	Experimental group demonstrated significant improvement in pain and disability
Lau et al. 2011	Thoracic manual therapy along with Infrared radiation therapy and exercise program	Infrared radiation therapy and exercise program	4 weeks 3 months 6 months	NPRS NPQ	Experimental group demonstrated significant improvement in pain and disability at 1,2 and 6 month follow up
Puentedura et al. 2011	Thoracic manual therapy along with exercise program	Cervical manual therapy along with exercise program	1 week 4 weeks 6 months	NPRS NDI GROC	No significant differences between groups in disability at 1 week and 4-week follow-up, however, the control group experienced significant improvement in disability at 6-month follow-up
Krauss et al. 2013	Thoracic manual therapy	No intervention	Immediately following thoracic manual therapy	FPS	Experimental group demonstrated significant improvement in pain

FPS, Faces Pain Scale; GROC, Global Rating of Change; NDI, Neck Disability Index; NPQ, Northwick Park Neck Pain Questionnaire; NPRS, Numerical Pain Rating Scale VAS, visual analog scale;

CONCLUSION

In literature, manual therapy is well supported in managing neck pain. Thoracic manual therapy has shown promising results in preliminary studies for management of neck pain. However, Literature concerning use of thoracic manual therapy in neck pain is not sufficiently available. In order to become clinically acceptable option for managing neck pain, effectiveness of thoracic manual therapy in neck pain needs more research data.

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