J Int Acad Phys Ther Res 2019; 10(3): 1862~1867
ISSN 2092-8475

www.iaptr.org
https://doi.org/10.20540/JIAPTR.2019.10.3.1862

Effect of Kinesiolology taping and Posture Stabilizing Exercise on Pain, Craniovertebral Angle, Proprioception in Adults with Forward Head Posture

Background: The importance of postural stabilization and cervical mobilization in subjects with pain from the anterior head posture is drawing more attention. However, studies on head and neck stabilizing intervention after mobilization are lacking.
Objective: To examine the effects of Kinesiotaping and posture setting exercise on forward head posture (FHP).
Design: Crossover Study Design
Methods: The subjects were 17 male and female college students in their 20s with FHP. They were randomized into the Kinesiology taping group (KTG) with 9 subjects and posture stabilizing exercise group (PSEG) with 8 subjects. The intervention was conducted for 4 weeks, and changes in pain, craniovertebral angle (CVA), and proprioception were observed before and after intervention.
Results: Pain was significantly reduced in the KTG and PSEG both before and after intervention. CVA and proprioception were significantly increased only in the PSEG. The differences in CVA and proprioception between the two groups were significant.
Conclusions: These findings suggest that the application of posture setting exercise could decrease pain, proprioceptive error and increase CVA on FHP

Key words: *Kinesioloty Taping; Posture Stabilizing Exercise; Pain; Craniovertebral Angle, Proprioception*

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Received : 05 July 2019
Revised : 07 August 2019
Accepted : 15 August 2019

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INTRODUCTION

In both, patients with neck pain and in healthy adults, with prolonged computer use, the pressure pain threshold between the neck and head muscles has been reported to decrease, as computer use time increases [1]. Modern working environments and lifestyles such as driving, working for a long time at a desk, or working in front of a computer require bending the neck forward or regularly moving the neck in a sitting position. Use of desks and stools inappropriate for somatype, and use of inadequate bedding and lack of exercise lead to muscle stiffness in the neck and shoulders. Overuse of those muscles with abnormal craniovertebral movement induces fatigue and weakening of soft tissues by reducing the effective biomechanical function [2, 3].

Dysfunction of deep muscles, which maintain cervical hypolordosis and are involved in the motor regulation of each segment, can cause proprioceptive paresthesia and muscle length changes, causing the head forward posture to be fixed [4]. Neck muscles have a larger distribution of muscle spindles than other muscles [5], and the suboccipital muscles have many muscle spindles per unit, indicating that they require a high proprioceptive function [6]. As cervical capsules are dominated by mechanical receptors that contribute to postural and motor sensations, they are particularly important for evaluating postural changes [7].

Taimela et al. (2000) reported that neck stabilization exercise had significant effects on neck pain symptoms and psychological factors in patients with chronic neck pain as compared with the control group [8].The

therapeutic intervention for patients with chronic neck pain is rarely applied with only one treatment, and in many cases, a combination of therapeutic approaches is often used [9].

Kinesiology taping has been shown to be effective in improving joint position by stimulating proprioception feedback [10]. Gonzales-Iglesias et al.(2009) stated that the application of KT significantly improved pain levels and cervical range of motion following the 24 hours of treatment in patients with whiplash-associated disorders [11]. Kinesio taping improve forward head posture (FHP) after intervention and a 2-week follow-up [12].

The importance of postural stabilization and cervical mobilization has been highlighted in subjects with pain from FHP, but studies on neck and shoulder stabilization interventions after mobilization have been insufficient. In this study, the effects of Kinesio taping and posture setting exercise on pain, CVA, and proprioception in adults with FHP were investigated, and we aimed to use the results as basic data for effective intervention for FHP.

SUBJECTS AND METHODS

Subjects

The subjects of this study were 17 male and female college students at N University in Chungnam Province, Korea, who were in their 20s and had FHP. The subjects were randomized into two groups, with 9 subjects (mean ± SD: age, 20.83 ± 0.98 years; height, 163.33 ± 7.20 cm; body weight, 69.48 ± 23.71 kg) in the Kinesio taping group (KTG) and 8 subjects (age, 21.00 ± 0.89 years; height, 164.90 ± 10.39 cm; body weight, 62.53 ± 10.06 kg) in the posture-stabilizing exercise group (PSEG).

Subjects who met the following criterion were selected: diagnosed as having FHP by an orthopedic surgeon among those whose cervical spine sides were measured on radiography at B Orthopedic Clinic in Cheonan-si and from the reference line vertically connecting the tragus and lateral angle of acromion, whose acromion was more forward than tragus [13, 14]

The exclusion criteria were as follows: Patients with cervical spine and spinal deformities, congenital upper extremities disorders, or severe surgical or neurological disorders who were unable to perform the detailed movements required for the experiment, and those who have been treated for trauma or pain in the cervical spine area for the last 6 months.

All the subjects were fully informed regarding the purpose and procedure of the study, and signed a consent form prior to voluntary participation in the study. This study was approved by the institutional review board of Namseoul University (NSUIRB-201903).

Intervention

Kinesiology taping and posture stabilizing exercise interventions were conducted for 4 weeks. Examinations and interventions were performed by a therapist who treated patients with musculoskeletal disorders for 10 years. The FHP subjects in the KTG and PSEG were first subjected to joint mobilization on the cervical spine for 10 minutes. In the prone position, the cervical spine was examined at each segment by central posterio-anterior (PA) mobilization. Afterward, the patients with reduced movement or pain were subjected to central PA mobilization or unilateral PA with Maitland grades II-IV. These grades were applied in consideration of the patients' resistance and visual analogue scale (VAS) score of ≤3 at 0.5-2Hz for 10 minutes. Mobilization was performed three times a week for 4 weeks. After mobilization, Kinesio taping and posture stabilizing exercises were applied in each group. The details of the Kinesio taping and posture stabilizing exercise interventions applied, are as follows.

Kinesiology

Shoulder attach the middle of the tape from the left of the spine to the right, almost horizontally, but angled just slightly upward, at the level of the upper third of the shoulder blade. While subjects breathe out, should pull the tape, with considerable stretch, toward the outer upper bony border of your shoulder. The end of the tape is applied, without stretch, to this bone and not to the upper arm. Follow the same procedure on the other side, again while you breath out. A third. short tape is applied vertically to your spine, over the middle of the tape on the thoracic spine. All the tapes were stretched from the base to the end, the length was measured, and then one-fourth of the tape was removed and then stretched again by that amount. Taping was applied after joint mobilization and continued until it was naturally removed from the skin [15].

Posture stabilizing exercise

Table 1. posture stabilizing exercise used during the training program(16)

Excise	Description	Duration	Period
Side-lying external rotation	Side lying with arm fully adducted to side and internally rotated with elbow flexed to 90[25]. Patients then externally rotate the shoulder with the hand moving in an arc away from the body.	5 set	5min
Prone horizontal abduction with external rotation	In a prone horizontal abduction position, the patient horizontally abducts the arm with the elbow extended and with external humeral rotation. The participant lifts the hand toward the ceiling keeping head/neck neutral and squeezing both shoulder blades together.	5 set	5 min
Y-to-I exercise	The patient retracts the scapulae with the arms abducted to 90. As the patient advances, the shoulders are externally rotated with the elbows flexed to 90[25], forming a Y. Then the patient moves into a position of full bilateral elevation with the elbow extension forming an I.	5 set	5 min
Chin tuck	This exercise targets the deep flexor muscles of the upper cervical region, the longus capitis and longus colli muscles. This is a low-load exercise that involves performing and holding inner range positions of craniocervical flexion that specifically activate and train the deep cervical flexor, rather than the superficial flexors muscles. This exercise is done in a supine lying position with the head in contact with the floor.	5 set	5 min

Measurement

The pain, craniovertebral angle, and proprioception were measured for 4 weeks before and after the intervention in the KTG and PSEG.

Pain

The VAS was used to assess neck pain before and after intervention. The VAS score was marked on a straight line from 0 to 10 in units of 1, with 0 indicating no pain and 10 defined as an unbearable pain state. That is, the larger the number to the right, the more severe the pain. The subjects were asked to indicate the pain level on a straight line. The intra-rater reliability of the VAS was .87 [17].

Craniovertebral Angle (CVA)

The cranial rotation angle was marked on the lateral inner angle, the seventh cervical spine, and the ear tragus. The angle created by the horizontal line passing through the ear tragus and the seventh cervical spine was defined as the craniovertebral angle (CVA). The subject stood up in a comfortable position, with the head maintained in the natural head posture (NHP) through a self-balance posture (SBP) and the arms relaxed and placed next to the trunk. During the NHP, the subject focused on a mark made at the front to prevent the posture from being distracted by vision. After taking head and neck pictures from the side with a digital camera (Samsung), the subject stood in a comfortable position, the distance between the center of the shoulder and the center of the ear was measured, and the base of the grid was adjusted to the center of the ear for the measurement [18, 19].

Proprioception (Head repositioning accuracy, HRA)

HRA was used to examine proprioceptive changes by assessing the ability to sense the head position and movement. The subject was blindfolded in a seated position in a chair with a low back, wearing a helmet with a laser point. After maximum flexion and maximum extension, the subject was asked to pose with NHP, and the center of the square target sheet with a grid line of 1-mm thickness and X- and Y-axes intersected at the center, which was 90 cm in front of the subject, and was adjusted to the laser point. The subject was asked to rotate the head to the left as much as possible and back to the NHP. In the target sheet, the distance between the new point indicated by the laser point and the original point was measured 10 times, and the mean value was calculated and included in the analysis. In addition, the measurement was performed five times each in flexion and extension, and the mean values were used [20].

Analysis

All statistical analyses were performed with the SPSS (version 20.0). General characteristics of the participants were presented by descriptive statistics. The Shapiro-Wilk test was conducted to check the normality of the outcome variables. Paired t-test was performed to compare intra-group dependent variables, and inter-group dependent variables were compared by independent t-test. All variables were expressed as mean ± SD. The significance level was set to α=.05.

RESULTS

Pain was significantly reduced in the KTG and PSEG before and after intervention. CVA and proprioception were significantly increased only in the PSEG. The differences in CVA and proprioception between the two groups were significant.

DISCUSSION

Among the clinical intervention methods for pain reduction and functional recovery of neck pain, traction, stretching exercise, joint mobilization technique, therapeutic exercise, and patient education and counseling are the clinically recommended treatments for reducing neck pain. Among these treatment methods, therapeutic exercise was reported to have the strongest evidence [21].

Therefore, this study comparatively analyzed changes in pain, craniovertebral angle (CVA), and proprioception after 4 weeks of Kinesio taping and posture setting exercise in adults with head forward posture.

In this study, pain was significantly reduced in the KTG and PSEG before and after intervention. In a previous study, the neck disability index was significantly reduced after 3 months of exercise with the scapula intervention program to restore the misaligned scapula in patients with neck pain [22]. In addition, Cho et al. performed mobilization of cervical and upper thoracic spine, and posture setting exercise for 6 weeks in the FHP subjects. They reported that in the cervical mobilization group, the numeric pain rating scale (NPRS) and neck disability index (NDI) were significantly reduced, and in the upper thoracic spine mobilization group, CVA was significantly decreased [23]. Similar results were found in the present study. The reason for this is that the pain symptom was alleviated by the change in neck alignment by mobilization exercise, and the taping and posture setting exercise may also have a positive effect on the correction of FHP [22-24].

Diab (2012) reported a significant increase in CVA after 10 weeks of FHP corrective exercise program in patients with scoliosis with FHP [26]. Also, the other study reported that correct alignment and stability improvements of head, shoulder, and upper extremities as well as muscle strengthening by applying the stretch exercise of chest muscles and shoulder retraction muscles for 6 weeks [27]. In this study, CVA decreased only in the PSEG after cervical mobilization. We think that this is because the posture setting exercise maintains the positively corrected cervical angle after cervical mobilization. The proprioceptive sensation consists of the kinesthesia that perceives the movement of the joint and the joint position sense [28].

Yong et al. analyzed the correlation between FHP and proprioceptive function, and reported that the subjects with FHP had reduced proprioceptive function than the subjects with a more upright posture [29]. In the present study, the proprioceptive function was improved in the PSEG before and after intervention. This may be due to the significant change in CVA.

Table 2. Comparison of pain, CVA, proprioception of KTG and PSEG

Variables	KTG			PSEG			
	Baseline	4 weeks	p	Baseline	4 weeks	p	Between group change(P)
Pain	4.37±0.55	3.18±0.75	.017*	4.82±0.61	3.20±0.97	.002*	0.513
CVA	46.14±7.58	48.23±5.54	.618	42.57±5.42	47.14±1.61	.004*	0.045*
Proprioception	11.42±4.84	10.96±4.34	.111	12.13±6.08	9.61±3.93	.036*	0.014*

*p<0.05, CVA: Craniovertebral Angle, KTG: Kinesiology taping group, PSEG: posture stabilizing exercise group

This study has a few limitations. First, as this study was conducted for college students in their 20s, its results are difficult to generalize to all ages. Second, the intervention period was short, and the number of participants in the experiment was small. Third, the study did not fully consider activities other than intervention. Future work will be needed to address these limitations for further investigation.

CONCLUSION

This study demonstrated that , the effects of Kinesio taping and posture setting exercise on pain, CVA, and proprioception in adults with FHP were investigated, and we aimed to use the results as basic data for effective intervention for FHP. These findings suggest that the application of posture setting exercise could decrease pain, proprioceptive error and increase CVA on FHP

ACKNOWLEDGMENT

Funding for this paper was provided by Namseoul University.

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