

Citation: Saraceni, N., Kent, P., Ng, L., Campbell, A., Straker, L., & O'Sullivan, P. (2019). To Flex or Not to Flex? Is There a Relationship Between Lumbar Spine Flexion During Lifting and Low Back Pain? A Systematic Review With Meta-Analysis. *Journal of Orthopaedic & Sports Physical Therapy*, 1–50. doi: 10.2519/jospt.2020.9218

Review Submitted By: Helen Shepard

Purpose: To evaluate the effects of lumbar flexion during lifting as it relates to onset or persistence of low back pain, or as a differentiating factor in people with and without low back pain.

Methods: Literature search of Proquest, CINAHL, Medline, and EMBASE for relevant articles that fit inclusion/exclusion criteria. Thirteen papers with a total of 697 participants met the inclusion criteria (one longitudinal, 11 cross-sectional). The modified Critical Appraisal Checklist and GRADE approach were used to assess the quality of studies included in the review. Data from the included studies was synthesized and authors were contacted if more information was needed. Data was sub-grouped based on the quality of the method of measurement used to assess lumbar spine flexion (intra-lumbar markers was higher quality than thoraco-pelvic). A meta-analysis was conducted and heterogeneity was assessed.

Results: Four studies used intra-lumbar angles to measure lumbar flexion and it was found that there were no differences in peak lumbar spine flexion angles when lifting. Seven studies used thoraco-pelvic angles and it was found that people with low back pain lifted with 6 degrees less lumbar flexion than those without. The overall quality of evidence in the review based on the GRADE approach was 'low'. The risk of bias was judged to be high given the indirect method of measuring lumbar curvature.

Conclusion: The authors found low quality evidence of no longitudinal relationship between greater lumbar spine flexion during lifting and low back pain onset or persistence. There is no credible evidence to support the notion that lumbar spine flexion should be minimized during lifting to prevent low back pain, and some studies even concluded that those with low back pain used less lumbar flexion though this may be due to education on lifting mechanics or pain avoidance. Due to the findings of this study and other studies that have looked at disc pressures during flexion, the advice to avoid flexion while lifting is unsubstantiated. Participants had a low pain intensity, did not specifically have lifting related pain, and amount of weight lifted ranged from a pen to a 12kg box. Manual labor workers are usually required to lift up to 23kg so the weight in the studies is not reflective of true workplace lifting. Authors suggest future high quality research on lumbar kinematics during lifting to determine the relationship with low back pain.

Commentary: This is a great example of an article where only reading the abstract leads to false conclusions. Many people have taken the abstract and applied it to deadlifting at the gym with much heavier loads than were actually included in the study. The heaviest weight examined was 12kg (26lbs), which is significantly less than most people are lifting at the gym, less than a standard barbell weight, less than the weight of a toddler, and less than most manual laborers are lifting throughout the day. Though findings suggest a lack of correlation between lumbar spine flexion and onset or persistence of low back pain, future research is needed to be more application to actual incidents of lifting related low back pain. It would be interesting to know the frequency of lifts (how many lifts per day) in the included studies due to manual laborers lifting heavier loads for a high frequency and weight liftings also having a high frequency of lifts. I think the results and conclusions are interesting, however, further research is needed prior to applying this clinically to the workforce and the gym.

Citation: Khalaj N, Vicenzino B, Heales LJ, Smith M. Is chronic ankle instability associated with impaired muscle strength? Ankle, knee and hip muscle strength in individuals with chronic ankle instability: a systematic review with meta-analysis. *Br J Sports Med.* 2020. doi:10.1136/bjsports-2018-100070

Review Submitted By: Anna Wilson

Objective: The purpose of this systematic review was to determine whether impairments in lower limb muscle strength exist in individuals with chronic ankle instability (CAI) compared with uninjured controls.

Methods: The authors searched PubMed, Cochrane, CINAHL, Web of Science, and EMBASE electronic databases with included dates from establishment of the databases to February 10, 2019. They included cross-sectional and case-control studies that objectively measured lower limb muscle strength in individuals with CAI compared with controls. Risk of bias assessment, quality assessment, and sensitivity analysis were conducted. Where able they also performed meta-analysis.

Results: 20 studies were included and 16 were eligible for meta-analysis. The majority of the studies (16/20) assessed strength of muscles around the ankle only, two assessed hip or knee muscle strength only, and two assessed both hip/knee and ankle muscle strength. Meta-analyses showed individuals with CAI had lower eccentric and concentric evetor strength, concentric invertor strength, and concentric knee extensor strength compared to control group. Effect sizes varied from small to large and many of the analyses demonstrated large heterogeneity. Ankle eccentric dorsiflexor strength was not different between groups. There was evidence from single studies that there may be limitations in ankle plantarflexor strength at higher movement velocities. Results of data that was not eligible for pooling indicated that hip flexor, abductor, and external rotator strength, but not hip adductor and extensor strength, was lower in individuals with CAI when compared to control participants.

Conclusion: Findings from this study indicate ankle invertor and evetor and knee extensor muscle weakness, but no ankle dorsiflexor weakness, in individuals with CAI compared with controls. While studies of hip strength are limited, individual study data also suggest lower hip flexor, abductor, and external rotator strength in individuals with CAI compared to controls. The authors state that these findings highlight the importance of looking at both proximal and distal strength in individuals with CAI.

Commentary: Strengths include a broad and well defined search strategy across multiple data bases and performance of quality assessment, risk of bias assessment, and sensitivity analysis to ensure appropriate reporting of findings. Some weaknesses include a large number of included studies being >20 years old, inability to perform meta-analysis across all studies, large heterogeneity across many of the findings, and lack of consistent definition/inclusion criteria across studies for identifying patients with CAI.

I felt like the abstract and conclusion of this article made the evidence seem more promising and of higher quality than the actual results pointed out. However, taking into consideration the limitations and varied quality of evidence included in this systematic review, this information can be useful to guide identification of potential areas of examination and treatment in patients with chronic ankle instability. These findings support the utility of assessing both local and proximal factors, which is likely something we are already doing, in this patient population due to differences observed between those with and without CAI. As with any research, weighing the evidence with patient presentation and clinician experience will help guide the usefulness of these findings in respect to patient care.

Citation: Spindler KP, Huston LJ, Zajichek A, et al. Anterior Cruciate Ligament Reconstruction in High School and College-Aged Athletes: Does Autograft Choice Influence Anterior Cruciate Ligament Revision Rates? *The American Journal of Sports Medicine*. 2020;48(2):298-309. doi:10.1177/0363546519892991.

Review Submitted By: Barrett Coleman

Objectives: To see if there was any difference in younger athletes requiring second surgeries for previous ACLR based off of what graft was initially used.

Methods: Enrolled pt's from 7 sites and 17 surgeons between the ages of 14-22 who were injured while participating in a sport. The two groups that were compared were those that had a BTB or hamstring autograft. Exclusion criteria included other reason for ACLR (i.e: car accident), previous surgery on either knee, concomitant injuries to other structures such as a meniscus or ligaments, and other types of grafts. Pt's filled out a pre-surgery questionnaire, surgeon notes about the surgery were kept, and other measures were taken. The study followed up with participants 6 years after initial surgery to determine if they received additional surgeries.

Results: 839 patients were eligible. 770 completed the 6-year follow-up for the measure of the incidence of subsequent ACLR. The groups were BTB 492 (64%) and hamstring grafts 278 (36%). The incidence of subsequent ACLR at 6 years was 9.2% in the ipsilateral knee. The odds of ACL graft revision were 2.1 times higher for patients receiving a hamstring autograft than patients receiving a BTB autograft (95% CI, 1.3-3.5; P = .004). The study also found high-grade preoperative knee laxity and age to be other significant factors influencing ACLR after 6 years.

Conclusions: There was a high incidence of both ACL graft revisions and contralateral normal ACL tears resulting in subsequent ACLR in this young athletic cohort. The incidence of ACL graft revision at 6 years after index surgery was 2.1 times higher with a hamstring autograft compared with a BTB autograft.

Commentary: We often deal with the athletic population with ACL repairs and need to be able to educate our patients appropriately about the evidence concerning surgeries and outcomes. The opening paragraph of this article summarizes the current literature of graft choice and outcomes:

“An ongoing debate continues in the autograft choice of either the bone–patellar tendon–bone (BTB) versus hamstring tendons in terms of which reduces the risk of recurrent ligament disruption. Systematic reviews, meta-analyses, and a 2011 Cochrane database review on randomized controlled trials between these autograft choices for anterior cruciate ligament (ACL) reconstruction (ACLR) have reported no major clinically relevant differences in terms of graft failure rates. However, these prior studies have failed to control for either sport-related variables (ie, sport played, competition level) or other important risk factors (ie, age, sex, preoperative knee laxity level), which some clinicians utilize when selecting between a BTB and hamstring tendon autografts.”

This study goes on to list the limitations in several studies and how it might not be reliable data when considering the sports population. The methods control for many variables and has a long follow up period (6 years) that would capture most people's athletic career given that they stop at the collegiate level (inclusion was 14-22 years old). It has several interesting findings that would be important in education with patient's seeking ACLR.

- A high number of people in this study who had an ACLR had another one, whether it was on the ipsilateral or contralateral knee (20%).
- The biggest determining factor in graft choice was the surgeon.
- High-grade knee laxity (determined by having either a Lachman or anterior drawer examination finding greater than a 10-mm difference from the contralateral side or a 31 pivot shift during their examination under anesthesia) was a risk factor for ACLR regardless of graft type. Age was another.
- BTB grafts had significantly fewer revisions on the ipsilateral knee than HS grafts.

With this information, there can be guide posts that frame our discussions with athletes about ACLR options, prognosis, and risk factors. For those patients that fit the demographics (ACL tear during sports; athlete; 14-22 years old), this study demonstrates important factors that affect care and should be shared with patients.

Citation: Reynolds B, Puentedura EJ, Kolber MJ, Cleland JA. Effectiveness of Cervical Spine High Velocity Low Amplitude Thrust Added to Behavioral Education, Soft Tissue Mobilization, and Exercise in Individuals With Temporomandibular Disorder (TMD) With Myalgia: A Randomized Clinical Trial. *J Orthop Sports Phys Ther.* 2020:1-40.

Review Submitted By: Lauren Carroll

Objective: The objective of this RCT was to determine the effects the combination of cervical spine high velocity low amplitude thrust with patient education, soft tissue mobilizations, and a home exercise program compared with sham manipulation, patient education, soft tissue mobilizations, and a home exercise program in patients with TMD for at least 4 weeks duration.

Methods: This is a prospective, longitudinal RCT that compared two parallel groups of 25 participants over time, where each participant was treated 4 times over 4 weeks. The two groups were divided into patients that received HVLAT or sham manipulation along with standardized behavioral education, soft tissue mobilization, and HEP.

Results: No significant differences between HVLAT and sham group with maximal mouth opening, pain, or secondary measures. The HVLAT group demonstrated significant differences with lower fear at 4 weeks and improved jaw function sooner than the sham group.

Conclusion: Both groups improved with the standardized care, but there appear to be minimal significant changes with the addition of HVLAT to treatment for TMD. The HVLAT group had a high percentage of patients that experienced a successful outcome on the GROC immediately following the initial treatment and at follow up visits, however there were no significant differences between groups on other primary outcomes.

Commentary: This study examines different treatment techniques for chronic TMD and has several strengths, but a few weaknesses as well. The population involved in this study was similar to a potential clinical population because the inclusion criteria was broad, with an age range from 18-65, primary complaints of TMD, and baseline pain <2/10 on NPRS to name a few. The mouth opening criteria was <50 mm, which is considered to be within the normal range, and this was used as a primary outcome, so I am interested to know if the outcomes would have been more clinically significant if the inclusion criteria had been within a smaller range. I'm also curious about how the results would have changed if the population had been narrowed down to arthrogenic, myogenic, or disc displacement TMD. The authors did an excellent job of outlining the soft tissue mobilizations, patient education, and standardized exercises completed by each patient, as well as only utilizing 2 experienced PTs with extensive post-graduate training and 17 and 38 years of experience, respectively, to deliver the manual treatments, but I feel like the standardized care also creates a limitation in this study because there was no individualized treatment specific to each patient's need. Another weakness of this article is the limited follow up time after treatment. They did follow ups after initial treatment, 1 week, and 4 weeks, but had no further follow up information to see if the differences between groups changed on a long-term scale, or if symptoms returned after a time period with either group. Overall, I think this article shows that you don't need to utilize the HVLAT technique described to be able to effectively treat patients with chronic TMD.

Citation: Shi X, Han J, Witchalls J, Waddington G, Adams R. Does treatment duration of manual therapy influence functional outcomes for individuals with chronic ankle instability: A systematic review with meta-analysis? *Musculoskeletal Science and Practice*. 2019;40:87-95. doi:10.1016/j.msksp.2019.01.015.

Review Submitted by: Brandon Reynolds

Objective: The authors objective of this study is to compare treatment duration of manual therapy and assess whether the duration influences functional outcomes for individuals with chronic ankle instability

Methods: Systematic review of four electronic databases utilizing PICO format to identify randomized controlled trials that used manual therapy as a non-operative treatment for chronic ankle instability. The authors only included RCT studies including manual therapy (joint mobilization or mobilization with movement) against sham treatment for CAI. Studies with combined protocols were excluded. Outcome measures of patient reported function questionnaire, or ankle DF ROM, or balance test had to be included. Two researchers independently completed the selection of studies and a third researcher was utilized if there were any disagreements about inclusion. Data for CAI were extracted before and after manual therapy and outcomes provided either after the first or sixth session of treatment. Four RCT were included into the meta-analysis after inclusion and exclusion criteria were utilized. The four studies were considered moderate to high quality with all PEDro scores greater than or equal to 6. All trials had random allocation for between-group comparisons. Blind allocation used by three of the four studies but no detail was provided.

Results: Six sessions compared to a single session of manual therapy can improve functional performance in individuals with chronic ankle instability. The study states that there is moderate to low evidence suggesting that six-session MT can improve ankle DF ROM and motor control. Improvements noted in balance indicated a potential benefit on ankle neuromuscular control. The aforementioned improvements may have implications for recurrent injury prevention and sports performance maintenance and improvement.

Conclusion: This study helps demonstrate that increased duration of manual therapy may be more beneficial than less. The authors suggest that the improvements in balance noted in the group that had six sessions of manual therapy may be related to enhancing afferent proprioceptive information. This study has some weaknesses as it only has four studies included in it consisting of a total of 200 participants. After reading this study, it helps reinforce utilization of manual therapy in patients with CAI to help improve DF ROM and proprioception which may in turn improve balance. Improvements in these areas may reduce the risk for recurrent ankle injuries and improve performance.

Citation: Giordano BD, Kuhns BD, Perets I, Yuen L, Domb BG. Acetabular Morphologic Characteristics Predict Early Conversion to Arthroplasty After Isolated Hip Arthroscopy for Femoroacetabular Impingement. *Am J Sports Med.* 2020;48(1):188-196. doi:10.1177/0363546519888894

Review Submitted by: Taylor Blattenberger

Objective: To determine if patients with acetabular inclination (AI) dysplasia who underwent arthroscopic surgery for femoroacetabular impingement (FAI) were more likely to be converted to total hip arthroplasty (THA).

Methods: Four hundred nineteen subjects undergoing hip arthroscopy for FAI and chondrolabral abnormality were recruited for this study. Subjects being treated for extra-articular impingement, open hip surgery, and labral reconstruction were excluded. Each subject was evaluated via radiograph for lateral center edge angle (LCEA) dysplasia and AI dysplasia. Based on these findings subjects were classified as AI dysplastic, LCEA dysplastic, AI and LCEA dysplastic, or nondysplastic. Subjects were evaluated using the Hip Outcome Score (HOS), modified Harris Hip Score (mHHS), and Non-Arthritic Hip Score (NAHS). Outcomes were measured preoperatively, two years post-operatively, and yearly after this up to five years. Three hundred thirty seven subjects completed 5-year follow up (80.4%). Outcomes were compared between groups as well as the rate of conversion to THA or resurfacing surgery.

Results: At 5-year follow up subjects with AI dysplasia had lower improvement as measured by the HHS, but no difference in NAHS, HOS, or pain scores. LCEA dysplasia resulted in no difference from the nondysplastic group.

No differences were noted in surgical revision rates as a whole between groups. When evaluating conversion to THA only, subjects with AI dysplasia (13/42, 31%) and subjects with LCEA dysplasia (5/9, 56%) required it more frequently than those without dysplastic deformity (45/336, 13%).

Conclusion: Pt's with AI and LCEA hip dysplasia were more likely to be converted to THA than those without acetabular deformity.

Commentary: This study aimed to identify risk factors for poor outcome following hip arthroscopy. This is an important question in this population given the cautionary to favorable outcomes in hip arthroscopy. It would be clinically helpful to determine what patients benefit most from hip arthroscopy. Hip dysplasia was a proposed risk factor for poorer outcomes of this surgical intervention.

The results of this study did show significantly higher conversion rate of arthroscopy to THA. I found these results to be interesting, but questionable given the small sample size of patients with AI or LCEA dysplasia as compared to the large sample of nondysplastic individuals. Overall outcomes following surgery were also not largely different between groups indicating that confounding factors may have played into the decision to move forward with revision surgery.

This study is a step in the right direction to help clinicians identify considerations for those who may respond poorly to hip arthroscopy. Although, the size of the dysplasia cohorts were small and the other outcomes did not differ much. It is also unknown how the converted subjects ultimately responded to THA follow conversion. The findings of this study may not be strong enough to rely on for clinical decision-making at this time.

Citation: Bryan M. Bond, Chris D. Kinslow, Adam W. Yoder & Wen Liu (2020) Effect of spinal manipulative therapy on mechanical pain sensitivity in patients with chronic nonspecific low back pain: a pilot randomized, controlled trial, *Journal of Manual & Manipulative Therapy*, 28:1, 15-27, DOI: 10.1080/10669817.2019.1572986

Review Submitted by: Steven J. Lagasse

Objective: There were several goals to this study, with the primary being to examine the effects of spinal manipulative therapy (SMT) on pain pressure threshold (PPT) at local and distant regions of the body for subjective with chronic non-specific low back pain (CNSLBP).

Methods: This study gathered 51 subjects, 22 of which did not meet the inclusion criteria. The remaining 29 subjects were randomly divided into two groups, SMT (n=14) and sham SMT (n=15). Both groups partook in seven total treatment sessions over three weeks. The treatment group received a rotary lumbopelvic high-velocity low-amplitude (HVLA) thrust twice to both the right and left sides. The control group also received two HVLA thrusts to both the left and right sides of the pelvis while in a supine posture; sham thrust was delivered anterior to posterior into the treatment table. PPT measures were taken at 5-cm lateral to the spinous process of L5 (local), tibialis anterior (regional), and lateral epicondyle of the elbow (remote), all of which were tested on the patient's dominant side. The Numeric Pain Rating Scale (NPRS) and Oswestry Disability Index (ODI) measures were also taken to assess pain and disability. All measures were taken a total of three times, at the beginning of the first visit, immediately after the first treatment session, and three weeks after the initial session. The clinicians who delivered the interventions were aware of group assignment, however, the assessors were blinded to both the experimental and the control. Participants were also blinded to their assigned group.

Results: Based on the results of the study, both the STM and sham STM groups received increased tolerance to PPT and improvements on the NPRS and ODI. Regarding PPT, both groups received improvements at the local and regional locations, however, neither group demonstrates improvements at the remote location. Although both groups improved, they improved nearly equally, with no significant differences seen between groups. However, the experimental group did reach minimal clinically important differences (MCID) for all variables while the control group did not.

Conclusion: After three weeks, both the experimental and control group showed increased PPT at local and regional locations. Additionally, both groups demonstrated improvements in the NRPS and ODI outcome measures. However, no significant differences were seen between the two groups.

Commentary: The primary strengths of this study were the use of patient blinding, blinding of assessors, and the use of randomization. Additionally, the study utilized a realistic placebo in the form of sham STM. This is significant, as roughly only one-third of all participants felt they were in the active treatment group, demonstrating adequate blinding. Furthermore, the exclusion criteria did not overly bar subjects from participating in the study. The primary weakness of this study was the age range of their subjects (mean age of 23.86) which may not allow for generalizability to older adults and the geriatric population. Furthermore, this study did not investigate long term follow up which could provide valuable information regarding how STM and sham STM did or did not benefit their subjects in the medium to long term. This may be especially important as there were no significant between group differences found.