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RESEARCH ARTICLE

Effect of thrust versus non-thrust mobilization directed at the thoracic spine in patients with mechanical neck pain: A randomized control trial

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ABSTRACT

Background: Neck pain (NP) is a major public health problem, both in terms of personal health and overall well-being as well as indirect expenses. Recently, published clinical practice guidelines suggest that the combination of manual therapy and therapeutic exercise is effective in patients with mechanical NP. One approach to conservative treatment of NP includes cervical mobilization, but it causes complications such as vertebra-basilar artery injury and paraplegia. Alternatively, thoracic spine thrust manipulation may effectively address mechanical NP. **Aim and Objective:** This study aims to compare the effect of thrust versus non-thrust mobilization of the thoracic spine in patients with mechanical NP. **Materials and Methods:** Seventy-five participants participated with 38 in Group 1 and 37 in Group 2. Group 1 received thrust mobilization whereas Group 2 received non-thrust mobilization. Outcomes were measured in the form of the numerical rating scale and neck disability index pre-intervention, immediately after treatment, and after 5 days of intervention. **Results:** Data were analyzed using paired and unpaired "*t*-test" and results showed that there was a significant improvement in both outcomes immediately and after 5 days of intervention in both groups. However, the greater improvement was seen in Group 1 compared to Group 2. **Conclusion:** It is concluded that thrust and non-thrust mobilizations of the thoracic spine are effective in patients with NP but thrust mobilization is more effective.

KEY WORDS: Thrust Mobilization; Non-Thrust Mobilization; Thoracic Spine; Mechanical Neck Pain

INTRODUCTION

Neck pain (NP) is one of the most important public health problems, both in terms of personal health and general well-being as well as indirect expenses.[1] From the perspective of the individual, NP induces activity limitations in daily life such as driving, reading, sleeping, and leisure activities more broadly; work absenteeism, reduced productivity, and treatment cost for NP impose substantial cost to the society.[2]

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Non-specific NP can be defined as simple NP without specific underlying disease causing the pain which is also known as mechanical NP. Symptoms of this may vary with physical activity and overtime. Pain in the neck may be acute, subacute, or chronic, where no atypical anatomic arrangement, as the cause of pain, can be identified as non-specific NP.[3] Usually, pain is regarded as chronic when it lasts or reoccurs for more than 3 months.[4] Initial first therapeutic option for individuals with insidious onset of mechanical NP is a physical therapy which includes spinal joint manipulation, exercises, and soft-tissue techniques, which are typically used for the treatment of mechanical NP.[5] There are different manual therapies for the treatment of NP such as massage, manipulations, mobilization, and myofascial release. Mobilization of the spine is a manual treatment in which a vertebral joint is passively moved between the normal range of motion and the limits of its normal integrity.[6] Practically, all physical

therapists use spinal manipulation regularly to treat neck and other musculoskeletal pain.[7] It generally uses a high-velocity thrust in which the joints are adjusted rapidly, often associated with pop sounds results in stretching of joint capsules which, according to researchers belief change the position of the spinal cord and nerves, allowing the nervous system to function properly and enhances the biomechanical efficiency of the body.[8]

Not like techniques of thrust mobilization, only some studies have discovered the utilization of non-thrust cervical manipulation to treat mechanical NP which includes central as well as one-sided posterior-to-anterior pressures.[9] However, the potential for complications caused by manipulation of the cervical spine such as vertebrobasilar artery injury has been extensively discussed in the literature.[10] There are very less data available which carries this theoretical source as how manual therapy applied at the thoracic spine may be effective in decreasing pain and get better function in the individual among pain in cervical region. Most of the research had studied the effects of thrust and non-thrust mobilization applied to the thoracic spine separately. As a result, it is not much clear that both of the methods have same effects. Hence, these studies have only investigated the short-term effects of thoracic spine mobilization on NP. Therefore, this study aimed to compare the effectiveness of thrust mobilization and non-thrust mobilization at immediate after the intervention and after 5 days of intervention directed at the thoracic spine for chronic mechanical NP patients.

MATERIALS AND METHODS

Ethical approval from the Institutional Ethics Committee of the institute and registration from the Clinical Trial Registry of India (CTRI/2019/01/016930) was taken and then data collection was started. Patients with chronic mechanical NP, that is, more than or equal to 3 months in duration and those seeking treatment at the physiotherapy department of tertiary care hospitals were recruited provided they satisfy inclusion and exclusion criteria. All the eligible patients were randomly assigned to two groups using a computer-generated scheme (WINPEPI software). The allocation of treatment was stored in concealed envelopes and the treatment was allotted only after eligible participant gives consent for the study. Inclusion criteria were age between 20 and 50 years, with a pain in cervical or neck region with no radiating pain in one or both upper limbs, pain minimum of 3 months, and the neck disability index (NDI) score of should be at least 10% and exclusion criteria were any signs indicating an non-musculoskeletal origin, recent whiplash injury, cervical canal stenosis, spinal nerve root compression or any indication of central nervous system attachment, and patients taking pharmacological intervention for pain reduction. For all patients, a standardized history and detailed physical examination were taken before the intervention. After examination of patients, a self-reported outcome measures including the NDI and the numeric pain rating scale (NPRS) were taken.

After the baseline evaluation and random allocation, patients who came under Group 1 (interventional group) received thoracic spine thrust mobilization and patients who came under Group 2 (control group) received thoracic spine non-thrust mobilization. Along with mobilization both the groups received moist heat for 10 min and therapeutic exercises in the form of general mobility exercises of the neck (10 repetitions 3 times/day).[11] The intervention to both groups was given for 5 days. Self-reported outcome measures were taken immediately after the session and after 5 days in the form of NDI and NPRS.

Group: 1 (Thrust Mobilization Group)

The patients received thrust mobilization at upper thoracic spine by placing the patient in the crook lying position and between the T1 and T4 spinous process were targeted along with it the patients who were asked to hold his or her hands to the contrary shoulder. To create flexion of spine, patient's arms have been pulled downward. The therapist's hand which was providing manipulation would be stabilized the moving segment (inferior vertebrae), and the force has been applied to the patient's arm by the therapist's body which produces a high-velocity and low-amplitude thrust. If no pop was heard, then the therapist can be repositioned the patient and executed the mobilization again up to 2 times. The time required to complete the thrust mobilization was approximately 3 min.[10]

Group: 2 (Non-thrust Mobilization Group)

Patients in this group positioned in the prone lying position and the T1–T6 spinous process of vertebrae were traced and marked before the manipulation. The physical therapist performed bouts of III or IV grade of non-thrust mobilization in posterior-anterior direction as illustrated by Maitland at the level of T1 spinous process for 30 s. After that, the therapist proceeded to T2 and performed the same technique. The similar method was continued in a downward route up to T6, approximately 3–4 min was required to complete whole intervention.[10]

RESULTS

A total of 75 patients have completed the intervention and data were analyzed. The results of the study were recorded in terms of NPRS and NDI. Intra and intergroup differences were assessed and compared to evaluate the effectiveness of treatment protocols under consideration in the present study. Table 1a shows the distribution of patients according to gender in that frequency of females (54.67%) in both groups was higher than males (45.33%). Table 1b shows the mean

age of the patients in Group 1 and Group 2 which was 30.86 ± 7.84 years and 30.97 ± 7.52 years, respectively.

Table 2 shows statistically significant differences in NPRS and NDI at pre-intervention (P0) compare to immediately after the intervention (P1) and after 5 days of intervention (P2) ($P < 0.05$) in Group 1. All the sections of NDI were except headache, driving, and sleeping showed a statistically significant difference in pre-intervention (P0) compare to immediately after the intervention (P1) ($P < 0.05$). However, all the sections showed a statistically significant difference after 5 days of intervention (P2) ($P < 0.05$).

A statistically significant difference in both the outcomes seen at pre-intervention (P0) compare to immediately after the intervention (P1) and after 5 days of intervention (P2) in Group 2 (control group), as shown in Table 3. However, the sections of NDI, that is, reading, headaches, concentration, work, driving, and sleeping do not show a statistically significant difference in pre-intervention (P0) to compare to immediately after the intervention (P1). However, all the sections showed a statistically significant difference after 5 days of intervention (P2).

Table 4 shows a statistical difference in NPRS and NDI at pre-intervention (P0) compare to immediately after intervention (P1) and after 5 days of intervention (P2) in both the groups. However, in NDI components such as personal care, reading, concentration, work, driving, sleeping, and recreation do not show any statistically significant difference in pre-intervention (P0) to compare to immediately after the intervention (P1), which indicates that thrust manipulation of the thoracic spine is more effective in the reduction of NP and disability in comparison of non-thrust mobilization of the thoracic spine. Moreover, all the sections of NDI show a statistically significant difference in pre-intervention (P0) compare to 5 days after intervention (P2), which indicates that thrust as well as non-thrust mobilization of the thoracic spine helps in reduction of NP and disability.

DISCUSSION

This study was expected to assess and compare the effectiveness of thrust and non-thrust mobilization of the thoracic spine on chronic NP. A total of 75 patients were assessed and randomly divided into two groups, that is, Groups 1 and 2. Along with mobilizations, that is, thrust or non-thrust, all the patients were told to do active neck mobility exercise (10 repetitions for 3 times a day) with 15 min of moist heat application. Outcome measures

Table 1a: For baseline characteristic

Characteristic	Group 1 (%)	Group 2 (%)	Total (%)
Male	17 (44.74)	17 (45.95)	34 (45.33)
Female	20 (55.56)	21 (54.05)	41 (54.67)
Total	38 (100.00)	37 (100.00)	75 (100.00)

Table 1b: For baseline characteristic

Characteristic	Group 1	Group 2
Age (Mean±SD)	30.86±7.84	30.97±7.52

Table 2: For Group 1 (intervention group [*n*=38]): Comparison of NRS and NDI score before intervention with immediate and after 5 days intervention

Characteristic	(Mean±SD)	(Mean±SD)	*P*-value
NRS			
A1	6.52±1.00	2.55±0.60	<0.001*
A2	6.52±1.00	0.26±0.50	<0.001*
NDI			
Section 1			
A1	3.65±0.66	1.50±0.60	<0.001*
A2	3.65±0.66	0.23±0.43	<0.001*
Section 2			
A1	1.86±0.57	1.57±0.55	0.0004*
A2	1.86±0.57	0.10±0.31	<0.001*
Section 3			
A1	3.68±0.77	2.47±0.89	<0.001*
A2	3.68±0.77	0.34±0.48	<0.001*
Section 4			
A1	3.05±0.67	2.83±0.84	0.0032*
A2	3.05±0.67	0.22±0.42	<0.001*
Section 5			
A1	1.21±0.99	1.21±0.99	0.9717
A2	1.21±0.99	0.05±0.22	<0.001*
Section 6			
A1	3.05±0.67	2.88±0.78	0.0121*
A2	3.05±0.67	0.25±0.430	<0.001*
Section 7			
A1	2.47±0.50	1.81±0.56	<0.001*
A2	2.47±0.50	0.28±0.45	<0.001*
Section 8			
A1	2.71±0.45	2.62±0.54	0.0831
A2	2.71±0.45	0.20±0.40	<0.001*
Section 9			
A1	1.31±0.47	1.31±0.47	0.9717
A2	1.31±0.47	0.10±0.20	<0.001*
Section 10			
A1	3.00±0.69	2.82±0.86	0.0120*
A2	3.00±0.69	0.20±0.41	<0.001*
Total			
A1	25.34±5.13	17.36±5.03	<0.001*
A2	25.34±5.13	1.81±2.12	<0.001*

NRS: Numerical Rating Scale, NDI: Neck Disability Index, A1=P0-P1, A2=P0-P2, P0: Before intervention, P1: Immediate after intervention, P2: After 5 days of intervention; LOS: <o.05 *Statistical significance

Table 3: For Group 2 (control group [*n*=37]): Comparison of NRS and NDI score before intervention with immediate and after 5 days of intervention

Characteristic	(Mean±SD)	(Mean±SD)	*P*-value
NRS			
A1	6.32±0.94	5.24±1.14	<0.001*
A2	6.32±0.94	1.97±0.68	<0.001*
NDI			
Section 1			
A1	3.89±0.65	3.02±0.44	<0.001*
A2	3.89±0.65	1.16±0.37	<0.001*
Section 2			
A1	2.00±0.52	1.64±0.58	0.0001*
A2	2.00±0.52	0.64±0.48	<0.001*
Section 3			
A1	3.81±0.77	3.45±0.93	0.0001*
A2	3.81±0.77	1.40 ±0.49	<0.001*
Section 4			
A1	3.06±0.66	2.96±0.78	0.0831
A2	3.06±0.66	0.87±0.33	<0.001*
Section 5			
A1	1.27±0.96	1.27±0.96	0.9717
A2	1.27±0.96	0.91±0.59	0.0009*
Section 6			
A1	3.05±0.68	2.97±0.78	0.0831
A2	3.05±0.68	0.88±0.40	<0.001*
Section 7			
A1	2.35±0.53	2.35±0.53	0.9717
A2	2.35±0.53	1.43±0.50	<0.001*
Section 8			
A1	3.05±0.67	2.97±0.73	0.0831
A2	3.05±0.67	2.05±0.62	<0.001*
Section 9			
A1	1.29±0.46	1.29±0.46	0.9717
A2	1.29±0.46	1.00±0.40	0.0004*
Section 10			
A1	2.02±0.50	1.66±0.58	0.0001*
A2	2.02±0.50	0.97±0.29	<0.001*
Total			
A1	25.24±4.07	22.67±3.93	<0.001*
A2	25.24±4.07	11.10±1.79	<0.001*

NRS: Numerical Rating Scale, NDI: Neck Disability Index, A1= P0-P1, A2= P0-P2, P0: Before intervention, P1: Immediate after intervention, P2: After 5 days of intervention; LOS: <0.05 *Statistical significance

Table 4: Between the group analysis: Comparison of NRS and NDI score before intervention to immediate after intervention and after 5 days of intervention between Groups 1 and 2

Characteristics	Group 1 *n*=38 (Mean±SD)	Group 2 *n*=37 (Mean±SD)	*P*-value
NRS			
A1	3.97±0.67	1.08±0.75	<0.001*
A2	6.26±0.82	4.35±1.20	<0.001*
NDI			
Section 1			
A1	2.15±0.67	0.82±0.53	<0.001*
A2	3.42±0.72	2.72±0.80	0.0002*
Section 2			
A1	0.28±0.45	0.35±0.48	0.5713
A2	1.76±0.48	1.35±0.63	0.0023*
Section 3			
A1	1.21±0.66	0.35±0.48	<0.001*
A2	3.34±0.53	2.40±0.68	<0.001*
Section 4			
A1	0.44±0.42	0.09±0.29	0.1555
A2	2.63±0.60	2.18±0.59	<0.001*
Section 5			
A1	0.47±0.50	1.81±0.56	<0.001*
A2	1.15±0.91	0.35±0.58	<0.001*
Section 6			
A1	0.16±0.36	0.08±0.28	0.3122
A2	2.80±0.62	2.17±0.61	0.0001*
Section 7			
A1	1.71±0.45	2.62±0.54	0.0831
A2	1.15±0.91	0.35±0.58	<0.001*
Section 8			
A1	0.08±0.28	0.10±0.28	0.9717
A2	2.51±0.50	1.00±0.71	<0.001*
Section 9			
A1	0.07±0.26	0.13±0.29	0.1563
A2	1.31±0.47	0.29±0.46	<0.001*
Section 10			
A1	0.17±0.38	0.36±0.48	0.0847
A2	2.79±0.64	1.05±0.58	<0.001*
Total			
A1	4.97±1.96	2.56±2.17	<0.001*
A2	23.56±3.97	14.13±3.39	<0.001*

NRS: Numerical Rating Scale, NDI: Neck Disability Index, P0: Before intervention, P1: Immediate after intervention, P2: After 5 days of intervention, A1=P0-P1, A2=P0-P2, *n* = Number of participants; LOS: <0.05 *Statistical significance

were recorded in the form of NPRS and NDI at baseline, immediately after the intervention, and 5 days after the intervention. After that intragroup of comparison of NPRS and NDI at baseline, immediately after the intervention and 5 days after the intervention were done by dependent 't' test and intergroup comparison of same outcome measures was done by independent *t*-test. $P > 0.05$ indicated that there was a significant change between the pre- and post-treatment scores of both the outcomes as well as there was a significant difference observed between both groups. While comparing

data at baseline, it is found that frequency of female was 54.67% and frequency of male was 45.33% [Table 1a] and mean age of the patients in both groups was 30.86 ± 7.84 years (Group 1) and 30.97 ± 7.52 years (Group 2) [Table 1b]. Patients of both groups show significant improvement in pain reduction and disability reduction due to chronic mechanical NP. However, when compared to both groups, it has been detected that Group 1, that is, the group which received thrust mobilization of the thoracic spine had grater reduction in both outcomes than Group 2.

It has been also noticed that there was reduction in pain and disability of neck in both groups immediately after intervention and a further reduction in NP and disability at the end of 5th day after the intervention was also seen, but this reduction was observed more in Group 1 compared to Group 2. Meanwhile, it is observed that reduction in NP, immediately after the intervention was more compared to 5 days after intervention in a group that received thrust mobilization. However, for NDI, it was opposite which suggests that thrust mobilization of the thoracic spine has both short- and long-term effects in reduction of pain and disability of neck, but the immediate reduction in pain is more than the long-term reduction while the immediate reduction in score of NDI is lesser than long-term reduction. Moreover, it has been also seen that the other group which received non-thrust mobilization of the thoracic spine had a reduction in NP and disability immediately after intervention and 5 days after intervention suggesting that it has both short- and long-term effect but short-term reduction in NPRS and NDI is lesser than the long term in this group. It has also determined changes in every component of NDI. It was seen that all the sections of NDI have a reduction in score immediately after the intervention and 5 days after intervention in Group 1 except section 1, that is, pain intensity the immediate reduction is lesser than the long-term reduction. Same as in Group 2 reduction in all the sections of NDI was observed but the reduction in immediate score was lesser than the long-term reduction. This reduction was even lesser than Group 1. ($P < 0.05$) It has been seen by Sampath *et al*. that the autonomic nervous system and the hypothalamic-pituitary-adrenal axis dysfunction occur in many chronic pain disorders. Manipulation of the spine is a technique used by manual therapists, which have widespread neurophysiological effects like influence on the autonomic nervous system. It has been hypothesized that through its anatomical along with physiological relations, the autonomic nervous system action following a thoracic manipulation might have an effect on the hypothalamic-pituitary-adrenal axis and therefore affects pain and healing through modulation of endocrine and physiological routes.[12] Bialosky *et al*. recommended a model that highlighted different probable mechanics of manual therapy for the curing of musculoskeletal problems.[13] The biomechanical connection between two segments of spine, that is, cervical and thoracic is well supported with literature.[14] It has been reflected that mobilization of the segment at thoracic spine might be enhanced the relationship of the thoracic and cervical spine, which diminished mechanical pain carrying by receptors. Furthermore, it has been recognized the association between pain detection patterns of the facets at the different spinal segments.[15] Thrust manipulation might have been change the sensitivity of mechanoreceptors of the thoracic spine and reduced the pain level at neck by altering the referral patterns of pain.[16] Vicenzino *et al*. have also investigated the association between hypoalgesia induced by manual therapy and excitation of the sympathetic system and conveyed that manual therapy is useful in the reduction of pain by causing excitation of the sympathetic system.[17] De Camargo *et al*. stated that muscle activity increases after manipulation of a particular location and site of the spinal column, with more resistance to the fatigue in the parallel muscle by studying the sensory and motor muscle activities.[18] Wright *et al*. observed a degree of hypoalgesia in a period of seconds to minutes after the application of mobilization to the spine. They said that mobilization stimulates the descending noradrenergic system and causes a reduction in the release of P substance, exciting the release of endogenous opioids in the spinal cord.[19] However, Raquel mart et al. contradicted this technique by performing a randomized control trial to notice immediate variations for pain in neck and cervical movement after thrust manipulation at thoracic region in patients with pain of neck and concluded that thrust manipulation does not have any additional effect on reduction in pain and augment in cervical motion of mechanical neck ache patients.[20] The important aspect of present study was that it compared the effects of thrust as well as non-thrust mobilization of the thoracic spine in mechanical NP. However, we have not assessed the long-term effects of both mobilizations.

CONCLUSION

The present study concluded that both thrust and non-thrust mobilization of the thoracic spine have a significant effect on the reduction of NP and disability. However, thrust mobilization of the thoracic spine has a significantly greater reduction in NP and disability in comparison to non-thrust mobilization.

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