Evaluation of inhibitory technique and stretching exercise in reducing musculoskeletal complaints of selected government workers

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Abstract - Musculoskeletal disorders are the most common work-related health problems, affecting millions of workers. One of the disorders that interfere with the activities at work is the myofascial pain syndrome (MPS), which can cause reduction in productivity and occupational disability. MPS is characterized by pain originating from trigger points at muscles and fascias associated with muscle spasm, tenderness, motion restriction, fatigue, and autonomic dysfunction. Numerous therapeutic approaches have been used with varying success rates to treat MPS. The common treatments for MPS include pharmacological therapy, ultrasound therapy, transcutaneous electrical nerve stimulation (TENS), relaxation techniques, acupuncture, and stretching exercise. Since MPS is a multi-factorial disorder, common management and approach is always a combination of different treatment interventions. However, response to a single particular treatment technique is still not yet documented. This research study sought to determine the extent of effectiveness of taping and stretching treatment procedures and its correlation when used in combination in treating MPS using an experimental research design. Thirty (30) participants of both genders with MPS, aged 23 to 58 were included in the study. One-way ANOVA and Post Hoc Multiple Comparisson Test of Scheffe were used to analyze the data. Regression analysis was used to correlate findings. Results revealed that stretching, when correlated to marital status is the most effective singular treatment for MPS. This entails that through lengthening tight or shortened muscle, pain in the upper trapezius will be reduced and limited lateral flexion and rotation of the cervical range of motion increase its range near normal to full range of motion; thus, reducing the disturbing factors, which interfere work there by improving the body condition of the workers.

Keywords **-**musculoskeletal disorders,myofascial pain syndrome, stretching, taping

INTRODUCTION

In industrialized countries, musculoskeletal disorders account for a large number of workers' compensation days and disability (Poitras et al., 2005; Torp and Moen, 2001; Van Der Beek and Frings-Dresen, 1998). Approximately 11 million persons in the working age group of 18 to 65 years are either totally or partially occupationally disabled (Lechner, 1994). Jobs requiring the use of a computer input device and video display terminal often expose workers to

incorrect sustained postures, poor ergonomics and repetitive motions of the upper extremities which have been demonstrated as causes of work-related shoulder and neck pain (Fabrizio, 2009; Si et al., 2008;Falla et al., 2007; In et al., 2006; Fenety and Walker, 2002; Iwama and Akama, 2000;Kietrys et al., 1998). According to a previous study by Pillastrini et al. (2007), these particular characteristics promote the onset of these disorders. The multifactorial causes of musculoskeletal disorders are widely recognized and attention has been focused by several researchers on the individual, physical, and psychosocial factors that may contribute to the development of these symptoms (Torp and Moen, 2001).

Myofascial pain syndrome (MPS) is an important cause of muscular disability in the shoulder girdle, neck and lumbar regions. MPS is the most common disorders encountered by physiatrists and is associated with muscle tenderness, typical referred pain, reduced muscle extensibility, restricted range of motion (ROM) and muscle imbalance (Si et al., 2008; Kıralp et al., 2006; Chu et al., 2004; Hakguder et al., 2003; Hanten et al., 2000;Iwama and Akama, 2000). It is initiated through a myofascial trigger point which occurs most commonly in the upper trapezius muscle. It has been described as an area of hyper-irritability located in a taut band of muscle, variously described as resembling a small pea or as a rope-like nodular or crepitant area within the muscle that is painful upon palpation (Bron et al., 2011; Vazquez-Delgado et al., 2009; Simons and Dommerholt, 2006). These myofascial trigger points may result from or be irritated by trauma, overuse, mechanical overload, immobilization, postural faults or psychological stress (Hanten et al., 2000). Many treatment approaches such as ice, heat, ultrasound, and massage with methods of stretching exercises, dry needling, transcutaneous electrical nerve stimulation (TENS), post-isometric relaxation, and acupuncture have been used to relieve the pain of myofascial trigger points and prevent it from becoming chronic (Garcia-Muro et al., 2009; Si et al., 2008; Hanten et al., 2000; Iwama and Akama, 2000;). Taping techniques with the primary purpose of altering muscle activity has also been used recently as an inhibitory procedure in a hyperactive muscle associated in myofascial trigger points (Garcia-Muro et al., 2009; MacDonald, 2010).

Taping is now recognized as a skill and is essential for all those involved in the treatment and rehabilitation of injuries. It is widely for sports injuries and for many conditions such as muscle imbalance, unstable joints and impaired neural control. A tape applied firmly across the fibers of a muscle has been proposed to decrease muscle activity. A number of studies have tested this hypothesis, mainly by applying rigid tape firmly, perpendicular to the direction of the muscle fibers over the upper trapezius and the vastus lateralis muscles. A study using an isometric muscle contraction of the upper trapezius into scapular retraction and elevation showed that the effect of the upper trapezius inhibitory taping resulted in a significant decrease in electromyographic (EMG) activity of the upper trapezius muscle and an increase in EMG activity in the middle portion of the trapezius muscle while taped when compared with a no tape condition. Tape may also be used to unload inflamed neural tissue. The unloading tape enables the patient to be treated without an increase in symptoms, so that, in the long term,

treatment is more efficacious. The mechanism of the effect is yet to be investigated, but according to studies, tape could inhibit an overactive muscle which is a protective response to mechanical provocation of neural tissue, have some effect on changing the orientation of the fascia and have just a proprioceptive effect, working on the pain gate mechanism (MacDonald, 2010).

Stretching procedures involve the application of a force in an effort to overcome the resistance to movement in a joint and to increase the available ROM (Condon and Hutton, 1987). Flexibility of soft tissues that cross or surround the joints such as muscles and fascia are certainly necessary for unrestricted, pain-free movement of the body during functional tasks of daily living (Kisner and Colby, 2007). Classically, passive stretching, which can be performed manually or mechanically, refers to a technique of lengthening a muscle group by slowly moving a joint to its maximal range of motion while applying a force opposite to the direction of shortening, maintaining the position for a period of 15–30 seconds (Abellaneda et al., 2009; Kisner and Colby, 2007). A 30-second duration of stretching has been shown to be effective in improving range of motion. The number of repetitions and the rest period were arbitrarily chosen, however, they are not atypical of what an individual on a stretching programme might undertake (McNair and Stanley, 1996). The recommended frequency of stretching is often based on the underlying cause of impaired mobility, the quality and level of healing of tissues, the chronicity and severity of a contracture. Because few studies have attempted to determine the optimal frequency of stretching within a day or a week, it is not possible to draw evidence-based guidelines from the literature. As with decisions on the most appropriate number of repetitions of stretch in an exercise session, most suggestions are based on opinion. Frequency on a weekly basis ranges from two to five sessions, allowing time for rest between sessions for tissue healing and to minimize post-exercise soreness. Ultimately, the decision is based on the clinical discretion of the therapist and the response and needs of the patient. Although stretch-induced gains in ROM persist for several weeks to a month in healthy adults after cessation of a stretching program, permanent improvement in mobility can be achieved only by use of the newly gained ROM in functional activities and/or with a maintenance stretching program (Kisner and Colby, 2007).

MPS is indeed one of the most prevalent musculoskeletal pains in the society which serves as a major cause of morbidity today. A growing number of individuals in the working population have musculoskeletal pain that affects their daily activities and function; thus, making a significant impact on their quality of life. This is creating a growing financial burden in the healthcare system (Poitras et al., 2005; Torp and Moen, 2001; Van Der Beek and Frings-Dresen, 1998).The most common physical therapy intervention for MPS is a combination of heating modalities, TENS, massage and stretching (Garcia-Muro et al., 2009; Si et al., 2008; Yap, 2007; Hanten et al., 2000). However, the said treatment approach is time-consuming and requires the personal intervention of a professional in a physical therapy clinic. Additionally, this is not suited for the active-paced lifestyle of patients with MPS. Taping and stretching has the potential to alleviate

symptoms of MPS and can be self-administered by patients once given proper instructions (Garcia-Muro et al., 2009; Si et al., 2008; Hanten et al., 2000). However, the extent of their effect when implemented singularly to patients with MPS is not yet studied. In this regard, this study seeks to determine the extent of effectiveness of taping and stretching techniques as well as to correlate the two in treating MPS with the end view of seeking a less costly treatment technique in patients with the said condition.

MATERIALS AND METHOD

Participants

A total of 30 participants (Simons and Dommerholt, 2006) of both gender (Hanten et al., 2000; Kiralp et al., 2006) between the ages of 23 and 58 years (Hanten et al., 2000) were purposively recruited from the three different departments, namely Accounting, Treasury, and Human Resource Department of the Batangas Provincial Capitol, to participate in the study. Participants were required to sign an institutionally approved informed consent form prior to participation in this study. The ethical approval for the use of human subjects in this study was sought from the Research Committee of the College of Allied Medical Professions of Lyceum of the Philippines University.

The exclusion criteria in this study included a history of orthopedic surgery to the neck or back, cardiovascular or neurological conditions, and treatment of myofascial pain at the time of the study (Hanten et al., 2000). Subjects were included if they have one or more active myofascial trigger points, complaining of dull aching pain in the neck or upper back. Trigger points inclusion criteria include a palpable tender spot in the right or left upper trapezius, taut band, reproduction of the participant's pain upon palpation, a "jump sign" characterized by patient vocalization or withdrawal and restricted range of motion in the joint the muscle crosses (Vazquez-Delgado et al., 2009; Fabrizio, 2009; Hanten et. al, 2000). Participants must be employed with a job requirement of desk works such as typing and computer use for 65% to 75% of their day and seated in a poor ergonomic and air-conditioned work setting. They should also be at their current job for at least six months (Fabrizio, 2009). Patient was instructed to avoid using topical creams and liniments within the time of the research study as these will give potential complementary effects that may influence the outcomes.

Design

This study utilized a cross-sectional comparative research design. It aimed to determine which between inhibition of sustained contraction of muscle through the taping intervention and muscle lengthening by means of stretching intervention is more effective in the treatment of myofascial pain on neck and upper back in terms of subjective and objective clinical findings.

Instruments

Subjective pain level is a pain scale felt by the participants and was determined by a visual analog scale (VAS). The VAS is 10 cm long with no anchors between the ends, and measures ranged from 0 (no pain) to 10 (unbearable pain). The participant was instructed to point to the position on the line between the faces to indicate how much pain they are currently feeling. The exact value of pain intensity could be obtained by referring the to the back side ruler (Si et al., 2008; Han et al., 2006; Kıralp et al., 2006; Simons and Dommerholt, 2006; Chu et al., 2004; Hakguder et al., 2003; Hanten et al., 2000; De Loach et al., 1998).

Objective finding are things that can be measured and that was the range of motion (ROM) measurement of the cervical spine. This was defined as the amount of lateral flexion and rotation of the neck to both the right and left side, carried out by a universal goniometer. Three repetitive measurements were performed continually, with their mean values used for analysis (Si et al., 2008). Both were measured before and after treatment.

Procedure

All participants were singly blinded. They were divided into three groups, consisting of 10 members each. They were randomly assigned to the following groups and received the listed interventions for 4 weeks, thrice a week.

- Group 1 - Taping Intervention
- Group 2 - Stretching Intervention
- Group 3 - Combination of Stretching and Taping Intervention

Participants in Group 1 have received a treatment using taping intervention. They were asked first to wash, clean and dry their neck and upper back for better tape adhesion. They were placed with the upper trapezius at rest, arm by the side in a supported position. Function of the tape and how it should feel was informed and explained to them prior to tape application. The 5 cm hypoallergenic tape was applied first smoothly without any tension to avoid skin irritation, from just over the mid-clavicle, with the medial border of the tape adjacent to the angle of the neck and over the shoulder and attaching as far down as T9/10 on the posterior torso. The 4 cm strip zinc oxide was applied next with minimal tension, from just above the clavicle, attached as far as the middle of the musclebelly from where a strong compressive force was applied to the muscleand the tail of the tape attached as far down as T9/10. On completion, the researchers checked if full movement was possible and the anterior clavipectoral area was not stressed by the tape. The tape should conform to even pressure and must be effective and comfortable. Tape was removed after 24 hours and skin was inspected if there was any adverse reaction. At least a day was provided before reapplication (MacDonald, 2010).

Participants in Group 2 received a treatment using manual passive stretching technique. The researchers had the participants assume a comfortable, stable position that allowed the correct plane for motion for the stretching procedure. The researchers explained the procedure to the participants, and ensured that they understand. The area to be stretched was free from any restrictive clothing, bandages or splints. They were asked to be as relaxed as possible and just let the researchers perform the treatment procedure. To stretch the left upper trapezius, right hand of the researcher was placed on top of the head and slowly and passively flexed the muscle laterally, away from the left shoulder through the free range to the point of tissue restriction. Researcher then applied a downward pressure on top of head and on left shoulder, opposite the line of pull of the range-limiting muscle. Force must be enough to place tension on upper trapezius but not so great as to cause pain or injure the structure. The participant should experience a pulling sensation, but not pain in the structure being stretched. Stretched position was maintained for 30 seconds. During this time, tension in the tissues was slowly decreased. When tension decreases, the head was moved or the cervical joint a little farther to progressively lengthen the hypomobile structure. Gradually the stretch force was released and allowed the participant to rest momentarily while maintaining the range-limiting tissues in a comfortably elongated position. Treatment was repeated 10 times. To stretch the right upper trapezius, reverse direction of the procedure above was performed (Kisner and Colby, 2007).

Participants in Group 3 received a treatment using both taping and stretching intervention using procedures as aforementioned.

Statistical Tool

All research data pertaining to patient results were expressed as Standard Error of Means (SEM). Differences between and within the groups of participants were analyzed using one-way Analysis of Variance (ANOVA) with a *p* value less than 0.05 considered as significant. All computations were done using the Statistical Package for Social Sciences (SPSS) version 17 software.

Limitations of the study

Given that all participants in the study were females, the researchers were not able to correlate gender regarding the effects of the interventions implemented.

In addition, given that all participants in the study were government employees who are all working for 8 hours each day, the researchers were not able to correlate working hours regarding the effects of the interventions implemented.

RESULTS

Results generally show that most of the participants in the study were from the age bracket of 42-50 and 24-32 years old correspondingly. Furthermore, most (80%) of the participants for the three groups were married. Also, majority of the group who participated in the study have 2-9 years of work service in their current job.

Table 1 shows the demographic profile of the thirty (30) participants from the three different departments at Batangas Provincial Capitol.

In terms of age, many of the participants from Group 1 were 42-50 years old (30%) and 51-59 (30%). For the second group, 40% of the participants were from 42-50 years age bracket. Group 3 were from the age bracket of 24-32 years old (30%) and 42-50 years old (30%).

In terms of civil status, majority (80%) of the participants of the three groups were married.

In terms of length of work service, less than half (40%) of the participants from both group 1 and group 2 had 2-9 years of work service. Moreover, 50% from group 3 participants had 2-9 years of work service. The table confirms that the participants are evenly and fairly distributed to the three groups in terms of age, marital status, and length of service; thus, eliminating factors that may influence the outcome of the research study.

Table 1
Demographic Profile of the Participants

Profile Variables	Group 1		Group 2		Group 3	
	Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)
Age						
24-32 years old	2	20.0	3	30.0	3	30.0
33-41 years old	2	20.0	1	10.0	2	20.0
42-50 years old	3	30.0	4	40.0	3	30.0
51-59 years old	3	30.0	2	20.0	2	20.0
Mean ± SD	43.65	11.61	12.70	40.30	40.30	10.63
Civil Status						
Single	2	20.0	2	20.0	2	20.0
Married	8	80.0	8	80.0	8	80.0
Length of Work service						
2-9 years	4	40.0	4	40.0	5	50.0
10-17 years	1	10.0	2	20.0	3	30.0
18-25 years	1	10.0	3	30.0	1	10.0
26-33 years	2	20.0	0	0.0	1	10.0
34-41 years	2	20.0	1	10.0	0	0.0
Mean ± SD	17.65	13.57	14.09	10.78	10.33	9.52

Table 2
One-way ANOVA for the difference of Pain and Motion when applied to the Intervention

		Sum of Squares	difference	Mean Square	F	Sig.
PAIN	Between Groups	1.067	2	.533	3.368	.049
	Within Groups	4.275	27	.158		
	Total	5.342	29			
MOTION	Between Groups	4.889	2	2.444	16.854	.000
	Within Groups	3.916	27	.145		
	Total	8.804	29			

Table 2 shows the results of One-way ANOVA for the difference of Pain and Motion when applied to the Intervention. The computed values for pain and motion were 0.049 & 0.000, respectively. The results were found to be significant since the values were both less than 0.05 level of significance. This explains that taping, stretching and combined taping and stretching interventions in between & within groups were effective in pain reduction and in increasing cervical range of motion.

Table 3, presents the Regression Analysis of Pain and Motion for Stretching Intervention. The computed values for pain and motion were 0.000 and 0.020, respectively. The values were found to be significant since the results were <0.05 level, therefore it signifies that stretching is the most effective intervention in reducing pain & increasing cervical range of motion.

However, other variables such as age and length of service were not considered, since the said variables statistically, have no interventions tested. Moreover, when the data were run through regression analysis, no significant system results were found.

Table 3
Regression Analysis of Pain and Motion for Stretching Intervention

Model		Sum of Square	Difference	Mean Square	F	Sig.
PAIN						
	Regression	.395	1	.395	33.684	.000
	Residual	.094	8	.012		
	Total	.489	9			
MOTION						
	Regression	.250	1	.250	8.372	.020
	Residual	.239	8	.030		
	Total	.489	9			

Predictors: (Constant), Stretch_motion and pain

Dependent Variable: Marital Status

DISCUSSION

MPS is one of the most prevalent work-related musculoskeletal disorders, affecting workers whose jobs are engaged in desk works such as typing and use of computers, which exposes the workers to incorrect sustained postures, poor ergonomics and repetitive motions of the upper extremities. The aforementioned activities had been demonstrated as causes of work-related shoulder and neck pain (Fabrizio, 2009; Si et al., 2008; Falla et al., 2007; Han et al., 2006; Iwama Fenety and Walker, 2002; and Akama, 2000; Kietrys et al., 1998). Numerous therapeutic approaches have been used with varying success rates to treat MPS like ice, heat, ultrasound, massage, taping, stretching exercises, dry needling, transcutaneous electrical nerve stimulation (TENS), post-isometric relaxation and acupuncture. The purpose of this study is to determine the extent of effectiveness of taping and stretching intervention and its correlation when used in combination in treating MPS. Taping and stretching which are both recognized as effective approaches in treating MPS by inhibiting sustained contraction and increasing flexibility of a muscle respectively (Abellaneda et al., 2008; Kisner and Colby, 2007; MacDonald, 2010). Three groups composed of 10 persons each were included. Participants in Group 1 received Taping intervention, with their upper trapezius at rest, arm by their side in a supported position. Hypoallergenic followed by the zinc oxide tape was applied, with minimal tension, from just above the clavicle, attached as far as the

middle of the muscle belly from where a strong compressive force was applied to the muscle. On completion, full movement was checked and made sure that the anterior clavipectoral area is not stressed by the tape. Tape was removed after 24 hours and at least a day was allotted for re-application (MacDonald, 2010).

Participants in Group 2 have received Stretching Intervention, with their upper trapezius at rest; the researchers then applied a gentle passive stretch, maintaining the position for a period of 15–30 seconds and was done for 10 repetitions (Abellaneda et al., 2008; Kisner and Colby, 2007).

Participants in Group 3 received the combined interventions with the same treatment parameters as of Groups 1 and 2.

Before and after implementation of the following interventions, pain and cervical motions of lateral flexion and rotation were measured using a VAS (visual analog scale) and a universal goniometer correspondingly and which served as the study's outcome measures. The entire treatment implementation was conducted thrice a week for 1 month.

Through this study, the researchers found out that stretching is effectual by itself in treating MPS and in improving related factors such as pain and cervical range of motions as to lateral flexion and rotation when correlated with the participant's marital status.

According to a previous study by Lewit and Simons (1984), muscle lengthening utilizing post-isometric relaxation appears to be successful in relieving pain due to MPS. Jaeger and Reeves (1986) suggested that stretching is the major and effective part of the treatment for MPS. Stretching of tight muscles is common in rehabilitation to relieve pain, muscle tension and tenderness, and to enhance the range of motion (Chu et al., 2004).

The researchers used the regression analysis to know which among the three interventions were more effective in reducing pain and LOM in treating MPS. However, taping and combination of both method showed no results when run to computer regression analysis. Stretching and taping have been used together to relieve the symptoms of MPS and prevent it from becoming chronic (Garcia-Muro et al., 2009; Si et al., 2008; Hanten et al., 2000; Iwama and Akama, 2000).

Based on the information collected, the researchers found out that the longer the working years the more possible for the person to develop MPS due to length of repetitive motions and stress it can get from work activities. While married people has more responsibilities than single when it comes to household chores and other factors such as taking care of baby and wife/husband. Majority of people who at peak age of working years develop MPS due to stress of workload.

CONCLUSION

This study revealed that passive stretching is an effective singular intervention in treating MPS. This entails that through lengthening a tight or a shortened muscle, pain in the upper trapezius will be reduced and limited lateral flexion and rotation of the cervical range of motion will be increasing its range near normal to full range of motion, thus reducing the disturbing factors, which interferes the activities in work and therefore improving the body condition of the workers.

Furthermore, marital status shows a statistical significant influence in the obtained outcomes of the research study.

RECOMMENDATIONS

Based on the collected findings and conclusions, the researchers recommend the following:

1. To increase the number of participants, including not only those government workers but as well as workers in the private companies.
2. To provide a tool which will quantitatively measure the manifestations of myofascial pain syndrome such as sensitivity of trigger point, which will serve as an additional outcome measure of the research study.
3. To investigate effectiveness of other treatment procedures such as ice, heat, transcutaneous electrical nerve stimulation, and other in reducing pain and increasing cervical range of motion as well in other factors associated to MPS when applied individually.
4. To conduct a further study regarding the influence of marital status in the symptoms manifested in musculoskeletal conditions such as myofascial pain syndrome.

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