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Human Kinetics
CRITICALLY APPRAISED TOPIC

The Effects of Hip Mobilizations on Patient Outcomes: A Critically Appraised Topic

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Clinical Scenario: Hip osteoarthritis currently affects up to 28% of the population, and the number of affected Americans is expected to rise as the American population increases and ages. Limited hip range of motion (ROM) has been identified as a predisposing factor to hip osteoarthritis and limited patient function. Clinicians often apply therapy techniques, such as stretching and strengthening exercises, to improve hip ROM. Although traditional therapy has been recommended to improve hip ROM, the efficiency of the treatments within the literature is questionable due to lack of high-quality studies. More recently, clinicians have begun to utilize joint mobilization and the Mulligan Concept mobilization with movement techniques to increase ROM at the hip; however, there is a paucity of research on the lasting effects of mobilizations. Given the difficulties in improving ROM immediately (within a single treatment) and with long-lasting results (over the course of months), it is imperative to examine the evidence for the effectiveness of traditional therapy techniques and more novel manual therapy techniques. ***Focused Clinical Question:*** Is there evidence to suggest manual mobilizations techniques at the hip are effective at treating hip ROM limitations? ***Summary of Clinical Findings:*** 5 Randomized Controlled Studies, improved patient function and ROM with the Mulligan concept, high velocity low amplitude improved. ***Clinical Bottom Line:*** We found moderate evidence to suggest favorable outcomes following the use of hip mobilizations aimed at improving hip ROM and patient function. ***Strength of Recommendation:*** Strength of the studies identified are 1B.

Keywords: Mulligan Concept, hip manual therapy, patient function

Clinical Scenario

Hip osteoarthritis affects up to 28% of the population and is expected to rise as the American population ages.[1,2] Limited hip range of motion (ROM) has been identified as a predisposing factor to hip osteoarthritis and limited patient function (ability to complete pain-free daily activities with achieving normal ranges of motion).[3,4] Clinicians often apply traditional therapy, such as stretching and strengthening exercises, to improve hip ROM.[5] Although traditional therapy has been recommended to improve hip ROM, the efficiency of the treatments is questionable.[3–8] More recently, clinicians have also begun to utilize joint mobilization and the Mulligan Concept (MC) mobilization with movement (MWM) techniques to increase ROM[3–8]; however, there is a paucity of research on the lasting effects of mobilizations. Given the difficulties in improving ROM immediately and with long-lasting change, it is imperative to examine the evidence for the effectiveness of traditional therapy techniques and more novel manual techniques.

Focused Clinical Question

Is there evidence to suggest manual joint mobilizations for the hip are effective at treating hip ROM limitations?

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Summary of Search, "Best Evidence" Appraised, and Key Findings

- The literature was searched for research of level 2 evidence or higher that investigated the effects of mobilizations on the hip joint within the healthy or nonsurgical patient population and compared mobilizations with other forms of treatments.
- The search of the literature provided 5 randomized control trial studies, which met the inclusion criteria and were included.[3,5–8]
- Three studies compared use of the MC on the hip joints to traditional therapy treatments,[3,7,8] one study compared high-velocity low-amplitude (HVLA) mobilizations to the hip joint to a grade 1 mobilization,[5] and one study compared HVLA on the sacroiliac joint to traditional treatments.[6]
- The 3 studies that utilized the MC reported improved patient function and ROM compared with stretching of the hips.[3,7,8]
- The study that utilized HVLA reported immediate improvements in ROM and pain.[5]

Clinical Bottom Line

We found moderate evidence to suggest favorable outcomes following the use of hip mobilizations aimed at improving hip ROM and patient function (Table 1); the evidence suggests that mobilizations can be used to decrease pain, while also leading to increased ROM and patient function.[3,5–8] The outcomes from traditional treatments (eg, stretching, exercises, or heat therapy) differed from the use of novel mobilization techniques. These findings suggest the utilization of the novel mobilization techniques is more effective than traditional therapies. The evidence included also suggests that the MC MWM techniques may be

Table 1 Summary of Study Designs of Articles Retrieved

Level of evidence	Study design	Number of results	Study authors
1b	Randomized controlled trial	5	Beselga et al[3] Makofsky et al[5] Méndez-Sánchez et al[6] Walsh and Kinsella[7] Yıldırım et al[8]

effective for treating hip ROM asymmetries. Therefore, it may be clinically useful for clinicians to utilize the MC MWM techniques to address hip ROM asymmetries.

Strength of Recommendation

Level 1b evidence exists supporting mobilizations as effective techniques for short-term improvements in patient perceived pain, ROM, and patient function. Although these studies were high quality (level 1), the strength of evidence supporting the long-term effects of novel hip mobilizations is questionable.

Search Strategy

Terms Used to Guide Search Strategy

A computerized search was completed in April and May 2016 (see Figure 1). The search terms used were as follows:

- **P**atient/Client group: healthy or non-surgical population and a decrease in hip ROM
- **I**ntervention/Assessment: hip mobilization or mobilisation or mulligan concept
- **C**omparison: control or other treatments
- **O**utcome: hip internal range of motion or hip external range of motion or hip-flexion ROM or patient function or pain

Sources of Evidence Searched

- PubMed
- Medline
- CINAHL
- SPORTDiscus
- EBSCOhost
- Google Scholar
- Cross Referencing

Inclusion and Exclusion Criteria

Inclusion Criteria

- Studies that compared traditional hip therapeutic exercise (including 1 or more of thermotherapy, stretching, modalities, or strengthening) or sham mobilization or a hip mobilization
- Limited to publications within the past 10 years (2007–2016)
- Limited to the English language
- Patients who were diagnosed with limitations in hip ROM or decreased strength at the hip
- Limited to humans
- Limited to level 2 evidence or higher

Exclusion Criteria

- Studies that included participants with postoperative surgeries of hip, knee, or ankle
- Studies that did not incorporate or directly compare mobilizations of the hip or therapeutic exercise or stretching of the hip
- Studies that included therapeutic interventions other than manual therapy (eg, cortisone injections, medications, surgeries)

Results of Search

Five studies met the established inclusion criteria and were categorized as presented in Table 1 (based on levels of evidence, Centre for Evidence-Based Medicine, 2011).[9]

Best Evidence

Our search strategy identified 5 applicable studies that were determined to be the best available evidence and were included in the critically appraised topic (Table 2). These studies were selected because each assessed novel manual therapy techniques of the hip joint and reported effects on hip ROM and patient function compared with either a traditional therapy (eg, stretching), to a sham treatment, or to no treatment. These studies were rated level 1b based on the 2011 levels of evidence from the Centre for Evidence-Based Medicine.

Implications for Practice, Education, and Future Research

Research focused on limited hip ROM, and pain related to decreased ROM suggests a potential mechanistic relationship between this condition and long-term pathology, such as hip osteoarthritis,[1–3,10] patellofemoral pain syndrome,[10] or low back pain.[11] A proposed mechanism of hip asymmetry may alter biomechanics and lead to varying pathologies long term.[4,11] Therefore, it is imperative to identify strategies to treat and resolve decreased hip ROM or asymmetry. The 5 articles[3,5–8] that met inclusion and were reviewed provided evidence that utilizing hip mobilizations was an effective short-term intervention compared with sham techniques and were clinically meaningful. In these studies, the researchers examined the effect of mobilizations on ROM,[3,8] patient functional tests,[6,7] and muscle torque.[5] The results were statistically significant and produced meaningful effect sizes (Table 3). In addition to improving clinical-based outcomes, such as ROM (ie, hip flexion, hip internal rotation, and hip external rotation), patients reported outcomes improved from hip mobilizations.[3,5–8] However, the results of the studies did not suggest 1 favorable mobilization technique (ie, MC vs HVLA) over another at this time.[3,5–8]

Specifically, for ROM, Beselga et al[3] reported a significant interaction for hip flexion and hip internal rotation ROM after the intervention of the MC MWM flexion and internal rotation technique compared with a sham group who received a simulated MC MWM, but the clinician did not apply a force or a glide. In this study, 100% of MC MWM (n = 20) and 55% of sham (n = 11) groups experienced an increase in hip flexion of more than the minimal detectable change of 1.11° and was clinically meaningful

Table 2 Characteristics of Included Studies

Authors	Beselga et al[3]	Makofsky et al[5]	Méndez-Sánchez et al[6]	Walsh and Kinsella[7]	Yıldırım et al[8]
Title	Immediate effects of hip MWM in patients with hip osteoarthritis: a randomized controlled study	Immediate effect of grade IV hip joint mobilization on hip adductor strength: a pilot study	Immediate effects of bilateral SIJ manipulation on plantar pressure distribution on asymptomatic patients	The effects of caudal MWM and caudal SMWM in relation to restricted internal rotation in the hip: a randomized control pilot study	Comparison of effects of static, proprioceptive neuromuscular facilitation and Mulligan stretching on hip-flexion ROM: a randomized controlled trial
Study design	Randomized controlled trial	Randomized controlled trial	Randomized controlled trial	Randomized controlled trial	Randomized controlled trial
Participants	40 patients (mean age: 78 [6] y)	30 healthy participants (20–65 y old)	62 participants (mean age: 20.66 [2.56] y)	46 males (average age: 20 [1.80] y)	40 students (mean age: 21.5 [1.3] y)
Inclusion and exclusion criteria	Inclusion: patients must meet clinical criteria of osteoarthritis Exclusion criteria: lower-extremity surgery in the last 6 mo, rheumatoid arthritis, uncontrollable hypertension, mobility aid during walking, primary neurogenic disorder, advanced osteoporosis, previous physiotherapy treatment to the hip, inability to understand the instructions or complete the study	Exclusion criteria: pain, muscle splinting, systemic disease, orthopedic surgery, patient report of lower back pain within the past 6 wk, hip, knee, or ankle pathology, hyper- or hypomobility at the hip joint, or any related surgeries	Inclusion: no physical activity participation 24 h prior to the study, asymptomatic Exclusion criteria: altered balance, deformities, orthopedic injuries, traumatic history in the lower limbs or spine, ventilatory disorders, pain during the study, receipt of physical therapy in the previous 6 mo, and contraindications to HVLA manipulation	Inclusion: participation in multidirectional sports; hip IR is less than 30° in the prone position Exclusion criteria: any lower-extremity injury in the last 6 mo, any surgery to the hip in the last year, previous diagnosis of rheumatoid arthritis, osteoarthritis, neurological conditions, or a positive anterior impingement test	Inclusion: <70° of hip flexion Exclusion criteria: more than 70° of hip flexion, history of hamstring injury, or current musculoskeletal pain
Intervention investigated	Placebo group: simulated MWM technique. Hip flexion and internal rotation were maintained for 10 s and repeated 3 series Experimental group: hip flexion MWM was carried out with the subject supine and the physical therapist standing next to the subject. 3 × 10, 1-min rest interval between each set. Hip internal rotation MWM	Group A: Grade 1 inferior hip joint mobilization. Group B: Grade IV inferior hip joint mobilization. 3 × 1 min, 30-s break in between repetitions	Experimental group: mobilization to the hips without tension and an HVLA manipulation to both SIJs Control group: only the placebo (mobilization without tension) to the hips	Control, MWM adductor modified 4-point kneeling, SMWM 4-point kneeling	(1) Static stretching: the participant was instructed to use the most common hamstring stretching technique (elevate the stretched leg forward with no hip internal or external rotation and hinge forward at the hip). 10 repetitions of 30 s were completed (2) PNF stretching: hold relax technique with SLR. 10-s hold followed by 10-s relax (3) Mulligan TSLR: 3 repetitions of pain-free straight leg raise traction were completed by the clinician on the patient (4) No intervention
Outcome measures	Pain intensity, hip flexion and IR ROM measurements, and functional tests	Cybex Norm isometric torque	Baropodometric analysis	FIRT and SIRT	Hamstring ROM with a digital goniometer
Main findings	Hip pain decreased immediately after a single session of MWM when compared with a sham technique in this sample of elderly subjects with hip OA Maximal hip flexion and internal rotation ROM and functional performance improved after MWM of the hip	Mobilizations of restricted structures in the hip capsule may allow the hip abductors to function more optimally through a full ROM	Mobilizations of the SIJ had an immediate effect on load distribution in the plantar aspect of the foot	SIRT and FIRT may improve in outcomes after 1 session of mobilizations	MWM may be beneficial in increasing hip-flexion ROM. PNF may be just as beneficial as the MWM at increasing hip flexion compared with the controlled and static stretching group
Conclusion	MC application immediately decreases pain	Grade IV mobilizations increase torque	Mobilizations of the SIJ redistribute body load force	MC application increases function	MC application increases hip ROM

Abbreviations: FIRT, functional internal rotation test; HVLA, high-velocity low-amplitude; IR, Internal Rotation; MC, Mulligan Concept; MWM, mobilization with movement; OA, osteoarthritis; PNF, proprioceptive neuromuscular facilitation; ROM, range of motion; SIJ, sacroiliac joint; SIRT, seated internal rotation test. SMWM, self-mobilization with movement; TSLR, traction straight leg raise.

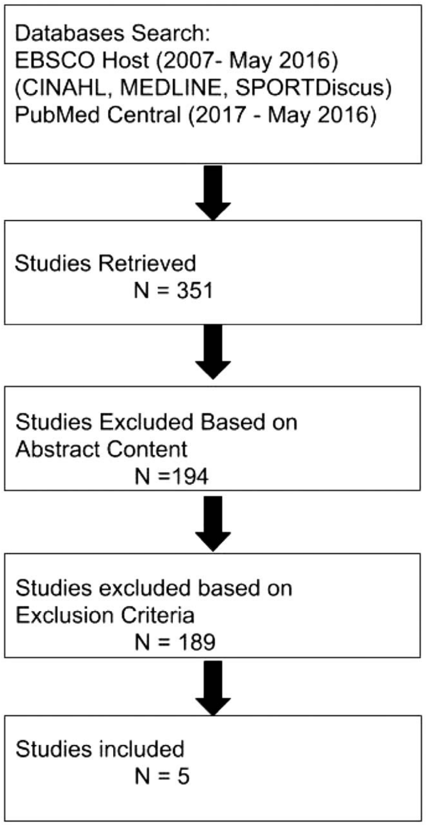

Figure 1 — Computerized search diagram, 2016.

(Cohen's *d* = 0.6).[3] In addition, 80% of the MC MWM (n = 16) and 20% of the sham (n = 4) groups experienced an increase in hip internal rotation of 4.4°, which was greater than the minimal detectable change of 0.55° and was clinically meaningful (Cohen's *d* = 1.4).[3] When MC MWMs were compared with stretching, Yıldırım et al[8] found a significantly greater acute ROM increase in hip flexion when the MC MWM traction straight leg raise was used compared with static stretching or no treatment; however, a significant difference was not found between the proprioceptive neuromuscular facilitation group and the MC MWM traction straight leg raise group. Each of these studies identified a statistically significant improvement in ROM following the use of MC MWM techniques, but did not compare the effectiveness of MC techniques to traditional joint mobilizations or assess the long-term effectiveness of the techniques.

Mobilizations may also be effective for improving patient functional outcomes. Méndez-Sánchez et al[6] found sacroiliac joint mobilizations (HVLA) produced an immediate effect on pressure load and weight distribution of the body when comparing the experimental group to a control group (a placebo load).[6] Due to the sacroiliac joints playing a role in load distribution while standing, altering weight distribution through a mobilization may prevent or improve patient functional outcomes in pathologies resulting from asymmetrical loading.[6] There was a significant effect on foot load distribution ($P = .03$) and foot weight distribution ($P = .01$) set at a 95% confidence interval.[6] Walsh and Kinsella[7] also found that clinician-applied and patient-applied MC MWMs resulted in improvement in patient functional tests after 1 session when compared with a control group. Improved activation of the gluteus maximus muscle may account for the increase in functional ROM, which may explain the significant improvement in ROM during the functional internal rotation test, but not the seated internal rotation test.[7,13] The results of the studies suggest that the use of MC MWM may be beneficial for improving patient functional outcomes.

To assess the effectiveness of various mobilization techniques, Makofsky et al[5] compared different grades of joint mobilization in healthy patients who were randomly assigned to a specific intervention group. The control group received a grade I inferior hip joint mobilization, whereas the experimental group received a grade IV inferior hip joint mobilization. Both groups received 1 set of 3 repetitions of 1 minute with a 30-second break

Table 3 Reported Effect Sizes by Study

Source	Cohen's *d*[a] effect size	Comparison
Beselga et al[3]	0.6	Lateral MWM glide with hip flexion vs no glide with hip flexion on hip internal rotation improvement
Beselga et al[3]	1.2	Lateral MWM glide with hip flexion vs no glide with hip flexion on NPRS for hip pain decrease
Makofsky et al[5]	0.7	Torque increase of hip adductors after grade IV hip mobilization vs grade 1 hip mobilization
Méndez-Sánchez et al[6]	0.55 (weight), 0.09 (LFF load), 0.63 (LHF load), 0.09 (RFF load), 0.65 (RHF load), 0.47 (LF and RF load)	HVLA manipulation to SIJs was performed vs mobilization of the hips without tension on location of pressure point
Walsh and Kinsella[7]	SIRT: 0.43 (MWM), 0.81 (SMWM); FIRT: 1.64 (MWM), 0.40	MWM with hip caudal glide vs SMWM and no treatment caudal glides on hip IR increase
Yıldırım et al[8]	0.94 (static stretching), 2.15 (PNF stretching), 2.21 (Mulligan TSLR), 0.01 (no intervention)	Mulligan TSLR vs PNF, vs control, vs static stretching on ROM increase

Abbreviations: HVLA, high-velocity low amplitude; LF, Left Foot; LFF, Left Forefoot; LHF, Left Hind Foot; RF, Right Foot; RFF, Right Forefoot; RHF, Right Hind Foot; FIRT, functional internal rotation test; MWM, mobilization with movement; NPRS, Numeric Pain Rating Scale; PNF, Proprioceptive Neuromuscular Facilitation; ROM, range of motion; SIRT, seated internal rotation test; SIJ, sacroiliac joint; SMWM, self-mobilization with movement; TSLR, Traction Straight Leg Raise. Note: General interpretation of the strength of the relationship: [a]Cohen's *d* focuses on the magnitude of difference. A *d* of 0.5 means the groups differ by 1.5 of a SD[12] (small = 0.2, medium = 0.5, and large = 0.8).[12]

between repetitions. The participants had a 15-minute break and then retested peak hip abductor torque values on the Cybex Norm dynamometer. The 1 set of 3 repetitions within the control group resulted in a 2.33-ft lb improvement, which exceeded the calculated minimal detectable change of 1.88 ft lb.[5] This was a significant increase in torque compared with the premeasurement and postmeasurement between the experimental group and the control group of $t = 1.024$ ($P = .31$).[5] Postintervention between group comparisons indicated an increase in hip abductor torque for the experimental group. The subjects were positioned in the right-side lying position with the hip abducted to 45°; with the hip in this position, the capsuloligamentous structures were put on a stretch.[5] Mobilizations of restricted capsuloligamentous structures in the inferior hip capsule may allow the hip abductors to function more optimally through a full ROM.[5] The researchers concluded that a joint mobilization may decrease the restriction in capsuloligamentous structures, which allows for greater joint ROM.[5]

One challenge for the use of mobilizations on the hip joint is the complexity of the region. With over 45 muscles attaching on the hip,[10] the source of pain/limitation can often be misdiagnosed. Although all of the studies included in this critically appraised topic incorporated a type of mobilization, the specific types of mobilizations varied. The use of mobilizations has an immediate effect of improving hip joint ROM and is recommended to be incorporated into patient treatments where hip ROM limitation and/or pain is present.[3,5–8] Beselga et al,[3] Walsch and Kinsella,[7] and Yıldırım et al[8] recommended use of the MC over other techniques, although all 3 studies used different MC techniques.

Clinicians can use the findings from this critically appraised topic as a general recommendation when incorporating hip mobilizations, attempting to improve patient outcomes. Patients who suffer from decreased hip ROM and pain may benefit from the application of either MC mobilizations or HVLA manipulations. However, the use of different interventions (MWMs and joint mobilizations) and inconsistent methodology make comparisons difficult across these 5 studies; thus, a recommendation on the most effective mobilization intervention or a gold standard to increase hip ROM is not recommended at this time. Future research should include well-designed prospective studies (eg, randomized controlled studies) investigating the effects of mobilizations on ROM at the hip for stratified populations. Recommended populations to study include active, competitive patients with healthy asymmetries of hip ROM and patients with specific pathologies limiting hip ROM. Future studies are also warranted to investigate the effects of specific MC MWM techniques on the hip joint ROM to determine model treatment techniques for improving hip ROM.

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