Seeking the Cause of Myofascial Pain Syndrome by Identifying which Manual Therapy is Effective against Muscle Tenderness and Stiffness

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Abstract. [Purpose] The purpose of this study was to identify which manual therapy technique was effective against muscle tenderness and stiffness of myofascial pain syndrome and then, based on the result, to determine the cause of myofascial pain syndrome. [Subjects] The subjects were 23 men and 67 women who had an average age of 65.5 ± 19.0 years. All subjects had normal results in imaging and neurological examinations but complained of chronic pain along with muscle tenderness and stiffness. [Methods] Using a muscle hardness meter, the muscle hardness of the tender, stiff muscles was measured before, immediately after, and 1 week after manual therapy. The subjects were divided into two groups according to the therapy given myotherapy/massage, to provide direct stimulus to the muscle, or joint facilitation/joint mobilization, to improve functional joint disorders. Statistical analysis was conducted using repeated measures ANOVA, and multiple comparisons were performed. [Results] A significant difference in muscle hardness was seen between pre-treatment and post-treatment. A significant difference in muscle hardness was seen between before and 1 week after manual therapy, but not between post-treatment and 1 week after. A significant difference was seen between the direct stimulus to muscle technique and the functional joint disorder technique. Post-treatment muscle hardness decreased more with direct muscle stimulus than with the functional joint disorder technique, and muscle stiffness was decreased even 1 week after treatment. [Conclusion] Manual therapy for muscle tenderness and stiffness of myofascial pain syndrome was effective at reducing muscle stiffness. Moreover, techniques that provide direct stimulus to the muscle are better at reducing voluntary muscle stiffness than techniques that improve functional joint disorders.

Key words: Myofascial pain syndrome, Manual therapy, Muscle tenderness and stiffness

INTRODUCTION

In recent years, studies using a muscle hardness meter have increasingly been performed1–3). In physical therapy, a muscle hardness meter has been used to measure muscle stiffness at the times of muscular contraction and relaxation. However, no studies have measured muscle stiffness in regions affected by muscle tenderness and stiffness, and there appear to have been no studies evaluating the effect of manual therapy using a muscle hardness meter. Thus, this study was performed to measure
muscle tenderness and stiffness in patients with myofascial pain syndrome (MPS) using a muscle hardness meter.

Various functions protect us from noxious exterior milieu. This is the basis of the immunological and inflammation systems, which also exist in primitive organisms\(^4\). Pain is a protective response of the human body, acute pain as a symptom and chronic pain as an illness\(^5\). Acute pain clearly plays a protective role and acts as an alarm signal. When acute pain continues for a long time, however, distress may result. Furthermore, the recognition of pain is modified by psychosocial factors\(^6\). Pathological pain can be defined as chronic pain that occurs repeatedly without an apparent physiological cause. Although such pain has a long duration, it originates in a histological lesion and feels similar to acute pain; that is, acute pain appears to have been prolonged\(^7\).

Patients with MPS are often encountered clinically, and in many cases, an area of muscle tenderness and stiffness can be palpated as a tumor-like lump. This area is generally recognized to be part of a parallel zone in the shape of a vinculum in a myoneme, or the shape of a node, and is thus referred to as “nodular”. However, at present, there is no unified terminology for muscle tenderness and stiffness, and various terms, such as tenderness spot, tenderness stiffness, contraction knot, and taut band, are used\(^8\). Moreover, since the tender point in an area of muscle tenderness and stiffness induces pain at the position of compression\(^9\), it is often called a trigger point. Therefore, MPS can be considered to exist when there is a region of muscle tenderness and stiffness that is currently painful. Kobayashi et al. consider that muscle tenderness and stiffness are the result of various intermingled pathologies, with a gelatinous area around a hard wick in which the center section is fibrosed, and muscle edema and muscle spasms surround the area of muscle tenderness and stiffness\(^10\). Moreover, since the gelatinous area emits pain through hyperpathia, the cause of the pain of MPS appears to be the muscle tenderness and stiffness\(^10\).

For these reasons, chronic MPS may reflect a state in which the muscle tenderness and stiffness formed during the healing process of a muscle lesion, and the muscle tenderness and stiffness continue to cause pain. Consequently, the present study was conducted to determine the cause of MPS by identifying which technique was effective for treating the muscle tenderness and stiffness of MPS.

**SUBJECTS AND METHODS**

**Subjects**

The subjects were persons who consulted a doctor in the 14 months from September 2007 to October 2008. None of the subjects had any abnormalities on imaging or neurological examinations. They all had MPS with chronic low back pain and shoulder stiffness. There were a total of 90 subjects with muscle tenderness and stiffness; however, one subject was excluded due to the presence of acute pain that required rest. The presence of muscle tenderness and stiffness was determined based on the presence of a hard lump, detected by finger palpation vertically along a muscle fiber, that did not simply disappear even under strong pressure.

Subjects were classified into two groups according to the type of manual therapy provided. Patients who were treated by direct stimulus to the muscle (myotherapy or massage) were included in the M group (16 men, 52 women; average age 69.1 ± 17.4 years), while patients treated with a technique for improving functional joint disorders (joint facilitation or joint mobilization) were included in the J group (7 men, 15 women; average age 57.5 ± 18.4 years).

The Ethics Committee of the international University of Health and Welfare approved the study, and the study was explained to the director of the hospital and his agreement was obtained. Written informed consent was obtained from each subject.

**Methods**

Manual therapy was performed after measuring the muscle stiffness of a region of muscle tenderness and stiffness, and follow-up measurements were performed after the intervention. A muscle hardness meter NEUTONE TDM-N1(DX) (TRY-ALL, Chiba City, Chiba, Japan) was used to measure muscle rigidity.

In order to standardize the measured region, the following area was defined. (1) For the longissimus, a point 2 finger-breaths lateral from the 4th lumbar spinous process in the prone position was used. (2) For the trapezius, in the prone position, the patient adopted the shoulder-joint internal-rotation position and the pronation-of-forearm position; then, the middle point between
the acromion and the 7th vertebra cervical spinous process was used. (3) For the rhomboid major, in the prone position, the patient adopted the arm position into the shoulder-joint internal-rotation position and the pronation-of-forearm position, and the point 3 finger-breadths lateral from the 4th vertebra thoracic spinous process was used. Patients whose areas of muscle tenderness and stiffness were not within this region were excluded.

Muscle rigidity was measured before treatment, immediately post-treatment, and 1 week after treatment.

Muscle hardness measurements were taken with the subject relaxed to avoid muscular contraction. The investigator pressed the muscle hardness meter vertically against the regions of muscle tenderness and stiffness, measured three times, and adopted the median of the three measured values. The study was started after the experimenter had practiced the measurements and the measured values stabilized within individuals and also became similar among individuals.

The M technique involved repetitive pressure applied vertically using the thumb for a total treatment time of 10 minutes. The J technique was applied to the joint that was considered to have a functional disorder responsible for the pain, and the treatment time was also about 10 minutes. Patients received other treatments not involving manual therapy to avoid disadvantaging any of the subjects.

The results were analyzed using repeated measures ANOVA with two factors. After conducting a spherical surface verification according to Mauchly, the revised Greenhouse-Geisser verification and multiple comparisons were performed.

RESULTS

Significant differences in muscle stiffness were observed over time (p<0.01) and between techniques (p<0.05). Compared with the pretreatment level of muscle hardness, the post-treatment level and the 1 week after treatment level both decreased significantly (p<0.01). However, there was no significant difference between the post-treatment and 1 week after treatment levels (p=0.78) (Table 1).

Thus, the effect of manual therapy was seen immediately and persisted. Muscle stiffness decreased significantly more post-treatment in the M group than in the J group (p<0.01). Moreover, muscle stiffness decreased significantly more 1 week after treatment in the M group than in the J group (p<0.05) (Table 2).

| Table 1. Muscle stiffness before (Pre-treatment), immediately after (Post-treatment), and 1 week after (1 week) manual therapy |
|-----------------|-----------------|-----------------|
|                  | Manual therapy  |
| Pre-treatment    | 25.5 ± 7.8      |
| Post-treatment   | 22.3 ± 7.1**    |
| 1 week           | 22.8 ± 6.6**    |

**: p<0.01, Not significant difference between the post-treatment and 1 week after treatment levels (p = 0.78).

| Table 2. Muscle stiffness by technique |
|-----------------|-----------------|-----------------|
|                  | Myotherapy      | Joint facilitation | p-value |
| Pre-treatment    | 25.4 ± 7.6      | 26.6 ± 8.1      | n.s.    |
| Post-treatment   | 21.4 ± 6.4      | 25.9 ± 8.0      | **      |
| 1 week           | 22.2 ± 6.1      | 25.5 ± 7.1      | *       |

n.s.: not significant, **:p<0.01, *:p<0.05.

DISCUSSION

The present study showed that manual therapy significantly reduced muscle hardness in the muscle region affected by tenderness and stiffness, and the effect continued for 1 week after treatment. Muscle hardness was reduced significantly more in the M group than in the J group.

Kuruma and colleagues compared the effect of myofascial release and stretching using the muscle hardness meter. They reported no significant difference in muscle hardness. Ylinen and colleagues are conducting a randomized, controlled trial involving 125 female patients with non-specific neck pain, comparing the results between manual therapy (mobilization or massage) and stretching exercise groups. In a previous study, the author measured muscle pain and stiffness using a visual analog scale (VAS) and found that both myofascial release and stretching significantly decreased pain and stiffness 4 weeks after treatment. However, Ylinen and colleagues have reported no significant difference between manual therapy and stretch exercise.

It is said that the incidence of MPS is higher than
that for low back pain. Thus, this study focused on the chronic muscle tenderness and stiffness of MPS. MPS usually ameliorates in 2 to 3 weeks with healing of the injury. However, chronic MPS is considered to exist when the pain continues for at least 2 to 3 months. A peripheral mechanism of the pain resulting from a muscle or myofascial origin may be malfunction in the endplate overloaded by a muscle or muscle injury, with excessive secretion of acetylcholine from the endplate causing continuous muscular contraction. Furthermore, it is said that continuous muscular contraction presses against intramuscular blood vessels, causing ischemia and a vicious circle of pain resulting from release of pain-producing and sensitization substances created by depletion and scarcity of energy supply.

Treatment of MPS includes injections of local anesthetic and physiotherapy, but the effects of these approaches are only temporary, and a decisive drug therapy and method of treatment are required to treat chronic pain. Kobayashi et al described the muscle tenderness and stiffness of MPS as inflammation that smolders, and myotherapy was described as the method of treatment that reignites the inflammation of affected muscle promoting the healing process. Based on these reports, it can be hypothesized that chronic MPS is a condition in which the muscle tenderness and stiffness have been molded by a delay of the healing process of a muscle injury, which then produces pain.

The results of the present study suggest that the M technique is an effective form of manual therapy for chronic MPS. Decreased muscle hardness implies that the muscle tenderness and stiffness abate, the strong compression of the blood vessels within the muscle is alleviated, and gradual improvement of ischemia and the vicious circle of pain. According to Ushida and colleagues, the low back pain of MPS is also the result of a delayed healing process following tissue injury. However, they also point out that many cases are the result of chronic inflammatory muscle fatigue, facet-joint impairment, and hernia of an intervertebral disk, which increase the muscle tone. However, this does not appear to agree with the results of the present study, in which there was no significant difference between the M and J groups 1 week after treatment. In addition, in the J group, voluntary muscle stiffness appears to have decreased. Therefore, in MPS patients with no abnormalities on imaging or neurological examinations, pain that becomes chronic originates in a muscle lesion.

Further studies that follow patients for 3 weeks after treatment for acute MPS are needed, since 2 to 3 weeks are required for healing of the muscle injury itself. Moreover, evaluation of the pain of MPS should be included in future studies.

REFERENCES