**Damsted, C., Parner, E. T., Sørensen, H., Malisoux, L., Hulme, A., & Nielsen, R. Ø. (2019). The Association Between Changes in Weekly Running Distance and Running–Related Injury: Preparing for a Half Marathon. Journal of Orthopaedic & Sports Physical Therapy, 49(4), 230- 238**

**Review Submitted by:** Cameron Holshouser, PT, DPT

**Objective:** To investigate the association between change in weekly running distance and running-related injury (RRI), and to examine whether the association may be modified by the running schedule the runner follows.

**Methods:** 261 healthy (non-injured) runners were included in this prospective cohort study over 14 weeks. Data on running activity were collected daily and objectively, using a global positioning system watch or smart phone. Instances of RRIs were collected using weekly emailed questionnaire. Primary exposure was defined as changes in weekly running distance. Data were analyzed with time-to-event models that produced cumulative risk difference as the measure of association. Participants were able to choose 1 of 2 running schedules: distance-based or a pace-based schedule. Participates were excluded if they reported an RRI within 6 months prior to baseline or had contraindications for physical activity. RRI was defined as, "running-related (training or competition) musculoskeletal pain in the lower limbs that causes a restriction on or stoppage of running (distance, speed, duration, or training) for at least 7 days or 3 consecutive scheduled training sessions, or that requires the runner to consult a physician or other health professional."

**Results:** 56 participants (21.5%) sustained an RRI during the 14-week study. At 21 days there were significantly more runners who sustained an injury when they increased their weekly running distance by 20-60% compared with those who increased their distance by less than 20% (risk difference, 22.6%; 95% CI: 0.9%, 44.3%; P=.041). There was no significant difference after 56 and 98 days. No significant effect-measure modification by running schedule was found.

**Conclusions:** There were significantly more runners who were injured 21 days into the study period when they increased their running distances by 20%-60% compared to those who increased their distances by less than 20%. There was no dose-response relationship between changes in training load and RRI.

**Commentary:**
There were many limitations of this article the authors described including: selection bias due to runners being allowed to self-select running schedule, whether running distance was the most appropriate variable representing training load (versus number of steps), the number of injuries did not allow for analysis did not allow for comparison of distance-based versus paced-based running regimens, results may differ if different cutoff values were used – these results only apply to a single increase from one week to another, where as a weekly increase over several weeks was not investigated which could potentially lead to runners to assume that just

keeping their weekly increase to less than 20% would keep the injury risk low, no matter the running schedule. Despite the many limitations of this study, I believe that this study would be helpful when educating an individual who is preparing to train for a half-marathon. This study demonstrates the importance of a gradual increase in a training program in regard to training load. I did like how this article used individual GPS devices to track training load – this may give easy feedback for the patient to calculate on a week to week basis. The authors state that there are many factors that can influence RRI's, not just weekly training load increase. Overall, I would take these results with caution when prescribing a running program, but these results may be beneficial to show patients (in a non-specific manner) what happens if they increase load too much, too soon.

---

**Lawrence RL, Braman JP, Ludewig PM. The Impact of Decreased Scapulothoracic Upward Rotation on Subacromial Proximities. Journal of Orthopaedic & Sports Physical Therapy. 2019;49(3):180-191. doi:10.2519/jospt.2019.8590.**

**Review Submitted By:** Jon Lester

**Objective:** To determine the impact of decreased scapulothoracic upward rotation (STUR) on subacromial proximities during arm elevation in the scapular plane.

**Methods:** 60 total subjects were chosen (30 symptomatic, 30 asymptomatic) and matched for age, sex, and hand dominance. Each subject was classified as being either low STUR, mid STUR, or high STUR. Kinematic data to determine this was done at various degrees of shoulder elevation during a dynamic trial. Kinematic data was taken using a BV Pulsera mobile C-arm fluoroscopy system and a 5 camera motion capture system. They placed each subject into groups retrospectively based on their relation to the cohort of subjects (i.e. the 20 subjects with the highest STUR were placed in the high STUR group). They only analyzed the high and low STUR groups for statistical outcomes.
Several outcome measures were chosen. Anatomical morphology was recorded and presented, including; acromial slope, glenoid inclination, glenoid version, critical shoulder angle, and humeral head radius. They also analyzed the amount of scapulothoracic IR/ER, UR/DR, and ant/post tilt at the various degrees of scapular elevation. Additionally, they analyzed the normalized minimum distance (%) between the coracoacromial arch and articular margin aspect of the humeral rotator cuff insertion. Subacromial proximity was analyzed and defined the surface area of the humeral rotator cuff insertion in immediate proximity to the subacromial arch. Lastly, the distance between the cuff tendon and the subacromial was calculated and this was compared at different angles of elevation.

**Results:** Normalized minimum distance was smallest below 70 degrees of elevation for all subjects. When the arm was at the side, the low STUR group had significantly smaller (p=.049) minimum distance. There was no significant difference in subacromial proximity area between the two groups (p=.14). The highest prevalence of contact between the RTC tendon and coracoacromial arch occurred at 60 degrees elevation. However, there was no significant

difference between the two groups in regards to prevalence (p>.41). There was also no difference between groups for the absolute minimum distance between the RTC tendon and coracoacromial arch (p=.41). Absolute minimum distance in the low STUR group was at 51.5 +/- 11.8 degrees, while the high STUR group was at 60.4 +/- 18.4 degrees, however this was not statistically significant (p=.07).

**Conclusions:** The subjects in this study had subacromial distances that were smallest between 50 to 70 degrees of scapular plane elevation. In subjects with low STUR, the ROM in which subacromial distances were smallest was lower.

**Commentary:** The findings of this study show that these subjects had subacromial distances minimized between 50-70 degrees of elevation, which contrasts other studies that show higher degrees of elevation as creating compression in this region (80+ degrees). This shows that symptoms of RTC tendon compression might occur earlier than I previously thought. This makes sense in regards to symptom reproduction due to the addition of the larger demand on force demands as a result of the larger moment arm to overcome. Additionally, only 45% of participants had actual contact of the RTC tendon and the coracoacromial arch, showing that the RTC tendon might not have been the pain generator in this subject pool. Although this is true, it appeared that the distance between the RTC tendon and coracroacromial arch was greater in the subjects with higher STUR. When I think about applying this research to my present practice, I would argue that unweighted, controlled scapular plane elevation is not necessarily functional and relatable to a patient's goals. I would utilize other examination skills (i.e. scapular relocation/assist test) when determining if improvement in scapular mechanics could lead to less pain with activities that they find painful. However, it's interesting to see subacromial distances as being minimized in lower degrees of elevation that I previously thought and this is worthwhile to take into consideration when evaluation of patient's with painful elevation ROM.

---

**Citation**: Fitzpatrick J, Bulsara MK, O'Donnell J, Zheng MH. Leucocyte-rich platelet-rich plasma treatment of gluteus medius and minimus tendinopathy. A double-blind randomized controlled trial with 2-year follow-up. *Am J Sports Med.* 2019;47(5):1130-1137.

**Review Submitted by:** Matt Fung PT, DPT, CSCS

**Background:** A previously published trial showed that patients with chronic gluteal tendinopathy achieved greater improvement at 12 weeks when treated with single platelet-rich plasma (PRP) injection than those treated with a corticosteroid injection (CSI).

**Objective**: This follow up study was conducted to determine whether there would be a sustained long-term difference in modified Harris Hip Score (mHHS) at 2 years for a leucocyte-rich PRP (LR-PRP)injection in the treatment of chronic gluteal tendinopathy. RCT; Level 1 evidence.

**Methods**: Double-blind RCT with two year follow up included 80 patients randomized 1:1 to receive either LR-PRP or CSI intratendinously under ultrasound guidance. Patients had a mean

age of 60 years, a 9:1 ratio of women to men, a mean BMI of 27 and a mean length of symptoms of 15 months. Patients were 18-80 years old and had a history of gluteal tendinopathy >4 months – with symptoms including lateral hip pain, pain with activity (eg, walking and stair climbing, and pain laying on the affected side at night and tenderness over the greater trochanter upon examination. Radiological confirmation of the diagnosis of grade 2-3 tendinopathy (no tear) was made with ultrasound and MRI. Exclusion criteria included full-thickness tears (grade 4), previous hip or tendon surgery, a history of breast cancer, warfarin use at the time of procedure, back surgery within the past 12 months, a history of recent sciatica, a cortisone injection within the previous 6 weeks, and the absence of physical therapy. In the first 4 weeks participants were instructed to avoid aggravating activities, including walking for exercise, stairs, squats, lunges and abduction exercises. At 6 weeks, they were instructed to begin a progressive walking program, which included the use of stairs, return to gym, and other sports. After 12 weeks there were no activity restrictions. An open-labeled extension allowed patients to receive crossover treatment after 3 months.

**Results:** The mean mHHS improved significantly at 12 weeks in the PRP group (74.05;SD, 13.92) as compared with CSI group (67.13;SD,16.04). At 24 weeks, the mean mHHS in the LR-PRP group (77.60;SD 11.89) had improved further than that of the CSI group (65.72; SD, 15.28; P=.0003). The LR-PRP group from baseline scores of 53.77 improved to 78.18 at 52 weeks and continued to improve to 82.59 at 104 weeks. Twenty-seven patients were deemed to have failed the CSI treatment at 16 to 52 weeks with a mean exit score of 59.22, having almost returned to their baseline score of 51.15. The crossover group (CSI + LR-PRP) had baseline scores equivalent to the other 2 groups. They improved from baseline (59.22;SD, 11.22) to 12 weeks (75.55; SD, 16.05), 24 weeks (77.69; SD, 15.30), and 104 weeks (77.53; SD, 14.54). Overall 5 patients failed the treatment and progressed to surgery.

TABLE 3
mHHS at All Time Points for Each Group[a]

| Time Point, wk | CSI | LR-PRP | CSI+LR-PRP[b] | Surgery |
|---|---|---|---|---|
| 0 | 40; 54.15 ± 10.88 | 40; 53.77 ± 12.08 | | |
| 2 | 39; 66.95 ± 15.14 | 39; 65.23 ± 11.59 | | |
| 6 | 37; 69.51 ± 14.78 | 39; 68.79 ± 13.32 | | |
| 12 | 37; 67.13 ± 16.04 | 39; 74.05 ± 13.92 | | |
| 24 (T2 = 0, group 3) | 37; 65.72[c] ± 15.28 | 38; 77.60 ± 11.88 | 27; 59.22[c] ± 11.54 | |
| 26 (T2 + 2 wk) | | | 27; 67.48 ± 13.97 | |
| 30 (T2 + 6 wk) | | | 27; 70.37 ± 15.21 | |
| 36 (T2 + 12 wk) | | | 27; 75.55 ± 16.05 | |
| 48 (T2 + 26 wk) | | | 26; 77.69 ± 15.30 | |
| 52 | 15; 70.53 ± 23.80 | 38; 78.18 ± 14.53 | | 3; 57.66 ± 1( |
| 76 (T2 + 52 wk) | | | 21; 79.04 ± 14.28 | |
| 104 | 10; 71.27 ± 25.78 | 35; 82.59 ± 9.71 | | 5; 67.80 ± 1: |
| 128 (T2 + 104 wk) | | | 13; 77.53 ± 14.54 | |

[a]Data reported as n; mHHS, mean ± SD. CSI, corticosteroid injection; LR-PRP, leucocyte-rich platelet-rich plasma; mHHS, modified H ris Hip Score.
[b]Scores for this group are recorded from a new baseline, where time point 0 (ie, T2) is the new starting point after crossover from grou (CSI) after 24 weeks.
[c]Scores at approximately 24 weeks. The 24-week score is recorded once for each patient but represents either the last score taken bel crossover or the continuing score if no crossover occurred.

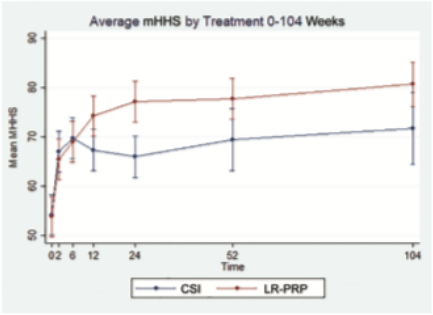


**Figure 3.** Modified Harris Hip Scores (mHHSs) in the CSI and LR-PRP groups at 0 to 104 weeks. CSI, corticosteroid injection; LR-PRP, leucocyte-rich platelet-rich plasma. Val-

**Conclusions:** Among patients with chronic gluteal tendinopathy and a length of symptoms >15 months, a single LR-PRP injection performed under ultrasound guidance results in greater improvement in pain and function than a single CSI. These results continue to improve out to 2 years.

**Commentary:** The efficacy of PRP injections for the treatment of tendinopathy has been controversial due to the fact that tendons vary in their response. It has been noted that PRP onset of action is slow and can take up to 3 to 6 months to see the effectiveness. The results of the

study support these claims as both the CSI and LR-PRP group demonstrated similar short-term improvements over the first 6 weeks post intervention. The LR-PRP group continued to demonstrate significant improvements in mHHS scores over the next 6 weeks until 24-month follow-up while the CSI group plateaued and returned to baseline. This was an interesting finding to me as participants were only educated to avoid aggravating factors for the first 4 weeks with all restrictions being lifted after 12 weeks. I am curious to see future studies looking at the effectiveness of LR-PRP + exercise + education in the treatment of gluteal tendinopathy.

The findings of this study would make me consider recommending LR-PRP injections for patients suffering from chronic lateral hip pain over a CSI. Despite the fact that LR-PRP does demonstrate superior outcomes as compared to CSI in pain and function, most health insurances do not cover PRP. Thus, it will not be my first line of treatment for my patients in the clinic due to potential out of pocket costs. If conservative treatment centered on exercise and education with potential cortisone injection fail then LR-PRP is a viable option.

---

**Risk factors for patellofemoral pain: a systematic review and meta-analysis. Neal BS, et al. *Br J Sports Med* 2019; 53: 270-281.**

**Review Submitted by**: Erik Kreil, PT, DPT, CSCS

**Objective**: To provide an evidence synthesis of variables predictive of patellofemoral pain, improving preventative interventions.

**Methods**: Authors duplicated search terms used in a similar study by Lankhorst et al, 2012 (cited in this review), and inclusion criteria were adopted from this study as well. These included 1) studies involving subjects who developed subsequent patellofemoral pain or a synonym thereof, 2) at least one variable was investigated as a risk factor for this pathology, and 3) the study was a prospective study design. Analyses were completed by 1 author and reviewed by a second author. Data were pooled in 2 manners: 1) heterogeneous PFP cohort and 2) specific homogenous subgroups. Meta-analysis was performed when methodology was adequately comparable.

**Results**: Authors followed the recommendations of the PRISMA checklist to include 18 studies evaluating 4818 participants through February 2017. They identified 3 subgroups: military recruits (11% prevalence), runners (6% prevalence) , and adolescents (11% prevalence). Of the 18 studies included, 9 were deemed high quality and 9 were deemed moderate quality. Author findings are as follows:

- Gender: Moderate evidence from three high quality and four moderate quality studies deemed that **sex is not a risk factor**. This does not change when data was pooled into subgroups.

- Height: Strong evidence from five high quality and seven moderate quality studies deemed that **height is not a risk factor**. This does not change when data was pooled into subgroups.

- Weight: Strong evidence from five high quality and seven moderate quality studies deemed that **weight is not a risk factor**. This does not change when data was pooled into subgroups.

- BMI: Strong evidence from four high quality and three moderate quality studies deemed that **BMI is not a risk factor**. This does not change when data was pooled into subgroups.

- Body Fat Percentage: Moderate evidence from one high quality and one moderate quality study deemed **that body fat percentage is not a risk factor**. Subgroups were not investigated.

- Age: Strong evidence from three high quality and five moderate quality studies deemed that **age is not a risk factor**. This does not change when data was pooled into subgroups.
- Limb Length: Limited evidence from two moderate quality studies deemed that **limb length is not a risk factor**. Subgroups were not investigated, and recreational runners were not investigated.

- Lower Limb Alignment: Data pooling was only possible for static Q angle. Limited evidence from one high quality and one moderate quality study indicated that **Q Angle is not a risk factor**. Subgroups were not investigated.

- Quadriceps Strength: Strong evidence supports that **quadriceps weakness is a risk factor**. Data pooling was only possible for the military subgroup for all quadriceps strength measures, and this is supported through moderate evidence from two high quality studies indicate when measuring using an isokinetic dynamometer. Further support is provided through moderate evidence from two high quality studies when normalized by body mass. Hand held dynamometer measurements also support this finding through moderate evidence from one high quality and one moderate quality study.

- Hamstrings Strength: Moderate evidence from two high quality studies deemed that **hamstrings strength is not a risk factor** in military subgroup. This was not investigated in recreational runners or adolescents.

- Hip Strength: Moderate evidence from one high quality and two moderate quality studies deem that **hip extension, internal rotation, and external rotation strength are not risk factors** when measured isometrically with a hand held dynamometer. Limited evidence from two moderate quality studies suggest that **hip adduction and flexion strength are not risk factors**. Data pooling was not possible. Moderate evidence from two high quality and two moderate quality suggest that **hip abduction strength is not a risk factor**. However, pooling data for the adolescent cohort demonstrates moderate evidence from one high quality and one moderate quality study suggests that **increased hip abduction strength is a risk factor in the adolescent cohort alone.**

- Dynamic Knee Valgus Angle: Moderate evidence from one high quality and one moderate study suggest that **knee valgus angle during a jump land task is not a risk factor**. Data pooling was not possible.

- Foot Kinetics: In the one high quality study that investigated this variable, data pooling revealed moderate evidence that indicates **no significant association** between time to peak force at any investigated region of the foot.

**Conclusion**: Of all studies and variables included, only quadriceps isokinetic weakness in the military cohort and higher hip abduction isometric strength in the adolescent cohort were identified as predictive factors. Predictive isokinetic quadriceps weakness is in agreement with the review by Lankhorst, et al; however the strength of this evidence has not improved. That said, the disparity between adult and adolescent findings observed cross sectionally may be suggestive as to why rehabilitation programs have been shown to be more effective in adults compared to adolescents.
Increased adolescent hip abduction strength in adolescent cohort has been suggested to be a result of higher peak hip adduction during dynamic tasks. This may also be a result of, more likely, an expression of a positive relationship between hip abduction strength and physical activity level of the adolescent.
No variable in this review suggested a predictive variable for recreational runners subgroup cohort.

**Commentary**: Patellorfemoral pain is evidently a complex pathology process, and cause-effect relationships may not be as linear as previously thought. While many factors may play different roles in its occurrence, few factors are identified as relevant in this review. Further, identifiable factors may be subgroup dependent. Because of the limitations in evidence, the biggest takeaway should be the weaving interrelationships between patient demographic, impairments, and characteristics. For instance, lower activity level may lead to lower quadriceps strength, which may result in patellofemoral pain.

---

**Jun-hee Kim, Ui-jae Hwang, Sung-hoon Jung, Gyeong-tae Gwak & Ohyun Kwon (2019) Immediate improvements of supination range of motion and strength following pronator teres muscle friction massage: a clinical trial comparing people with and without supination limited motion, Journal of Manual & Manipulative Therapy, 27:2, 109-114, DOI: 10.1080/10669817.2018.1542559**

**Review Submitted By**: Jeff Peckins

**Objective**: To determine if friction massage to pronator teres improves supination ROM and/or strength in patient with and without supination ROM limitation.

**Methods**: The article included 26 pain-free participants who volunteered to participate in the study. Participants were divided into two groups, those with supination ROM deficits and those without supination ROM deficits (control). Measurements of participants' supination ROM and strength were taken before and after 5 rounds of 3 min friction massage to pronator teres.

**Results**: Supinator ROM significantly improved after friction massage in both the supination ROM limitation and control groups (8.1 +/- 6.5 deg and 6.3 +/- 8.2 deg respectively). Supinator strength significantly increased following friction massage in the supinator ROM limitation group (1.0 +/- 1.1kg), however did not improve in the control group (0.2 +/- 1.1 kg).

**Conclusion**: The results of this article suggest that friction massage to pronator teres improves ROM and strength in pain-free individuals who have supination ROM limitations.

**Commentary:** There are several limitations of this study. The study recruited volunteers of young participants without any elbow or wrist pain. The vast majority of patients seen in a PT clinic will present with pain, and this may inhibit the ability to perform friction massage. A patient's high pain may inhibit the ability of friction massage to be appropriately administered. The efficacy of friction massage may also be different in someone with pain versus an individual without pain.

The conclusions of this study alone do not provide a great amount of applicability to the clinical setting, however provide a good foundation for future research. This article demonstrates that friction massage may be a good tool in increasing ROM and strength at least immediately after the intervention. The article does not discuss if these improvements lasted, and did not follow up with patients in the future. Similar to other manual therapy techniques, friction massage may give the PT a window of opportunity to work on strengthening and other exercises that the patient was not able to perform prior to administration of the technique. Again, the participants were not in pain, so this is an extrapolation. Further studies need to be conducted where their participant population involves those who have elbow pain.

---

**Docking S.I., Cook J., Chen, S., Scarvell J., Cromick W., Smith P, Fearon A. (2019). Identification and differentiation of gluteus medius tendon pathology using ultrasound and magnetic resonance imaging. *Musculoskeletal Science and Practice*, 41, 1-5.**

**Review Submitted By:** Casey Moler

**Objective:** The ability of MR and US imaging to identify pathological gluteus medius tendon compared to histological and surgical findings to investigate the diagnostic accuracy of imaging, independent of clinical symptoms.

**Methods:** Participants (29 women, >18 y.o.) were recruited from two different surgical waiting list. The first group included those waiting for gluteal tendon reconstruction that had refractory lateral thigh pain over the greater trochanter who failed conservative management (PT or corticosteroid injection) confirmed by MR or US. The second group was recruited from a primary hip arthroplasty surgical waiting list with clinical and radiological signs of hip OA. Both groups excluded those who met the criteria of the other. MR and US was performed on each participant and read by radiologist and nuclear physicians who were blinded to the clinical

presentation, side and type of surgery. Surgeons and histological assessments and samples were taken and then compared to the imaging results.

**Results:** At surgery, 26 participants were included with 20 having pathological tendons. Pathological gluteus medius was correctly identified by ultrasound imaging (17/19) however indicated pathology on 5 of the 6 healthy tendons. MR imaging correctly identified 11 out of the 17 pathological tendons and 4 out of 6 of the healthy tendons. See full results below.

| Diagnosis | MR Imaging | Ultrasound |
|---|---|---|
| True + | 11 | 17 |
| True - | 4 | 1 |
| False + | 2 | 5 |
| False - | 6 | 2 |
| Sensitivity | 64.7% (38.3–85.8) | 89.5% (66.9–98.7) |
| Specificity | 66.7% (22.3–95.7) | 16.7% (0.4%-64.1) |
| PPV | 84.6% (62.1–94.7) | 77.3% (69.7%-83.4) |
| NPV | 40.0% (22.1–61.1) | 33.3% (5.2–82.1) |
| LR+ | 1.94 (0.59–6.35) | 1.07 (0.73–1.59) |
| LR- | 0.53 (0.22–1.25) | 0.63 (0.07–5.80) |
| Accuracy | 65.2% | 72.0% |

| Diagnosis | True + | True - | False + | False - |
|---|---|---|---|---|
| *Tendinosis with no tear* | | | | |
| MR imaging | 2 | 11 | 3 | 7 |
| Ultrasound | 2 | 12 | 5 | 6 |
| *Partial-thickness tear* | | | | |
| MR imaging | 2 | 13 | 6 | 2 |
| Ultrasound | 2 | 11 | 9 | 3 |
| *Full-thickness tear* | | | | |
| MR imaging | 0 | 19 | 0 | 4 |
| Ultrasound | 3 | 18 | 1 | 3 |

**Conclusion:** Both MR and US imaging have adequate ability to identify global tendon pathology (abnormal vs. normal) however this study suggests limited ability of both imaging tools to identify specificity of tendon pathology for structural diagnosis (tendinosis, partial thickness and full thickness).

**Commentary:** This study reinforces previous studies, with US being superior to MR in identifying presence of gluteal tendon pathology, however both were found to have poor accuracy in differentiating between tendinosis, partial-thickness and full thickness tears. Ultrasound tended to over-report pathological findings while MR imaging under-reported and should be taken into consideration in clinical practice. This data should reinforce clinicians to proceed with caution when relaying imaging results to patients as the current relationship between pathological state (tendinosis, partial thickness, full thickness) and pain as well as their response to various treatments is still unknown and may provoke undue fear and inappropriate management. Therefore, imaging results could be clinical irrelevant and heavy reliance should be placed on clinical examination and functional limitations to guide treatment.

I found it interesting that the data from this study showed that the MR modality was unable to identify full-thickness tears in any cases compared to its comparison ultrasound. Based on this

information, I believe pushing conservative management should be the first line of defense. If conservative treatment does fail and understanding where the patient lies on the continuum of tendinopathy and its interplay among structure, pain and function, this data suggests ultrasound may be superior to MR.