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Scientific/Clinical Article

Kinesio taping and manual pressure release: Short-term effects in subjects with myofascial trigger point



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ABSTRACT

Study design: Randomized controlled trial.

Introduction: Myofascial pain syndrome is characterized by myofascial trigger points (MTrPs) and fascia tenderness.

Purpose of the study: We investigated the effects of manual pressure release (MPR) alone or in combination with taping (MPR/MKT) in subjects with MTrPs.

Methods: Fifteen and 16 subjects received MPR and MPR/MKT respectively. Outcomes including Pressure pain threshold, muscle stiffness, mechanomyography were assessed at baseline, post-intervention and 7-days later.

Results: Pressure pain threshold improved significantly ($d = 1.79$, $p < 0.005$) in both groups. Significant improvement in muscle stiffness in the MPR/MKT group (0.27–0.49 mm) as compared to the MPR group (–0.02–0.23 mm). Mechanomyography amplitude in the MPR/MKT group was significantly higher than that of the MPR group ($p < 0.05$).

Conclusion: MPR and MPR/MKT are effective in reducing pain in these subjects. MPR/MKT has a greater effect on muscle stiffness and contraction amplitude.

Level of evidence: IV.

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Myofascial pain syndrome (MPS) is a pain syndrome characterized by myofascial trigger points (MTrPs) and fascia tenderness.^{1,2} A MTrP is defined as a hyperirritable spot associated with a taut band of a skeletal muscle that is painful on compression or stretching.^{2,3} The MTrP facilitates a local twitch response under snapping palpation and can be stimulated locally by compression; and causes pain, tenderness, autonomic phenomena and motor dysfunction. This reaction is not only local, but also distally in a target area as referred pain that is specific to each muscle.^{2,4,5} Additionally, muscle weakness and severe limitation in the range of motion of the affected muscle

can further result in disability. Consequently, patients with MPS can have impairment of their work, social activities and quality of life.⁵

Management of MPS can be based on the proposed mechanisms of causing MTrP.² Travell and Simons³ presumed that excessive acetylcholine release occurring in a muscle contraction can lead to a perpetuated shortening of the muscle and development of MTrPs. Based on this, inactivating TrPs is a potential treatment option. Such treatments include ischemic compression,³ spray and stretch,³ manual pressure release,^{4,5} needling technique,^{6,7} and physical therapy modalities.³ Manual pressure release of MTrPs can reduce spontaneous pain and increase the pressure pain threshold in patients with shoulder impingement.⁴ Manual pressure release on upper trapezius with trigger point has been reported to improve cervical range of motion and reduce the pressure pain sensitivity.⁴ Injection is effective but is an invasive and unpleasant process for patients, and has a substantial expertise requirement. Kinesio taping (KT), using an adhesive tape with elasticity over the contraction muscle, is another treatment option.⁸ This technique can be used in an attempt to normalize muscular function, increase lymphatic and vascular flow, diminish pain, and aid in the

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Conflict of interest: None declared.

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correction of possible articular malalignments.^{9,10} Although KT has been increasingly used in rehabilitation protocols and the prevention of sports injuries, scientific evidence of its effectiveness in patients with MPS is limited.

The proposed effects of KT on MTrP can be tested with mechanomyography (MMG). MMG is used to detect the pressure waves from vibrations of contracting muscles.¹¹ Stiffness or a taut band of muscle can change the pressure wave detected by MMG.¹² When the subject reaches maximal force, stiffness can reduce the amplitude of the signal due to the synchrony of motor unit twitches, which also limits the oscillation. In subjects with MTrP, a taut band and trigger point of the muscle can lower the amplitude and increase the frequency of the pressure wave detected by MMG. We believe that Kinesio taping can reduce the taut band/stiffness and pain of the contracted muscle in subjects with MTrP.

This study had two purposes. The first was to compare the effects of manual pressure release and manual pressure release plus Kinesio taping on the pressure pain threshold, muscle stiffness, and the vibration amplitude/frequency of muscle contraction in subjects with upper trapezius MTrP. The second purpose was to explore relationships between the pressure pain threshold, muscle stiffness, and the vibration amplitude/frequency of muscle contraction towards understanding possible mechanisms of action of manual pressure release and KT in these subjects.

Methods

Design and subjects

This was a randomized controlled trial. All participants were blinded and randomly allocated to the manual pressure release group (MPR) or the manual pressure release plus Kinesio taping (MPR/MKT) group. Based on the judgment of what constitutes clinically meaningful differences and variability estimates from a

previous study,¹³ a sample size of 15 subjects per group provided 80% power to detect differences of 50% difference in the pressure pain threshold (PPT) between the 2 groups of interest at an alpha level of 0.05 with a two-tailed test.

Subjects received a written and verbal explanation of the purposes and procedures of the study. If they agreed to participate, they signed informed consent forms approved by the Human Subjects Committee of University hospital. Consenting patients were randomized by computer generated permuted block randomization of 5 to receive different treatments. Outcome measurements were collected at baseline, post-intervention, and 7-day follow-up (Fig. 1).

Patients were recruited from the general population using public postings in several health care units and referrals from physicians in the Chronic Pain Service at a university hospital. Criteria for the diagnosis of myofascial trigger points in the upper trapezius muscle were the following: (1) a palpable taut band and tender spot; (2) patient's recognition of pain on stretching the tissues; (3) normal neurological examination; and (4) pain characterized as *dull* or *deep* that is exacerbated during stress.² Participants were excluded if they (1) were diagnosed with fibromyalgia syndrome; (2) had received myofascial therapy within the past month; (3) had a history of cervical spine or shoulder surgery; (4) were diagnosed with cervical radiculopathy or myelopathy; (5) had taken medicine that might change the pain intensity or pain threshold; or (6) had a history of previous surgery on the affected areas. Each subject signed an informed consent form approved by an Institutional Review Board.

Procedures and measurements

After signing the informed consent form, the subjects were examined by an assessor blinded to treatment group to establish the clinical conditions of MTrP in upper trapezius muscle

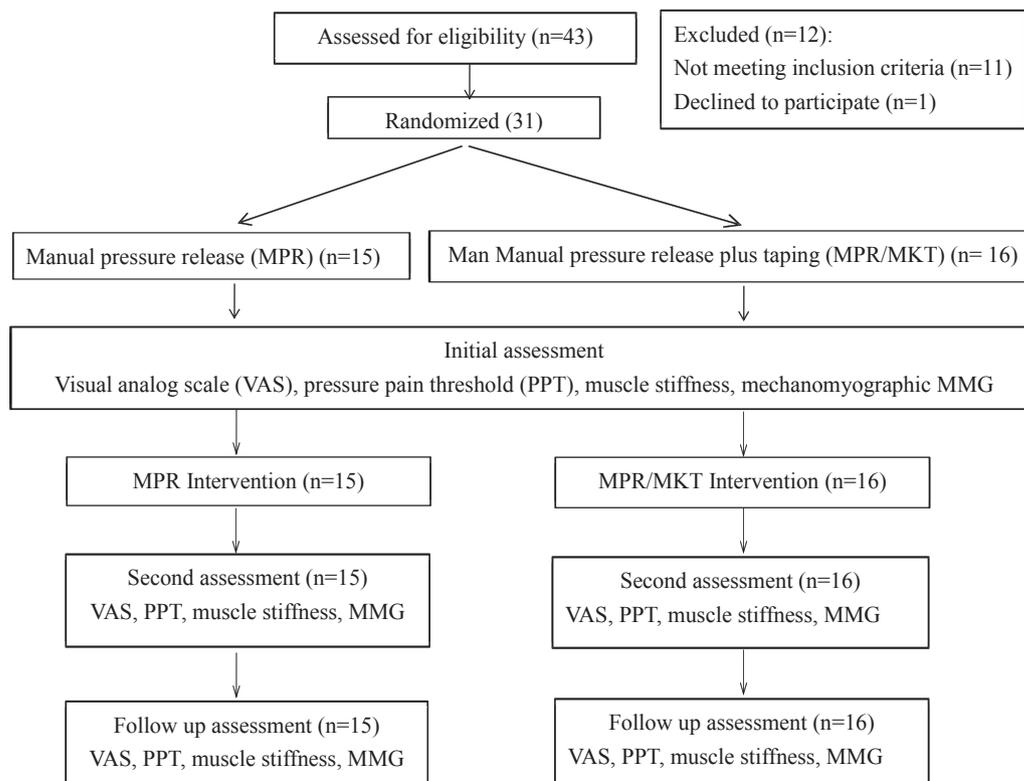


Fig. 1. Flow chart of study participants. Second assessment was conducted at post-intervention. Follow-up assessment was conducted at 7-day after initial intervention.

assessing the visual analog scale (VAS) and pressure pain threshold (PPT). The VAS is a tool with a 100 mm horizontal line bounded by “no pain” on the left and “worst pain possible” on the right.¹⁴ Pain VAS response to manual palpation of the trigger point was recorded. Algometry is a method of quantifying soft tissue tenderness that records the force (in kilograms per square centimeter) required to cause the amount of pressure over tissue that causes pain, called the PPT.¹⁵ The measurements were conducted by two assessors using pressure algometry (Wagner FPN 50 algometer, Wagner Instruments Inc., Greenwich, CT). The first assessor applied pressure at a right angle, steadily and gradually increasing the pressure to the upper trapezius, stopping when the subject indicated when the sensation of pressure had become painful. The second assessor recorded the force value (Newtons). The PPT was recorded three times at 15-s intervals, and the mean was calculated for analysis.

Then the stiffness of upper trapezius of each subject was measured with a myotonometer. The myotonometer (Neurogenic Technologies, Inc) is a computerized, noninvasive portable electronic instrument that is capable of quantifying muscle stiffness at rest.¹⁶ The myotonometer measures tissue tightness by quantifying the amount of tissue displacement (± 0.1 mm) by the applied pressure as a probe is pushed downward onto the muscle and underlying tissue. The tissue displacement values were recorded at 4 force probe pressures (0.50, 1.00, 1.50, 2.00 kg). The force–displacement curves were generated from these data. Less penetration of the probe and a sharp slope of the force–displacement curve indicate higher resistance (more tightness). Based on our pilot study on 8 subjects, high intrarater within-session (20 min time lapsed) reliability (intraclass correlation coefficient = 0.98) of this measurement was observed. Additionally, construct validity of this measurement was observed as less penetration of the probe was observed in end-range internal rotation compared to neutral internal rotation in our pilot study ($p < 0.05$).

Then the mechanomyography (MMG) signal was investigated for each subject. The MMG system (Sonostics BPS-II VMG transducer package) includes an MP150 data acquisition system (Biopac Systems, Inc., Santa Barbara, CA), a high-level transducer module (HLT100C, Biopac Systems Inc.), a sensitive microelectromechanical (MEMS) accelerometer (TSD250; bandpass filtering: 20–360 Hz) and AcqKnowledge software using signal analysis algorithms (wavelet packet analysis) to extract the vibrational components of the muscle contraction. The MMG sensor was placed on the trigger point of the upper trapezius and held in place by *adhesive tape*. After the MMG electrodes were placed, the subject performed isometric elevation of the arm in the scapular plane with load applied to the distal forearm for 5 s while sitting.¹⁷ Each subject was asked to support one load each time as 1 kg, 2 kg, 3 kg, 4 kg, or 5 kg in random order for 5 trials. The vibration occurring during upper trapezius contractions was measured for each subject using MMG. The measurement was collected at 2000 samples per second.

Intervention

Manual pressure release (MPR)

In the supine position with the cervical spine in a neutral position, subjects were encouraged to relax as much as possible. Then the therapist identified the MTrPs in the upper trapezius muscle as described above and applied pressure gradually with his thumb over the MTrPs until the subject reported a ‘moderate but easily tolerable’ pain value of 7 out of 10 (where 0 is no pain and 10 is severe pain). This level of pressure was maintained until release of the tissue barrier was felt (indicated by pain of a lesser value of 3 or

4). At the same time the therapist also detected a physical softening in the MTrP. Then the pressure was increased until a new barrier was reached (pain of the original value of 7). This process was repeated until there was no MTrP tension/tenderness or 60 s had elapsed, whichever occurred first.¹⁸

Kinesio taping

We applied a Y-shaped kinesio tape (Kinesio Tex KT-X-050, Osaka, Japan) on the upper trapezius muscle. The term “Y-shaped” refers to a piece of tape cut down the middle to produce 2 tails. First, participants were asked to sit in an erect posture with the head tilted to the affected side. At the same time, we applied the taping from insertion to origin of the upper trapezius muscle, which is the acromion process of the scapula to the upper cervical spine, with the 2 tails enveloping the muscle belly by palpation.¹⁹ After the application of taping, subjects left the laboratory with the taping for 3 days. Then subjects returned to laboratory and was removed and re-applied the taping by the same therapist. After the application of taping for the other 4 days, subjects were assessed by the outcome measurements as described above.

Statistical analysis

The Statistical Package for Social Science (SPSS 16) was used for data analysis. The Shapiro–Wilks test was performed to confirm normality of data. If the results showed non-normal distribution, non-parametric analysis was used. Independent *T* test was performed to compare basic data between groups.

To determine if a significant VAS, PPT, muscle stiffness, and MMG amplitude/frequency existed between the 2 groups, 2×3 mixed analysis of variance (ANOVA), with group (MPR group, MPR/MKT group) as the between-subject factor and time (pre, post and follow-up) as the within-subject factor, was used to evaluate the effects of the interventions. Following significant ANOVA results, posthoc analysis with Bonferroni correction was performed where appropriate. For the non-parametric test, the Mann–Whitney test was used to determine if significant differences existed between the 2 groups.

To assess the strength of the relationship between VAS, PPT, muscle stiffness, and MMG amplitude/frequency, the Pearson correlation coefficient was calculated for the change scores of the outcomes before and after the intervention. Change scores were based on differences between the baseline and scores after intervention, as well as between the baseline and follow-up. Change scores were calculated using the following formula: [(final score – initial score)/initial score]. The Pearson correlation value (*r*) ranges from –1 to +1, wherein 0.00–0.25 indicates a poor relationship; 0.25–0.5, a fair relationship; 0.5–0.75, a moderate to good correlation; and above 0.75, a good to excellent correlation.²⁰

Results

Thirty-one subjects completed the study (15 in the MPR group and 16 in the MPR/MKT group) in 8 months. The characteristics of the subjects are provided in [Table 1](#). The Shapiro–Wilks test confirmed the normality of the VAS and PPT data. For the VAS score, results supported the hypothesis that significant differences existed between groups at different times ($F(2,58) = 5.399, p = 0.007$). VAS scores were significantly lower in the MPR group than in the MPR/MKT group immediately after intervention ($d = -2.97$ vs. $d = -1.67$) ([Table 2](#)). For the PPT, ANOVA results did not support the hypothesis of interaction, but a significant main effect was found. In both groups, scores on the pain scale were lower after intervention and follow-up ($d = 1.79, p < 0.005$) than at baseline.

Table 1
Demographic data of participants

	MPR group		MPR/MKT group		p-value
	Mean	SD	Mean	SD	
Age (yrs)	30	6.5	28	4.6	0.56
Height (cm)	163.5	10.3	160	6.2	0.23
Weight (kg)	59	13.3	50	5.3	0.019 ^a
Gender (male/female)	(3/12)	–	(4/12)	–	0.93
Duration of symptom (month)	11.2	8.6	11.4	7.2	0.93
Dominant side (right/left)	(11/4)	–	(14/2)	–	0.08
Involved side (right/left)	(13/2)	–	(12/4)	–	0.87
Pain (VAS)	5.07	1.67	5.69	0.6	0.46

MPR: manual pressure release, MPR/MKT: MPR plus taping, VAS: Visual Analog Scale.

^a Significant difference between MPR and MKT group.

For non-normal distribution of myotonometer data, the Mann–Whitney test revealed a significant improvement on tissue displacement in the MPR/MKT group (0.27–0.49 mm) as compared to the MPR group (–0.02 to 0.23 mm) after intervention and at follow-up. This improvement supports the hypothesis that MPR/MKT can decrease muscle stiffness. Mann–Whitney tests were also performed on non-normal distribution of MMG amplitude/frequency data. There was no significant difference between two groups at baseline; however, in the MPR/MKT group, the MMG amplitude was significantly higher than that of the MPR group at the 4 and 5 kg force levels after intervention ($p < 0.05$) and at the 4 kg force level at follow-up ($p < 0.05$) (Fig. 2). These results support the hypothesis that MPR/MKT can increase the amplitude of MMG. The results of the MMG frequency, however, did not support the hypothesis of the present study, since no significant frequency differences were found at any of the force levels ($p > 0.05$) (Fig. 3).

Correlation of tissue displacement, PPT and VAS

Neither group supported the hypothesis that VAS, PPT and muscle stiffness are related, except for a moderate relation between VAS and tissue displacement in the MPR/MKT group. Between VAS and tissue displacement, a fair relationship ($r = -0.36$ to -0.42) was obtained by the MPR group, whereas a moderate relationship was obtained by the MPR/MKT group ($r = 0.53$ – 0.55).

Correlation of MMG amplitude/frequency, tissue displacement, VAS and PPT

A poor to fair relationship was found in all of the comparisons between MMG amplitude and other outcomes for both groups after intervention and follow-up ($r \leq 0.25$). For the MPR group, a fair to excellent relationship ($r = -0.23$ to -0.95) between MMG

Table 2
Clinical data at pre- and post-treatment and at 7-day follow-up of manual pressure release (MPR) and MPR plus taping (MPR/MKT) groups

	Pre	Post	Follow-up
MPR group ($n = 15$)			
Pressure pain threshold (Newtons)	15.19 \pm 3.53	34.79 \pm 3.82	30.77 \pm 2.84
Visual analog scale	5.07 \pm 1.67	2.13 \pm 1.64 ^a	0.73 \pm 0.88
MPR/MKT group ($n = 16$)			
Pressure pain threshold (Newtons)	13.92 \pm 2.45	36.75 \pm 4.61	26.95 \pm 4.70
Visual analog scale	5.96 \pm 0.6	3.56 \pm 0.81 ^a	0.37 \pm 0.81

Values are expressed as mean \pm S.D.

^a Significant difference between groups ($p < 0.05$).

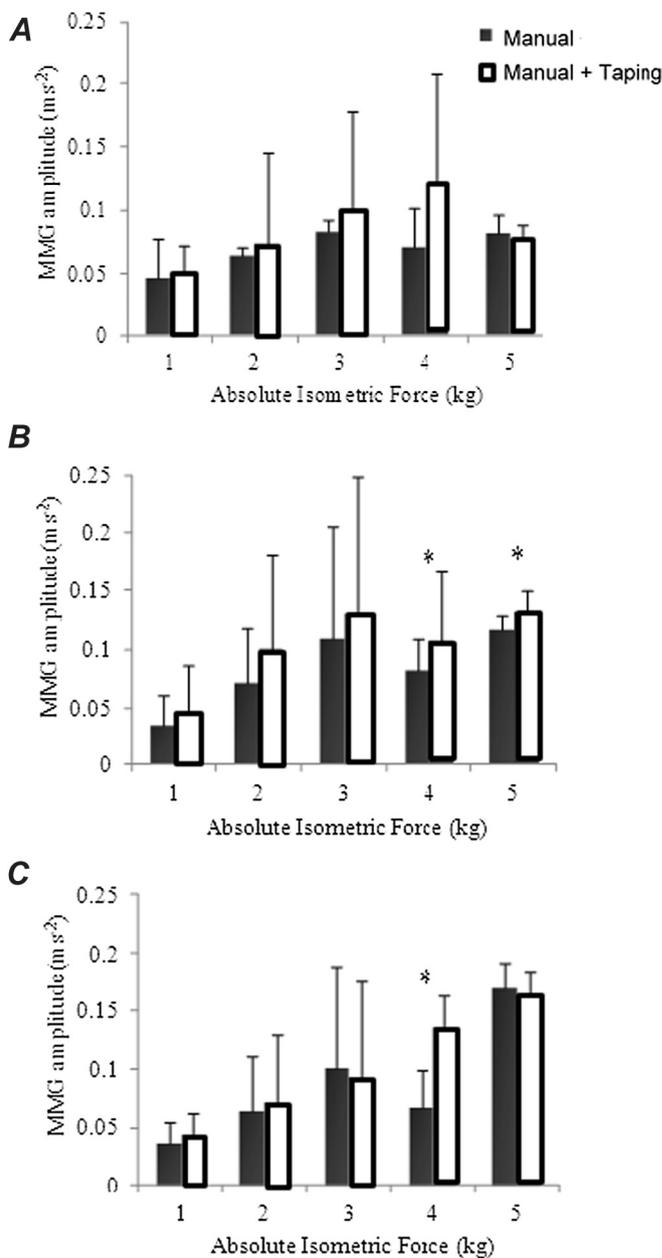


Fig. 2. Mean mechanomyographic (MMG) amplitude across absolute isometric force at (A) pre intervention, (B) post-intervention and at (C) follow-up for both groups, respectively. The error bars represent standard deviation. *Significant difference between groups ($p < 0.05$).

frequency and VAS/PPT was found after intervention and follow-up (Supplemental Table). For the MPR/MKT group, the major significant finding was that the correlations between MMG frequency and tissue displacement were moderate to excellent ($r = 0.44$ – 0.85) at follow-up (Supplemental Table).

Discussion

This study assessed the effects of MPR and the combined use of MPR and Kinesio taping (MPR/MKT) on pain intensity, pressure pain sensitivity, muscle stiffness, and MMG signals in subjects with upper trapezius trigger points. Both groups showed similar improvements in pain intensity after intervention and follow-up. After intervention, the MPR/MKT group demonstrated higher

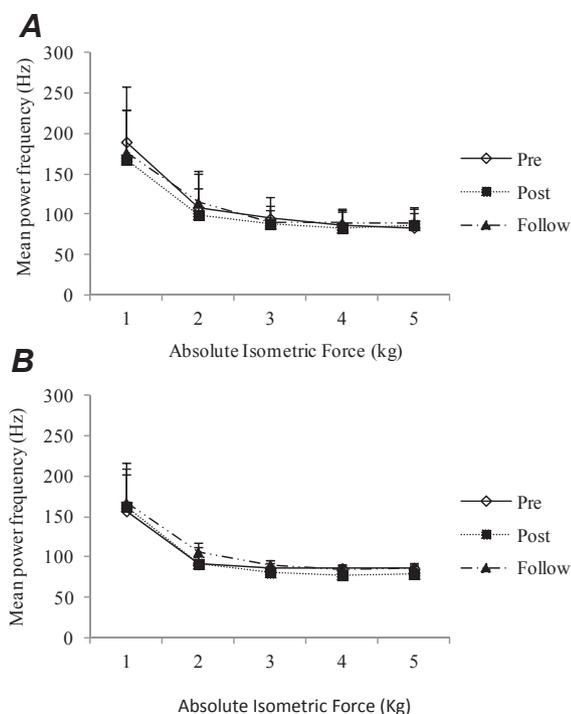


Fig. 3. Mean mechanomyographic (MMG) frequency across absolute isometric force for three separate time points for the (A) Manual pressure release group (MPR) and (B) MPR plus Kinesio taping group (MPR/MKT), respectively. The error bars represent standard deviation. There was no significant frequency difference at any of the force levels between groups.

MMG amplitude during contraction, and this difference was maintained to the follow-up assessment. The MPR/MKT group also demonstrated lower muscle stiffness than the MPR group immediately after intervention. Thus, our first hypothesis was partially supported. The effects of manual pressure release plus taping are better than those of manual pressure release only.

The results of the current study are consistent with the findings concerning the effectiveness of manual pressure release for the reduction of pain intensity over MTrPs.²¹ It has been proposed that appropriate treatment of MTrPs involves manual pressure release of muscle tension for the reduction of pain intensity.² Our results support this proposition, for both groups showed similar improvements in pain intensity after intervention and follow-up.

In addition to the common pain assessment for illustrating the effects of treatment in subjects with MTrPs, the muscular features were analyzed to characterize the effects of Kinesio taping. In the literature, only a few studies have examined the effectiveness of Kinesio taping in subjects with MTrPs. García-Muro et al⁹ demonstrated a significant improvement in shoulder range of motion and functional tests immediately after Kinesio taping for deltoid MTrPs. Similarly, Wang et al¹³ reported immediate effects for reducing pain intensity after the application of taping for upper trapezius MTrP. Our results showed that additional application of Kinesio tape plus manual pressure release resulted in a significant improvement not only in pain intensity but also in MMG amplitude and tissue displacement. Our results support the additional effectiveness of the Kinesio taping over MTrPs.

Increased muscle stiffness is related to increased torque production during contraction and limits pressure waves of the MMG amplitude in particular at high force levels.²² Theoretically, a muscle that is completely depleted of its energy (ATP), in this case a myofascial trigger point becomes stiff in a sustained muscle contraction, which increase the MMG amplitude as load increases

in our investigation. On the other hand, after intervention, more tissue displacement and greater MMG amplitude values were found, suggesting that subjects in the MPR/MKT group could tolerate activities with higher amplitude and force level. In the present investigation, MMG MPF decreased with the amount of weight lifted from 1 to 5 kg for both groups (Fig. 3), which corroborated with the findings.²³ In Beck's study, the biceps brachii muscle was measured during isometric forearm flexion (20%–100% MVC), and the results showed a linear decrease in MMG MPF with torque.

The limitations of our investigation should be noted. Myofascial trigger points can occur in any muscle of the body. Caution should be taken when interpreting the patterns of responses in our study, which investigated only upper trapezius muscle, since these patterns may vary on a muscle-by-muscle basis. Based on the single week of treatment in our results, low correlations between outcome variables should be validated. Longer treatment and assessment periods may be required to represent these correlations in subjects with MTrPs. In addition, the age of the participant population in this study was between 25 and 31. The generalization of the study results to elderly subjects is not suggested. It should be considered that low power make explain some of our non-significant findings because our study had a small sample that may not have been adequate for all outcome measures. The isometric test was selected in our study to measure the activity of the muscle fibers, which may not fully represent a functional movement. It would be worthwhile to design similar studies with a larger sample size to investigate the effects of taping on other chronic pain or MPS syndromes, and to confirm the findings revealed in the present study.

In conclusion, manual pressure release and manual pressure release plus taping are effective for reducing pain in subjects with upper trapezius trigger point. Kinesio taping plus manual pressure release has an additional effect on muscle characteristics such as tissue displacement and muscle contraction pattern. These effects may be related to relaxation of muscle trigger point contractions. Long-term follow-up study is needed to validate this assumption.

Supplementary data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.jht.2015.10.003>.

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Quiz: #396

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- #1. Trigger point subjects exhibited
- a palpable taut band and tender spot
 - pain with stretching
 - dull or deep pain with stress
 - all of the above
- #2. The study design was
- 10 subject cohort
 - systematic chart reviews
 - RCT
 - qualitative
- #3. Algometry was expressed in
- kgs/cm²
 - pain units
 - lbs/in²
 - footpounds
- #4. The myotonometer measured the stiffness of the
- deltoid
 - upper trapezius
 - lower trapezius
 - pectoralis minor
- #5. The kinesio tape was applied in the traditional J (Japan) pattern
- true
 - false

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