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The Effect of Kinesiology Tape on Pain and Neck Range of Motion After Cervical Manipulation

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Background: Annually, ~30%–50% of adults will experience some form of debilitating neck pain. One approach to treating neck pain is cervical manipulation. This treatment modality has, at times, been reported to result in a short-term increase in pain, which in turn has been linked to reduced neck range of motion (ROM). Elastic therapeutic tape (ETT) has been shown to reduce musculoskeletal pain, although limited research has been conducted to determine if ETT can mitigate pain and facilitate neck ROM following cervical manipulation.
Purpose: The purpose of this study is to compare the pain and neck ROM among patients with acute neck pain who do and do not receive ETT following cervical manipulation.
Methods: A convenience sample of 50 patients between 18 and 64 years of age presented with acute noncomplicated neck pain was recruited from an outpatient chiropractic clinic. Patients were randomly assigned to 2 groups. In the tape group (n = 27), ETT was applied to their neck immediately following cervical manipulation for neck pain. In the control group (n = 23), cervical manipulation was performed with no application of ETT following the procedure. Pain and neck ROM were recorded at the following 3 different intervals: pre-cervical manipulation (T1), within 5 minutes of cervical manipulation (T2), and 24–48 hours after manipulation (T3). In total, 6 cervical ROM values were recorded with dual inclinometers. Pain was measured by asking of each patient to rate their neck pain using the numeric pain rating scale from 0 to 10.
Results: The tape group demonstrated a significant decline ($P < 0.00$) in pain between T1 (x = 6.15) and T2 (x = 5.37) and between T1 and T3 (x = 4.89). The control group did not report significant changes in their pain over the duration of the study. Neither group reported any significant change in any measure of neck ROM over the duration of the study.
Clinical Relevance: Results from this study support the use of ETT to reduce pain immediately and 24–48 hours following cervical manipulation among patients presenting with acute neck pain.

Keywords: Neck pain; manipulation; elastic therapeutic tape; kinesiology tape

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Key Point: TheraBand® Kinesiology tape applied immediately in patients after cervical manipulation significantly reduced neck pain compared with patients receiving manipulation alone for up to 48 hours.

Neck pain is the fourth leading cause of disability.[1] Neck pain has a chronic recurrent course, with more than one-third of the population suffering from persistent neck pain annually.[2] Acute neck pain may resolve regardless of treatment, although 50% of individuals continue to experience some degree of pain or reoccurrence of disability attributable to this condition.[3] A common treatment option for acute neck pain is cervical manipulation. This intervention has been found to be effective in reducing pain and increasing cervical range of motion (ROM).[4] Few investigators have reported that neck pain remained unchanged or increased immediately following cervical manipulation.[5,6] Further, neck pain has been inversely related to neck ROM.[7]

BACKGROUND

Neck pain is commonly associated with activity limitations.[8,9] This condition ranks 4th out of 291 health conditions as contributing to years lived with a disability and 21st in contributing to disabled adjusted life years.[10] Severe neck pain can result in disability and increased utilization of healthcare resources, as well as negatively influence an individual's perceptions of their own abilities.[11,12] Kinesiophobia, a fear-based movement avoidance, has been reported by those who suffer from persistent and chronic neck pain.[13] This fear-based movement avoidance can lead to increased anxiety and depression and self-reported disabilities.[12] The fear–avoidance model indicates that anxiety and depression can lead to fear–avoidance beliefs, resulting in illness behavior and a decline in physical activity.

A common treatment option for neck pain is cervical manipulation. This intervention has been found to be effective in reducing pain and increasing short-term cervical ROM; however, the long-term effects of this intervention on ROM are still unclear.[14] Primary care referral to physical therapy is a widely adopted treatment option for patients with chronic neck pain, and the best evidence suggests that therapies involving exercise and cervical mani-pulation are more effective than other conservative approaches in long-term management of neck pain and stiffness.[15] Although exercise-based physical therapy is a common clinical approach, therapeutic exercise can be difficult for people suffering from neck pain and neck stiffness.

Another approach to treating neck pain is to apply elastic therapeutic tape (ETT), also known as "kinesiology tape." This treatment modality is hypothesized to facilitate positional sense, aid movement of interstitial fluid into the lymphatic vessels, reduce edema,[16] and enhance proprioception in addition to reducing neck pain.[17,18] Limited research on the efficacy of therapeutic elastic taping is available for specific patient populations, including patients suffering from neck pain. In a study by Gonzalez-Iglesias et al., the investigators reported that neck pain and ROM significantly improved immediately and 24 hours after the application of ETT in patients of acute whiplash injury compared with that after sham taping.[19] Although the results were statistically significant, the difference between groups did not surpass the minimal clinically important difference for reducing neck pain (>2 points on the numeric pain rating scale [NPRS]) or increasing ROM.[19,21] No study has examined the efficacy of ETT following cervical manipulation among patients with acute neck pain.

The purpose of this study is to compare pain and neck ROM among patients with acute neck pain who receive and do not receive ETT following cervical manipulation. This purpose was addressed by testing the following 2 hypotheses:

H1. Patients with mechanical neck pain who receive ETT immediately following manipulation will report less post-manipulation pain compared with those who do not receive ETT immediately following manipulation.

H2. Patients with mechanical neck pain who receive ETT immediately following manipulation will exhibit greater post-manipulation ROM compared with those who do not receive ETT immediately following manipulation.

METHODS

A randomized clinical trial was conducted to determine if the application of ETT (TheraBand® Kinesiology Tape, Performance Health, Akron, OH) to the neck immediately following cervical manipulation for patients with mechanical neck pain reduces post-manipulation pain and increases neck ROM. Patients were recruited at a single outpatient chiropractic clinic that specializes in sport and spine rehabilitation. A convenience sample of patients attending this clinic was recruited until 50 patients completed the trial. The sample size of 25 patients per group was anticipated to yield adequate statistical power (η = 0.80) to detect a moderate effect (d = 0.4–0.6) of the intervention on the outcome variable of pain. Individuals were included in the study if they were between the ages of 18–65 years, presented with non-radicular mechanical neck pain, and were prescribed by the clinical staff to receive a cervical manipulation. The following were the exclusion criteria:

(1) patients not receiving a cervical manipulation;
(2) patients with radicular signs and/or symptoms; and
(3) patients who did not consent to be in the study.

This study received institutional review board approval from the Sport and Spine Rehab Clinical Research Foundation IRB (SSR.2015.3).

Outcome Measures

Data collection was conducted during 2 clinic visits separated by 24–48 hours. Background characteristics were collected from the patient's clinical chart. Variables extracted from the chart included gender, age, duration since onset of symptoms, height, weight, and body mass index. Neck pain was measured immediately before the cervical manipulation (T1), within 5 minutes of cervical manipulation (T2), and 24–48 hours after manipulation (T3). At each of these data collection points, the patient was asked to rate their level of neck pain using the NPRS from 0 to 10 in response to the question, "On a scale of 0 to 10, rate the neck pain you are experiencing at this moment, with 0 being 'no pain' and 10 being the 'worst pain imaginable.'" This measure is an established method of assessing musculoskeletal pain in clinical settings.[21]

In total, 6 measures of neck flexibility were assessed in the sagittal, frontal, and horizontal planes using the ACUMAR DataCapture handheld dual inclinometer (Lafayette Instrument Company, Lafayette, IN). These assessments included neck flexion, extension, right-side bending, left-side bending, left rotation, and right rotation. These movements of neck flexibility were measured immediately before the patient underwent cervical manipulation (T1), within 5 minutes of cervical manipulation (T2), and 24–48 hours after manipulation (T3). The patient was instructed to perform the neck movements 3 times to their maximum ROM. The greatest flexibility in degrees achieved over the 3 trials was considered the individual's maximum flexibility for the specific neck motion. Each trial of these neck motions was measured from the anatomical position by the same research staff at each data collection point.

Intervention

After providing informed consent and completion of baseline data collection, pa-

tients were randomly assigned by coin flip to receive application of ETT to their neck immediately following their cervical manipulation (tape group) or no ETT following their cervical manipulation (control group). Immediately following cervical manipulation, 5 minutes before T2 data collection, patients who were assigned to the tape group had a reverse Y-strip applied at 25% tension, applied just below the hairline, with each arm extending down each side of the cervical spine. A second piece of tape was applied at 50% over the C7 spinous process. The application of the ETT was performed by the same clinical staff that completed training in ETT application. The ETT was applied directly over the erector spinae muscles directly over the area of pain. Patients in the tape group also received the usual post-manipulation care consisting of post-procedure pain management with over-the-counter NSAIDs as needed. Patients in the tape group were asked to not alter their physical activity or bathing routines and to leave the tape on their neck until their next visit to the clinic in 24–48 hours for T3 data collection. If any portion of the tape became disconnected from the skin, patients were instructed not to attempt to reattach the ETT. Patients who were assigned to the control group did not receive the ETT application following cervical manipulation and were provided with the same post-manipulation care as the tape group.

Data Analysis

Data were transcribed from data collection sheets or original data sources onto Version 20 of the Statistical Package for the Social Sciences (SPSS International Business Machines Corp., Armonk, NY) spreadsheets. These spreadsheets were double checked for data entry and transcription accuracy. Descriptive statistics confirmed the appropriateness of using parametric statistics to evaluate the hypotheses. The first step in the analysis was to compare the 2 groups to determine the effectiveness of randomization to produce similar groups with regard to all of the variables collected at T1 before cervical manipulation. To address the 2 hypotheses, separate repeated-measures ANOVAs were calculated to determine if the study groups changed their pain rating or neck ROM over the duration of the study. Significant main effects of any of the repeated-measures ANOVAs (time, group, interaction) were further addressed by calculating Tukey least significant difference post hoc comparisons.

RESULTS

Table 1 presents comparisons between the 2 study groups at T1 before cervical manipulation. This table indicates that there were no statistically significant differences ($P < .05$) between the 2 study groups on any of the background characteristics, pain or neck ROM. The sample included patients who were ~37 years of age, who were experiencing neck pain for >9 days, and who reported moderate level of neck pain before cervical manipulation. At T1, the patients in both the tape and control groups reported a similar level of moderate neck pain at 6.12 and 5.65 out of 10, respectively. Table 1 also indicates that the 2 study groups exhibited similar neck ROM on all 6 measures at T1. When comparing these initial measures of neck ROM with previously established norms[22] for these measures, both groups exhibited severely reduced neck ROM on all 6 measures.

The analysis to address *H1* indicated a significant time effect ($P < .05$) within the model, although the nonsignificant group and the interaction effect indicated that the groups did not report significantly different levels of pain at any of the data collection points. Post hoc comparisons based on the significant time effect demonstrated that the tape group reported significantly lower pain at T2 and T3 compared with that at T1, whereas the control group did not report a significant change in their pain over the duration of the study (Table 2). Table 2 also presents the comparisons within and between

Table 1. Comparison of study groups at T1

Variable	Tape Group (n = 27) M ± SE	Control Group (n = 23) M ± SE	Statistical Comparison (t)	$P <$
Age	36.93 ± 2.28	36.52 ± 2.42	0.12	.90
Days since onset of neck pain	9.56 ± 1.17	10.48 ± 1.38	−0.51	.61
Number of previous clinic visits	0	0		
Height (cm)	65.48 ± 0.94	65.91 ± 1.14	−0.30	.77
Weight (kg)	173.41 ± 7.94	179.83 ± 6.66	−0.60	.56
BMI	28.27 ± .933	29.54 ± 1.48	−0.75	.46
Pain 1–10 VAS	6.12 ± .35	5.65 ± .38	0.96	.34
Neck flexion (65°)[a]	37.86 ± 12.59	36.87 ± 11.57	0.29	.78
Neck extension (57°)[a]	34.30 ± 7.26	32.39 ± 10.06	0.78	.44
Left-side bending (44°)[a]	27.89 ± 11.76	27.96 ± 9.08	0.02	.98
Right-side bending (44°)[a]	31.56 ± 8.96	32.65 ± 8.87	0.43	.67
Left rotation (72°)[a]	54.52 ± 18.13	51.65 ± 18.28	0.55	.58
Right rotation (72°)[a]	52.56 ±14.39	50.21 ± 19.08	0.49	.62
Variable	**Tape Group (n = 27) M ± SE**	**Control Group (n = 23) M ± SE**	**Statistical Comparison (χ^2)**	**$P <$**
Gender	M = 11 (40.7%) F = 16 (59.3%)	M = 11 (47.8%) F = 12 (52.5%)	0.25	.62
Race	White = 22 (81.5%) Black = 3 (11.1%) Other = 2 (7.4%)	White = 18 (78.3%) Black = 2 (8.7%) Other = 3 (13.0%)	0.48	.79

[a]Normal range of motion.[22]
Abbreviation: VAS, visual analog scale.

groups on the 6 measures of neck motion flexibility to address *H2*. Neither of the study groups showed a significant change in their neck ROM following cervical manipulation.

DISCUSSION

These findings partially support *H1* and fail to support *H2*. The results indicate that patients with mechanical neck pain who receive ETT immediately following manipulation reported less post-manipulation pain within 5 minutes and 24–48 hours following the manipulation. The pain levels that significantly reduced as reported by the tape group were not different than the pain levels reported by the control group at any point over the duration of the study. Further, the statistically significant reductions in pain reported by the tape group failed to achieve a clinically important

Table 2. Means of outcome variables by group over time

Outcome	Pre-cervical Manipulation (T1) Mean ± SE	Within 5 min of Cervical Manipulation (T2) Mean ± SE	Within 30 min of Cervical Manipulation (T3) Mean ± SE
Pain 1–10 VAS	T: 6.12 ± 0.35	T: 5.38 ± 0.36	T: 4.89 ± 0.39
	C: 5.65 ± 0.38	C: 4.96 ± 0.39	C: 4.88 ± 0.42
Neck flexion	T: 37.85 ± 2.33	T: 39.51 ± 2.12	T: 42.44 ± 2.23
	C: 36.87 ± 2.53	C: 37.48 ± 2.30	C: 39.04 ± 2.42
Neck extension	T: 34.30 ± 1.67	T: 36.52 ± 2.07	T: 41.74 ± 2.20
	C: 32.39 ± 1.81	C: 38.70 ± 2.24	C: 36.88 ± 2.38
Right-side bending	T: 27.89 ± 2.04	T: 30.52 ± 2.84	T: 36.70 ± 2.03
	C: 27.96 ± 2.21	C: 33.70 ± 2.26	C: 32.22 ± 2.20
Left-side bending	T: 31.55 ± 1.72	T: 35.30 ± 1.99	T: 38.97 ± 1.01
	C: 32.65 ± 1.86	C: 34.52 ± 2.16	C: 35.09 ± 2.07
Left rotation	T: 54.52 ± 3.50	T: 53.22 ± 3.32	T: 52.81 ± 3.26
	C: 51.65 ± 3.80	C: 53.22 ± 3.60	C: 50.04 ± 3.53
Right rotation	T: 52.56 ± 3.21	T: 53.82 ± 3.20	T: 56.52 ± 3.18
	C: 50.22 ± 3.48	C: 50.88 ± 3.47	C: 52.48 ± 3.45

Note: Shading indicates a within-group difference from T1.
Abbreviations: T, tape group; C, control group; VAS, visual analog scale.

difference for reducing neck pain set by previous investigators at >2 points on the NPRS.[20,21] In addition, the findings fail to support *H2*, indicating that none of the neck ROM measures changed over the duration of the study within or between the study groups.

There are a number of explanations for these findings. Applying ETT following cervical manipulation among patients with acute neck pain had only a minor benefit of pain mitigation, but no effect on neck ROM. Cervical manipulation with the addition of ETT did not appear to improve either pain or ROM compared with the control condition. In addition, the possible confounding effects of NSAIDS and strength and flexibility exercises may have biased any beneficial effects of the tape. Further, a single cervical manipulation session may be inadequate to result in a measurable impact on either neck pain or ROM. This explanation is supported by a recent systematic review that indicates minimal treatment differences in pain or functional improvement following short-term therapy or when comparing cervical manipulation with physical therapy or exercise in patients with neck pain.[23] Thus, future investigators may wish to examine the effects of ETT over a greater number of cervical manipulation sessions and study the separate and combined effects of ETT following cervical manipulation with and without NSAIDS as needed and the effect of prescribed exercises to be performed between cervical manipulations sessions.

Investigators may also consider addressing a number of limitations of this study. First, the placebo effect of ETT may have resulted in the observed reduction in pain. This limitation is difficult to ameliorate, as an adequate sham version of ETT has yet to be identified. Second, all patients were recruited from a single clinical practice and may not represent all patients with neck pain. A third limitation was that the ETT was applied by a single ETT-trained practitioner who used a single taping technique; this may or may not exhibit reliability and/or validity of the application. Finally, no attempt was made to measure the patient's adherence to the post-procedure pain management with NSAIDS as needed and the prescribed strength and flexibility exercises that had to be performed daily until the following schedules clinic visit.

CONCLUSION

Mechanical neck pain is one of the most commonly treated conditions in chiropractic clinics. The findings of this study indicate that post-cervical manipulation pain may be mitigated at 5 minutes and 24–48 hours post manipulation with the application of ETT immediately following cervical manipulation, although the level of relief may not be clinically important.

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