Effect of Latent Myofascial Trigger Points on Strength Measurements of the Upper Trapezius: A Case-Controlled Trial

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ABSTRACT

Purpose: The purpose of this article was to determine whether strength is altered in the upper trapezius in the presence of latent myofascial trigger points (MTrP).

Methods: This study was case controlled and used convenience sampling. The sample recruited was homogeneous with respect to age, sex, height, and body mass. Participants were assessed for the presence of latent MTrP in the upper trapezius and placed into two groups: an experimental group that had latent MTrP in the upper trapezius and a control group that did not. Eighteen women (mean age 21.4 y, SD 1.89; mean height 156.9 cm, SD 4.03; and mean body mass 51.7 kg, SD 5.84) made up the experimental group, and 19 women (mean age 20.3 y, SD 1.86; mean height 158.6 cm, SD 3.14; and mean body mass 53.2 kg, SD 5.17) made up the control group. We obtained strength measurements of the non-dominant arm using a handheld dynamometer and compared them between the two groups.

Results: The difference in the strength measurements between the two groups was not statistically significant ($p = 0.59$).

Conclusions: The presence of latent MTrPs may not affect the strength of the upper trapezius.

Key Words: muscle strength dynamometer; myofascial pain syndromes; muscle strength; upper extremity.

RÉSUMÉ

Objectif : Vérifier si la force musculaire du trapèze supérieur est affectée en présence de points de déclenchement de la douleur myofasciale (MTrP).

Méthode : Une étude cas-témoin a été réalisée à l'aide d'un échantillonnage de commodité. Les participantes recrutées étaient homogènes en termes d'âge, de sexe, de grandeur et de masse corporelle. Chacune a été évaluée afin de détecter les points de déclenchement de la douleur myofasciale au trapèze supérieur. On a ensuite séparé les participantes en deux groupes : un groupe expérimental avec MTrP latents et un groupe de contrôle sans MTrP latents au trapèze supérieur. Le groupe expérimental était composé de 18 femmes ($21,4 \pm 1,89$ ans, $156,9 \pm 4,03$ cm de taille, et $51,7 \pm 5,84$ kg) et de 19 femmes ($20,3 \pm 1,86$ ans, $158,6 \pm 3,14$ cm de taille, et $53,2 \pm 5,17$ kg) pour le groupe de contrôle. Les mesures de force du bras non dominant ont été obtenues à l'aide d'un dynamomètre manuel et ont été comparées entre les deux groupes.

Résultats : La différence dans les mesures de force entre les deux groupes n'était pas significative sur le plan statistique ($p = 0,59$).

Conclusions : La présence de MTrP latents pourrait être sans effets sur la force du trapèze supérieur.

Myofascial pain syndrome is a complex pain disorder characterized by a steady dull ache referring to a specific reference zone from a myofascial trigger point (MTrP) within a palpable band of muscle.¹ A MTrP is a hyper-irritable spot, located within a taut band of skeletal muscle, that is painful on compression or stretch and that can give rise to a typical referred pain pattern as

well as to autonomic phenomena.^{1,2} MTrPs are further grossly subdivided into active MTrPs and latent MTrPs.

An active MTrP is defined as

a myofascial trigger point that causes a clinical pain complaint. It is always tender, prevents full lengthening of the muscle, weakens the muscle, refers a patient-recognized

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pain on direct compression, mediates a local twitch response of the muscle fibers when adequately stimulated and when compressed within the patient's pain tolerance produces referred motor phenomena and often autonomic phenomena generally in its pain reference zone and causes tenderness in the pain reference zone.^{1(p.1)}

A latent MTrP is defined as

a myofascial trigger point that is clinically quiescent with respect to spontaneous pain; it is painful only when palpated. A latent trigger point may have all the other clinical characteristics of an active trigger point and always has a taut band that increases muscle tension and restricts range of motion.^{1(p.4)}

Although MTrPs are a widely recognized phenomenon in clinical practice, we must note that much of the early literature on trigger points was based on theories generated by anecdotal reports and clinical experience of the practitioners treating MTrPs.¹ In recent years, a more scientific approach to identifying and understanding MTrPs has developed.^{3–10} Despite increasing interest, fundamental understanding of this phenomenon remains based in part on the theories of the early clinicians and still requires experimental verification.

Many studies, some dating back to the early twentieth century, have referred to the prevalence of MTrPs. Sola and colleagues³ assessed 200 asymptomatic young adults and found focal tenderness representing latent trigger points in the shoulder girdle muscles of 54% of female and 45% of male participants; 25% of these participants demonstrated referred pain. Fröhlich and Fröhlich⁴ examined lumbo-gluteal muscles in 100 asymptomatic control participants and found latent trigger points in the quadratus lumborum (45% of the participants), gluteus medius (41%), iliopsoas (23%), gluteus minimus (11%), and piriformis (5%). Lucas and colleagues⁵ examined 154 healthy adults for the presence of latent MTrPs in the scapular positioning muscles and found that nearly 90% of the population had at least one trigger point in the muscles assessed. These prevalence studies have shown that the presence of latent MTrPs is very common in the general population.

Although no studies have assessed the strength deficits in muscles that harbour latent MTrPs, various experimental studies have established what delineates normal muscles from those harbouring MTrPs. Lucas and colleagues⁶ found an alteration in the muscle activation pattern of a muscle group with a latent MTrP, which was corrected after treatment. Shah and colleagues⁷ and Shah and Gilliams⁸ found elevated levels of sensitizing substances in muscle tissues harbouring MTrPs compared with healthy muscle tissue; sites with active MTrPs had increased levels of sensitizing substances relative to sites with latent MTrPs. Li and colleagues⁹ showed the presence of nociceptive and non-nociceptive hypersensitivity

at latent MTrPs. Ge and colleagues¹⁰ found decreased blood flow at the site of latent MTrPs, which they suggested could be because of increased vasoconstriction activity at the trigger point.

Some evidence has suggested that altered pathophysiology exists at the site of latent MTrPs.^{6–10} Such altered physiology may affect a muscle's capacity to generate force and, therefore, its strength. Latent MTrPs are clinically significant because they remain clinically quiescent, such that a person will not even be aware of the presence of a trigger point that may render him or her weaker and more susceptible to fatigue. This is important in many areas, including sports, industrial settings, desk jobs, and any other occupation for which muscle efficiency is important.

Although latent MTrPs have been found to be quite prevalent and are thought to affect a muscle's ability to produce a contraction, research evidence demonstrating the difference in strength between a muscle with a latent MTrP and a normal muscle is lacking. We were unable to find any high-quality trials in PubMed, PEDro, CINAHL, or Cochrane until 2008, using the search terms *myofascial trigger points* and *strength*. The impact of latent MTrP on skeletal muscle remains largely unexplored. The purpose of this study, therefore, was to identify people with a latent MTrP in the upper trapezius and compare their muscle strength measurements with those of a similar group that did not have a latent MTrP.

METHODS

A notice advertising the study was placed on the notice board of KMCH College of Physiotherapy, a unit of Kovai Medical Center Research and Educational Trust in Coimbatore, India. Ethical approval to conduct the study was obtained from the college's research committee. Candidates interested in taking part in the study were asked to contact Magesh Anand Doraisamy. To maintain homogeneity among participants, we selected only women between ages 18 and 25 for the study. The exclusion criteria were neck pain, surgery on the neck or shoulder, presence of active MTrPs in the upper trapezius, any orthopaedic problems pertaining to the spine–shoulder complex (e.g., fractures, arthrosis, listhesis, sprains, strains), and cardiac problems that might be aggravated during the assessment (which involved maximal isometric contraction of the upper trapezius). Potential participants were screened for the presence of exclusion criteria by interview and physical examination.

Seventy-six women satisfied the initial inclusion criteria. Written informed consent was obtained from all participants before they took part in the study. Descriptive and demographic data were obtained from the participants, including age, height, body mass, and length of the upper trapezius. Body mass was measured using a standard weighing scale, and the person's height and

Table 1 Descriptive and Demographic Characteristics of the Study Participants

Characteristics	Group; mean (SD); range		
	Overall population; <i>n</i> = 76	Experimental; <i>n</i> = 18	Control; <i>n</i> = 19
Age, y	20.9 (2.13); 18–25	21.4 (1.89); 19–25	20.3 (1.86); 18–24
Height, cm	156.6 (5.65); 150–162	156.9 (4.03); 153–162	158.6 (3.14); 150–160
Body mass, kg	52.6 (8.65); 46–57	51.7 (5.84); 46–55	53.2 (5.17); 48–57
Length of upper trapezius muscle, cm	34.8 (2.6); 32–37	34.8 (1.86); 33–37	34.8 (1.91); 32–36

Figure 1 Handheld dynamometer used in the study.

the length of the upper trapezius (distance between the distal medial margins of the acromion processes) were measured using a standard measuring tape.

To obtain reliable results, we selected a homogeneous sample on the basis of age, sex, height, body mass, and length of the upper trapezius muscle. In addition to the other characteristics, we used muscle length as a selection criterion for participants because a larger muscle has been shown to generate more force than a smaller muscle.¹¹ Because the entire size of the muscle could not be measured, we assumed that the length of the muscle represented its size. We chose the non-dominant arm for testing because the effect of daily activities in altering the strength of the muscles may be less for the non-dominant arm than for the dominant arm.

The means and standard deviations (SDs) for age, height, body mass, and muscle length were, respectively, 20.9 years (SD 2.1), 156.6 cm (SD 5.7), 52.6 kg (SD 8.7), and 34.8 cm (SD 2.6). Participants retained for the study were those for whom all measurements obtained (height, body mass, length of the muscle) fell within one standard deviation of the mean of the normal distribution for the overall population.

The parameters obtained from 37 of the 76 participants fell within one SD of the mean of the overall population, and we therefore included these 37 in the study. Participants were assessed for the presence of latent MTrPs in the upper trapezius. Those who had a

latent MTrP in the upper trapezius muscle of the non-dominant arm were assigned to the experimental group (*n* = 18), and those who did not have a MTrP in the upper trapezius of either arm were assigned to the control group (*n* = 19). Demographic and descriptive characteristics of the participants are given in Table 1.

Latent MTrP was diagnosed through physical exploration of the upper trapezius by a physical therapist with more than two years' experience in the assessment and management of myofascial pain syndrome. Another physical therapist, who was not blinded to the group to which participants belonged, assessed muscle strength. To assess the trigger point, the participant was positioned in high sitting with her arms supported on her lap. The therapist palpated the entire stretch of muscle from the origin at the cervical spine to the insertion of the muscle fibres at the medial border of the lateral acromion process. The minimum essential criteria recommended by Simons¹ were followed for assessment and diagnosis of a latent MTrP. The physical signs considered were presence of a palpable taut band or a nodule in the skeletal muscle, an exquisite tender spot in the taut band or nodule, a positive jump sign, and referred pain to an area away from the site of the MTrP.

Assessment of Strength

We used a handheld dynamometer, or HHD (hydraulic dynamometer, Baseline Inc., FEI, Irvington, NY; see Figure 1) to measure the strength of the upper trapezius muscle. The HHD has been shown to be a valid and reliable instrument for this purpose.¹² The entire procedure for measuring muscle strength was explained to the participant before she performed the task, which was adapted from the method described by Hislop and colleagues¹³ to prevent any substitution from the trunk.

To measure the strength of the upper trapezius, the participant was placed supine on a treatment table, the HHD was stabilized against a footstool to prevent it from moving upward, and padding was placed at the acromion process to prevent compression pain from the HHD. The lever of the HHD was positioned at the superior lateral acromion of the non-dominant arm. The participant was asked to shrug her shoulder and push

Figure 2 A model depicting the method in which upper trapezius strength was measured using a handheld dynamometer.

upward with a maximal contraction, held for 3 seconds (see Figure 2). Three consecutive measurements were taken, and the attempt in which the person exerted the greatest force was recorded for the study. Muscle strength was measured in kilograms.

Data Analysis

We calculated and compared the mean and standard deviation of the strength measurements for the experimental and control groups using an unpaired *t*-test; the significance level was set at $p < 0.05$.

RESULTS

The mean strength measurement for the control group was 18.6 kg (SD 3.4); for the experimental group, the mean was 17.8 (SD 4.3). The difference in strength measurements between the two groups was not statistically significant ($p = 0.59$).

DISCUSSION

In this study, we attempted to determine any differences in strength between a normal skeletal muscle and a skeletal muscle with a latent MTrP. The main result of this study was that we observed no significant difference in strength between people with and without a latent MTrP in the upper trapezius. During the past few decades, MTrPs and myofascial pain syndrome have received a great deal of attention in the scientific and clinical literature.²⁻⁹ Researchers around the world have investigated various aspects of MTrPs, including their specific etiology, pathophysiology, histology, referred pain patterns, and clinical applications.³⁻⁹

The existing literature^{1,2} has suggested that the presence of MTrPs in a muscle may lead to weakness. Inhibition of muscle activity has been seen in the upper trapezius after experimentally induced pain.¹⁴ One can infer from this finding that a muscle with an active pain symptom is prone to inhibition, leading to poor contrac-

tion capacity and hence to weakness. This concept can be applied in the case of an MTrP as well, but we must note that an active pain symptom is observed only in the presence of an active MTrP, which is compounded by the increased presence of nociceptive substances^{6,7} that may cause pain as well as inhibition of nerve conduction at the level of the nerve ending. In the case of a latent MTrP, no active pain symptom is present; moreover, the concentration of nociceptive substances at the site of a latent MTrP is less than that at an active MTrP,^{6,7} and thus the contribution of nociceptive inhibition of the nerve endings is also reduced.

From a mechanistic viewpoint, the muscle that harbours a latent MTrP has a dysfunctional unit inside the muscle that can potentially render it inefficient. Lucas and colleagues⁶ showed that a latent MTrP can alter the muscle's activation pattern. In explaining the reasons for the alteration of the muscle activation pattern, Lucas and colleagues⁶ hypothesized that in the latent MTrP-affected muscle fibres, the active insufficiency of the sarcomeres under contracture (knot) and the lengthened sarcomeres outside the contracture can affect the muscle's contractile capacity. This hypothesis can be further expanded to posit that the latent trigger point can potentially influence the strength capabilities of the skeletal muscle. However, although we found a nominal difference in the mean value of the strength measurements between the experimental (latent MTrP) and control (no MTrP) groups, the values had no statistically significant difference.

The probable reason for the lack of differences in the strength measurement is the small size of the dysfunctional unit relative to larger normal muscle fibres. On the basis of the current understanding of MTrPs, a trigger point is characterized as a nodule in a taut band of a skeletal muscle. Although there is no experimental verification to date, the myofascial nodule or band may not occupy more than 10% of the actual muscle area, and thus one could conclude that the smaller dysfunctional unit may not affect maximal muscle strength.

This study's results could have been more emphatic if we had used a study design involving a pretest-posttest comparison after a trigger-point release or if we had carried out a two-group study in which the experimental group received treatment to alleviate the trigger point. Ensuring the complete return of muscle to its normal state by ascertaining the complete mitigation of the trigger point using advanced techniques such as thermography¹⁵ and ultrasound¹⁶ would also have strengthened our results.

CONCLUSIONS

Most studies on MTrPs are related to pain complaints. In this study, a comparison of maximal strength of the upper trapezius between people with and without latent MTrP did not show a statistically significant difference.

However, strength was assessed using a gross-motor activity in which the participant shrugged the shoulder against resistance. The results might have been different if the participant had been given a task involving a certain combination of movements, such as lifting boxes, in which the activation patterns of the synergists and the firing rate of the muscles moving the shoulder complex would be important to the pace of the task. Future studies should compare the performance of people with and without latent MTrPs on functional repetitive tasks.

KEY MESSAGES

What Is Already on Known on This Topic

A MTrP is considered to weaken the muscle. Some studies have suggested that a latent MTrP renders a muscle weak;^{1,2} however, this suggestion has not been experimentally verified. The current understanding of the impact of latent MTrPs on the strength of a skeletal muscle is more a theoretical explanation than an experimental confirmation.

What This Study Adds

This study provides early evidence that the presence of a latent MTrP may not affect the maximal strength of the upper trapezius muscle. Our results represent experimental progress toward understanding the impact of latent MTrPs on a skeletal muscle (the upper trapezius). A hypothesis to explain why a latent trigger point may not affect the strength of the muscle is proposed, and future prospects to draw more emphatic conclusions are discussed.

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