Trigger Points and Pressure Pain Hypersensitivity in People With Postmeniscectomy Pain

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Objectives: The objectives of this study are (1) to assess the presence of myofascial trigger points (TrPs) and widespread pressure hyperalgesia; and (2) to assess the relationship between the presence of active TrPs, pain intensity, and widespread pressure hypersensitivity in individuals with postmeniscectomy pain.

Methods: Thirty-three patients with postmeniscectomy pain, 46 to 60 years of age, and 33 matched controls participated. TrPs were explored bilaterally within the tensor fasciae latae, rectus femoris, vastus lateralis, vastus medialis, adductor magnus, adductor longus, semitendinosus, biceps femoris, and gastrocnemius muscles in a blinded manner. TrPs were considered active if the referred pain reproduced knee symptoms. Pressure pain thresholds (PPT) were also assessed bilaterally over the vastus medialis, vastus lateralis, patellar tendon, second metacarpal, and tibialis anterior. Pain was collected with a numerical pain rate scale (0 to 10).

Results: Patients with postmeniscectomy pain showed a greater ($P < 0.001$) number of active TrPs (mean: 2 ± 1) and a similar number ($P = 0.611$) of latent TrPs (mean: 4 ± 4) than pain-free controls (mean latent TrP: 4 ± 1). A greater number of active TrPs was associated with higher pain intensity ($r = 0.352$; $P = 0.045$). Patients also exhibited reduced PPT over the affected vastus medialis and patellar tendon ($P < 0.05$) and bilaterally over the tibialis anterior muscle ($P = 0.001$). A greater the number of active muscle TrPs was also associated with widespread pressure pain hyperalgesia.

Conclusions: The referred pain elicited by active TrPs reproduced knee symptoms in patients with postmeniscectomy pain. Patients also showed localized reduction of PPT. The number of TrPs was associated with the intensity of pain and pressure hyperalgesia. Our findings suggest the presence of peripheral sensitization in patients with postmeniscectomy pain could be associated with the presence of active TrPs.

Key Words: meniscectomy, pain, trigger points, pressure pain, knee

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Meniscal injuries are one of the most common musculoskeletal injuries in the general population and nearly 80% of all magnetic resonance imaging studies of the knee identify a meniscal tear.[1] Therefore, it is not surprising that meniscal injuries are one of the most common conditions of the knee with a reported prevalence of 61 of 100,000 individuals.[2] In the United States, it has been estimated that nearly 10% to 20% of the total orthopedic surgeries performed each year are directly related to meniscal injuries.[3]

Meniscectomy is the most common surgical procedure for the management of meniscal injuries. In fact in 2011 over 54,000 meniscectomies were performed compared with only slightly over 3500 meniscal repairs in the US[4] resulting in substantial costs to the health care system and society. In addition, it has been reported that meniscectomies have a significantly lower reoperation rate than a meniscal repair.[5]

Although meniscectomies are performed arthroscopically the procedure can lead to a number of postoperative impairments including pain.[6,7] Drosos et al[7] examined postoperative pain for a 24-hour period after meniscectomy and found that even though pain levels decreased over this time, patients still had pain at the 24-hour period. In fact, a recent systematic review has demonstrated that even when patients receive appropriate postoperative rehabilitation, they continue to experience pain symptoms as far out as 6- and 12-week follow-up periods.[6] The exact mechanism for the persistent pain remains to be elucidated. It is possible that synovial inflammatory mediators might be the cause of patients' postoperative pain. However, Scanzello et al[8] did not find that synovial inflammation was correlated with pain, yet they noted that the sample size may have been small to identify this relationship. Further, it has been demonstrated that mice receiving a meniscectomy exhibit mechanical allodynia, mechanical hyperalgesia, and cold allodynia for months after the surgery.[9] These findings are manifestations of peripheral and central sensitization mechanisms; however, it is difficult to generalize these results to a human population. Further research is needed to identify the postmeniscectomy pain mechanisms experienced by patients, particularly the presence of sensitization mechanisms.

In addition to experiencing postoperative pain, patients undergoing meniscectomy also exhibit weakness of the muscles of the lower extremity, particularly the quadriceps. It has been shown that patients exhibit significantly less girth of the vastus lateralis and vastus medialis muscles on the surgical side as compared with the contralateral limb as measured by magnetic resonance imaging.[10] Aikima et al[11] reported that in patients' status postmeniscectomy the ipsilateral quadriceps femoris muscle had significantly less (22%) EMG activity during concentric and eccentric contractions compared with the opposite side. It is possible that the surgical procedure may play a role in muscle damage.

In fact, muscle damage occurring during the surgical meniscectomy can induce the activation of myofascial trigger points (TrPs). A TrP is defined as a hypersensitive spot within a taut band of a skeletal muscle that is painful on contraction, stretching, or stimulation and elicits a referred pain pattern.[12] TrPs are clinically classified as active or latent. Active TrPs cause spontaneous sensory or motor symptoms, their stimulation reproduces the patient's symptom and the pain is recognized as a familiar phenomenon for the patient. Latent TrPs do not cause spontaneous pain symptoms, but they refer pain which is not recognized as a familiar phenomenon to the patients when they are stimulated.

There are no available data related to the presence of TrPs and sensitization pain mechanisms in patients with postmeniscectomy pain. Therefore, the aims of the current study were to investigate the presence of active and latent TrPs, to determine the presence of widespread pressure hyperalgesia, and to assess the relationship between the presence of active TrPs, intensity of ongoing pain, and widespread pressure pain hypersensitivity in individuals with postmeniscectomy pain.

METHODS

Participants

In this study, patients scheduled for partial knee arthroscopic meniscectomy due to a medial meniscus tear were recruited. All operations were performed by the same surgeon, under local anesthesia using the same protocol (Fig. 1). Demographic and clinical data including age, sex, past medical history, location and nature of the symptoms, mechanism of injury, intensity and duration of symptoms, radiologic evaluation, and medication were collected. An 11-point numerical pain rate scale (0: no pain; 10: maximum pain) was used to assess the mean intensity of pain experienced after surgery.[13] To be included, patients had to exhibit postmeniscectomy pain ≥ 3 points on the numerical pain rate scale (0 to 10). In addition, sex-matched and age-matched volunteers who had no knee pain, history of knee injury, physical sign and/or symptoms of meniscus tear, or other long-lasting pain problems in the past year were included as pain-free controls. Participants were excluded if they exhibited any of the following: (1) previous lower extremity surgery; (2) previous knee surgery; (3) previous diagnosis of lower extremity radiculopathy or myelopathy; (4) radiologic evidence of knee osteoarthritis; (5) any sensory dysfunction (eg, nerve damage); or (6) if they had received any therapeutic intervention, including medication, for the knee in the 6 months before the study.

The protocol was approved by the Local Ethics Committee and conducted following the declaration of Helsinki. All patients signed an informed consent before their inclusion in the study.

Pressure Pain Thresholds (PPT)

PPT, defined as the amount of pressure applied for the pressure sensation to first change to pain,[14] was assessed bilaterally with a mechanical pressure algometer (Pain Diagnosis and Treatment Inc., New York) over the vastus medialis, the vastus lateralis, the patellar tendon, the second metacarpal, and the tibialis anterior muscle to determine widespread pressure sensitivity. Patients were instructed to press a switch when the sensation first changed from pressure to pain. The mean of 3 trials was calculated and used for analysis. A 30-second resting period was allowed between each trial. Several studies had documented high intraexaminer and interexaminer reliability (intra-class correlation coefficient, 0.80 to 0.97) for PPT assessment in patients with pain.[15,16] The order of assessment was randomized between participants. They were requested to maintain their current analgesic medication for postsurgery pain.

TrP Examination

TrPs were explored bilaterally in the tensor fasciae latae, rectus femoris, vastus lateralis, vastus medialis, adductor magnus, adductor longus, semitendinosus, biceps femoris, and medial and lateral gastrocnemius muscles by a blinded assessor with 9 years of experience in TrPs diagnosis. The order of evaluation was randomized between subjects with a 2-minute rest period between muscles.

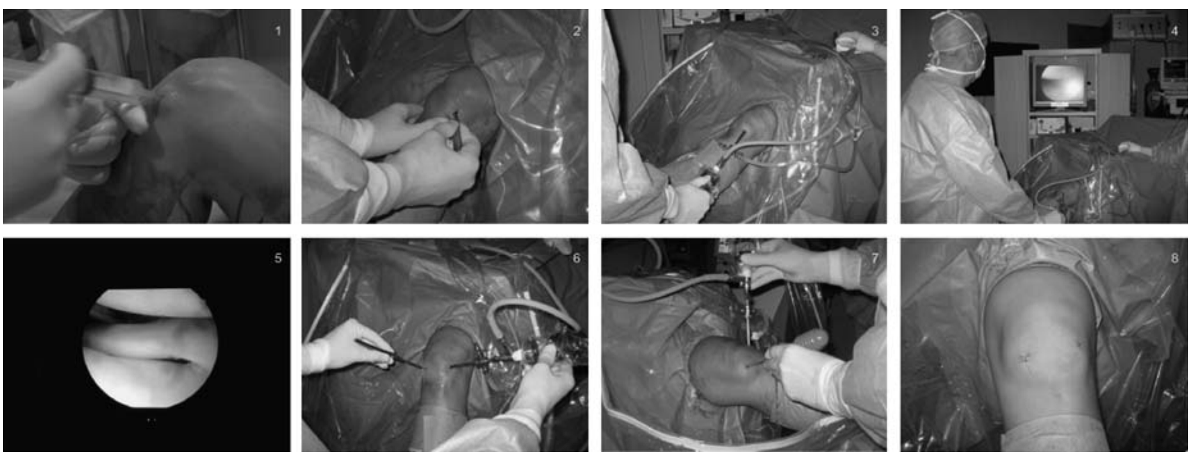

FIGURE 1. Representation of arthroscopic partial meniscectomy with local anaesthetic.

TrP diagnosis was performed following the criteria described by Simons et al[12]: (1) presence of a hypersensitive spot within a palpable taut band in a skeletal muscle; (2) local twitch response elicited by the snapping palpation of the taut band; and (3) presence of referred pain in response to TrP compression. TrPs were considered active when the local and referred pain reproduced any clinical pain symptom perceived by the patients and the patients recognized the pain as familiar. TrPs were considered latent when the elicited local and the referred pain did not reproduce any symptoms familiar to the patient.[12] These criteria, when applied by a trained assessor, have shown a good interexaminer reliability (κ) ranging from 0.84 to 0.88.[17]

TrP examination was conducted in a blinded manner. After TrP assessment in all muscles, participants were asked for: "When I pressed each of these muscles, did you feel any pain locally, and in other areas (referred pain). Please tell me whether the pain that you feel in the other area reproduced any symptom that you usually suffered from." Participants had to indicate whether the pain elicited by palpation reproduced their symptom (familiar pain) or another nonfamiliar pain around the knee region.

Sample Size Determination

The sample size determination and power calculations were performed with the ENE 3.0 software (GlaxoSmithKline, Universidad Autónoma, Barcelona, Spain). The determinations were based on detecting significant differences of 20% on PPT[18] over each point between groups with α-level of 0.05, and a desired power of 80%. This generated a sample size of at least 16 participants per group.

Analysis of Data

Data were analyzed with the SPSS statistical package (18.0 version). Descriptive data was collected on all patients. Results are expressed as mean ± SD and 95% confidence interval (95% CI). The Kolmogorov-Smirnov test revealed that all data showed a normal distribution ($P > 0.05$); therefore, parametric tests were used in the analysis. Differences in the number of TrPs (active or latent TrPs) between groups were assessed with the unpaired Student t test. The χ^2 test was used to analyze the differences in the distribution of muscle TrPs (active or latent) for each muscle within both study groups. A 2-way ANOVA test was used to evaluate the differences in PPT levels assessed over each point (vastus medialis, vastus lateralis, patellar tendon, second metacarpal, and tibialis anterior) with side (affected/unaffected or dominant/nondominant) as within-subject factor and group (patients or controls) as between-subject factor. Finally, the Pearson correlation test (r) was used to determine the associations between the number of TrPs, PPT data, and the clinical variables relating to symptoms. The statistical analysis was conducted at a 95% confidence level, and a P-value <0.05 was considered statistically significant.

RESULTS

Thirty-three individuals who had received partial knee meniscectomy (39% women), 46 to 60 years of age (mean age: 51 ± 14 y) and 33 age-matched and sex-matched controls were included (40% women, age: 53 ± 11 y). Within the meniscectomy group, 19 patients (58%) received the surgery on the right knee and the remaining 14 (42%) on the left knee. The mean duration of history from meniscus tear diagnosis was 2.3 years (95% CI, 1.0-3.7). The mean time from surgery and exploration was 3.8 days (95% CI, 1.9-5.6). The mean current intensity of postmeniscectomy knee pain was 4.1 (95% CI, 3.4-4.8). No significant association between clinical pain variables was found.

TrPs in Postmeniscectomy Pain

The mean ± SD number of TrPs for each patient with postmeniscectomy pain was 6 ± 4 of which 2 ± 1 were active TrPs and the remaining 4 ± 4 were latent TrPs. Pain-free controls only had latent TrPs (mean ± SD: 4 ± 1). Therefore, the number of active TrP between both groups was significantly different for active TrPs ($t = 4.661$, $P < 0.001$), but not for latent TrPs ($t = 0.511$, $P = 0.611$): patients with postmeniscectomy pain showed a greater number of active, but a similar number of latent TrPs, as compared with healthy controls.

The distribution of TrPs in the analyzed muscles was significantly different between patients with postmeniscectomy pain and controls for the vastus medialis, vastus lateralis, semitendinosus, and biceps femoris (all, $P < 0.01$), but not for the tensor fasciae latae, rectus femoris, adductor magnus, adductor longus, and medial and lateral gastrocnemius (all, $P > 0.129$) muscles. Active TrPs in the vastus medialis (35%) and the vastus lateralis (15%) muscles on the affected side were the most prevalent in patients with postmeniscectomy pain. Table 1 summarizes the distribution of active and latent TrPs for all muscles in patients with postmeniscectomy pain and controls.

Significant positive associations between the number of active TrPs and the mean intensity of pain ($r = 0.352$; $P = 0.045$) and the history from meniscus tear diagnosis ($r = 0.507$; $P = 0.005$) were found: the higher the number of active TrPs, the greater the intensity of the ongoing clinical pain or the longer the duration from the meniscus tear diagnosis.

Pressure Pain Hyperalgesia in Postmeniscectomy Pain

The ANOVA revealed significant differences between both groups, but not between sides, for PPT levels over the tibialis anterior muscle (group: $F = 29.157$, $P = 0.001$; side: $F = 2.922$, $P = 0.334$): patients with postmeniscectomy pain showed bilateral lower PPT than controls. No significant effect for group or side were observed for PPT over the vastus medialis (group: $F = 2.758$, $P = 0.345$; side: $F = 0.151$, $P = 0.764$), vastus lateralis (group: $F = 0.266$, $P = 0.697$; side: $F = 3.091$, $P = 0.329$), patellar tendon (group: $F = 0.917$, $P = 0.514$; side: $F = 1.065$, $P = 0.490$), and second metacarpal (group: $F = 2.791$, $P = 0.189$; side: $F = 1.356$, $P = 0.471$).

A significant interaction between side and group for PPT levels over the vastus medialis ($F = 3.842$, $P = 0.048$) and the patellar tendon ($F = 4.405$, $P = 0.038$) was found: PPT levels over the vastus medialis and patellar tendon were significantly lower on the affected side as compared with the nonaffected side and both sides in controls. Table 2 summarizes PPT assessed over vastus medialis, vastus lateralis, patellar tendon, second metacarpal, and tibialis anterior muscle for both sides within each study group.

Significant negative associations between the history of pain from meniscus tear diagnosis and PPT over the vastus medialis ($r = -0.421$, $P = 0.023$, Fig. 2A) and vastus lateralis ($r = -0.416$, $P = 0.025$, Fig. 2B) on the affected side

TABLE 1. Number (n) of Patients With Postmeniscectomy Pain and Healthy Controls With Muscle TrPs

	Patients With Postmeniscectomy Pain (n = 33)									
	Tensor Fasciae Latae		**Rectus Femoris**		**Vastus Medialis***		**Vastus Lateralis***		**Adductor Magnus**	
	Affected	**Nonaffected**	**Affected**	**Nonaffected**	**Affected**	**Nonaffected**	**Affected**	**Nonaffected**	**Affected**	**Nonaffected**
Active TrPs (n)	0	1	1	1	11	2	5	0	1	0
Latent TrPs (n)	18	11	5	5	10	13	12	12	6	8
No TrPs (n)	15	21	27	27	12	18	16	21	26	25
	Adductor Longus		Semitendinosus*		Biceps Femoris*		Medial Gastrocnemius		Lateral Gastrocnemius	
Active TrPs (n)	0	0	2	1	3	0	3	1	3	1
Latent TrPs (n)	6	7	7	9	8	8	17	19	11	15
No TrPs (n)	27	26	24	23	22	25	13	13	19	17
	Healthy Controls (n = 33)									
	Tensor Fasciae Latae		Rectus Femoris		Vastus Medialis		Vastus Lateralis		Adductor Magnus	
	Dominant	No-Dominant	Dominant	No-Dominant	Dominant	No-Dominant	Dominant	No-Dominant	Dominant	No-Dominant
Active TrPs (n)	0	0	0	0	0	0	0	0	0	0
Latent TrPs (n)	12	15	2	1	13	12	21	10	7	12
No TrPs (n)	21	18	31	32	20	21	12	23	26	21
	Adductor Longus		Semitendinosus		Biceps Femoris		Medial Gastrocnemius		Lateral Gastrocnemius	
Active TrPs (n)	0	0	0	0	0	0	0	0	0	0
Latent TrPs (n)	8	7	0	2	4	6	21	19	12	9
No TrPs (n)	25	26	33	31	29	27	12	14	21	24

*Statistical significant differences between patients with postmeniscectomy pain and pain-free controls ($P < 0.001$; χ^2).
TrPs indicates trigger points.

TABLE 2. Pressure Pain Thresholds (kg/cm^2) in Patients With Postmeniscectomy Pain and Pain-free Controls

	Vastus Medialis*	Vastus Lateralis	Patellar Tendon*	Second Metacarpal	Tibialis Anterior#
Patients with postmeniscectomy pain (n = 33)					
Affected side	3.4 ± 1.3	4.3 ± 1.4	4.2 ± 1.6	3.3 ± 0.8	4.6 ± 1.3
Nonaffected side	3.9 ± 1.3	4.6 ± 1.4	5.4 ± 1.9	3.5 ± 1.3	5.1 ± 1.7
Healthy controls (n = 33)					
Dominant side	4.4 ± 1.1	4.4 ± 1.3	5.3 ± 1.9	3.5 ± 0.8	5.8 ± 1.1
Nondominant side	4.2 ± 1.1	4.4 ± 1.2	5.3 ± 1.1	3.6 ± 1.0	6.0 ± 1.1

Values are means ± SD.
*Statistical significant differences between sides (P < 0.05; group × side interaction; ANOVA test).
#Bilateral statistical significant differences between groups (P < 0.001; ANOVA test).

were observed: the longer the duration from the meniscus tear diagnosis, the higher the pressure pain hyperalgesia, for example, the lower the PPT, over the affected vastus medialis and lateralis muscles.

Association Between TrPs and Pressure Pain Hyperalgesia in Postmeniscectomy Pain

Finally, we observed significant negative associations between the number of active TrPs and PPT bilaterally over the vastus medialis (affected: $r = -0.596$, $P < 0.001$; nonaffected: $r = -0.569$, $P < 0.001$—Fig. 3A), vastus lateralis (affected: $r = -0.709$, $P < 0.001$; nonaffected: $r = -0.619$, $P < 0.001$—Fig. 3B), patellar tendon (affected: $r = -0.369$, $P = 0.035$; nonaffected: $r = -0.384$, $P = 0.027$—Fig. 4A), second metacarpal (affected: $r = -0.341$, $P = 0.049$; nonaffected: $r = -0.349$, $P = 0.047$—Fig. 4B) and tibialis anterior (affected: $r = -0.587$, P < 0,001; nonaffected: $r = -0.530$, $P = 0.001$—Fig. 4C): the greater the number of active TrPs, the lower the widespread PPT, that is, the higher the widespread pressure pain hyperalgesia in patients with postmeniscectomy pain.

DISCUSSION

The current study found that patients with postmeniscectomy pain exhibited active TrPs in the knee muscles and localized pressure pain hyperalgesia as compared with healthy people. A greater number of active TrPs was associated with higher intensity of ongoing pain and widespread pressure hyperalgesia. The current findings would suggest the presence of peripheral sensitization mechanisms in patients with postmeniscectomy pain could be associated with the presence of active TrPs.

TrPs and Postmeniscectomy Pain

Simons[19] previously suggested that surgical procedures can promote the activation of myofascial TrPs; however, no previous study has investigated the presence of active and latent TrPs in patients with postmeniscectomy pain. The current study found that the referred pain elicited by active TrPs reproduced the knee pain symptoms seen after the arthroscopy procedure and the number of active TrPs was associated with the intensity of ongoing pain. When the assessor applied pressure to active TrPs, patients

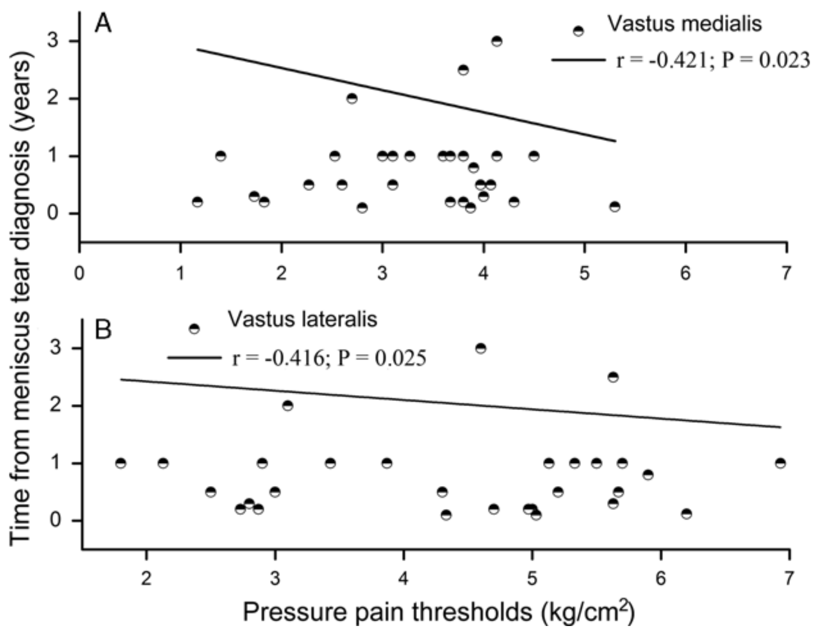

FIGURE 2. Scatter plots of relationships between the time from meniscus tear diagnosis (years) and pressure pain thresholds (kg/cm^2) over the vastus medialis and lateralis muscles on the affected side (n = 33). Note that some points are overlapping. A negative linear regression line is fitted to the data.

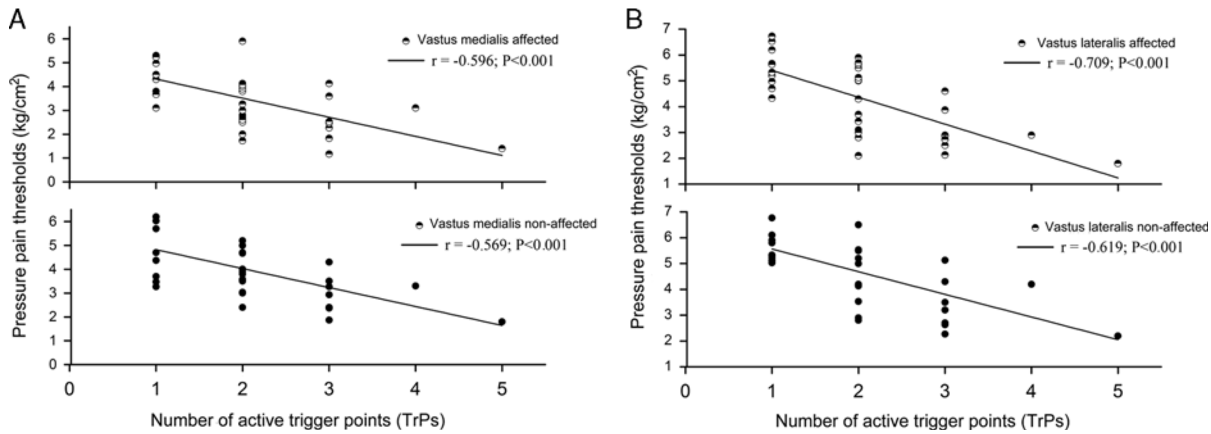

FIGURE 3. Scatter plots of relationships between the number of active trigger points (TrPs) and pressure pain thresholds (kg/cm^2) over both vastus medialis (A) and lateralis (B) muscles (n = 33). Note that some points are overlapping. A negative linear regression line is fitted to the data.

reported: "Yes, this is exactly the pain that I actually feel in my knee." We observed that active TrPs in the vastus medialis and vastus lateralis muscles were the most prevalent in patients with postmeniscectomy pain. The presence of active TrPs in these muscles seems expected as the vastus medialis and vastus lateralis are intrinsically related to knee load and stabilization. One possible mechanism of activation is that changes in dynamic loads due to the meniscus tear and the arthroscopy procedure induced muscle overload and promote activation of TrPs in these muscles. Another explanation may be that the arthroscopy procedure induces damage to these muscles because they are the points of access to the knee of the patient (Fig. 1). Finally, the fact that a higher number of active TrPs was associated with greater pain intensity would support a role of active TrPs in postmeniscectomy pain; however, longitudinal studies are needed.

An interesting finding was that patients with postmeniscectomy pain exhibited a similar number of latent TrPs as the controls. In fact, the number of latent TrPs was higher than the number of active TrPs. These findings are similar to other studies conducted in individuals with mechanical neck pain[20,21] but contrary to studies conducted in individuals with whiplash injury,[22] tension type headache,[23,24] lateral epicondylalgia,[25] or shoulder impingement[26] where pain-free controls exhibited lower number of latent TrPs than the pain populations. The presence of some latent TrPs in asymptomatic people can be expected and it is commonly observed in clinical practice; however, it is expected that this prevalence would be lower than in the symptomatic population. These discrepancies can be related to specific areas of the body or muscles. The presence of latent, but not active, TrPs in our control group supports that we were able to find an appropriate comparison group to accomplish a properly blinded study. Clinical distinction between active and latent TrPs is substantiated by histochemical findings because higher levels of algogenic substances and chemical mediators (ie, bradykinin, serotonin, or substance P) are found in active TrPs as compared with latent TrPs.[27] Nevertheless, the clinical relevance of latent TrPs has recently increased[28] as latent TrPs disturb normal patterns of motor recruitment and movement efficiency[29] and induce sensitization mechanisms.[30] In fact, our study suggests that postmeniscectomy pain patients seems to reveal a change from latent into active TrP, which may be caused by an increased presence of inflammatory mediators being released due to the surgical procedure.

A systematic review found that patients exhibit quadriceps muscle weakness status postarthroscopic partial meniscectomy that persists even up to 6 months.[31] A recent study found that it might take up to 2 years for a patient to regain their quadriceps strength back to equal that of pain-free controls.[32] Therefore, it is possible that motor disturbances induced by both active and latent TrPs also contribute to motor deficits experienced by individuals experiencing postmeniscectomy pain. The fact that experimental muscle pain induced into the knee muscles provokes generalized muscle inhibition supports this hypothesis.[33] In fact, the vastus medialis and lateralis were the muscle most affected by active TrPs in postmeniscectomy pain.

Sensitization Mechanisms in Postmeniscectomy Pain

We also found that patients with postmeniscectomy pain exhibited lower PPT over the vastus medialis and patellar tendon on the affected side and bilaterally over the tibialis anterior muscle compared with pain-free people. The presence of localized pressure pain hyperalgesia supports the development of peripheral sensitization in patients with postmeniscectomy pain. In addition, lower PPTs were associated with a higher number of active TrPs suggesting a spatial summation effect. It is possible that a nociceptive barrage induced by TrPs[27] can contribute to the development of peripheral sensitization by inducing neuroplastic changes at the dorsal horn.[34] Therefore, it is possible that the presence of active TrPs can promote the development of future widespread pressure pain hyperalgesia in patients with postmeniscectomy pain if TrPs are not properly treated; although further studies are required to confirm this hypothesis.

Patients with postmeniscectomy pain also exhibited bilateral pressure pain hyperalgesia over the tibialis anterior muscle, suggesting that localized pain in the knee area can induce contralateral sensitization at the dorsal horn neurons. This finding is similar to studies performed on animal models where unilateral localized musculoskeletal pain causes sensitization of contralateral segments.[35] Increased

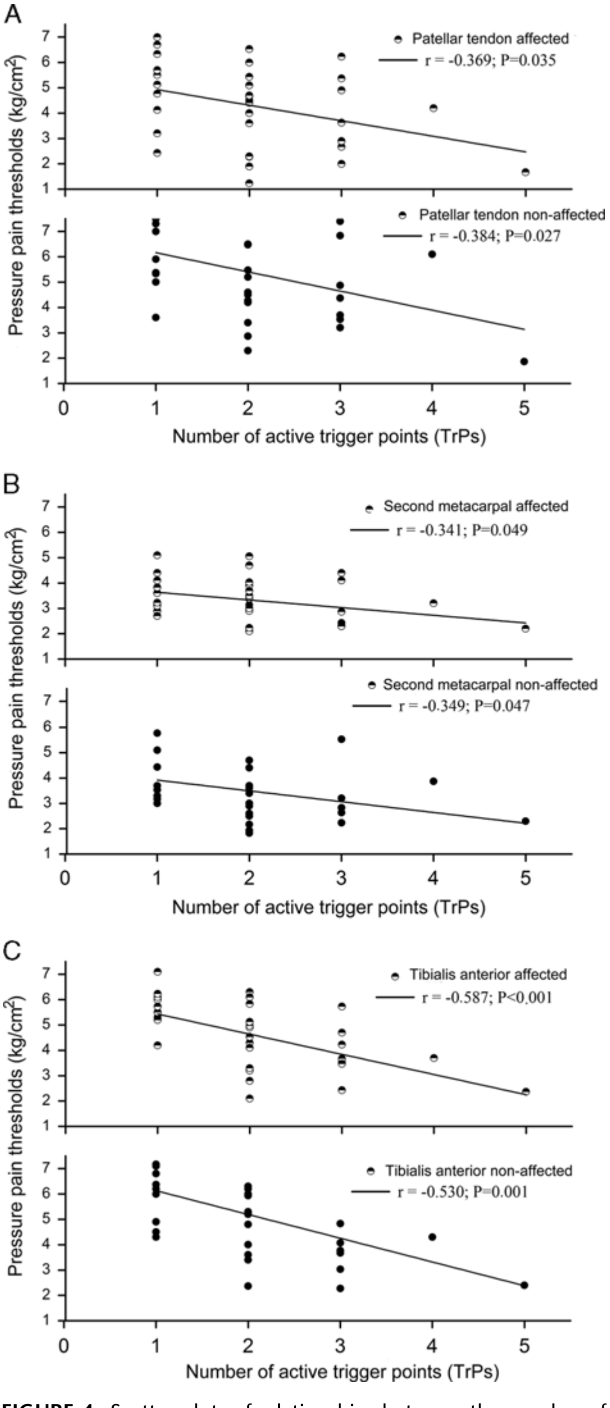

FIGURE 4. Scatter plots of relationships between the number of active trigger points (TrPs) and pressure pain thresholds (kg/cm^2) over both patellar tendon (A), second metacarpal (B) and tibialis anterior muscle (C) (n=33). Note that some points are overlapping. A negative linear regression line is fitted to the data.

recruitment of central neurons by peripheral nociceptive stimulation, enhanced spatial summation, and nociceptive inputs from muscle tissues have been suggested to be potential peripheral mechanisms.[36] In this scenario, an initial painful condition, such as postmeniscectomy pain produced by active TrPs may act as a trigger for the development of chronic symptoms through gradual sensitization of nociceptive pathways in this population.

Finally, it is important to note that sensitization mechanism is involved into a continuous process during a prolonged time. A relevant finding of the current study was that localized pressure pain hyperalgesia over the vastus medialis and vastus lateralis was associated with the time from the meniscus tear before surgery. This finding would support the needed for early management of meniscal tears, either with arthroscopy or rehabilitation to avoid further development of localized and future widespread pressure pain hyperalgesia.

Limitations

We should recognize potential limitations of the current study. First, the cross-sectional nature of the study design does not permit us to establish a cause and effect relationship. We do not know if TrPs were present before the partial meniscectomy or were activated after the surgery. Future studies should longitudinally investigate the etiologic role of referred pain elicited by active muscle TrPs in the development of postmeniscectomy pain. Second, we only included patients with postmeniscectomy pain. It would be interesting to determine if active TrPs and pressure pain hyperalgesia are also present in patients who had received an arthroscopic partial meniscectomy but without pain; however, this situation is not commonly seen in clinical practice as pain is extremely common after the surgery. Third, we only assessed pressure pain sensitivity to determine sensory abnormalities in this study. It would be of importance to perform a comprehensive sensory profiling of patients with postmeniscectomy pain utilizing a board spectrum of sensory tests combined with assessment of descending modulation. Fourth, we did not collect data on catastrophizing, anxiety, fear, uncomfortable sleep position, or medication usage. However, as we analyzed the development of pain in an acute stage after the surgery, the influence of these factors seems to be minimal. Future longitudinal studies including management of active TrPs are required to further determine the etiologic role of myofascial TrPs in pressure pain hyperalgesia in patients with postmeniscectomy pain.

CONCLUSIONS

This study found that the referred pain elicited by active TrPs reproduced knee pain symptoms in patients with postmeniscectomy pain. The number of active TrPs was associated with the intensity of ongoing pain. Patients with postmeniscectomy pain also exhibited lower localized PPTs as compared with pain-free controls suggesting the presence of peripheral sensitization. Similarly, a greater number of active TrPs was associated with widespread pressure hyperalgesia. The current findings would suggest that the presence of peripheral sensitization mechanisms in patients with acute postmeniscectomy pain could be associated with the presence of active TrPs.

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