

ORIGINAL ARTICLE

Prevalence of Myofascial Trigger Points in the Hip in Patellofemoral Pain

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Abstract

Objectives: To determine the prevalence of myofascial trigger points (MTrPs) in the gluteus medius (GMe) and quadratus lumborum (QL) for subjects with patellofemoral pain (PFP), and to examine the relationship between MTrPs and force production of the GMe after treatment.

Design: Randomized controlled trial.

Setting: A physical therapy clinic.

Participants: Subjects (N=52; mean age \pm SD, 30 \pm 12y; mean height \pm SD, 172 \pm 10cm; mean mass \pm SD, 69 \pm 14kg) volunteered and were divided into 2 groups: a PFP group (n=26) consisting of subjects with PFP, and a control group (n=26) with no history of PFP.

Interventions: Patients with PFP received trigger point pressure release therapy (TPPRT).

Main Outcome Measures: Hip abduction isometric strength and the presence of MTrPs.

Results: Prevalence of bilateral GMe and QL MTrPs for the PFP group was significantly higher compared with controls ($P=.001$). Subjects in the PFP group displayed significantly less hip abduction strength compared with the control group ($P=.007$). However, TPPRT did not result in increased force production.

Conclusions: Subjects with PFP have a higher prevalence of MTrPs in bilateral GMe and QL muscles. They demonstrate less hip abduction strength compared with controls, but the TPPRT did not result in an increase in hip abduction strength.

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Patellofemoral pain (PFP) is a common orthopedic problem, accounting for 21% to 40% of all knee problems addressed in sports medicine centers.^{1,2} PFP often lacks a clear diagnosis or treatment plan that could improve successful outcomes. Recent literature³⁻⁵ on PFP has drawn attention to the importance of hip strength, in particular the hip abductor and external rotator muscles, in controlling for excessive valgus forces at the knee. Ireland et al⁴ have demonstrated that most active females with PFP have significant weakness in the hip muscles, which may lead to an alteration in lower extremity mechanics and increased forces on the knee. A better understanding of the underlying variables contributing to decreased hip strength could lead to more effective management of PFP.

Research has shown that weakened proximal hip musculature may influence the development or chronicity of PFP.⁶ Recent interest has focused on the relationship of PFP and poor eccentric control of hip adduction during the early stance phase of gait⁷ and weight-bearing activities.^{3,5} This change in control of eccentric hip adduction during weight-bearing activities may result in an increased internal rotation of the femur with resultant increased lateral patellar contact pressures.⁸ Powers³ has suggested that interventions for PFP should include a focus on hip muscular strength to enhance stability of the hip and pelvis and reduce excessive valgus stress at the knee.

The presence of muscle damage is a factor that contributes to decreased muscular force production and decreased stability.⁹ This can occur after a bout of unaccustomed eccentric exercise that often results in the formation of a myofascial trigger point (MTrP),¹⁰ defined as "a hyperirritable spot in skeletal muscle that is associated with a hypersensitive palpable nodule in a taut band."^{11(p9)} The presence of MTrPs has been associated with disordered fine movement control and unbalanced muscle

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activation.¹² Elimination of MTrPs can result in an improvement in motor function.¹³ MTrPs are either classified as active or latent. The active trigger point causes a clinical pain complaint, is always tender, prevents full lengthening of muscle, weakens the muscle, and causes referred pain during direct compression. In contrast, latent trigger points are only painful when palpated; however, they can have all the clinical characteristics of the active trigger point and always have a taut band that increases muscle tension and restricts range of motion.¹⁴

Lucas et al¹² found changes in motor activation patterns within the shoulder girdle muscles presenting with MTrPs. It may be plausible that the same pattern of altered motor control of the gluteus medius (GMe) exists when MTrPs are present within the muscle. Altered motor activation of the GMe may significantly alter eccentric hip adduction that potentially could lead to increased valgus forces at the knee with excessive frontal plane motion at the pelvis.^{3,15} Porterfield and DeRosa¹⁶ have mentioned that the contralateral quadratus lumborum (QL) may play a role in stabilizing the pelvis in the frontal plane during unilateral stance and may also contribute to contralateral valgus angulation at the knee.

Based on the above findings, the purpose of this study was to determine the prevalence of MTrPs present in the GMe and QL of subjects with PFP as compared with controls. In addition, we have analyzed the relationship between MTrPs and force production of the examined muscles to determine whether treatment of GMe MTrPs results in an increase in hip abduction strength. We hypothesized that there would be a significantly higher prevalence of GMe and QL MTrPs in subjects with PFP as compared with controls, and treatment of GMe MTrPs was expected to result in an increase in force production with hip abduction.

Methods

The study consisted of 52 volunteer subjects (24 men, 28 women; mean age \pm SD, 30 \pm 12y; mean height \pm SD, 172 \pm 10cm; mean mass \pm SD, 69 \pm 14kg). The PFP group (n=26) consisted of subjects with PFP. The control group (n=26) did not have a history of PFP. The human subjects review board at Rocky Mountain University of Health Professions and the University of Oregon approved the protocol for the study. All subjects provided written informed consent before their participation in the study, and the rights of the subjects were protected. Subjects selected for this study met the following criteria for the PFP group: generalized anterior, anterior/medial knee or retropatellar pain for 1 month or longer associated with prolonged sitting, ascending/descending stairs, sports activity, and/or running. Exclusion criteria for both groups included a history of patellar dislocation, cartilage or ligamentous damage, surgery for trauma to the knee, and a known history of osteoarthritis. All subjects completed the Anterior Knee Pain Scale (AKPS), which is a validated questionnaire tool used to subjectively measure normal knee function.¹⁷ The AKPS includes 13 self-reported

questions that address functional tasks such as running, walking, and climbing stairs.¹⁷

Study design

Subjects with PFP were required to attend 2 clinical visits, while the control group was required to attend only 1 visit. The visits consisted of peak isometric strength testing for bilateral hip abduction of subjects with PFP, and the dominant leg of controls. The dominant leg was determined by subjects reporting the leg that they would prefer to kick a ball. Testing of strength was conducted using a Microfet^a handheld dynamometer before (Baseline) and after treatment (Treatment). All subjects were examined for the presence of GMe and QL MTrPs using the criteria as described by Njoo and Van der Does¹⁸ on both limbs of localized tenderness and a jump sign. The coinvestigator (E.S.) performed the strength evaluations, and the primary investigator (S.R.) executed the MTrP evaluation and treatment. The investigators were blinded to the results of each other's findings.

The testing for all subjects began by assessing hip abduction strength following the methods described by Ireland.⁴ The subjects were in a side-lying position on a treatment table. With a pillow placed in between the subject's knees, the hip of the leg to be tested was abducted approximately 10°. The subject's trunk was stabilized using a strap placed inferior to the iliac crest and secured firmly around the underside of the table. The handheld dynamometer was placed 5.0cm proximal to the lateral knee joint line and was secured to the thigh with a strap wrapped around the table. The subject was instructed to push the thigh upward with maximal effort for 5 seconds. One practice trial and 3 experimental trials were performed, with 15 seconds of rest between trials. The peak output of the 3 trials was used for maximum hip abduction strength.

Subjects were then assessed for the presence of an MTrP in the GMe. With the subjects in a side-lying position, the primary investigator used a flat palpation of the thumb to examine for MTrPs of the GMe. Travell and Simons¹⁴ describe 3 potential MTrPs within the GMe. Trigger point 1 (posterior trigger point) is located proximal to the greater trochanter and inferior to the iliac crest in the upper lateral quadrant of the buttock. The second MTrP was palpated just anterior to trigger point 1, deep to the iliac crest. The last GMe MTrP was located just posterior to the tensor fascia latae muscle and was palpated by rolling the thumb over the muscle in a fashion that is perpendicular to the muscle fibers. Trigger points were also assessed for the QL¹⁴ in a side-lying position, and palpation was directed over the lateral third of the lumbar transverse processes. Criteria for diagnosing the presence of a trigger point included localized taut bands with tenderness, and the presence of a jump sign.¹⁴ Subjects were scored as having an MTrP, with criteria being at least 1 of the 3 present, or not having an MTrP. Subjects with GMe MTrPs and PFP were randomly divided into equal-sized groups and labeled as treatment or sham. All control subjects were not required to complete further testing or intervention.

The treatment group received trigger point pressure release therapy (TPPRT) over each identified GMe MTrP, in the side-lying position, with flat palpation of the primary investigator's thumb for 60 seconds each.¹⁹ The examiner monitored the proper amount of pressure by asking subjects to report when the pressure reached the upper limits of their tolerable discomfort (pain threshold). At any point, subjects were permitted to discontinue their participation in

List of abbreviations:

AKPS	Anterior Knee Pain Scale
GMe	gluteus medius
MTrP	myofascial trigger point
PFP	patellofemoral pain
QL	quadratus lumborum
TPPRT	trigger point pressure release therapy

the treatment. During the 60-second compression, it was expected that the MTrP compression discomfort would significantly decrease. Hanten et al²⁰ demonstrated that sustained pressure over an MTrP resulted in softening of the region, and these investigative authors have found in clinical practice that 60 seconds was often a sufficient period to note significant softening of MTrPs. The sham group was treated in a side-lying position. The primary investigator gently laid hands over the lateral hip of the affected side for 60 seconds.

After the treatment or sham interventions, each subject was reevaluated for hip strength using the methods described above. The coinvestigator was blinded regarding the type of intervention provided to the subject in order to protect the evaluation from biasing.

Statistical analysis

All analyses were done in SPSS version 20.0.^b There were no missing data. Chi-square tests were used to assess differences in the proportion of MTrPs between the PFP and control groups. An independent-samples *t* test was used to test statistical difference in force production between the control and the PFP group. A 2-way repeated-measures analysis of variance was used to compare hip force production between the treatment and the sham group. An alpha level of .05 was used for all tests of significance.

Results

Table 1 depicts the number of PFP and control subjects who had GMe and QL latent MTrPs. There were significantly more ($P=.001$) subjects who had both left and right GMe latent MTrPs in the PFP group as compared with the control group. For the QL, there were significantly more ($P=.001$) subjects who had both left and right QL latent MTrPs in the PFP group as compared with the control group.

The subjects in the PFP group displayed statistically significant ($P=.02$) less hip abduction strength compared with the control group (fig 1). Table 2 describes the average force production for PFP subjects who received the real and sham treatments. There was no significant difference between the treatment and control groups in regards to improvement in force production ($P=.93$).

Discussion

The purpose of this study was to determine whether there is a significant difference in the prevalence of GMe and QL MTrPs in subjects with PFP as compared with control subjects. The

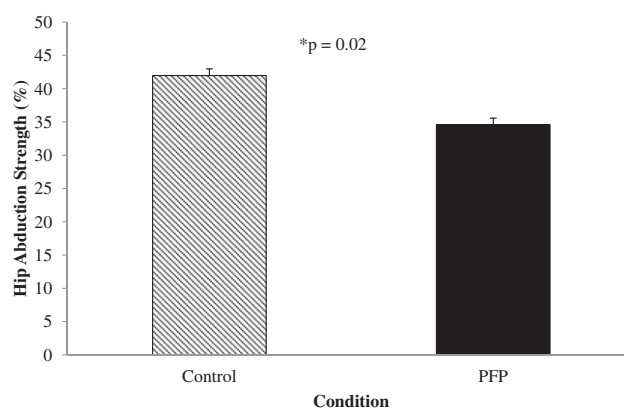


Fig 1 Normalized hip abduction strength between the control subjects and the subjects with PFP.

second objective was to determine whether treatment of GMe MTrPs would result in an increase in hip abduction force production.

The results of the current study showed a significant difference between the control and experimental group in the prevalence of GMe and QL MTrPs. The experimental group demonstrated at least 1 GMe MTrP in 97% of subjects as compared with the control group at 23%. These high numbers indicate that soft tissue and muscular dysfunction may play a role in PFP. Also, 87% of subjects presented with bilateral GMe MTrPs as compared with 13% in the control group, highlighting the possibility that the entire pelvis needs to be considered during clinical intervention, not just the ipsilateral side. All subjects presenting with MTrPs in this study had latent, and not active, MTrPs. Lucas¹² reported that latent MTrPs in several shoulder muscles altered motor activation patterns under light loading conditions of 1 to 4kg as compared with the control group. This may also have implications for pelvic musculature motor activation, although this variable was not measured in this study.

Additionally, the present data indicate a significant prevalence of QL MTrPs in subjects with PFP. Eighty percent of subjects with PFP had bilateral QL MTrPs, while 93% had the QL MTrP on the side contralateral to the PFP, and all subjects with PFP had at least 1 QL MTrP. One consideration is that the primary function of the QL is to stabilize the trunk laterally.²¹ During the gait cycle, the GMe helps in providing pelvic stability in the frontal plane. If the muscle lacks sufficient force production, the outcome can take 2 possible forms: an uncompensated Trendelenburg gait resulting in an increased Q angle on the affected side, or a compensated Trendelenburg gait in which the trunk is laterally displaced over the affected hip.²² The compensated gait will shift the center of mass laterally over the weakened hip.²³ As a result, the contralateral QL has to eccentrically control lateral trunk motion in the

Table 1 Presence of latent MTrPs

Group	Both Left and Right		Either Left or Right	
	GMe	QL	GMe	QL
Control	4	4	7	9
PFP	26	24	25	26

NOTE. N=52. Values are the number of PFP and control group subjects with latent MTrPs.

Table 2 Normalized hip abduction force

PFP Group	Baseline	Treatment
Treatment (n=13)	31.7±8.6	31.7±9.2
Sham (n=13)	36.5±9.5	38.8±11.4

NOTE. Values expressed as mean ± SD normalized force production (%) before and after the treatment.

frontal plane. This compensation could cause development of MTrPs in the QL.

Numerous studies on MTrPs have examined their effects on muscle activation^{12,13} and pain.²⁴⁻²⁶ To our knowledge, this is the first study that examined the force production of the hip abductors in subjects with PFP before and after intervention with TPPRT. In our study, the control group demonstrated higher force production compared with the PFP group before any intervention. We hypothesized that the intervention of TPPRT would increase force production in patients with PFP and GMe MTrPs. However, this particular intervention of TPPRT was not shown to be an effective treatment to improve strength output of the lateral hip musculature.

An alternative treatment to TPPRT is the use of dry needling. Dry needling is a procedure in which an acupuncture needle is inserted directly into the MTrP in order to induce a localized twitch response, resulting in the possible disruption of the dysfunctional motor endplate.²⁷ Lucas²⁸ conducted a study examining latent MTrPs in the shoulder and scapular region in which muscle activation and movement efficiency were measured. Lucas was able to demonstrate a significant improvement in motor function of all affected muscles with the use of dry needling of latent MTrPs.

Study limitations

The participants in this study had a diagnosis of anterior knee pain; therefore, the results of this study cannot be generalized to all patients with PFP. Several points need to be addressed regarding the lack of effect of TPPRT to increase force production of the hip abductors. One factor may have been that the pressure of the treatment by the primary investigator, and by subjects with the home exercise program, was not sufficient. Greater pressure may have been needed to reach deeper MTrPs, to have a greater effect on the mechanism involved in eliminating MTrPs and to account for different subjects' body composition. The GMe TPPRT for this treatment was limited to only 1 MTrP, while more may have been present but were not treated.

Conclusions

The results of the current study indicate that a significant weakness exists in the hip abductors of those with PFP, and that this population also presents with a significant prevalence of MTrPs in the GMe and QL that may be an important variable to consider in the evaluation and treatment of this condition. Future studies need to focus on objective measurements of MTrP location and improved treatment strategies to determine whether this can result in an improvement in muscle activation patterns of these important pelvic stabilizers.

Suppliers

- a. Hoggan Health, 8020 South 1300 West, West Jordan, UT 84088.
- b. SPSS Inc, 233 S Wacker Dr, 11th Fl, Chicago, IL 60606.

Keywords

Anterior knee pain; Hip joint; Knee; Muscle, skeletal; Rehabilitation

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