Citation: The Effect of Direction Specific Thoracic Spine Manipulation on the Cervical Spine: A Randomized Controlled Trial. Karas S, Hunt M, Temes B, Thiel M, Swoverland T, Windsor B. J Man Manip Ther. 2018 Feb;26(1):3-10. Epub 2016 Nov 30.

Review Submitted by: Jon Lester

Objective: To determine the short- (2 day) and medium- (2 week) term effect of thoracic spine manipulation on cervical spine outcomes based on the direction of manipulation being matched or unmatched to the subject's thoracic spine joint limitation (i.e. flexion or extension).

Methods: Subjects were between the ages of 18-60 yo with the primary complaint of mechanical neck pain. PTs were the administrators of both the assessment and interventions. Outcome measures were the NDI, GROC, and NPRS. Assessment was performed as a standard clinical examination. PA mobs in prone were utilized to assess the most hypomobile segment in the Tsp, which was then determined to be more limited in Tsp flexion or extension. Subjects were then randomized to receive Tsp manipulation that was either matched or unmatched to their determined directional hypomobility.

Standard manipulation was performed in supine. PT hand placement was on the inferior vertebrae of the segment that was determined to be hypomobile. For the flexion manipulation, the patient was in relative flexion at this segment prior to a downward and upward directed thrust as the PT's hand pulls the vertebrae inferiorly. For the extension manipulation, the patient was in relative extension with the same direction of thrust as the PTs hand attempted to move the targeted vertebrae superiorly.

The subjects were then asked to perform a HEP that attempted to maintain the motion attained from the manipulation, which was different for each subject based on the PT's clinical reasoning. Subjects came in 2 days and 2 weeks later for follow-up and completed the NDI, GROC, and NPRS again. "Appropriate treatment and exercise" were completed in between follow-up sessions.

Results: The entire subject pool (including both the matched and unmatched groups) demonstrated improvements in the GROC, NPRS, and NDI. However, there was not a significant difference noted based on the subject receiving a matched vs unmatched Tsp manipulation (all p-values >.05 for each outcome measure). Effect sizes for change in each outcome measured at each follow-up were also calculated, but all effect sizes were weak (ranging from -0.101 to 0.330).

Conclusions: Based on the above results, all subjects improved in each outcome measure (NDI, NPRS, GROC) over time. However, the results suggest that directing a thoracic spine manipulation based on the subject's directional joint limitation (flexion or extension) did not cause a significant difference in the amount of improvement noted.

Commentary: As we have learned previously, thoracic spine manipulation is warranted in those with mechanical neck pain as it can lead to improvements in both pain and function. Intuitively, you would expect a manipulation or mobilization that focuses on improving upon a patient's joint/movement limitation would be optimal regardless of the joint in question. However, from the results of this study, it does not appear that directing a thoracic spine manipulation to improve a patient's directional joint limitation influences neck pain/function. It appears that a thoracic manipulation, when directed at a hypomobile segment, will improve cervical spine outcomes regardless of direction. This goes along with a discussion that I have had with Aaron in the past. He told me that there are times where the concave/convex rules will dictate the direction of our mobilization/manipulation, but at other times

there can be improvements regardless of the direction of our forces. This goes along with the results of this study, whereas treating from a biomechanical construct perspective did not improve outcomes in this subject pool. Perhaps this supports the neurophysiological effect of mobilization/manipulation, which suggests that movement at a hypomobile segment will result in changes regardless of the direction. In clinic, these results are useful in the sense that the direction of our thrust might not matter for a patient with neck pain. However, there is no way of concluding that a directional thrust at a painful segment (i.e. Tsp thrust in a patient with Tsp pain) would not lead to differences in their outcomes. Therefore, the results could be viewed as a stepping stone for possible future research on the effect of directional thrusts at a symptomatic segment.

I would like to point out a major limitation of the study, which was the lack of consistency with the other treatments that the subjects received between baseline and follow-ups (manual therapy, exercise, personal interactions, etc). This could certainly influence the outcomes; however, I acknowledge that this is difficult to do with a symptomatic population in clinic.

Estébanez-de-Miguel, E., et al. Comparison of high, medium and low mobilization forces for increasing range of motion in patients with hip osteoarthritis: A randomized controlled trial. *Musculoskeletal Science and Practice*. 2018. Aug. Vol 36. 81-86.

Review Submitted by: Cameron Holshouser, PT, DPT

Objective: The objective of this study was to compare the effectiveness of high, medium, and low mobilization forces for increasing range of motion in patients with hip osteoarthritis and to analyze the effect size of the mobilization.
Methods: This was a doubled blind randomized controlled trial. All patients met the inclusion criteria of unilateral primary hip OA according to clinical criteria of the American College of Rheumatology, a grade III on the Kellgren & Lawrence classification, mild to moderate pain categorized by the Western Ontario and McMaster Universities (WOMAC) pain subscale, and aged 50 years or older. Participants were randomized into one of three groups: low, medium, or high force mobilization group. Each participant received three treatment sessions of long-axis distraction mobilization. Sessions were held on alternate days. Each treatment session was 10 minutes. The low force mobilization was applied continuously, the medium and high force group was applied for 45 and 30 seconds respectively followed by a 15 second rest period. The intensity of forces was defined by Kaltenborn criteria, as the low force was defined as "the slack zone/before marked resistance," medium force was defined as "to the first stop / marked resistance," and the high force group was defined as a "force past the first stop / marked resistance." Long-axis distraction mobilization was performed in the open packed position of the hip in supine. Hip range of motion and pain were both measured before and after each of the three treatment sessions.
Results: 60 patients were included in this study (20 participants in each group, 63 $\pm$ 9.7 years, 58.3% male). Mean distraction forces: low (26.4 $\pm$ 6.8 N), medium (50.7 $\pm$ 7.8 N), and high (68.6 $\pm$ 2.9 N) measured by a dynamometer. Hip ROM increased significantly in the high-force mobilization group: (flexion: 10.6°, extension: 8.0°, abduction: 6.4°, external rotation: 5.6°, internal rotation: 7.6°) after three treatment sessions. This was statistically significant between low and high force groups. The high force was the only force group to show change in ROM after each session. There were no significant

changes in the low and medium force groups for hip ROM. No significant differences in hip pain were found between treatment groups.
Conclusions: The conclusions of this study are that using high force long-axis distraction mobilization technique in the hip open packed position significantly increased range of motion in all three planes of motion compared to medium and low force mobilization groups for patients with unilateral hip osteoarthritis after three, ten-minute sessions.
Commentary: This study compliments previous research on manual therapy for hip OA. The JOSPT clinical practice guidelines in 2009 for hip OA state that manual therapy received a grade B for short-term pain relief and improving hip mobility and function. This study found that using long axis distraction improved range of motion but only with high force applied. Kaltenborn's grades I and II are typically thought for pain relief, while grade III is typically for range of motion improvements. Interestingly, this study did not find any improvements with pain in the low and medium force groups but did find ROM improvements with the high force group. This article did not describe specifically how long between sessions but stated "sessions were held on alternate days." Long axis distraction appears to be clinically applicable for patients with hip OA for improving range of motion when applied at a specific intensity.

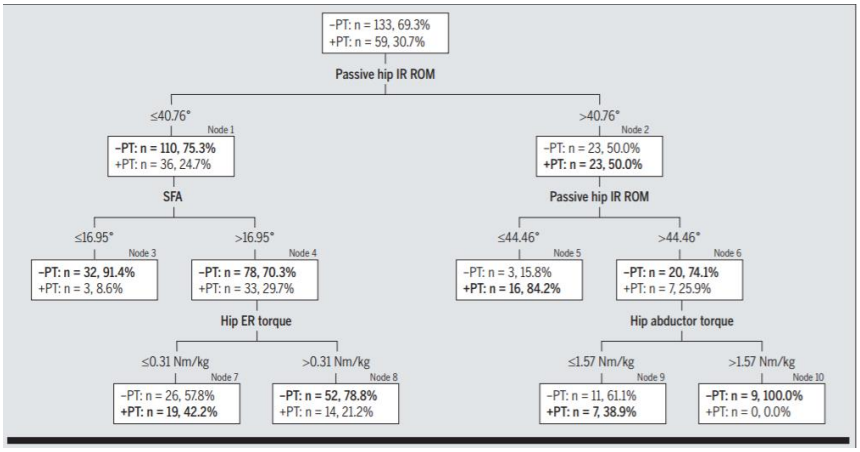
Citation: Association of Hip and Foot Factors with Patellar Tendinopathy in Athletes. Mendonca L, et al. J Orthop Sports Phys Ther 2018;48(9):676-684.

Review Submitted: Casey B Moler

Objective: To investigate impairments of the foot-ankle complex and hip joint with the presence or absence of patellar tendinopathy in volleyball and basketball athletes.

Methods: 192 jumping athletes (volleyball and basketball) were assessed for the following clinical measurements: shank-forefoot alignment, DF ROM, iliotibial band flexibility, passive hip IR ROM, hip ER and abductor isometric strength. A CART analysis (multivariate and nonparametric classification model) was performed to determine their relationship with the absence or presence of patellar tendinopathy. They created a decision tree based on their results. See below.

Results: The following impairments were identified, using the CART model, to be associated with the presence or absence of patellar tendinopathy: passive hip IR ROM, shank-and-ankle angle, hip ER and abduction strength. Passive hip IR ROM was found to be the first predictor in the decision tree, with



40.76 degrees of motion being the cut of value. Those athletes presenting with lower hip IR values (the left of the treet), shank-forefoot angle (SFA) was then classified as the second predictor with a cutoff value of 16.95 degrees, followed by hip ER torque (cutoff o.31 Nm/kg). While individuals who had higher values of hip IR (>40.76), found that passive hip IR ROM was also the 2nd predictor (cutoff at 44.46 degrees). Followed

by hip adductor strength with a cut off of 1.57 Nm/kg. Using this model, athletes with passive hip IR ROM <40.78° and SFA </=16.95° was the most accurate at predicting those without patellar tendinopathy, with a prevalence ratio of .24, or a 76% less likelihood of having patellar tendinopathy. While individuals that had those same lower values of hip IR but greater SFA angles had a 41% less likelihood with adequate hip ER torque >.31Nm/kg. The CART model has a 71.2 percent sensitivity, and 74.4 specificity. In this population, the best predictors of the absence of patellar tendinopathy was lower values of passive hip IR and SFA. While the best predictors of the presence of patellar tendinopathy were hip passive IR between 40.7 and 44.5 degrees.

Conclusion: Using the CART model, hip and ankle objective clinical measures: passive hip IR ROM, shank-and-foot angle, hip ER and abduction torque have been shown to be associated with the absence (71.2% sensitivity) or presence (74.4% specificity) of patellar tendinopathy in young jumping athletes.

Commentary: Using this CART Model, passive hip IR ROM can be used to predict the occurrence or absence of patellar tendinopathy based on the cutoff points as well as the presence of other predictors (SFA and hip abductor and ER torques). When treating patients with patellar tendinopathy or in the case of injury prevention, passive hip IR ROM should be assessed and taken into consideration for therapeutic interventions and preventative exercises. This study like many others show that adequate passive hip IR ROM and appropriate foot alignment can decrease the probability of excessive lower-limb IR and therefore decrease patellar tendon loading with functional activities. Therefore, addressing mobility to restore hip IR should be warranted with prevention or with treatment. The research here also suggests that varus foot alignment in jumping athletes are at higher risk, potentially due to the excessive pronation and IR, for increased tendon loading and subsequently presence of patellar tendinopathy. This research also suggests that if hip IR motion is inadequate, the presence of sufficient hip ER strength may help in controlling lower-limb IR, and in turn decrease patellar tendon loading. It should also be noted, that those athletes who did present with excessive passive hip IR ROM but exhibited adequate hip abduction strength were all classified as not having PT and should be considered when working with individuals with increased motion. When interpreting this data and its prediction value, it's important to take into consideration that the specificity and sensitivity of the model is only validated on the sample specific population (young jumping athletes). It's important to be aware that the clinical application of this model does not take consider the biomechanical (like movement analysis), behavioral, and physiological factors that may also contribute to presence of patellar tendinopathy. However, this research demonstrates there are associations among passive hip IR ROM, SFA, and hip torques and are associated with the presence of patellar tendinopathy depending on their cutoff values found in the chart above.

Efficacy of foot orthoses for the treatment of plantar heel pain: a systematic review and meta-analysis. Rasenberg N, Riel H, Rathleff MS, *et al*. *Br J Sports Med* 2018;52:1040-1046

Review Submitted By: Jeff Peckins

Objective: To determine the effectiveness of foot orthoses compared to other conservative treatment in decreasing pain, improving function, and improving self-reported recovery.

Methods: Studies included in the meta-analysis were RCTs that evaluated the effectiveness of different foot orthoses on patients with plantar heel pain (PHP). Inclusion criteria included all adolescents and adults with PHP, regardless of acuity. Studies that were included compared at least one foot orthosis with another conservative treatment. After reviewing and excluding all potential articles, the authors found 20 RCTs to include in the study, 12 of which were rated at low risk of bias.

Results: There was no significant difference in short or long term pain and function found between prefab and custom-made orthoses, custom-made and sham orthoses, or real and sham orthoses. When comparing prefab to sham orthoses, prefab showed better improvement in short-term function (MD 8.4 (scale 0-100) (95% CI 1.00 to 15.80)), however there was no difference in long-term pain or function. Custom-made orthoses demonstrated decreased long-term pain when compared to tension night splints (62% vs 48%, P<0.01). Medial arch support had improved short-term pain and function when compared to low dye taping (MD 1.67 (scale 0-10) (95% CI 0.58 to 2.77)) and (MD 5.00 (scale 0-51) (95% CI 1.50 to 8.51)) respectively. When comparing orthoses vs corticosteroid injections, corticosteroid injections showed improved ratings of short-term pain (MD 6.05 (scale 0-100) (95% CI 0.66 to 11.42)), but not mid-term pain. Lastly, heel cup orthoses demonstrated increased self-reported recovery at short-term when compared to stretching exercise (OR 7.79 (95% CI 3.85 to 15.84)), however no other orthoses in the study demonstrated a significant difference.

Conclusion: Foot orthoses are no better for decreasing pain or improving function when compared to other orthoses, sham orthoses, or other conservative treatments in patients who have PHP.

Commentary: Although there were several significant differences between foot orthoses and conservative treatments, the differences were usually small and rarely lasted for longer than the short-term. Subjects were randomly assigned into intervention groups in the studies, so there was no clinical reasoning behind which individuals may benefit from an orthotic. This may or may not have impacted the effectiveness of the different foot orthoses, as physical therapists likely assess patients' biomechanics with different activities to determine the necessity of the orthoses. For active conservative management, the only intervention the meta-analysis compared orthoses to was stretching. It would interesting to determine how orthoses compare to resistance exercise, manual therapy, gait mechanics, or other conservative interventions a physical therapist may prescribe for a patient suffering from PHP.

The meta-analysis reported that most participants in the studies saw an improvement regardless of what their treatment was. None of the studies compared orthoses to no treatment, and there is the possibility that the sham orthoses provided a therapeutic effect since they are made to resemble real orthoses. It is important to take patient preference and orthotic cost into account when

determining whether or not to advise a patient to purchase an orthotic. However according to the results of this meta-analysis, there is no benefit to the patient to purchase a more expensive custom-made orthotic, as there was no difference between these and prefabricated, over-the-counter, or sham orthoses. If the patient has no preferences for or against orthoses, it does not seem advantageous to recommend orthoses for patients with PHP.

Citation:

Mendonca LD, Ocarino JM, Bittencourt NF, Macedo LG, Fonseca ST. Association of hip and foot factors with patellar tendinopathy (jumper's knee) in athletes. *J Orthop Sports Phys Ther*. 2018;48(9):676-684.

Review submitted by: Matthew Fung

Objective: Investigate, by CART analysis, the impairments of the hip and foo/ankle that are associated with patellar tendinopathy (PT) in volleyball and basketball athletes.

Methods: 190 athletes were assessed over an 8-month period for impairments of the hip and foot/ankle including: shank-forefoot alignment (SFA), ankle dorsiflexion ROM,, ITB flexibility, passive hip IR ROM, and isometric strength of hip external rotators and abductors. Inclusion criteria: regular sport participation >12 hours/week, absence of Osgood-Schlatter disease, absence of anterior knee pain not related to patella tendon, no history of lower limb surgery and/or patellar tendon steroid injection. Athletes with tenderness and/or pain at the inferior pole of the patella were considered having PT. Exclusion criteria: Athletes with VISA-P scores above 80 points, no pain at single-leg decline squat and no history of patella tendon pain. CART analysis was performed to identify interacting factors associated with PT.

Results: The CART model predicted correctly 42 of the 59 athletes with PT (71.2 sensitivity) and 99 of the 133 athletes without OT (74.4% specificity. The total prediction of the model was 73.4% and the area under the ROC curve was 0.77 (95% CI: 0.70-0.84; standard error 0.03; $p<0.0001$) indicated the model's classification was not due to chance. Passive hip IR ROM was the first predictor selected by CART with a cut-off of 40.8°. Individuals with lower values of passive hip IR ROM, SFA was the second predictor with a cut-off point of 16.9° and hip ER torque was selected as the third predictor with cut-off points 0.31 Nm/kg. For individuals with passive hip IR ROM values above the cut-off point, the model selected another passive hip IR ROM cut-off point of 44.4° on the second level and hip abductor torque, with a cut-off point of 1.57 Nm/kg, on the third level.

Conclusions: The CART model revealed that different interactions of passive hip IR ROM, SFA, hip ER torque, and hip abductors torque were associated with PT occurrence. PT occurrence was best predicted by passive hip IR ROM between 40.7° and 44.4° and interaction of lower passive hip IR ROM (<40.7°), greater SFA (>16.9°) and lower hip ER torque (<0.31 Nm/kg) had a 55% increased likelihood of having

PT. Model also indicated that lower values of passive hip IR ROM (<40.7°) with lower values of SFA (<16.9°) were best at predicting non-PT occurrence; 76% less likely. Interestingly, all athletes with greater values of passive hip IR ROM (>44.5°) and greater values of hip abductor torque (>1.57 Nm/kg) were classified as not having PT (n=9; 100% not having PT). Overall the model identified accurately 71.2% of athletes with PT and 74.4% of athletes without PT. Thus, interactions among other variables not investigated on this study, including biomechanical, behavioral, and physiological factors, also may contribute to the occurrence of PT and should be explored in future studies. Results of this study should be interpreted with caution as causal relationships cannot be established by the methods used (cross-sectional study). Limitations of the study include the fact that some of the participants were undergoing physical therapy, which could have affected results. Moreover, factors such as trunk, quadriceps and hamstrings strength and flexibility, years of sport practice and hours played, although were not the focus of the present study, should be investigated in the future.

Commentary: The results of this study revealed non-linear and complex interactions between predictors and outcome variable and identified profiles related to PT occurrence or absence. I have only been practicing for a short period of time, but the preliminary implications of this study will allow better identify risk profiles associated with patellar tendinopathy. Prior to reading this article I would have considered that hip ER isometric strength to be the primary predator for anterior knee pathology. I now know not to overlook the fact that passive hip IR ROM either excessive or limited plays a large part in determining LE biomechanics and likelihood ratio for developing patellar tendinopathy. For younger athletes presenting to PT with complaints of anterior knee pain at the inferior pole of the patella, these results will be in the forefront of my thinking during my initial evaluation and treatment interventions.

Does iliopsoas lengthening adversely affect clinical outcomes after hip arthroscopy? A Multicenter comparative study. David R Maldonado, Aaron J Krych, et al. The American Journal of Sports Medicine 2018 doi: 10.1177/0363546518785966

Review Submitted by: Erik Kreil PT, DPT, CSCS

Objective: To determine if performing arthroscopic iliopsoas fractional lengthening to treat painful snapping syndrome, in the context of FAI and a labral tear, produces adverse effects to postoperative patient-reported outcomes at minimum 2-year follow-ups.

Methods: A retrospective review of data from July 2009 to April 2015 was conducted that included patients who had received hip arthroscopy for both FAI and labral tear with and without iliopsoas fractional lengthening. Comparisons were made of postoperative patient-reported outcomes between the 2 groups.

Results: 307 patients were identified to have met the inclusion criteria for the treatment group receiving iliopsoas fractional lengthening, and 354 patients were included for the control group with comparable mean follow-up times. Statistically significant differences between group characteristics of sex and age, as well as intraoperative differences of acetabular labrum articular disruption and acetabular

Outerbridge grades were noted; however, remaining between group characteristics, intraoperative findings, and intraoperative procedures remain statistically insignificant. Calculation of 9 outcome measures found no differences between groups for any measure. Delta values measuring change in quantity found statistically significant improvements between preoperative and follow-up scores for both groups, and delta value differences were not found between the 2 groups.

Conclusions: The findings demonstrate that arthroscopic iliopsoas fractional lengthening does not produce adverse effects when treating painful internal snapping syndrome in patients with FAI and labral tear. Both groups with and without iliopsoas fractional lengthening demonstrate similar outcomes with minimum 2-year follow-up.

Commentary: Medical waste and demonstrating successful treatment outcomes are growing emphases to deter unnecessary procedures and maximize patient outcomes. Iliopsoas fractional lengthening is an additional treatment that may be provided to patients with painful internal snapping syndrome in the context of FAI and labral tear, and it requires cutting a portion of the iliopsoas tendon within the capsule. With modification of the tissue's musculotendonous junction, a number of subsequent problems may occur, including muscle atrophy and instability. This retrospective study demonstrates comparable outcomes, including mean changes of the Modified Harris Hip Score of 20.7 and 20.9, between the groups, respectively. Clinically, we can be more confident that properly selected patients who have failed conservative approaches will have positive outcomes with the addition of iliopsoas fractional lengthening, when indicated.