Short-Term Effects of Thrust Versus Nonthrust Mobilization/Manipulation Directed at the Thoracic Spine in Patients With Neck Pain: A Randomized Clinical Trial

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Background and Purpose

Evidence supports the use of manual physical therapy interventions directed at the thoracic spine in patients with neck pain. The purpose of this study was to compare the effectiveness of thoracic spine thrust mobilization/manipulation with that of nonthrust mobilization/manipulation in patients with a primary complaint of mechanical neck pain. The authors also sought to compare the frequencies, durations, and types of side effects between the groups.

Subjects

The subjects in this study were 60 patients who were 18 to 60 years of age and had a primary complaint of neck pain.

Methods

For all subjects, a standardized history and a physical examination were obtained. Self-report outcome measures included the Neck Disability Index (NDI), a pain diagram, the Numeric Pain Rating Scale (NPRS), and the Fear-Avoidance Beliefs Questionnaire. After the baseline evaluation, the subjects were randomly assigned to receive either thoracic spine thrust or nonthrust mobilization/manipulation. The subjects were reexamined 2 to 4 days after the initial examination, and they again completed the NDI and the NPRS, as well as the Global Rating of Change (GROC) Scale. The primary aim was examined with a 2-way repeated-measures analysis of variance (ANOVA), with intervention group (thrust versus nonthrust mobilization/manipulation) as the between-subjects variable and time (baseline and 48 hours) as the within-subject variable. Separate ANOVAs were performed for each dependent variable: disability (NDI) and pain (NPRS). For each ANOVA, the hypothesis of interest was the 2-way group × time interaction.

Results

Sixty patients with a mean age of 43.3 years (SD=12.7) (55% female) satisfied the eligibility criteria and agreed to participate in the study. Subjects who received thrust mobilization/manipulation experienced greater reductions in disability, with a between-group difference of 10% (95% confidence interval [CI]=5.3–14.7), and in pain, with a between-group difference of 2.0 (95% CI=1.4–2.7). Subjects in the thrust mobilization/manipulation group exhibited significantly higher scores on the GROC Scale at the time of follow-up. No differences in the frequencies, durations, and types of side effects existed between the groups.

Discussion and Conclusion

The results suggest that thoracic spine thrust mobilization/manipulation results in significantly greater short-term reductions in pain and disability than does thoracic nonthrust mobilization/manipulation in people with neck pain.

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The prevalence of neck pain in the general population has been reported to be 15% for men and 23% for women, with nearly half of these individuals experiencing constant unremitting symptoms.[1] It has been estimated that as many as 70% of individuals report experiencing neck pain at some point in their lifetimes, and at a 5-year follow-up, 78% of men and 85% of women report full recovery.[2,3] The economic burden associated with neck pain is immense, and nearly one third of people who experience a first-time onset of neck pain will continue to report health care utilization for their neck pain at a 5-year follow-up.[4] Additionally, nearly 25% of all visits in outpatient physical therapist practice are made by people with a primary report of neck pain.[5]

Physical therapists use several interventions and modalities in the management of neck pain, including joint mobilization/manipulation (nonthrust and thrust), therapeutic exercise, and traction.[6] However, robust evidence to support the use of many of the aforementioned management strategies is lacking.[7–11] The Philadelphia Panel evidence-based clinical practice guidelines concluded that there is insufficient evidence for the use of many commonly used interventions for people with neck pain.[8] Perhaps this finding is at least partially responsible for the lack of clinical improvement observed in people with neck pain compared with people with low back or lower-extremity pain.[12]

Recently, evidence has begun to emerge for the use of manual therapy, specifically, thrust mobilization/manipulation procedures, directed at the thoracic spine in people with mechanical neck pain. In a randomized controlled trial, Cleland et al[13] demonstrated that people who received thoracic spine thrust mobilization/manipulation experienced immediate and significant ($P<.001$) reductions in pain, as measured with a visual analog scale, compared with people who received a placebo mobilization/manipulation; the between-group difference was 11.3 mm (95% confidence interval [CI]: 6.9–15.7). It was also demonstrated that people with whiplash-associated disorders who received thoracic spine thrust mobilization/manipulation experienced a significantly greater ($P<.003$) reduction in pain than those who did not receive thoracic spine thrust mobilization/manipulation.[14]

There is little evidence supporting a theoretical rationale as to why manual physical therapy techniques directed at the thoracic spine may be beneficial in reducing pain and improving function in people with neck pain. Additionally, all studies to date that have investigated the effects of treatments targeting the thoracic spine have incorporated only thrust mobilization/manipulation procedures. Thus, it is not known whether non-thrust mobilization/manipulation procedures will result in similar outcomes or whether thrust mobilization/manipulation is essential in the recovery process for people with neck pain. The main purpose of this study was to compare the short-term effectiveness of thrust mobilization/manipulation with that of nonthrust mobilization/manipulation directed at the thoracic spine in patients with mechanical neck pain. We also sought to compare the frequencies, durations, and types of side effects between people receiving thrust mobilization/manipulation and those receiving non-thrust mobilization/manipulation.

Method

Subjects

Consecutive patients, who were referred over a 13-month period (June 2005 to July 2006) for physical therapy at 1 of 5 outpatient orthopedic physical therapy clinics (Rehabilitation Services, Concord Hospital, Concord, NH; Newton-Wellesley Hospital, Newton, Mass; Centennial Physical Therapy, Colorado Springs, Colo; Groves Physical Therapy, St Paul, Minn; and Sharp HealthCare, San Diego, Calif) by their primary care physicians because of a complaint of mechanical neck pain, were screened for eligibility criteria. Inclusion criteria required subjects to be between the ages of 18 and 60 years and to have a primary complaint of neck pain with or without unilateral upper-extremity symptoms and a baseline Neck Disability Index (NDI) score of 10% or greater.

Exclusion criteria were: identification of any medical signs suggestive of a nonmusculoskeletal etiology of symptoms, a history of a whiplash injury within 6 weeks of the examination, a diagnosis of cervical spinal stenosis, evidence of any central nervous system involvement, signs consistent with nerve root compression (at least 2 of the following had to be diminished for nerve root involvement to be considered: myotomal strength, sensation, or reflexes), previous cervicothoracic surgery, or pending legal action. All subjects reviewed and signed a consent form approved by the respective institutional review board before participation.

Therapists

Twelve physical therapists (mean age=36 years, SD=6.4) participated in the examination and treatment of all subjects in this study. All therapists underwent a standardized training regimen, which included studying a manual of standard procedures with the operational definitions of each examination and intervention technique used in this study. All participating therapists underwent training provided by a current Fellow in the Manual Physical Therapy Fellowship Program, Regis University, Denver, Colo. During this training session, all participating therapists were required to demonstrate the examination and intervention

techniques to ensure that all study procedures were performed in a standardized fashion. Participating therapists had a mean of 9.7 years (SD=6.8, range=1–19) of clinical experience.

Examination Procedures

All subjects provided demographic information and completed several self-report measures, and a standardized history and a physical examination were obtained (baseline). Self-report measures included a body diagram,[15] the Numeric Pain Rating Scale (NPRS),[16] the NDI,[17] and the Fear-Avoidance Beliefs Questionnaire (FABQ). The FABQ was used to quantify a subject's fear-avoidance beliefs about physical activity as well as work.[18] The FABQ consists of work (FABQW) and physical activity (FABQPA) subscales, each of which has been shown to exhibit a high level of test-retest reliability.[19] The FABQW subscale has been shown to exhibit predictive validity in the identification of people who have low back pain and who are likely to respond to spinal mobilization/manipulation.[20,21] Additionally, lower scores on a modified FABQ (FABQPA and FABQW) have been shown to be predictive for people who have neck pain and who likely will benefit from spinal mobilization/manipulation applied to the thoracic spine and rib cage.[22] For this study, the FABQ was modified by replacement of the word "back" with the word "neck."[22] The standardized history and the physical examination were obtained in a fashion identical to that described by Cleland et al.[22]

Outcomes

The primary outcome measure used in this study was the subjects' perceived level of disability as a result of their neck pain, as captured with the NDI.[17] The NDI contains 10 items—7 related to activities of daily living, 2 related to pain, and 1 related to concentration.[23] Each item is scored from 0 to 5, and the total score is expressed as a percentage, with higher scores corresponding to greater disability. The NDI has been demonstrated to be a reliable and valid outcome measure for people with neck pain[24–26] and has been used widely in clinical trials of people with neck pain.[17,27–29]

Westaway et al[30] identified the minimal detectable change (MDC) on the NDI as 5 points, and Stratford et al[26] also identified the MDC to be 5 points for a group of people with neck pain. In both of these studies, the investigators reported the MDC on a 50-point scale; we calculated the NDI as a percentage of 100, which would translate to an MDC of 10%. Although these investigators reported that a change of 5 points (or 10%) must be observed to be certain that the change in scores is greater than measurement error, no values for the minimal clinically important difference have been reported in the literature for people with mechanical neck pain.[26,31]

Secondary outcome measures included pain and a subject Global Rating of Change (GROC) Scale. The NPRS was used to capture a subject's level of pain. Subjects were asked to indicate the intensity of current, best, and worst levels of pain over the preceding 24 hours by using an 11-point scale ranging from 0 ("no pain") to 10 ("worst pain imaginable").[32] The average of the 3 ratings was used to represent a subject's level of pain over the preceding 24 hours. The minimal clinically important difference for the NPRS has been reported to be 2 points.[33]

At the time of follow-up, subjects completed the GROC Scale.[34] They were asked to rate their overall perception of improvement since beginning the interventions on a scale ranging from −7 ("a very great deal worse") to 0 ("about the same") to +7 ("a very great deal better"). It has been suggested[34] that scores on the GROC Scale of between ±3 and ±1 represent small changes, scores of ±4 and ±5 represent moderate changes, and scores of ±6 and ±7 represent large changes.[34]

Randomization

After the baseline examination, subjects were randomly assigned to receive thrust or nonthrust mobilization/manipulation directed at the upper thoracic spine and the middle thoracic spine. Concealed allocation was performed by use of a computer-generated randomized table of numbers created before the beginning of the study. Individual, sequentially numbered index cards with the random assignments were prepared. The index cards were folded and placed in sealed opaque envelopes. A second therapist who was unaware of the baseline examination findings opened the envelopes and proceeded with the interventions according to the group assignments. All subjects received the interventions on the day of the initial examination.

Interventions

Nonthrust mobilization/manipulation group. Subjects who were randomly assigned to receive nonthrust mobilization/manipulation were positioned in the prone position. The clinician performed one 30-second bout of grade III or IV central posterior-anterior nonthrust mobilization/manipulation at the T1 spinous process as described by Maitland et al.[35] After the 30-second bout, the therapist proceeded to T2 and performed the same technique. This process was continued sequentially in a caudal direction to T6, for an overall intervention time of approximately 3 minutes (Fig. 1).

Subjects then were instructed in a general cervical mobility exercise as originally described by Erhard.[36] To perform this exercise, each subject was instructed to place the fingers over the manubrium and to start in a position with the chin placed directly on the fingers. Next, the subject was asked to rotate the head and neck to one side as

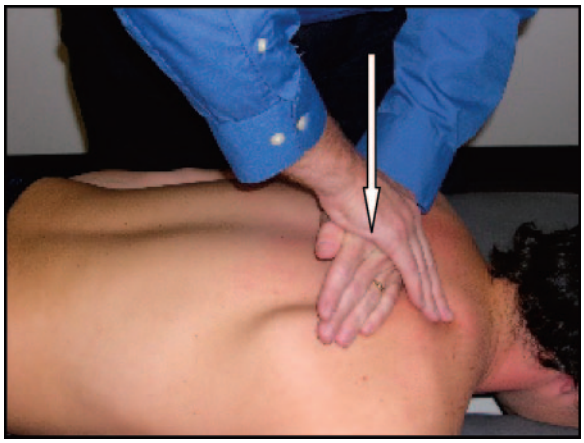

Figure 1.
Nonthrust mobilization/manipulation technique used in this study.

far as possible and return to the starting position. The subject was instructed to perform this maneuver alternately to both sides within pain tolerance. The subject was asked to start by using 5 fingers and then to progress to 4, 3, and 2 fingers and finally to 1 finger as mobility improved. The subject was instructed to perform this exercise within pain tolerance for 10 repetitions to each side, 3 or 4 times per day, each day during participation in the study. Additionally, subjects were instructed to maintain their usual activities within the limits of pain and to avoid activities that aggravated symptoms. Subjects also were instructed to maintain their current medication regimens throughout the course of the study and to avoid any other cointerventions.

Thrust mobilization/manipulation group. Subjects in this group received thrust mobilization/manipulation targeting the upper thoracic spine and thrust mobilization/manipulation targeting the middle thoracic spine. The upper thoracic spine procedure was administered first and was performed with the subject in the supine position. The clinician was instructed to target between segments T1 and T4 with this technique. Because thrust mobilization/manipulation of the thoracic spine reportedly lacks spatial sensitivity,[37] we did not capture the exact segments targeted for each subject. The subject was instructed to clasp his or her hands across the base of the neck. The subject's arms then were pulled downward to create spinal flexion down to the upper thoracic spine. The therapist's manipulative hand was used to stabilize the inferior vertebra of the targeted motion segment, and his or her body applied force through the subject's arms to produce a high-velocity, low-amplitude thrust (Fig. 2). If a pop occurred, then the therapist moved on to the next procedure. If not, the subject was repositioned, and the technique was performed again. This procedure was performed for a maximum of 2 attempts.

Figure 2.
Upper thoracic spine thrust mobilization/manipulation technique used in this study.

The subject remained in the supine position, and the treating therapist performed a middle thoracic spine thrust mobilization/manipulation. The clinician was instructed to target between segments T5 and T8 with this technique. The subject was instructed to clasp his or her hands to the opposite shoulder. The subject's arms were pulled downward to create spinal flexion down to the targeted motion segment. The therapist's manipulative hand was used to stabilize the inferior vertebra of the motion segment, and his or her body was used to apply force through the subject's arms to produce a high-velocity, low-amplitude thrust (Fig. 3). If no pop was heard on the first attempt, then the therapist repositioned the subject and performed the mobilization/manipulation again. A maximum of 2 attempts were made. A similar amount of time was required to complete the thrust mobilization/manipulation and nonthrust mobilization/manipulation techniques (approximately 3 minutes), minimizing the potential for an attention effect.

Subjects assigned to the thrust mobilization/manipulation group also received instructions in the same general cervical exercise program as those assigned to the nonthrust mobilization/manipulation group and

were instructed to maintain their usual activities within the limits of pain and to avoid activities that aggravated symptoms. Subjects in this group also received instructions to maintain their current medication regimens throughout the course of the study and to avoid any other cointerventions.

Follow-up

All subjects were scheduled for follow-up within 2 to 4 days of the initial examination and intervention session. At the time of follow-up, subjects again completed the NDI and the NPRS, as well as the GROC Scale. Additionally, subjects completed a questionnaire regarding any side effects that they may have experienced since the initial intervention session. The questionnaire was modified from that used by Cagnie et al[38] and included questions regarding commonly described side effects associated with the use of manual physical therapy techniques, such as stiffness, headaches, muscle spasm, fatigue, or radiating discomfort. Subjects also could mark "other" and then identify any other unusual side effects that they had experienced since the initial intervention session. If the subjects indicated that they had experienced any side effects, then they were asked to report the time of onset (categorized as ≤24 hours or >24 hours), the duration (categorized as ≤24 hours or >24 hours), and the severity (scored on a scale of 1–4, where 1=light to 4=severe) of the symptoms.

Sample Size Determination

The sample size and power calculations were performed with Sample Power statistical software, version 10.1.* The calculations were based on detecting a 10% difference in the NDI at follow-up, assuming a standard deviation of 13%, a 2-tailed test, an alpha level of .05, and a desired power of 80%. These assumptions generated a sample size of 30 subjects per group.

Figure 3.
Middle thoracic spine thrust manipulation technique used in this study.

Data Analysis

Key baseline demographic variables, including current medication usage and scores on the self-report measures, were compared between the groups by use of independent *t* tests for continuous data and chi-square tests of independence for categorical data (Tab. 1). The primary aim (effects of interventions on disability and pain) was examined by use of a 2-way repeated-measures analysis of variance (ANOVA), with intervention group (thrust versus nonthrust mobilization/manipulation) as the between-subjects variable and time (baseline and follow-up) as the within-subject variable. Separate ANOVAs were performed with disability (NDI) and pain (NPRS) as the dependent variables. For each ANOVA, the hypothesis of interest was the 2-way interaction (group × time). An independent *t* test was used to determine differences in the GROC Scale scores between the groups at follow-up. We used intention-to-treat analysis with subjects analyzed in the group to which they were allocated. Data analysis was performed with the SPSS, version 13.0, statistical software package.*

The proportion of subjects reporting side effects in each group was analyzed by use of a chi-square test. Additionally, the number of side effects experienced by subjects in each group was calculated. Chi-square tests also were used to determine whether a difference existed between the groups for the proportion of subjects experiencing an onset of symptoms within 24 hours of the interventions, for whether the symptoms diminished within 24 hours of onset, and for the severity of the reported symptoms. We also calculated the odds ratio and the corresponding 95% CI for experiencing a side effect associated with the interventions.

Results

A total of 104 consecutive patients were screened for possible study eligibility. Sixty patients, with a mean age of 43.3 years (SD=12.7) (55% female), satisfied the eligibility criteria, agreed to participate, and were randomly assigned to the thrust (n=30) and nonthrust (n=30) mobilization/manipulation groups. The reasons for ineligibility are shown in Figure 4, which is a flow diagram of subject recruitment and retention. All 60 participants returned for the follow-up visits and were included in the analysis.

* SPSS Inc, 233 S Wacker Dr, Chicago, IL 60606.

Table 1.
Demographics, Outcome Measures, and Selected Physical Impairments at Baseline

Variable[a]	Nonthrust Mobilization/ Manipulation Group (n=30)	Thrust Mobilization/ Manipulation Group (n=30)	*P*
Age, $\bar{X}$ (SD)	42.7 (13.9)	43.8 (11.5)	.75[b]
Women	15 (50)	18 (60)	.29[c]
Duration of symptoms, d, $\bar{X}$ (SD)	56.1 (27.6)	54.9 (46.0)	.90[b]
NPRS, $\bar{X}$ (SD)	4.5 (2.1)	5.3 (1.4)	.086[b]
NDI, $\bar{X}$ (SD)	29.6 (12.6)	33.5 (11.2)	.20[b]
FABQPA, $\bar{X}$ (SD)	11.2 (5.0)	11.5 (4.9)	.82[b]
FABQW, $\bar{X}$ (SD)	12.3 (10.6)	12.5 (10.7)	.93[b]
Symptoms distal to shoulder	6 (20)	4 (13)	.73[c]
Mode of onset—traumatic	11 (37)	11 (37)	1.0[c]
Previous history of neck pain	11 (37)	8 (27)	.29[c]
Receiving workers' compensation	3 (10)	9 (30)	.045[c]
Taking medications at start of study	17 (57)	12 (40)	.30[c]
Symptoms aggravated by:			
Turning right	21 (70)	23 (77)	.39[c]
Turning left	21 (70)	15 (50)	.25[c]
Looking up	19 (63)	21 (70)	.39[c]
Looking down	18 (60)	16 (53)	.45[c]
Driving	22 (73)	19 (63)	.29[c]
Cervical range of motion, degrees, $\bar{X}$ (SD)			
Flexion	51.1 (12.8)	6.4 (13.2)	.17[b]
Extension	38.8 (13.9)	44 (14.9)	.17[b]
Side bending right	32.4 (12.7)	33.2 (13.1)	.80[b]
Side bending left	30.6 (10.7)	40.0 (34.3)	.16[b]
Rotation right	59.1 (11.8)	59.1 (12.2)	.98[b]
Rotation left	61.1 (12.6)	63.6 (11.4)	.43[b]
Medication usage			
Total	16 (53)	12 (40)	.30[b]
NSAIDs	9 (30)	8 (27)	.98[b]
Pain medications	4 (13)	2 (7)	.67[b]
Muscle relaxants	3 (10)	2 (7)	.98[b]

[a] Data are reported as number (percentage) of subjects, unless otherwise indicated. FABQPA=Fear-Avoidance Beliefs Questionnaire physical activity subscale (range=0–24), FABQW=Fear-Avoidance Beliefs Questionnaire work subscale (range=0–42), NDI=Neck Disability Index (range=0%–100%), NPRS=Numeric Pain Rating Scale (range=0–10), NSAIDs=nonsteroidal anti-inflammatory drugs.
[b] As determined by independent sample *t* tests.
[c] As determined by chi-square tests.

Baseline characteristics for the groups were similar for all variables ($P>.05$), with the exception of the number of subjects receiving workers' compensation (9 in the thrust mobilization/manipulation group and 3 in the nonthrust mobilization/manipulation group; $P=.045$) (Tab. 1). Sixty-seven percent of subjects in the thrust mobilization/manipulation group attended their follow-up visits at 2 days, 20% attended at 3 days, and 13% attended at 4 days. Sixty percent of subjects in the nonthrust mobilization/manipulation group attended their

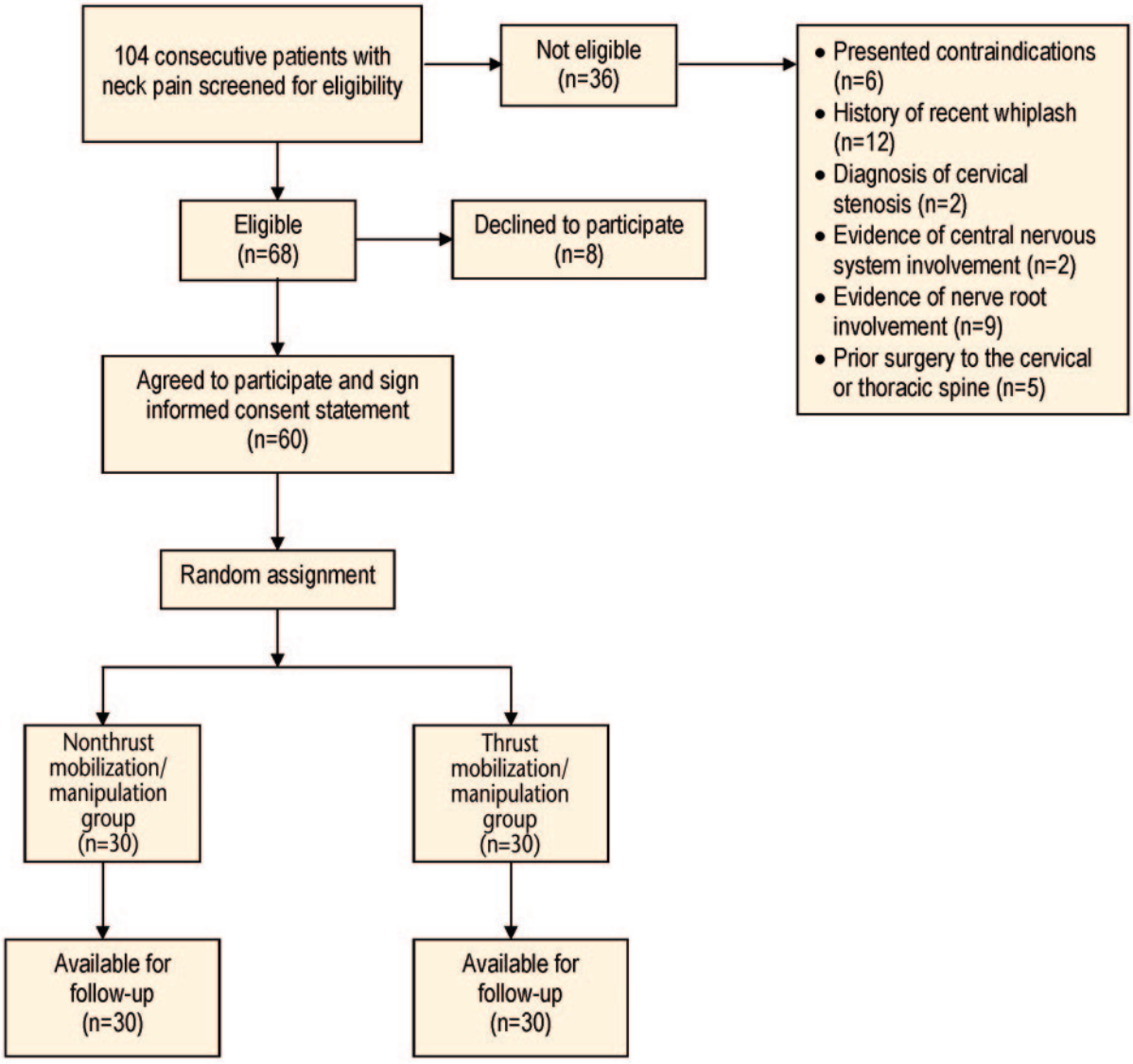

Figure 4.
Flow diagram of subject recruitment and retention.

follow-up visits at 2 days, 30% attended at 3 days, and 10% attended at 4 days. Additionally, the 95% CI for the difference in time to follow-up between the groups crossed 0 (−0.36 to 0.90).

The overall 2-way group × time interaction for the repeated-measures ANOVA was statistically significant for disability ($P<.001$) and pain ($P<.001$). The intercept graph for the NDI and scores of intervention time is shown in Figure 5. Subjects receiving thrust mobilization/manipulation experienced greater reductions in disability, with a between-group difference of 10% (95% CI=5.3–14.7), and pain, with a between-group difference of 2% (95% CI=1.4–2.7) (Tab. 2). Subjects in the thrust mobilization/manipulation group exhibited significantly ($P<.01$) higher scores on the GROC Scale at the time of follow-up, with a mean difference between the groups of 1.5 points (95% CI=0.48–2.5).

There was no significant difference ($P=.78$) between the numbers of side effects experienced by subjects in the nonthrust and thrust mobilization/manipulation groups (9 and 10, respectively). The odds ratio for experiencing a reported side effect for subjects receiving thrust mobilization/manipulation was 1.17 (95% CI=0.39–3.47). The specific reported side effects for subjects in the nonthrust mobilization/manipulation group included an aggravation of symptoms (n=2), muscle spasm (n=1), neck stiffness (n=2), headache (n=2), and radiating symptoms (n=2). Subjects in the thrust mobili-

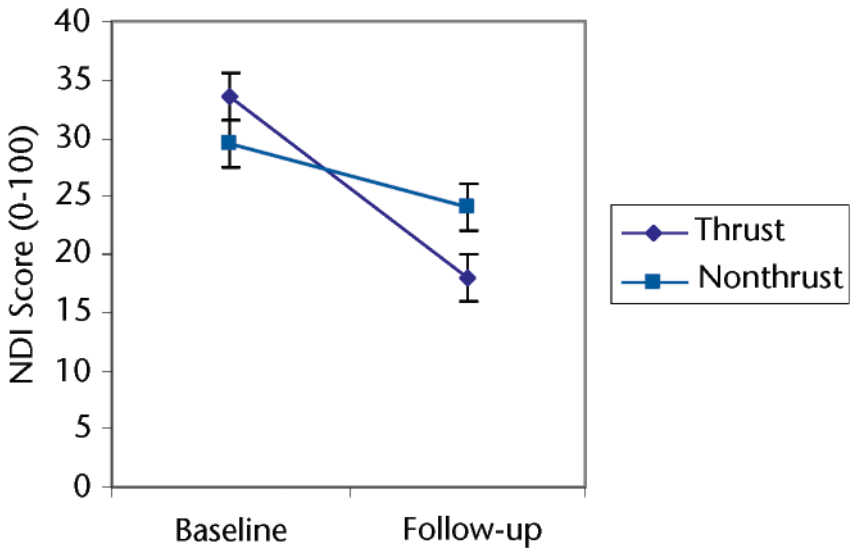

Figure 5.
Intercept graph for Neck Disability Index scores of intervention time ($P<.001$).

zation/manipulation group experienced the following side effects: aggravation of symptoms (n=8), muscle spasm (n=1), and headache (n=1).

There was no difference in the onset of side effects between the groups, with 90% of all subjects (8 in the nonthrust mobilization/manipulation group and 9 in the thrust mobilization/manipulation group) reporting that the symptoms began within 24 hours of the interventions ($P=.74$). All subjects in both groups who reported experiencing a side effect noted that the symptoms lasted 24 hours or less. The severity of the complaints was not significantly different between the groups ($P=.67$) and was reportedly mild (7 subjects in the nonthrust mobilization/manipulation group and 8 subjects in the thrust mobilization/manipulation group) to moderate (2 subjects in the nonthrust mobilization/manipulation group and 2 subjects in the thrust mobilization/manipulation group). No serious complications were reported by any subjects in the study.

Discussion and Conclusion

The results of the present study demonstrate that the differences between the groups in change scores for disability and pain exceeded the boundaries of measurement error. Fifty percent of subjects in the thrust mobilization/manipulation group reached the cutoff on the GROC Scale, indicating a moderate change in status (scores of greater than or equal to +4), whereas only 10% of subjects in the nonthrust mobilization/manipulation group reached this cutoff. Additionally, the difference between the groups in changes in disability was 10% or approximately one third of the initial disability. Considering the moderate effect size between the interventions and the negligible disparity in associated risks, the differences demonstrate that, compared with thoracic spine nonthrust mobilization/manipulation, thoracic spine thrust mobilization/manipulation results in short-term reductions in pain and disability in people with neck pain.

We recognize that a variety of mobilization/manipulation techniques are used by physical therapists as well as other health care professionals.[39] However, to improve the generalizability of the findings to clinical practice, we standardized the treatment program to a few techniques that have

Table 2.
Baseline, Final, and Change Scores for the Neck Disability Index and the Numeric Pain Rating Scale

Measure	Group (n)	$\bar{X}$ (SD)			Between-Group Change Score, %, $\bar{X}$ (95% Confidence Interval)
		Baseline	Final	Within-Group Change Score	
Neck Disability Index	Nonthrust mobilization/manipulation (30)	29.6 (12.6)	24.0 (13.4)	5.5 (8.8)	10.03 (5.3–14.7)
	Thrust mobilization/manipulation (30)	33.5 (11.2)	18.0 (10.9)	15.5 (9.3)	
Numeric Pain Rating Scale	Nonthrust mobilization/manipulation (30)	4.5 (2.1)	3.9 (2.2)	0.54 (1.07)	2.03 (1.4–2.7)
	Thrust mobilization/manipulation (30)	5.3 (1.4)	2.7 (1.4)	2.6 (1.5)	

been well documented in the literature.[13,14,40,41] In addition, the clinicians did not use intersegmental mobility assessments to directly target a specific segmental restriction during our interventions.[35,42,43] Regardless of the clinical presentation, the subjects received specific nonthrust or thrust mobilization/manipulation directed at consistent segments across all subjects because of the inherent lack of evidence to support decision making based on biomechanical theoretical constructs.

Compared with other studies investigating the prevalence of side effects associated with thrust mobilization/manipulation directed at the entire spine, the present study demonstrated lower rates for both thrust and nonthrust mobilization/manipulation procedures.[38,44] Senstad et al[44] reported that, in 4,700 subjects, a variety of side effects occurred after mobilization/manipulation for 55% of the treatments. The most common side effect was local discomfort and was experienced with over one half of the treatments. Although the authors did not report the side effects associated with the area of the spine treated, they concluded that these reactions were benign and should be considered normal events. More recently, Cagnie et al[38] identified that 60% of subjects receiving mobilization/manipulation of the spine experienced a number of side effects, including headache (20%), stiffness (19%), dizziness (4%), and nausea (3%).

Although the types of associated side effects experienced by subjects in our study were similar to those in the studies of Senstad et al[44] and Cagnie et al,[38] the rates were significantly lower. Senstad et al[44] and Cagnie et al[38] investigated side effects associated with thrust mobilization/manipulation directed at the entire spine; our study included techniques directed only at the thoracic spine. Perhaps techniques directed at the thoracic spine result in fewer side effects than techniques directed at the cervical or lumbar spine; however, this hypothesis requires further investigation. Additionally, it should be recognized that the sample size calculations in the present study were not based on identifying differences in side effects between the groups; therefore, it is possible that the present study did not have adequate power to detect such disparities.

Although we cannot make direct generalizations about the effectiveness of other thrust mobilization/manipulation techniques in people with neck pain, evidence suggests that the specific technique used may not influence patient-centered outcomes.[29,45,46] One substantial limitation of the present study is the failure to collect long-term follow-up data. Participation in the present study ended after the follow-up session, which occurred between 2 and 4 days after the baseline examination and intervention session. Although the differences between the groups were noted at the short-term follow-up session, the data cannot be used to ascertain the outcomes for subjects in either group at any time period longer than 2 to 4 days. The implications of this finding should be recognized clearly when the results of the present study are applied to clinical practice. Future studies should seek to investigate the long-term benefits of thoracic spine thrust and nonthrust mobilization/manipulation.

Because we used a standardized treatment program, the results cannot be generalized to other mobilization/manipulation techniques. In addition, it should be recognized that another potential limiting factor of the present study was the inability to keep the subject or clinician unaware of the interventions being delivered. Future clinical trials should investigate the effectiveness of different thrust and nonthrust mobilization/manipulation procedures directed at the thoracic spine for people with neck pain and should compare thrust mobilization/manipulation techniques directed at the thoracic spine in combination with exercise and manual physical therapy techniques directed at the cervical spine for people with neck pain.

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