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The effects of the application of not-stretchable tapes before and after scapular stabilization exercises in patients with myofascial pain syndrome

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Abstract: The aim of this study is comparing the effects of taping application before and after stabilization exercise on the level of pain and muscle activation in patients with myofascial pain syndrome. Group A (n=10) performed 30-min scapular stabilization exercise. Group B (n=10) performed 30-min scapular stabilization exercise with taping before therapy. Group C (n=10) was provided with taping therapy only after 30-min scapular stabilization exercise. Subjects were measured for pain on a visual analog scale and pressure pain threshold, and were tested for muscle activation on electromyogram. There were significant changes of the level of pain among three groups ($p<0.05$). Intergroup difference of PPT and VAS was bigger in taping applying group before stabilization exercise than other groups. There were significant changes of EMG on upper trapezius muscle among three groups ($p<0.05$). The intergroup difference of upper trapezius muscle activation was bigger in taping applying group before stabilization exercise than other groups ($p<0.05$). Taping application before stabilization exercise can be said to be effective at reducing the pain and preventing the over activity of upper trapezius muscle.

Keywords: Shoulder, Taping, Stabilization Exercise, MPS

1. Introduction

Myofascial pain syndrome is a syndrome generating sensitive areas in skeletal muscle or fascia caused by trigger point. Following trigger point pressure, there occur some features such as reproduction of pain, referred pain in specific area and limited mobility in involved muscles [1].

The therapeutical aim of myofascial pain syndrome is to reduce the pain and alleviate muscle tone in impaired muscle. The treatments include intermittent cold therapy, stretching, post-isometric relaxation, thermal therapy, massage, trigger point injection and the removal of pain factors [2]. In addition, many previous studies have conducted about many approaches using dry needling, laser therapy and magnetic therapy to treat the trigger points [3].

Taping therapy has been widely used by physical therapists and it is reported that taping crossing with muscle belly would restrain muscles [4]. Non-stretchable taping is made of materials which are not flexible or elastic so as to be used for the purposes of restricting joint movement or supporting the less-movable structure like ligament and joint capsule [5].

Although many therapists have been studying stabilization exercises and taping therapy, there are still not sufficient studies about the effects of applying stabilization exercises and taping therapy in patients with myofascial pain syndrome of upper-trapezius.

Thus, the purpose of this study is to provide patients with more precise and effective treatment, comparing the effects of taping application before and after stabilization exercise on the level of pain and muscle activation in patients with myofascial pain syndrome.

2. Method

2.1. Subjects

This study was conducted with participants, including all of following criteria according to Simons' diagnostic criteria;

1) patients with a diagnosis of myofascial pain syndrome from a doctor, 2) taut band was palpated, 3) local pain exists with a compression of the nodule of taut band, and 4) range of motion was limited by pain during passive stretching.

30 subjects were randomly divided into three groups, scapular stabilization exercise group (group A, n=10), taping group before scapular stabilization exercise (group B, n=10) and taping group after scapular stabilization exercise (group C, n=10).

All the subjects understood the purpose of this study. And this study's subjects provided their written informed consent prior to their participation according as the ethical standards of the Declaration of Helsinki <Table 1>.

Table 1. *General characteristics of subjects (Mean±SD).*

	Group A	Group B	Group C
Age (Year)	48.55±10.65	46.98±11.78	47.12±10.96
Height (Cm)	163.65±8.13	165.77±9.23	164.36±8.44
Weight (Kg)	57.23±9.65	59.13±9.42	57.11±8.69

Group A; stabilization exercise
Group B; taping application before stabilization exercise
Group C; taping application after stabilization exercise
*p<0.05

2.2. Experimental Equipment and Procedure

To examine the pain, subjects were told to mark the subjective level of pain on the 100mm visual analog scale (VAS), and to examine the pressure pain threshold (PPT), trigger points of trapezius muscle were measured using the pressure algometer (EN-121485, J Tech Medical, Australia). PPT of the upper trapezius was measured with subjects comfortably sitting. The measurement was performed with 1kg/sec application after the pressure algometer was vertically placed on skin. Measured position was set up by marking the mid-spot between C7 spinous process and the acromion.

Surface electromyogram (EMG) was used to evaluate the muscle activation along the painless and non-invasive method. Surface electrod signal was measured using Myosystem1200 (Noraxon Inc, Arizona, USA) during abduction of shoulder joint. Collected analog signals was passed Myosystem 1200 and then converted to digital signals. Myoresearch XP 1.04 software was also used for filtering the signal and other signal process.

Scapula stabilization exercise included scapula setting exercise and open-kinetic exercise. In exercise, subjects were told to follow the instruction, "Move your shoulder toward spine". When subjects following the instruction, the earlobe should be in the horizontally same line with acromion with the scapula adducted, retracted, depressed and downward rotated in the prone position.

Total 3 sets of scapula setting exercise were performed by maintaining the posture for 10 seconds and then resting 3 seconds, 10 times per each set. 3-min break was given between each sets. Open kinetic exercise was applied as a second exercise which is along the same line with Cools' method.

Non-stretchable taping (Spiral Tape, Jaehwal Medicine, Korea) was used in this study. Subjects were instructed to maintain the retraction and depression of scapula when the taping was attached on an inner third of clavicle in the shape of "I" with 12th thorax fully extended [6].

Group A performed 30-min scapular stabilization exercise. Group B performed 30-min scapular stabilization exercise with taping before therapy. Group C was provided with taping therapy only after 30-min scapular stabilization exercise. Interventions were conducted 3 times a week during 6 weeks, totally 18 times in all three groups.

2.3. Statistical Analysis

To investigate the general characteristics of subjects, descriptive statistics and frequency analysis were performed. Kruskal Wallis test was performed to evaluate the changes between before and after the intervention in three groups. Mann-Whitney test was also used for post-hoc comparison. The data were processed using SPSS for Windows Version 20.0, and a significance level (α) of 0.05.

3. Result

3.1. Changes in PPT and VAS Before and After the Application of Interventions

There were significant changes of the level of pain among three groups according to Kruskal Waliis test ($p<0.05$). As the result of Mann-Whitney test, intergroup difference of PPT and VAS was bigger in group B than in group A and C <Table 2>.

Table 2. *Comparison of PPT and VAS among the groups.*

	Difference of pre test - post test		Post-hoc test
PPT*	Group A (n=10)	-3.94	B>A B>C
	Group B (n=10)	-6.56	
	Group C (n=10)	-3.89	
VAS*	Group A (n=10)	3.09	B>A B>C
	Group B (n=10)	4.64	
	Group C (n=10)	2.68	

PPT; Pressure pain threshold
VAS; Visual analog scale
Group A; stabilization exercise
Group B; taping application before stabilization exercise
Group C; taping application after stabilization exercise
*p<0.05

3.2. Changes in EMG Before and after the Application of Interventions

There were significant changes of EMG on upper trapezius muscle among three groups ($p<0.05$), but no significant change was shown in lower trapezius muscle and serratus anterior muscle in three groups ($p>0.05$). The intergroup difference of upper trapezius muscle was bigger in group A than other groups ($p<0.05$) <Table 3>.

Table 3. *Comparison of EMG among the groups.*

	Difference of pre test - post test		Post-hoc test
Upper trapezius*	Group A (n=10)	1.77	B>A
	Group B (n=10)	6.54	
	Group C (n=10)	5.46	
Lower trapezius	Group A (n=10)	2.86	
	Group B (n=10)	-1.65	
	Group C (n=10)	-2.24	
Serratus anterior	Group A (n=10)	-1.29	
	Group B (n=10)	-5.79	
	Group C (n=10)	-2.44	

Group A; stabilization exercise
Group B; taping application before stabilization exercise
Group C; taping application after stabilization exercise
*$p<0.05$

4. Discussion

In the past, pain relief was the main target for the treatment of myofascial pain syndrome. However, the importance of increased muscle tone and disability caused by the pain has been on the rise for the treatment. Especially in chronic pain patients, functional recovery is the important target more than pain relief. That is, it is highly important to identify whether there are any movement or abnormality accompanying the stress which facilitate and maintain the trigger points in specific muscles [7].

If there remain any abnormality causing limitation of muscle strength and associative movement during activities of daily living, active exercise has to be trained for the patients to recover the normal function. For patients with myofacial pain syndrome in upper trapezius muscle, controlled movement of scapula and proper posture are very important to improve the function of upper limb. Scapula stabilization exercise is effective to actively control the position of scapula and to correct the related functional disorder in movements. Furthermore, the exercise can provide the whole shoulder girdle stability [8]. That is, the decrease of upper trapezius activation, pain relief, improved function and decrease of neck pain are expectable by the increase of scapular stability.

Taping application is a therapy to maintain the homeostasis by attaching the tape to the muscles. As the results, taping therapy has gotten a lot of attention to be effective for normalizing the muscle spasm and tone, improving the circulation of blood, tissue-liquid and lymph, resulting in increased balance of muscle and pain relief [9]. The pain relief mechanism of taping therapy is known as that once tape is attached on the muscles within eccentric contraction, the wrinkle is formed during muscle contraction resulting in the broaden space between skin and fascia, and then the blood supply to the muscle becomes smooth and so pain is relieved [10].

As seen in this study, the level of pain in upper trepezius musucle significantly decreased after the taping ($p<0.05$). Another reason for the decreased pain might be because of a kind of pumping effect. Taping might softly contract muscles through a skin stimulation and then blood vessel and lymphatic vessel are contracted, leading to the vigorous inducement of body fluid like a pumping effect. It is believed that this result is because the exercise with taping application could last the intrinsic effect even after the exercise as well as the effect of taping therapy is overlapped and then overall therapeutic effects could be increased and maintained.

Stretching exercise should be performed to relieve the muscle pain from the tenderness caused by myofascial pain syndrome, and many previous studies have proved the effects of stretching exercise [11]. The taping is to maximize the stretching effect by improving the stability of proximal part such as shoulder girdle and trunk muscles.

According to Smania(2005) study which reported that the reduction of pain cuased by myofascial pain syndrome in upper trapezius leaded to the improvement of symptoms in cervical region, the reduction of pain can be thought to facilitate the improvement of function [3]. This result is in line with Downey's (1994) study [12]. When diversely stimulating skins, γ-motor neuron reflex cause the muscle contraction and then origin and insertion parts of the muscle become close to each other resulting in the transverse expansion. Taping application on this part of muscles has a kind of fine pressure effect on the muscle spindle and golgi tendon organ and then the relaxation of muscle tone and pain relief would be generated which can lead to the increase of muscle strength.

Furthermore, the effect of taping therapy can be explained by the irradiation that the response is increased and diffused by the increased intensity and frequency of stimulation [13]. That is, the response and contractile force of muscle can be increased by increasing the intensity of stimulation through taping application. In this study, it is believed that the level of pain in taping group more decreased than other groups because taping was applied on the scapula in normally aligned position.

Normal alignment of scapula and voluntary motor control is necessary for the effective upper limb function [14]. In addition, it is reported that upper, lower trapezius and serratus anterior muscle cooperate with each other for the scapular movement [15]. Imbalance of the scapula might cause the change of counterbalance mechanism as well, resulting in abnormal alignment of scapula. Therefore, weakness of lower trapezius and serratus muscle can cause the over activity and overload of upper trapezius and then this leads to the chronic pain of upper trapezius muscle.

In this study, there were statistically significant changes of muscle activation in upper trapezius muscle in group B, C ($p<0.05$). This result means the scapula stabilization exercise and taping application would have effects on decreasing the upper trapezius muscle activation as being in line with Alexander and Harrison's study [16]. However, the sample size of this study was small and the period was relatively short. Thus, the therapeutic effect is thought be changed as time passed.

Previous studies have focused on taping application just only after the intervention in order to maintain the effects of intervention. However, this study investigated not only the

therapeutic effects but also the preventive effects of taping application. In this study, taping application before stabilization exercise can be said to be effective at reducing the pain and preventing the over activity of muscles.

5. Conclusion

Previous studies have focused on taping application just only after the intervention in order to maintain the effects of intervention. However, this study investigated not only the therapeutic effects but also the preventive effects of taping application. In this study, taping application before stabilization exercise can be said to be effective at reducing the pain and preventing the over activity of muscles.

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