
ARTICLE

Investigation of the Efficacy of Different Physiotherapy Methods for Neck Pain

Bahar Kavlak, PT, MSc¹, Yeşim Bakar, PT, PhD² and Zübeyir Sarı, PT, PhD¹

¹Faculty of Health Science, Physical Therapy and Rehabilitation Department, Marmara University, Istanbul, Turkey, ²School of Physical Therapy and Rehabilitation, Abant İzzet Baysal University, Bolu, Turkey

ABSTRACT

Objectives: This study was carried out to compare the efficacy of mobilization, Kinesio tape [KT], and classic treatment methods in patients with neck pain.

Methods: Sixty patients with neck pain were enrolled. The patients were divided into three groups with 20 patients in each, for classic therapy, classic therapy plus mobilization, and classic therapy plus KT administered respectively to the first, second, and third groups. Pain levels and effects of the pain on daily life were assessed, respectively, with a visual analog scale and neck disability index [NDI].

Results: Following the treatment, decreases were observed in pain and NDI scores in all three groups [$P < 0.001$]. However, no significant difference was observed in the inter-group comparison [$P > 0.05$]. While all three groups individually responded significantly to treatment, none of the groups superseded the others.

Conclusions: The results of this study suggest that KT and mobilization may be helpful as an alternative treatment in neck pain. Multi-centered studies in which the efficacy of KT and mobilization can be compared more objectively would be beneficial.

KEYWORDS: Neck pain, Kinesio tape, mobilization

INTRODUCTION

Pains in the neck region, which exhibits different anatomic and functional properties from other regions of the spine, are encountered frequently in clinical practice. The cervical spine may be the source of pain due to many different etiologic reasons as it is more active and prone to trauma compared to other regions of the spine (1). Similar to low back pain, neck pain is also associated with significant negative economic, social, and health impacts, though not to the same extent as low back pain (2). It has been estimated that about 70 percent of adults are afflicted by neck pain at some time in their lives, 10–40 percent of adults are bothered by neck pain each year, 10–15 percent of adults report neck pain that has persisted more than six months in the past year, and 5 percent of adults are currently experiencing disabling neck pain (3).

Women are more likely than men to develop and suffer from persistent neck pain (4). Neck pain has been well recognized as a source of disability in the working population (2).

Manual therapy administered for the treatment of pains and functional disorders in the spine and extremity joints over the past 300 years has included methods such as manipulation, mobilization, and post-isometric relaxation techniques (5–9). Manipulation [adjustments to the spine] and mobilization [movement imposed on joints and muscles] can be used alone or in combination with other physical therapies to treat neck pain (10). Spinal mobilization is defined as slow passive movements within the joint's movement space or its limits (5–9). Reflex reactions stimulated by mobilization of the joint structures are effective in cases of painful joints and functional disorders (9).

Address correspondence to: Bahar Kavlak, PT, MSc, Faculty of Health Science, Physical Therapy and Rehabilitation Department, Marmara University, Istanbul, Turkey. [E-mail: bahar_sengun@yahoo.com].

Submitted: October 7, 2011; Revisions Accepted: March 21, 2012

The use of Kinesio tape [KT] has become quite popular in recent years. KT is designed to simulate the properties of human skin. It is as thick as epidermis and it may stretch 30–40 percent according to the resting length. Therefore, it is considered as an effective therapy in correcting muscle function and alleviating pain (11,12). KT has many other benefits: 1. Stimulating a positional warning throughout the skin. 2. Regulating the fascial tissues. 3. Tape convolution areas may increase the flow of blood and lymphatic fluids due to a lifting effect, which creates a wider space between the skin and the muscle and interstitial space. 4. Stimulating emotional warning for facilitating or preventing movement. 5. Facilitating excretion of edema by directing the wastes toward the lymphatic duct (11).

Although there are studies concerning the effects of cervical mobilization on neck pain in the literature (5–9,11–13), we encountered no study on the effect of KT on neck pain. Therefore, the aim of this study was to compare the efficacy of cervical mobilization and KT administered in cases of neck pain in addition to the classic physiotherapy methods.

MATERIALS AND METHODS

Approval for the study was obtained from Abant Izzet Baysal University, Medical Ethics Committee of Faculty of Medicine.

The purpose and scope of the study were explained to patients suffering from neck pain and diagnosed by a doctor with cervical disc herniation, cervical spondylosis, or cervical radiculopathy. Their consent to participate was obtained, and they were enrolled in the study. Patients were accepted to the study if they had acute subacute or chronic pain before the treatment. The therapy groups were numbered 1, 2, or 3. The patients receiving a plus score in a minimum of one of the measurements of night visual analog scale [VAS], resting VAS, or activity VAS drew one of the protocols and underwent treatment in that group. All patients were randomized into three groups via closed-envelope technique [sealed-envelope randomization]. The age range was 18–70. The study was carried out with male and female patients without gender discrimination. The patients were divided into three groups. Classic therapy, classic therapy plus mobilization, and classic therapy plus KT were administered respectively to the first, second, and third groups. All the patients were evaluated by the same physiotherapist who was blinded to the study randomization codes and was physically separated from treating physiotherapists at the first and last session of the patients' therapy.

Excluded were patients who had undergone physical therapy in the previous one month; patients who were suffering from neck pain due to fracture, infection, or non-mechanical reasons; or patients who had a history of cervical spine surgery or inflammatory pathologies that can affect the vertebral column such rheumatoid arthritis, progressive neurological deficit, or myelopathy, were not enrolled in the study. Of 80 patients with neck pain screened for eligibility criteria, 20 were excluded from the study and 60 were evaluated for the study [Figure 1].

Pain levels in all the patients and the effects of this pain on daily life were assessed, respectively, with a VAS and Neck Disability Index [NDI] before and after the treatment (14–19). The VAS was a 100-mm line with pain descriptors marked “good” at one end and “bad” at the other. The subject was asked to rate the intensity of pain before and after the treatment. Perceived pain level was reported by marking the VAS with a perpendicular line. This mark was measured in millimeter from the same end of the 100-mm line in all patients. In general, this method of clinical pain assessment has been shown to be reliable and valid and seems to be the most sensitive. The VAS provides the patient with a robust, reproducible method of expressing pain severity (14).

We assessed the disability due to neck pain with the Turkish version of the NDI (15), a modified version of the Oswestry Low Back Pain Disability Index with a score range of 0–50. The NDI contains 10 items, with 7 related to activities of daily living, 2 related to pain, and 1 item related to concentration. 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 shown to have high internal consistency, high test–retest reliability, and responsiveness to change (13,16).

Each group received 15 sessions of therapy. While only five sessions were administered to the mobilization group during their therapy, tape administration in the KT group was repeated every session. The three groups were administered a therapy program comprised of ultrasound, interferential current, hot-pack, classic neck massage, and exercise. This program was named the classic treatment. While the first group was administered only the classic treatment, the second group was administered mobilization with the Cyriax technique in combination with classic therapy, and the third group was administered KT in addition to classic therapy. All treatment sessions were applied by the same physiotherapist.

Ultrasound, interferential current, hot-pack, and classic neck massage were applied to the neck and midscapular regions. The duration of the neck

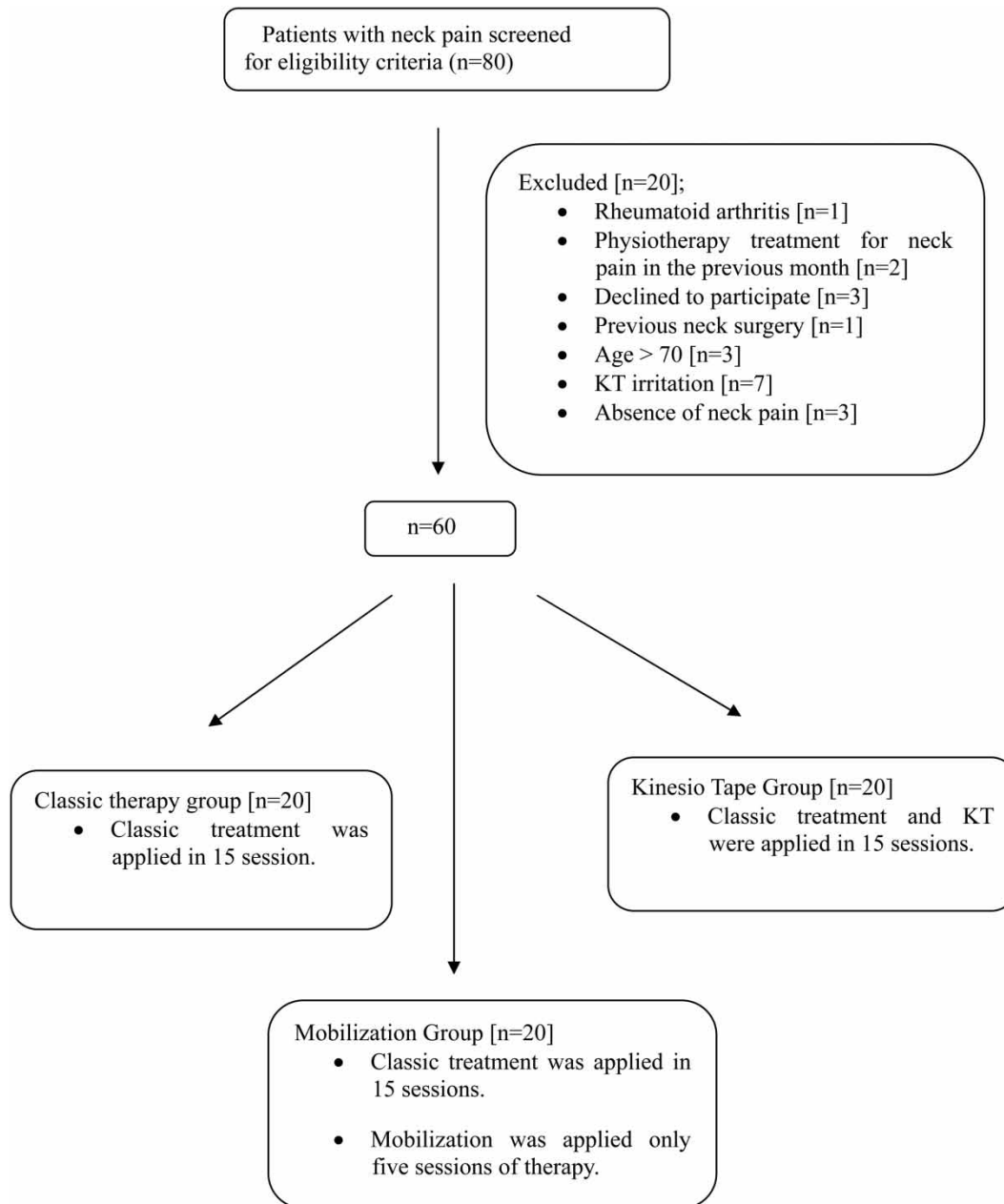


FIGURE 1. Flow chart of the study protocol and exclusion diagram for patients of study.

massage was 10 minutes and it consisted of stroking and kneading motions to relax the muscles [m. erector spinae, m. levator scapulae, m. trapezius]. Cervical flexion, extension, lateral flexion, rotation, and strengthening exercises were given to the patients as an exercise program. Exercises were started during their therapy for all three groups and these were taught as programs to be performed at home.

All patients in the mobilization group were administered the same cervical mobilization with the Cyriax technique following their classic therapy. Cyriax mobilization [Grade A or B] techniques refer to the application of rotational and extension maneuvers (20) at cervical spine joint segments [bridging,

manual traction, antero-posterior gliding, and lateral gliding techniques]. The duration of the each mobilization session was 20–30 minutes. Administration of mobilization on consecutive days was avoided and the administration was repeated five times in total at a frequency of two times a week. Five mobilization sessions were chosen based on previous studies of similar design (21).

Before neck mobilization, a vertebral artery test was administered to eliminate the potential risks that cerebral blood flow could become impaired (22).

Neck mobilization was administered in the supine position. The physiotherapist sat at the bedside of the patient, supporting his/her forearms. As the oil



FIGURE 2. Bilateral kinesio tape application for splenius capitis.

remaining on the skin decreased hand contact, classic massage was not applied to the patient on the days of mobilization.

The patients in the KT group were administered KT every session after their classic therapy. Although the KT could have remained unchanged for four to five days, it was removed before the therapy in each session and re-administered after the session in our study.

To enable the administration of KT, the patient was asked to sit on a chair with his/her back to the physiotherapist and the region of administration was cleared of hair and oil. The origin of the KT shaped Y was placed, while the head of the patient was in a neutral position and he/she was instructed to perform neck flexion. After the medial tail of the KT was adhered in this position, the patient was instructed to perform rotation in combination with neck flexion, and the lateral tail of KT was adhered in this position. The administration was repeated on the other side bilaterally [Figure 2].

Data Analysis

Gender, diagnosis, occupation, and dominant hand distributions in the three different therapy groups were analyzed with the chi-square test and the inter-group age distribution with one-way variance analysis. Kruskal–Wallis one-way analysis of variance was used for determining VAS and NDI distributions of the groups before the therapy. The first and last measurement test results of the intragroup VAS and NDI parameters were examined using Wilcoxon marked ranking analysis. Kruskal–Wallis statistical analysis was used for determining the inter-group difference. All the statistical analysis was performed by one statistician using SPSS version 11.0.

RESULTS

The study was carried out with 60 patients, comprising 8 males and 52 females without gender

discrimination. There were 20 patients in each of the 3 groups. No significant difference was detected between the groups in terms of gender, diagnosis, occupation, and dominant hand distributions [$P > 0.05$] [Table 1]. Before the treatment, VAS and NDI values were observed to be distributed homogeneously [$P > 0.05$] [Table 2]. A significant difference was detected in VAS [$P < 0.05$] and NDI scores within all three groups after treatment [$P < 0.001$] [Table 3].

No significant difference was detected among the groups when VAS and NDI scores were examined [$P > 0.05$]. No significant difference was detected when pre- and post-therapy differences in VAS and NDI scores were compared among the groups [$P > 0.05$] [Table 4].

DISCUSSION

Neck pain not only causes functional limitations and functional impairments by affecting both the physical and psychological functions, but also prevents the performance of daily life activities (23).

There is a finding of a net significance such as $P < 0.001$ in VAS and NDI scores when KT, mobilization, and classic therapy groups were compared after the therapy. Our study indicates that none of the groups is superior to the others. The VAS and NDI are subjective assessment parameters where the severity and effects of this pain on daily life are determined by the patient, and the responses received from the patient can reflect his/her satisfaction with the therapy. The lack of superiority among the groups is interpreted as showing that the patients benefited from and were satisfied with the therapy in all three groups.

When inter-group pre- and post-therapy differences of VAS are examined, it is seen that the difference in VAS values in all three groups was significant and the pain decreased. However, when median values are examined, it is seen that the effect in the

TABLE 1. Gender, Diagnosis, Occupation, Dominant Hand Distributions and Age between Groups

		Kinesio tape group		Mobilization group		Classic therapy group		χ^2	P
		n	%	n	%	n	%		
Gender	Men	5	25	1	5	2	10	3.75	0.15
	Women	15	75	19	95	18	90		
Diagnosis	Cervical disc herniation	10	50	10	50	11	55	4.44	0.35
	Cervical spondylosis	8	40	5	25	3	15		
	Cervical radiculopathy	2	10	5	25	6	30		
Occupation	Working	8	40	4	20	7	35	2.03	0.35
	Not working	12	60	16	80	13	65		
Dominant Hand	Right	19	95	19	95	15	75	6.1	0.19
	Left	1	5			3	15		
	Both			1	5	2	10		
Age		M \pm SD [n = 20]		M \pm SD [n = 20]		M \pm SD [n = 20]		F*	p
		47.35 \pm 12.94		47.40 \pm 9.11		51.45 \pm 12.57		0.81	0.49

χ^2 , Chi-square test; F*, one-way analysis of variance; M, mean.

TABLE 2. VAS [cm] and NDI Values before Treatment

Group		M \pm SD	Median	χ^2	P
VAS resting	Kinesio tape	5.38 \pm 2.54	5.85	4.44	0.11
	Mobilization	3.84 \pm 2.83	3		
	Classic therapy	3.77 \pm 3.29	2.9		
VAS activity	Kinesio tape	6.94 \pm 2.31	7.45	3.50	0.17
	Mobilization	4.98 \pm 3.26	5.65		
	Classic therapy	6.28 \pm 2.87	5.3		
VAS night	Kinesio tape	6.07 \pm 2.78	6.6	1.32	0.52
	Mobilization	4.99 \pm 2.90	5.15		
	Classic therapy	5.14 \pm 3.35	5.3		
NDI	Kinesio tape	34.75 \pm 13.28	34	0.26	0.87
	Mobilization	31.90 \pm 12.03	34		
	Classic therapy	33.80 \pm 12.16	32		

M, mean; SD, standard deviation; χ^2 , Kruskal-Wallis one-way analysis of variance; VAS, Visual Analog Scale; NDI, Neck Disability Index.

TABLE 3. VAS [cm] and NDI Scores within Three Groups after Treatment

Group		M \pm SD	Median	Z	P
VAS resting	Kinesio tape	1.99 \pm 1.76	2	-3.88	P < 0.001
	Mobilization	1.21 \pm 1.60	0.3	-3.40	P < 0.001
	Classic therapy	1.71 \pm 2.19	0.9	-2.03	0.04
VAS activity	Kinesio tape	3.23 \pm 2.43	3.15	-3.66	P < 0.001
	Mobilization	1.96 \pm 1.85	1.6	-3.22	P < 0.001
	Classic therapy	3.17 \pm 2.36	2.6	-3.57	P < 0.001
VAS night	Kinesio tape	2.73 \pm 2.92	1.8	-3.70	P < 0.001
	Mobilization	0.90 \pm 1.19	0.3	-3.92	P < 0.001
	Classic therapy	1.25 \pm 1.48	0.7	-3.44	P < 0.001
NDI	Kinesio tape	20.3 \pm 11.22	18	-3.848	P < 0.001
	Mobilization	12.6 \pm 7.86	11	-3.828	P < 0.001
	Classic therapy	17.4 \pm 8.46	16	-3.704	P < 0.001

M, Mean; SD, standard deviation; Z, Wilcoxon signed rank test; VAS, Visual Analog Scale; NDI, Neck Disability Index.

KT group in a resting condition was higher than in the other groups. Moreover, the KT and mobilization groups had similar activity scores; their results were better than those of the classic therapy group, and

the best results in terms of night pains were obtained in the mobilization group. Before mobilization was administered, deep friction massage was applied to the masseter, levator scapula, or sternomastoid

TABLE 4. Comparison of Pre- and Post-Treatment Difference Values of VAS [cm] and NDI Parameters

	Group	M ± SD	Med	χ^2	P
VAS resting	Kinesio tape	3.39 ± 2.29	3.25	2.814	0.25
	Mobilization	2.63 ± 2.71	2.45		
	Classic therapy	2.06 ± 3.87	2.05		
VAS activity	Kinesio tape	3.71 ± 2.84	3.50	0.842	0.66
	Mobilization	3.02 ± 2.83	3.45		
	Classic therapy	3.12 ± 2.81	2.70		
VAS night	Kinesio tape	3.34 ± 2.47	3.65	0.586	0.75
	Mobilization	4.09 ± 2.78	4.20		
	Classical therapy	3.90 ± 3.56	3.90		
NDI	Kinesio tape	14.45 ± 9.84	14	1.43	0.48
	Mobilization	19.3 ± 12.30	19		
	Classic therapy	16.4 ± 11.94	16		

M, Mean; SD, standard deviation; Med, Median; χ^2 , Kruskal-Wallis one-way analysis of variance; VAS, Visual Analog Scale; NDI, Neck Disability Index.

muscles of the patients, and it was ensured that these regions were relaxed before mobilization. We think that the reason for the observance of the highest decrease in night pains in the mobilization group was that the relaxation felt by the patients generally in their muscles that went into spasm continued throughout the night.

Gonzalez-Iglesias et al. (24) enrolled 41 patients in their study on the effects of cervical KT administration on pain and range of motion in patients with acute whiplash injury. While KT was administered with stress to the cervical spine in the experimental group, tape was administered to the same regions in the control group without stress. As a result, a significantly higher improvement was observed in the experimental group in terms of neck pain and cervical ROM compared to the control group in the measurements performed both immediately after and 24 hours after the tape administration (24). Similar to that study, a decrease in neck pain in the KT group was observed in our study as well.

Glynn and Cleland (25) used NDI for assessing the results of when they administered cervical and thoracic manipulations to a patient suffering from neck and upper extremity pains. The NDI score of the patient, which was 30/100 in the pre-therapy assessment, had decreased to 14/100 by the end of the second week and to 0/100 by the end of the fourth week, and this score remained unchanged for 10 weeks after. While the mean NDI score of the patients in the KT group was 34/100 in our study, similar to the aforementioned study, it had decreased to 18/100 by the end of their therapy, which lasted approximately 2.5 weeks. Accordingly, it had decreased to 11/100 by the end of the therapy, despite having been 34/100 in the first assessment in the mobilization group, and it decreased to 16/100 from 32/100 in the classic therapy group. When pre- and post-therapy

difference median values of NDI scores among the groups are examined, it is seen that the median value in the mobilization group is higher, but not significantly so. Many negative changes such as excessive connective tissue storage in the musculoskeletal system, the formation of adhesions and scarring inside the joints, and decreases in the distention capacity of the structures may be observed due to inactivity. These negative changes may affect the daily life activities of the people as well. We consider that mobilization created such a difference [even slight] in NDI median scores due to its effects of decreasing joint disabilities, pain, or protective muscle spasms (9,22).

Various studies investigating the effects of mobilization and manipulation on neck pain and comparing these modalities with each other have been reported in the literature. Hurwitz et al. (13) compared the effects of cervical manipulation and mobilization on neck pain in 336 patients. They found that cervical mobilization is as effective as manipulation in decreasing neck pain and accompanying failures. Hurwitz et al. also indicated that heat administration and electrical stimulation do not change the clinical result when administered separately or in combination with manipulation or mobilization even if they may be beneficial for some patients in the short term. Therefore, they have suggested that clinicians can treat neck pains by means of mobilization and achieve the same effect without the risks involved in manipulation.

Irreversible side effects of manipulation are mentioned in the research and review articles, and it is indicated that the rate varies between one side effect in every 3,020 to 1,000,000 manipulations. This result has not been reported with mobilization or massage. In the review performed by Gross et al. (26), it is stated that manipulation and mobilization have similar effects on the pain. In compliance with

the knowledge in the literature, mobilization was administered to the patients in our study due to its being less prone to adverse effect risk than manipulative therapy, and accordingly, our results indicated that mobilization had positive effects on the pain. This indicates that we can alleviate pain in the neck region by means of mobilization without performing a more hazardous procedure such as manipulation therapy.

Gross et al. (26) stated in their review that combinations of mobilization/massage or manipulation with exercise or thermal modalities, training, and rare use of a cervical collar are superior to manipulation, specific medical modalities, rest, and continuous use of cervical collar in relation to decrease in pain, (26). In compliance with this knowledge in the literature, the patients in our study were instructed to start exercises during their therapy and these were taught as programs to be performed at home. Exercises were given to all three groups; therefore, the possibility of inequality in the comparison of the efficacy of KT and mobilization was ruled out. We think this multimodal approach is responsible for the positive response of all three groups.

Gross et al. (26) stated in their review that combinations of mobilization/massage or manipulation with only exercise or thermal modalities, training, the rare use of a cervical collar and exercise are superior to only manipulation administration, specific medical modalities, rest, and the continuous use of cervical collar in relation to decrease in pain, continuing to work, and pain satisfaction. In compliance with this knowledge in the literature, the patients in our study were instructed to start exercises during their therapy and these were taught as programs to be performed at home. Exercises were given to all three groups; therefore, the possibility of inequality in the comparison of the efficacy of KT and mobilization was ruled out. We think that this multimodal approach is responsible for the positive response of all three groups to therapy as well.

In another review (27), patients were compared with an untreated group notwithstanding single administration of mobilization and/or manipulation or their combination with modalities such as heat. When combined with exercise, mobilization and/or manipulation were more effective in alleviating the persistent neck pain and increasing function compared to the untreated group. However, when compared with each other, neither mobilization nor manipulation was found to be superior to the other. Mobilization was administered in combination with classic therapy and exercise in our study and it effectively relieved pain; however, when pre- and

post-therapy differences of VAS values were compared among the groups, the KT group was found superior to the mobilization group in terms of resting and activity VAS values. We believe KT is more advantageous than the other therapy techniques as it has positive effects on the pain like mobilization without risks like manipulation, and its clinical administration is easy.

CONCLUSION

Classic therapy, mobilization, and KT in the treatment of neck pain were compared in this study. The results obtained indicated that a significance of $P < 0.001$ was found in all the parameters when pre- and post-therapy VAS and NDI scores of all three groups were compared.

As a result, the KT and mobilization groups were found to be similar to each other and superior to the classic therapy group in terms of many parameters, although significant responses were obtained in all three groups. These results indicate that all three groups responded positively to the therapy, but it was observed that the mobilization and KT groups, the groups in which there was much more contact between the hands of the physiotherapist and the patient, responded better.

Classic therapy was administered to all the patients to ensure that they benefitted from the therapy against the possibility that KT or mobilization did not have the desired effect on neck pain, and KT and mobilization were performed after this basic therapy. As all three groups responded significantly to the therapy, we think that broad-based, multi-center studies in which the efficacy of KT and mobilization can be compared with a larger sample size would be beneficial.

KT can be used three to four days without losing its effectiveness. However, the tape was removed before each session and adhered after the session for administering classic therapy to the patients in our study. Removing and adhering the tape again with such frequency during the therapy caused irritation in patients with sensitive skin and the therapy in these patients was discontinued. We think that the studies in which KT can remain for three to four days following its administration would be more informative.

The limitations of our study are that lack of assessment in the middle of the treatment, and the lack of a long-term follow-up.

Studies similar to the research we have carried out are not included in the literature. The originality of this study and its potential as a source for prospective research increases the value of our study.

Declaration of Interest: The authors report no conflicts of interest.

AUTHOR NOTES

Bahar Kavlak, PT, MSc.

Yeşim BAKAR, PT, PhD, Assoc. Prof.

Zübeyir SARI, PT, PhD, Assist. Prof.

REFERENCES

- Cimen A: Omurganın servikal bölümü ve ağrı. *Ağrı* 19: 2, 2007.
- Benyamin R, Singh V, Parr AT, Conn A, Diwan S, Abdi S: Systematic review of the effectiveness of cervical epidurals in the management of chronic neck pain. *Pain Physician* 12(1): 137–157, 2009.
- Sherman KJ, Cherkin D, Hawkes RJ, Miglioretti DL, Deyo RA: Randomized trial of therapeutic massage for chronic neck pain. *Clin J Pain* 25(3): 233–238, 2009.
- Andersen LL, Kjaer M, Sogaard K, Hansen L, Kryger AI, Sjøgaard G: Effect of two contrasting types of physical exercise on chronic neck muscle pain. *Arthritis and Rheum (Arthritis Care & Research)* 59: 84–91, 2008.
- Bronfort G, Haas M, Evans RL, Bouter LM: Efficacy of spinal manipulation and mobilization for low back pain and neck pain: a systematic review and best evidence synthesis. *Spine J* 4: 335–356, 2004.
- Hakguder A, Kokino S: Manuel terapi. *Trakya Üniversitesi Tıp Fakültesi Dergisi* 19: 128–136, 2002.
- Hurley DA, McDonough SM, Baxter D, Dempster M, Moore AP: A descriptive study of the usage of spinal manipulative therapy techniques within a randomized clinical trial in acute low back pain. *Man Ther* 10: 61–67, 2005.
- Hurley DA, McDonough SM, Dempster M, Moore AP, Baxter D: A randomized clinical trial of manipulative therapy and interferential therapy for acute low back pain. *Spine* 29: 2207–2216, 2004.
- Sahin E: Miyofasial ağrı sendromunda klasik fizyoterapi yöntemlerine ek olarak uygulanan servikal mobilizasyonun etkinliği. PhD Dissertation. Baskent University, Institute of Health Sciences, Department of Physical Therapy and Rehabilitation, 2007, Ankara.
- Gross A, Miller J, D'Sylva J, Burnie SJ, Goldsmith CH, Graham N, Haines T, Bronfort G, Hoving JL: Manipulation or mobilization for neck pain (review). *Cochrane Database Syst Rev* 20: 315–333, 2010.
- Thelen MD, Dauber JA, Stoneman PD: The clinical efficacy of kinesio tape for shoulder pain: a randomized, double-blinded, clinical trial. *J Orthop Sports Phys Ther* 38: 389–395, 2008.
- Yoshida A, Kahanov L: The effect of kinesio taping on lower trunk range of motions. *Res Sports Med* 15: 103–112, 2007.
- Hurwitz EL, Morgenstern H, Harber P, Kominski GF, Yu F, Adams AH: A randomized trial of chiropractic manipulation and mobilization for patients with neck pain: clinical outcomes from the UCLA neck-pain study. *Am J Public Health* 92: 1634–1641, 2002.
- Pikula JR: The effect of spinal manipulative therapy (SMT) on pain reduction and range of motion in patients with acute unilateral neck pain: a pilot study. *J Can Chiropr Assoc* 43: 111–119, 1999.
- Aslan E, Karaduman A, Yakut Y, Aras B, Simsek IE, Yağlı N: The cultural adaptation, reliability and validity of neck disability index in patients with neck pain: a Turkish version study. *Spine* 11: 632–635, 2008.
- Cleland JA, Whitman JM, Fritz JM, Palmer JA: Manual physical therapy, cervical traction, and strengthening exercises in patients with cervical radiculopathy: a case series. *J Orthop Sports Phys Ther* 35: 802–811, 2005.
- Issa TS, Huijbregts PA: Physical therapy diagnosis and management of a patient with chronic daily headache: a case report. *J Man Manipulative Ther* 14: 88–123, 2006.
- Visscher CM, Lobbezoo F, de Boer W, van der Zaag J, Verheij JGC, Naeije M: Clinical tests in distinguishing between persons with or without craniomandibular or cervical spinal pain complaints. *Eur J Oral Sci* 108: 475–483, 2000.
- Yap EC: Myofascial pain – an overview. *Ann Acad Med Singapore* 36: 43–48, 2007.
- Hurley DA, McDonough SM, Dempster M, Moore AP, Baxter GD: A randomized clinical trial of manipulative therapy and interferential therapy for acute low back pain. *Spine* 29: 2207–2216, 2004.
- Schellingerhout JM, Verhagen AP, Heymans MW, Pool JJJ, Vonk F, Koes BW, Wilhelmina de Vet HC: Which subgroups of patients with non-specific neck pain are more likely to benefit from spinal manipulation therapy, physiotherapy, or usual care? *Pain* 139: 670–680, 2008.
- Kesson M, Atkins E: *Orthopaedic Medicine, A Practical Approach*, Butterworth-Heinemann, Oxford, 1998, 216–261.
- Luo X, Edwards CL, Richardson W, Hey L: Relationships of clinical, psychologic, and individual factors with the functional status of neck pain patients. *Value Health* 7: 61–69, 2004.
- Gonzales-Iglesias J, Fernandez-De-Las-Penas C, Cleland J, Huijbregts P, Del Rosario Gutierrez-Vega M: Short-term effects of cervical kinesio taping on pain and cervical range of motion in patients with acute whiplash injury: a randomized clinical trial. *J Orthop Sports Phys Ther* 39: 515–521, 2009.
- Glynn PE, Cleland JA: Evidence-based approach to the physical therapy diagnosis and management of neck and upper extremity pain using cervical and thoracic spine thrust manipulation: a case report. *J Man Manipulative Ther* 14: 30–45, 2006.
- Gross AR, Kay T, Hondras M, Goldsmith C, Haines T, Peloso P, Kennedy C, Hoving J: Manual therapy for mechanical neck disorders: a systematic review. *Man Ther* 7: 131–149, 2002.
- Gross AR, Hoving JL, Haines TA, Goldsmith CH, Kay T, Aker P, Bronfort G: A Cochrane review of manipulation and mobilization for mechanical neck disorders. *Spine* 29: 1541–1548, 2004.