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ADDITIONAL EFFECTS OF KINESIOTAPING TO MOBILIZATION TECHNIQUES IN CHRONIC MECHANICAL NECK PAIN

RESEARCH ARTICLE

ABSTRACT

Objectives: The aim of this study was to investigate the additional effects of kinesio taping to mobilization techniques on muscle activation of deep cervical flexors and neck pain in chronic mechanical neck pain.

Methods: Twenty-eight participants with mechanical neck pain were included in this study. The participants were randomized into two groups: mobilization group (Group 1) and kinesio taping group (Group 2). Treatment for Group 1 (Mean age: 25.71±8.39 yrs) included scapular mobilization, ischemic compression for trigger points and Cyriax mobilization techniques for cervical region. Treatment for Group 2 (Mean age: 30.29±12.92 yrs) included kinesio taping, additionally. Head and neck pain were assessed by Visual Analog Scale, while the muscle activation of deep neck cervical flexors was assessed by Craniocervical Flexion Test, using "Stabilizer Pressure Biofeedback" device before treatment and four days after treatment. Inter-group differences were analyzed by Mann Whitney U Test, and intra-group changes were analyzed by Wilcoxon Test. Also the effect sizes of intra-group changes were analyzed.

Results: There was no significant difference between the groups for any outcome ($p>0.05$). Endurance of deep cervical flexors improved (Group 1, $p=0.018$; Group 2, $p=0.004$), and intensity of headache reduced significantly, in both groups (Group 1, $p=0.038$; Group 2, $p<0.001$). Effect sizes of changes in activation of deep cervical flexor muscles were d: 0.68 and d: 0.863 in Group 1 and 2, respectively. Effect sizes of changes in headache intensity were d: 0.86 and 0.83 in Group 1 and 2, respectively.

Conclusions: When effect size differences were analyzed, it was considered that kinesio taping could be used in addition to mobilization techniques in the treatment of mechanical neck pain.

Key words: Manual therapy, cervical pain, neck muscles

KRONİK MEKANİK BOYUN AĞRISINDA MOBİLİZASYON TEKNİKLERİNE EK KİNEZYO BANTLAMANIN ETKİLERİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Çalışmanın amacı, mekanik boyun ağrılı hastalarda manuel tedavi tekniklerine eklenen kinezyo bantlamanın, ağrı ve derin servikal kas aktivasyonu üzerine ek katkılarını araştırmaktır.

Yöntem: Yirmi sekiz mekanik boyun ağrılı katılımcı çalışmaya dahil edildi. Katılımcılar rastgele iki gruba ayrıldı: mobilizasyon grubu (Grup 1), kinezyo bantlama grubu (Grup 2). Grup 1'e (Ortalama yaş: 25.71±8.39 yıl) skapular mobilizasyon, iskemik kompresyon ve boyun bölgesi için Cyriax Mobilizasyon tekniklerini içeren tedavi uygulandı. Grup 2'ye ise (Ortalama yaş: 30.29±12.92 yıl) Grup 1'e uygulanan tedavinin yanında kinezyo bantlama uygulandı. Tedavi öncesi ve tedaviden 4 gün sonra, derin servikal fleksör kasların enduransı "Basınç Biofeedback'' aygıtı kullanılarak Kraniyoservikal Fleksiyon Test, baş ve boyun ağrısı Görsel Analog Skalası ile değerlendirildi. Gruplar arası farklar Mann Whitney U test ile, grup içi değişimler ise Wilcoxon Test ile analiz edildi. Grup içi değişimlerin etki büyükleri de incelendi.

Sonuçlar: Gruplar birbirleriyle karşılaştırıldığında, hiçbir parametrede fark bulunmadı. ($p>0.05$). Her iki grupta da derin servikal fleksörlerin enduransı gelişirken, baş ağrısı şiddetleri önemli ölçüde azaldı ($p<0.05$). Grup 1'in derin servikal kaslarının aktivasyonundaki değişimde etki büyüklüğü d: 0.68, Grup 2 için d: 0.863 olarak bulundu. Baş ağrısı yoğunluğunda ki etki büyüklükleri ise Grup 1 için d: 0.65, Grup 2 için d: 0.83 olarak bulundu.

Tartışma: Grupların etki büyüklükleri arasındaki fark incelendiğinde kinezyo bantlamanın, mekanik boyun ağrısı tedavisinde mobilizasyon tekniklerine ek olarak kullanılabileceği düşünüldü.

Anahtar Kelimeler: Manuel terapi, servikal ağrı, boyun kasları

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INTRODUCTION

Mechanical neck pain is characterized by chronical pain on cervical region, which is not originated from neurological, rheumatologic or other systemic diseases. Nearly 50 % of the population suffer from mechanical neck pain at least once in their life (1). Reduction of the activation of deep cervical flexor muscles (longus colli, longus capitis) is one of the most important factors in mechanical neck pain. Superficial neck muscles become overactive and painful when the activation of deep cervical flexor muscles (sternocleidomastoid and anterior scalene) reduce (2,3). A strong relationship was found between neck pain intensity and the activity of superficial neck muscles especially sternocleidomastoid and anterior scalene, During Craniocervical Flexion Test (3). In addition, the reduction of the activation of deep cervical muscles is highly correlated with the anterior tilt angle of the head (4).

Generally, the physiotherapy methods for mechanical neck pain consist of stretching and strengthening the neck muscles, cervical stabilization exercises, cervical mobilization, thoracic thrust manipulation, ischemic compression on trigger points, and kinesio taping method (5-9).

Nowadays, taping techniques are widely used for the treatment of mechanical neck pain. Especially kinesio taping, which was developed by Japan Chiropractor Dr. Kenzo Kase in 1988, is used to reduce muscle spasm by increasing blood circulation and thus to reduce neck pain and headache (10).

The studies about the effects of kinesio taping on neck pain only investigated pain and/or cervical range of motion. Karatas et al. found that kinesio taping had a decreasing effect on cervical pain in surgeons (11). However, there is limited information about the effects of kinesio taping on the performance of deep cervical flexor muscles (12). Therefore, the purpose of this study was to determine the additional effect of kinesio taping method to manual therapy techniques on deep cervical flexors muscle activation, headache intensity and neck pain-free duration. We hypothesized that additional kinesio taping to mobilization techniques would be more effective than using only mobilization techniques, in increasing the activation of deep cervical flexor muscles and neck pain-free duration, as well as reducing the headache intensity.

METHODS

Thirty-one participants (18-50 years), suffering from mechanical neck pain at least for 3 months and getting at least five points from Neck Disability Index, were included in this study. We have not got any radiologic test results of participants about their problems. The participants, who had neck surgery, traumatic spinal cord injury, radiculopathy, myelopathy (sensory or motor deficit), neurological or rheumatologic disease and structural scoliosis, were excluded from this study. This study was carried out at Hacettepe University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation. All patients were referred from Neurosurgery and Orthopaedic and Traumatology Departments of Hacettepe University. Informed consent was obtained before the examination, and approval for the study was granted by the local ethical committee of the university. (Ethical committee number: GO 13/168).

The participants were divided into two groups through a computerized randomization. Treatment for Group 1 (n: 14) included scapular mobilization for ten minutes, ischemic compression for trigger points, and Cyriax mobilization techniques with antero-posterior and medio-lateral cervical glidings, and cervical manual traction. Treatment for Group 2 (n: 14) included kinesio tape application, as well.

In addition to the applications of Group 1, kinesio taping was applied to Group 2, in order to enhance blood flow and to provide passive correction for biomechanical problems. Kinesio tape was taken off after 4 days. Before treatment and 4 days after treatment, head and neck pain intensity was determined by Visual Analog Scale, and the muscle activation of deep neck cervical flexors was measured by a “Stabilizer Pressure Biofeedback” device (13). The participants were asked to note down the time the pain reoccurs. Also, Neck Disability Index and Beck Depression Questionnaire were performed to all participants before the treatment.

Interventions

Scapular mobilization: The particiants were positioned in sidelying. The therapist placed the index finger of one hand under the medial scapula border, while the other hand grasping the superior

border of scapula. The scapula was moved superiorly and inferiorly, and was also rotated upward and downward to enhance the mobility. Additionally, the physiotherapist put the ulnar finger under the medial border and distracted the scapula from the thorax. Ten sets of 10 repetitions were applied with rest intervals of 30 seconds between sets (14) (Figure 1).

Cyriax Mobilization Techniques: Deep friction massage on painful spasmotic nuchal muscles and painful ligaments was applied for increasing blood flow and releasing stiff soft tissues, for 3-4 minutes, at supine position (15,16). Vertebrobasilar Insufficiency Test was applied to all participants to determine the suitability of cervical mobilization. Then, the physiotherapist applied manual traction, antero-posterior gliding and medio-lateral to the cervical spine for 10 minutes (17).

Ischemic Compression: Ischemic compression was applied on the determined sensitive areas. Compression intensity was gradually increased until the tissue turned white. The duration of the compression was one minute for each painful area on upper back and cervical region. After this treatment, the therapist stretched compressed areas for 20 seconds (18,19).

Kinesio taping: Kinesio tape was applied to upper trapezius, levator scapulae and sternocleidomastoideus muscles to increase blood flow and to relive pain. Then, mechanical correction technique was performed to correct the malpositioned scapula and upper body posture. The participants were instructed to take off the tapes from their body after 4 days (20).

All treatment techniques were applied for one session. Duration of one session was approximately 40-45 minutes.

Test Procedure

Craniocervical Flexion Test (CCFT): The participants were supine-positioned with knees bending and arms lying along the trunk. The head and neck were placed in a standardized position so that the participants' forehead and chin were horizontal and in mid position. The pressure feedback device (Chattanooga Group, Hixon , TN) was used to assess the deep neck flexor muscle activation. The device was inflated to 20 mmHg, and was placed under the suboccipital region. Then, the participants were instructed to perform nodding movement by increasing the pressure while watching the monometer of the device in 5 levels: 22, 24, 26, 28 and 30 mm Hg. After learning the movements, they were asked to do that task for 10 seconds at each pressure level. The rest time between repetitions was 30 seconds. The participants were warned not to retract their neck, protruse their jaw or contract the superficial muscles during the tests (13).

Pain: Visual Analog Scale (VAS) was used to asssess the intensity of headache and neck pain. The participants were asked to mark a point on 10-cm-line. Zero point means "no pain" and 10 point means "pain as bad as it could be" (21).

Neck Disability: Neck Disability Index Turkish Version (NDI) was used for determining the pain experience and functional disability of the participants (22). NDI is a questionnaire of 10 questions. The questions measure the pain severity, ability for personal care, lifting weight, job capability headache intensity, concentratio, quality of sleeping and driving and recreation activities. The participants can get maximum 50 points from the questionaire. 0-4 points mean "no disability", 5-14 points mean "light disability", 15-24 points mean "modarete disability", 25-34 points mean "severe disability" and 35-50 points mean "complete disability" (22).

Emotional Situation: Turkish version of Beck Depression Inventory was used to assess psychological condition of the participants (23). The inventory consists of 21 questions and each question is scored between 0 and 3. 10-16 points mean "light depressive symptoms", 17-29 points mean "moderate depressive symptoms", 30-63 points mean "severe depressive symptoms" (23).

All tests were performed before and after 4 days treatment. These tests were performed by another physiotherapist, blinded to the treatment group of participants.

Statistical Analysis

SPSS 15 (Illinois, USA) was used for statistical analysis. The descriptive data were expressed as mean and standard deviation. Mann Whitney U Test was used to determine the differences between two

Table 1. Demographic Characteristics of the Subjects (Before Treatment)

	Group 1 (n14) Mean ±SD	Group 2 (n14) Mean ±SD	P
Age (years)	25.72±8.39	30.29±12.92	0.277
Height (cm)	162.5±4.25	162.6±7.71	0.469
Body weight (kg)	60±6.83	59.33±8.42	0.717
BMI (kg/m2)	22.07±3.2	21.88±2.29	0.821
NDI	27.04±12.80	34.21±16.50	0.210
BDI	5.57±4.55	8.86±5.78	0.107
CCFT1	224.29±79.27	164.43±95.33	0.082
Headache (VAS)	4.25±2.54	5.42±2.40	0.096

Mann Whitney U Test

Abbreviations: Mean ±SD, NDI: Neck Disability Index, BDI: Beck Depression Inventory, CCFT 1 : First measurement of Craniocervical Flexion Test, VAS: Visual Analog Scale

groups in terms of NDI, CCFT, headache intensity and the neck pain-free duration. To analyze the differences between pre and post-test outcomes, Wilcoxon Test was performed. Level of significance was set at p< 0.05.

RESULTS

There was no significant difference between groups in terms of Neck Disability Index scores (p=0.210), Beck Depression Inventory (p=0.107), first Craniocervical Flexion Test Scores (p=0.169) and first headache pain intensity (p=0.096) (Table1). There was significant improvement in the muscle activation of deep cervical flexors in both groups after treatment (Group 1: p=0.018; Group 2: p=0.004), (Table 2), (Figure 1). There was significant difference between pre and post-test in headache levels in both groups (Group 1: p=0.038; Group 2: p<0.001), (Table 2), (Figure 2).

There was no significant difference between groups on improvement of Craniocervical Flexion Test Scores (p=0.322), intensity of headache

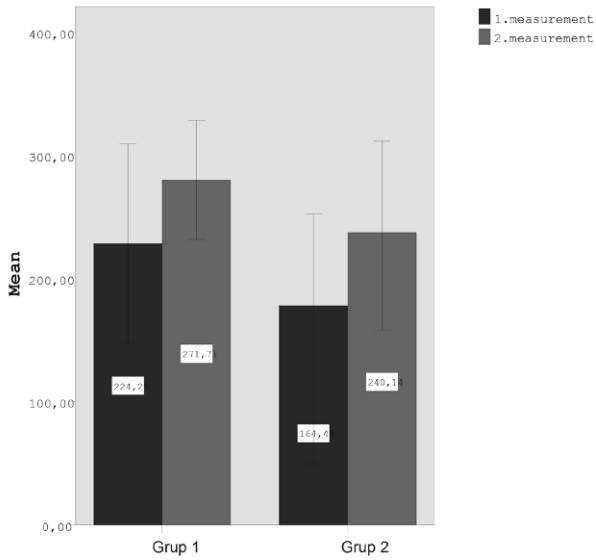

Figure 1: Development of CCFT in both groups

(p=0.728), and neck pain-free duration (p=0.857) (Table 3), (Table 4). However, the effect sizes were analyzed in groups due to our limited sample size. Effect size of deep cervical flexor muscle activation

Table 2. Intra-group differences of CCFT Scores, Headache intensity and neck pain

	Group 1 Mean ±SD				Group 2 Mean ±SD			
	B.T	A.T	p	*Cohen d*	B.T	A.T	p	*Cohen d*
CCFT Score	224.29±79.27	271.71±59.47	0.018*	0.677	164.43±95.33	240.14±79.30	0.004*	0.654
Headache (VAS)	4.25±2.54	2.53±2.72	0.038*	0.863	5.42±2.40	3.42±2.44	<0.001*	0.826
Neck pain-free time (hours)	.....2.79±42.05				.....55.43±34.42			

Wilcoxon Test

Abbreviations: Mean ±SD, CCFT: Craniocervical Test Score, VAS: Visual Analog Scale *p<0.05, B.T: Before treatment, A.T: After Treatment

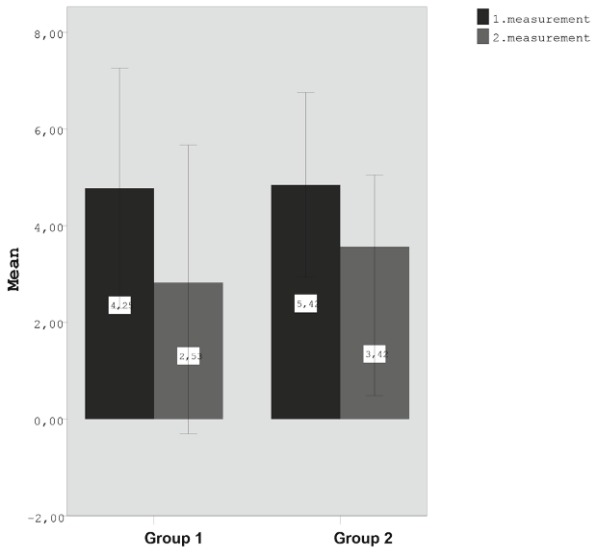

Figure 2: Change of headache intensity in two groups

Table 3. Inter-group differences of CCFT Scores and Headache Intensity

	Group1 Difference Score Mean ±SD	Group2 Difference Score Mean ±SD	p
Improvement CCFT	47.42±17.55	75.71±32.31	0.322
Headache Intensity	-1.72±0.89	-2.00±1.55	0.728

Mann Whitney U Test, Difference Score: After Treatment Score - Before Treatment Score, CCFT: Craniocervical Test Score

Table 4. Inter-group differences of neck pain-free time (hours)

	Group 1 Mean ±SD	Group 2 Mean ±SD	p
Neck painless time (hours)	52.79±42.05	55.43±34.42	0.857

Mann Whitney U Test

was d: 0.68 and d: 0.86, in Group 1 and 2, respectively. Effect size of headache intensity difference was 0.86 in Group 1, and 0.83 in Group 2 (Table 2).

DISCUSSION

The results of this study showed that kinesio taping application had no additional effect to the mobilization techniques on decreasing the neck pain, headache intensity and enhancing the activation of deep cervical neck flexor muscles in mechanical neck problems. However, depending on the effect size analysis, kinesio taping was effective on chronic mechanical neck pain with mobilization techniques. Therefore, we could support our hypothesis. In addition, the muscle activation of deep cervical flexors increased after both treatments, while headache intensity decreased.

Experimental studies showed that there was reorganization in neuromuscular response according to the chronic mechanical neck pain. This reorganization was explained by a compensatory neural strategy, which was redistributing loads between muscles to achieve the tasks (24,25). Falla et al. investigated the immediate changes in the neuromuscular control of the cervical spine in healthy individuals after hypertonic saline injection into the cervical muscles (25). They aimed to induce neck pain after saline injection and observed if there was any difference in neuromuscular response of the muscles. They found that electromyographic activations of the deep cervical muscles were became lower after reproducing neck pain. It was also reported there was a decrease in firing rates of active motor units (26).

Previous studies have shown that scapular mobilization, cervical mobilization and ischemic compression reduce neck pain and disability (27-29). Scapular mobilization increases the scapular and shoulder motions with breaking up adhesions, realigning collagen and increasing fiber glide in periscapular muscles (30-32). Increasing motions of the scapula and shoulders are found to be related with decreased tenderness of muscles especially upper trapezius, levator scapulae and the rhomboid muscles. The pain reducing mechanism of the cervical mobilization could be neurophysiologic which is based on stimulation of the peripheral mechanoreceptors and on the inhibition of nociceptors of the muscles and the cervical ligaments (33). Some researchers have shown that synovial joint mobilization may provide sufficient sensory input to activate the endogenous pain inhibitory systems (34).

Active trigger points in the muscles are more common in subjects with mechanical neck pain than in healthy subjects. Suboccipital, upper trapezius, levator scapulae and sternocleidomastoideus muscles contain the most intensive trigger points (35). Trigger points of upper back and cervical region contribute to the neck symptoms via referred pain.

Ischemic compression treatment on trigger points increase blood flow and resolve local ischemia. Thus, adenosine triphosphate (ATP) in blood could penetrate into tissues, re-absorb calcium ions into sarcoplasmic reticulum, and actin-myosin cross fibers in spasmodic areas break. Finally, contractile structures can release and pain can reduce (16).

Similarly to the results given here about kinesio taping for decreasing neck pain and releasing spasmodic tissues, the previous studies suggest that kinesio taping is an effective method for neck pain and disability (11,12). We expected that increasing muscle activation of deep cervical flexors, because of decreasing pain and spasm effect of kinesio taping application on more superficial muscles like upper trapezius, levator scapulae, sternocledio mastoideus and changing motor strategy responses. Kinesio taping is an effective method for decreasing tightness and pain intensity on soft tissues (11). Studies about effect of kinesio taping on muscle activation are limited. Kinesio taping increased muscle activation on back extensor muscles was observed in a study (36). Reduction of the activation of deep cervical flexor muscles (longus colli, longus capitis) is the most important factor causing the mechanical neck pain. Due to the reduction of the activation of deep cervical flexor muscles, superficial neck muscles (sternocleidomastoideus and anterior scalene) become more active and painful. Shaun O'Leary et al. showed that there was a strong relationship between superficial muscle activity and pain intensity, and he also showed the same relationship in craniocervical flexion test for both sternocleidomastoid and anterior scalene muscles (3). Neck Disability Index and Beck Depression Inventory were used only as descriptive data and not applied after treatment as follow-up time was only 4 days due to carrying time of kinesio tape.

In conclusion, ischemic compression and cervical and scapular mobilization are effective techniques for short period so as to increase the activation of deep cervical flexor muscles, and thus to decrease neck pain intensity. In addition, kinesio taping in addition to mobilization techniques was found to be effective on chronic mechanical neck pain. Further studies about this subject should contain a longer-term follow-up.

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