Citation: Green, B., Bourne, M. N., Dyk, N. V., & Pizzari, T. (2020). Recalibrating the risk of hamstring strain injury (HSI): A 2020 systematic review and meta-analysis of risk factors for index and recurrent hamstring strain injury in sport. *British Journal of Sports Medicine*. doi:10.1136/bjsports-2019-100983
Review Submitted By: Helen Shepard

Purpose: The purpose of this systematic review was to analyze risk factors for hamstring strain injury in athletes. It is an update to a systematic review conducted in 2013.

Methods: Databases were searched for articles from 2011 to December 2018 that presented prospective data that evaluated risk factors for hamstring strain injury. Included databases were Medline, CINAHL, Embase, AMED, AUSPORT, SportDIscus, PEDro, and the Cochrane Library. Articles included in the previous systematic review were also included in this study. Studies analyzing both first time and recurrent hamstring injuries were included, though studies examining tendinopathy, non specific thigh injuries, hamstring origin avulsions, and contusion-type pathologies were excluded. Intervention studies were also excluded.

Results: Seventy-eight studies were included, which yielded 8,319 total hamstring strain injuries in 71,324 athletes. Significant risk factors for hamstring strain injuries included older age, history of hamstring strain injury, previous ACL injury, and previous calf strain injury. Factors related to flexibility and mobility did not significantly influence hamstring injury risk. In relation to sports performance, running and hamstring strength were most consistently associated with hamstring strain injury risk.

Conclusion: Authors concluded that the strongest risk factors were older age and previous hamstring strain injury. Athletes who had a history of hamstring injury were 2.7 times more likely to sustain another hamstring injury. Authors hypothesized both of these non-modifiable risk factors may be associated with structural and neurological qualities that come with older age and previous injury. Baseline hamstring strength deficit was associated with increased injury risk, however, authors note that it may not be valid to assess strength on a single occurrence and suggest that it be monitored throughout the season. Risk of injury is also higher in athletes whose positions require high speed running, likely due to fatigue and eccentrically induced muscle damage. A new discovery with this review is that athletes with a history of ACL injury are 70% more likely to have a hamstring injury, and those with a previous calf injury are 50% more likely. While the mechanism is unclear, authors suggest strength deficits, reduced proprioception, and altered gait could contribute to the relationship.

Commentary: It is important to be able to identify risk factors associated with injury in order to attempt to minimize the risk of injury. While we can’t change an athlete’s age, the other highest risk factor was previous hamstring injury. This makes me think there is a potential the original injury was not rehabbed fully prior to returning to sport. We as physical therapists need to ensure objective data is taken in order to clear an athlete to begin higher level activities and encourage research in the field to find functional tests that can be used, such as the Nordic hamstring exercise test. It is also interesting to note that injury risk was associated with the athlete's position in their sport. It may be beneficial for coaches to put athletes in positions that require less high intensity running immediately after hamstring injury in order to reduce the risk of injury. Lastly, I would be curious to know if the graft site for ACLR influences hamstring injury risk since authors pointed to previous ACL injury as a significant risk factor.

Citation: Chia L, Silva DDO, Mckay MJ, Sullivan J, Azevedo FMD, Pappas E. Limited Support for Trunk and Hip Deficits as Risk Factors for Athletic Knee Injuries: A Systematic Review With Meta-analysis and Best-Evidence Synthesis. *Journal of Orthopaedic & Sports Physical Therapy*. 2020;50(9):476-489. doi:10.2519/jospt.2020.9705
Review Submitted By: Barrett Coleman

Objectives: Determine whether neuromuscular deficits in trunk and hip-related function are risk factors for athletic knee injuries

Methods: Researchers performed an etiology systematic review searching 6 databases looking for studies that assessed trunk and hip neuromuscular function as risk factors for knee injuries in healthy populations. The data was quantified by odds ratios and qualitatively by best-evidence synthesis.

Results: Twenty one studies were included in the study. There was low certainty evidence that hip ER strength protected against knee injuries (odds ratio = 0.78; 95% confidence interval: 0.70, 0.87; $P<.05$). There was not enough evidence to prove that deficits in trunk proprioception and neuromuscular control or combination of excessive knee valgus and ipsilateral trunk angle when landing unilaterally from a jump were risk factors for knee injuries

Conclusions: Most variables of trunk and hip function were not risk factors for injuries. Further research is required to confirm whether hip external rotation strength, trunk proprioception and neuromuscular control, and the combination of knee valgus angle and ipsilateral trunk control are risk factors for future knee injuries

Commentary: Part of the role of physical therapists is injury prevention. By identifying what factors put athletes at risk for knee injuries, we can assess for the appropriate impairments to prevent future problems. Often, glute med motor control, dynamic valgus, and hip ER strength have been identified as risk factors for knee injury and treatment of these deficits a standard part of prevention programs.
This study would seem to suggest that these aren't concrete impairments to use for prophylactic treatment. However, the study has a few limitations which calls into question this conclusion.

First, the systematic review includes all knee injuries. Given that different structures are at fault for different pathologies, grouping all pathologies together dilutes the usefulness of this systematic review. I would suspect that preventing PFPS versus ACL versus Meniscus would look very different. This might be the reason why there was no apparent benefit of treating neuromuscular deficits.

Second, the paper researches wide variability in how these impairments were tested. Hip abduction strength was tested in different positions using different methods with different parameters. This variability makes it hard to be certain that everyone was measuring the same impairment.

The Systematic Review ends with the classic "further research is required." Given the limitations of the study, I would continue to use the aforementioned impairments if identified within patients as part of a prevention program.

Citation: Brian T. Swanson, J. Adrienne McAuley, Michael Lawrence, Changes in glenohumeral translation, electromyographic activity, and pressure-pain thresholds following sustained or oscillatory mobilizations in stiff and healthy shoulders: Results of a randomized, controlled laboratory trial. *Musculoskeletal Science and Practice*
https://doi.org/10.1016/j.msksp.2020.102243.
Review Submitted By: Steven J. Lagasse

Objective: To assess for differences in sustained and oscillatory posterior glides (PG) on glenohumeral joint (GHJ) translation and rotator cuff (RC) activity in both stiff and healthy shoulders. EMG and ultrasound were used to assess muscle activity and translation, respectively.

Methods: This study was an assessor-blinded, randomized controlled laboratory trial. Subjects were allowed to participate based on inclusion and exclusion criteria. Individuals were reported to have shoulder stiffness if there was an observed $\geq$ 15-degree loss in shoulder range of motion in comparison to the contralateral limb with a firm end-feel. Healthy subjects and stiff subjects were evenly split into either sustained (n = 44) or oscillatory (n = 44) mobilization groups via blocked randomization. An independent researcher was in charge of block randomization. Only the researcher supplying the mobilizations was aware of the patient's allocation. All participants provided demographic information, however, those subjects with GHJ stiffness completed the Shoulder Pain and Disability Index (SPADI), and Visual Analog Pain Scale (VAS). The intervention consisted of four 30-second bouts of grade 3 PG to the GH. EMG and ultrasound were used to assess muscle activity and translation, during the intervention.

Results: Sustained glides were superior and significantly different in achieving changes in GHJ translation compared to oscillating glides. Those subjects with shoulder stiffness demonstrated significantly greater RC activity than healthy subjects. This was seen both pre- and post-intervention

Conclusion: Sustained mobilizations demonstrated greater changes in GHJ translation. RC activity was higher in the stiff shoulder group, despite improvements in GHJ translation. There was no significant correlation between improved transnational and changes in RC activity.

Commentary: This study had a sound methodology and utilized blinding and randomization. The author discussed how they achieved their sample size and how they planned to account for attrition. This study design collected all pertinent data to be collected immediately, which prevented subjects from being lost to follow-up. Many of the more glaring limitations of this study were acknowledged by the authors. Firstly, a convenience sample was utilized to acquire the subjects for this study. Additionally, the sample was made up of a younger population which may decrease generalizability. The authors also disclose that their study was underpowered.

A salient implication of the study would be that capsular tightness was attributed more to GHJ stiffness than increased RC activity. Additionally, sustained glides appear to improve GHJ translation more than oscillatory mobilizations.

Citation: Martinez-Calderon J, Flores-Cortes M, Morales-Asencio JM, Fernandez-Sanchez M, Luque-Suarez A. Which Interventions Enhance Pain Self-efficacy in People With Chronic Musculoskeletal Pain? A Systematic Review With Meta-analysis of Randomized Controlled Trials Including Over 12000 Participants. *J Orthop Sport Phys Ther 2020;50(8):418- 430. doi:10.2519/jospt.2020.9319.*
Review Submitted By: Anna Wilson

Background/Objective: The purpose of this study was to identify interventions to enhance pain self-efficacy in people with chronic musculoskeletal pain**.** The authors defined pain self-efficacy as “the belief in one’s ability to manage and complete a task, despite pain.”

Methods: This was a systematic review with meta-analysis of randomized controlled trials that evaluated pain self-efficacy. PubMed, Embase, Scopus, PsycINFO, CINAHL, PEDro, and the Cochrane Central Register of Controlled Trials were searched up to September 2019. The Cochrane risk of bias tool was used to evaluate risk of bias and the GRADE approach to evaluate certainty of evidence.

Results: Sixty randomized controlled trials were included (12,415 participants). There was a small effect of multicomponent, psychological, and exercise interventions improving pain self-efficacy at follow-ups of 0 to 3 months, a small effect of exercise and multicomponent interventions enhancing pain self-efficacy at follow-ups of 4 to 6 months, and a small effect of multicomponent interventions improving pain self-efficacy at follow-ups of 7 to 12 months. No interventions improved pain self-efficacy after 12 months. Self-management interventions did not improve pain self-efficacy at any follow-up time. The certainty of the evidence for all included interventions was low, due to serious risk of bias and indirectness. No trial reported the intervention in sufficient detail to allow full replication.

Conclusion: There was low-quality evidence of a small effect of multicomponent exercise and psychological interventions improving pain self-efficacy in people with chronic musculoskeletal pain.

Commentary: This study was fairly well done with various methods used to assess quality of the studies, risk of bias, and effect size. “Usual care” and wait-and-see approaches were the most common control groups, which adds in a lot of variability in what the different subjects were receiving based on the authors definition of these things. Multicomponent intervention was the most common intervention studied followed by psychological therapy. The definition of multicomponent intervention varied based on study, but in general included some sort of exercise, education, and psychological therapy component. The length of the sessions varied from 30 minutes to two hours, the duration of the treatment varied from 3-12 weeks, and those involved included PT, OT, psychology, nursing, fitness/exercise instructors.

Overall the authors identified the evidence as low-quality with small effect. Despite this I think the value in this study is in identifying potential methods that help patients with self-management. Each patient requires a tailored, individual approach, but based on the evidence presented in this study a multi-modal and inter-professional approach seems to be most beneficial with more of a long term carryover. It looked like some of the studies used booster sessions further out after a more concentrated treatment period, which could be something to help improve long term carryover for these patients.

Citation: Mohamed AA, Jan Y-K, Sayed WHE, Wanis MEA, Yamany AA. Dynamic scapular recognition exercise improves scapular upward rotation and shoulder pain and disability in patients with adhesive capsulitis: a randomized controlled trial. *J Man Manip Ther*. 2020; 28(3):146-158. doi:10.1080/10669817.2019.1622896
Review Submitted By: Taylor Blattenberger PT, DPT

Objective: To assess the effect of a dynamic scapular recognition exercise on scapular upward rotation, shoulder pain, and disability in patients with adhesive capsulitis

Methods: This study included 60 patients from the clinics of Beni-Suef University faculty. In order to be included in this study subjects demonstrate less than 100 degrees of shoulder elevation in the scapular plane, limitation of both active and passive shoulder ROM, and the presence of daily pain interfering with daily activity. Subjects with cancer, active infection, active inflammatory disease, or recent dislocation, subluxation, surgery, or fractures were excluded from this study. Finally, subjects must score a positive scapular dyskinesis test.

Each subject was assessed for scapular upward rotation, shoulder flexion, abduction, and external rotation with the use of a digital inclinometer. Subjects were also assessed for shoulder function as measured by the SPADI.

Both groups received 40-minute physical therapy sessions three times per week. They both received 20 minutes of hot packs, and 5 minutes of scapular mobilization. The control group performed AROM exercises in flexion and abduction at 5 sets of 20 repetitions. The study group performed dynamic recognition exercise by using an audible biofeedback device.

Results: Scapular upward rotation, shoulder flexion, and shoulder abduction were significantly improved at 2 weeks in the study group while there was no significant improvement in the control group. At two month follow up both groups demonstrated significant improvements in scapular upward rotation, shoulder flexion, abduction, and external rotation. All ROM measurements were significantly higher in the study group at all follow up points.

Conclusion: This dynamic scapular recognition exercise significantly improves scapular upward rotation, flexion, abduction, and external rotation at two weeks. These improvements can persist for a period of 6 months.

Commentary: Shoulder proprioception seems to be a contributing factor to the loss of shoulder ROM and function in patients with adhesive capsulitis. This study evaluated the effectiveness of a dynamic shoulder proprioception exercise in patients with adhesive capsulitis. The authors found significant improvements, and significantly better improvements as compared to AAROM exercises, especially in the short term.

Unfortunately, it is difficult to understand the true differences between groups due to the vague explanation of treatment. Without understanding what this exercise is it is impossible to compare it to supervised AAROM. It is also not something repeatable in clinic.

What this study does offer is some hope that a more involved exercise that is therapist driven and impairment focused may improve the short term outcomes in patients with adhesive capsulitis. Ultimately the long-term outcomes were also significant in the AAROM group, which aligns with current practice standards for this patient population.

Citation: Dunning J, Butts R, Fernández-de-Las-Peñas C, et al. Spinal Manipulation and Electrical Dry Needling in Patients With Subacromial Pain Syndrome: A Multicenter Randomized Clinical Trial [published online ahead of print, 2020 Aug 28]. *J Orthop Sports Phys Ther*. 2020;1-46. doi:10.2519/jospt.2021.9785
Review Submitted By: Lauren Carroll

Objective: Analyze treatment effects of thrust manipulation and electrical dry needling (TMEDN-group) on pain and function compared to a nonthrust peripheral joint/soft tissue mobilization with exercise and interferential current group on pain and function in a population of patients with subacromial pain syndrome (SAPS).

Methods: Randomized, single blinded, multi center, parallel-group trial with 73 participants in the TMEDN group and 72 patients in the NTMEX group, using the SPADI and NPRS as primary outcomes of function and pain. The GROC and reported medication intake were used as secondary outcome measures.

Results: The TMEDN group showed greater reductions with the SPADI and NPRS at 3 months compared to the NTMEX group; the TMEDN group also demonstrated a larger portion of participants that achieved a successful outcome, according to the GROC and were able to stop taking medication for their shoulder pain.

Conclusion: The TMEDN group displayed greater reductions in shoulder pain, overall disability, and medication intake at 3 months compared the NMETEX group in a population of patients with SAPS.

Commentary: This article does an excellent job of outlining the large sample of patients from across the US with very specific inclusion criteria (primary complaint of anterolateral shoulder pain >6 weeks duration, (+) Neer test &/or (+) Hawkins-Kennedy test, as well as one of more of painful arc, pain with resisted shoulder ER at 90 of abduction, or pain with empty can test). There was also a very detailed list of exclusion criteria that ruled out red flags and ensured that patients were safe to participate in either treatment group. The methods section was also very detailed, describing the thrust manipulations, nonthrust manipulations/soft tissue mobilizations, dry needling techniques and locations, and the exercise regimen for the NTMEX group in great detail. I think the biggest take home from the results is that the treatment effects were not significantly different until 4 weeks after treatment with a “moderate” treatment effect that shifted to a “large” treatment effect at 3 months. I also think it would be interesting to see how this evidence would change if there was thrust manipulation without dry needling involved to see how which component is more beneficial. At the end of the day, I think it goes back to both groups having improved outcomes, but the group with the thrust manipulation as well as the dry needling appeared to maintain improvements in pain and function for a longer time period than the soft tissue and exercise group.

Citation: Utility of Neuromuscular Electrical Stimulation to Preserve Quadriceps Muscle Fiber Size and Contractility After Anterior Cruciate Ligament Injuries and Reconstruction A Randomized, Sham-Controlled, Blinded Trial Michael J. Toth,* yz§ PhD, Timothy W. Tourville,z|| PhD, ATC, Thomas B. Voigt,y BS, Rebecca H. Choquette,z BS, ATC, Bradley M. Anair,y BS, Michael J. Falcone,z BS, ATC, Mathew J. Failla,|| PT, PhD, Jennifer E. Stevens-Lapslaey,{ PT, PhD, Nathan K. Endres,z MD, James R. Slauterbeck,z MD, and Bruce D. Beynnon,z PhD Investigation performed at the Larner College of Medicine, University of Vermont, Burlington, Vermont, USA
Review Submitted by: Brandon Reynolds

Objective: To examine whether early NMES use can preserve quadriceps muscle size and contractile function at the cellular level in the injured versus noninjured leg of patients undergoing ACLR.

Methods: This study was a prospective, randomized, sham-controlled, blinded trial that included 25 patients (12 men/13 women) with an acute, first-time ACL rupture. Patients were randomized into a NMES or shame treatment to the quadriceps muscle of injured lower extremity. Bilateral biopsies of vastus lateralis were performed 3 weeks after surgery to measure skeletal muscle fiber size and contractility. Quadriceps muscle size and strength were assessed 6 months after surgery

Results: Twenty-one of the twenty-five patients completed the trial. Muscle fiber size and contractility were reduced in the injured lower extremity post ACLR compared to the non-injured leg 3 weeks after surgery. NMES reduced muscle fiber atrophy through effects on fast-twitch myosin heavy chain II fibers. NMES preserved contractility in slow-twitch MHC1 fibers, increasing maximal contractile velocity and preserving power output but not in MHC II fibers. Differences in whole muscle strength between groups was not seen 6 months after surgery. No group differences in patient- or clinician-reported outcomes or single-leg hop performance 6 months after surgery were found

Conclusions: Early use of NMES status post ACLR demonstrates decreased single muscle fiber atrophy and helped retain contractility of slow twitch fibers. No group differences were noted at 6 month follow-up. The results provide evidence demonstrating the benefits of utilizing NMES in patients recovering from ACLR to reduce maladaptations post-operation.

Commentary: I found that this was an interesting article in the fact that it was focusing on the cellular level in regards to effects of the treatment (NMES). NMES is a commonly used modality post-operatively especially in ACLR in order to assist in improving contraction of quadriceps musculature. This study provides cellular level data to demonstrate the potential effects of NMES compared to a sham treatment which I think may be beneficial in helping us know potential effects of the treatment itself. I think it is important to note that the groups began intervention within 3 weeks of injury and continued until three weeks after surgery. NMES was discontinued just before surgery and resumed within 72 hours after surgery. NMES was utilized at home 5 days per week for 60 minutes per day. All participants underwent ACLR rehabilitation with similar goals and benchmarks. The discussion in the article also brings up an interesting point that due to this study measuring single muscle fiber assessments, they were better able to avoid the potential bias of fluid infiltration registering as muscle tissue and therefore skewing muscle atrophy measurements when measuring whole muscle size. Some of the strengths of this article include eligibility criteria, a sham control intervention, assessments of PA throughout the study, and measurements of the quad at cellular level. Some limitations include extent of comitant meniscus injuries were not balanced by randomization, secondly the study was not adequately powered to assess group differences in whole leg function or patient-reported outcomes, and that the results are limited to the cohort tested (active patients with no history of significant knee trauma, first acl disruption, and ACLR with bone-patellar tendon-bone graft). One of the conclusion statements best summarizes the findings:

> "In conclusion, our study shows that both muscle fiber size and contractility were markedly reduced 3 weeks after surgery. These results are clinically relevant, as they suggest that both should be targeted by rehabilitation programs. Additionally, we found that early NMES after ACL injury and ACLR surgery beneficially modified adaptations in both muscle size and contractility at the cellular (ie, muscle fiber) level."