Evidence Table
Hip Pain Mobility Deficits 2025 Revision

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
Bennell Kim L, et al. 2018 Effects of internet-based pain coping skills training before home exercise for individuals with hip osteoarthritis (HOPE trial): a randomised controlled trial *Pain* doi:10.1097/j.pain.0000000000001281 PMID: edsovi.10.1097.j.pain.0000000000001281 **Study Setting:** clinical **Inclusion Criteria:** Inclusion criteria were: (1) age >50 years; (2) hip pain for 3 months on most days of the past month; (3) average hip pain during walking ≥4 on an 11-point numerical rating scale (NRS, terminal descriptors of 0 “no pain” and 10 “worst pain possible”) in the previous week; (4) able to attend a trial physiotherapy clinic; (5) computer/internet access; (6) can commit to be involved in the study for 12 months; and (7) could read/understand English. **Exclusion Criteria:** Exclusion criteria were: (1) hip joint replacement on symptomatic side; (2) awaiting joint replacement surgery within 12 months or any knee surgery in previous 12 months; (3) use of oral or intraarticular corticosteroids in past 3 months; (4) systemic arthritic condition; (5) cognitive behavioral treatment for pain in past 12	**Initial LOE Based on Study Design:** I **Quality Rating:** high **Final Level of Evidence:** I	**Sample Size:** 144 participants; 73 experimental; 71 comparison **Age Description:** Age (y) 61.2 (7.2) experimental 61.3 (7.1) comparison Female, n (%) 45 (62) 37 (52) **Sex Distribution:** Female, n (%) 45 (62) experimental 37 (52) comparison **Conditions:** hip OA (not confirmed by radiograph)	**% Follow up:** Loss to follow-up was 7/144 (5%), 13/144 (9%), and 17/144 (12%) at 8, 24, and 52 weeks, respectively, and was similar across groups **Primary Outcome Measure:** Primary outcomes were valid, and reliable self-reported pain and physical function measures recommended for hip OA clinical trials. Overall, average pain on walking over the previous week was measured with an NRS with terminal descriptors of “no pain” (score 0) and “worst pain possible” (score 10). Difficulty with physical function over the previous 48 hours was measured by the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) (Likert version 3.1) function subscale,[1] with scores ranging from 0 (no dysfunction) to 68 (maximum dysfunction) **Primary Results for Outcome Measure:** For the week-24 primary outcomes (Figure 2), there was no between-group difference in change in walking pain (mean difference 0.5 units; 95% CI, 20.3 to 1.3), although a greater proportion of participants in the comparison group (78%) exceeded the MCID for change in walking pain than in the PCST group (59%) (odds ratio 2.57, 95% CI 1.08-6.11). At week 24, there was also no between-group difference in change in WOMAC function (20.9 units; 95% CI, 24.8	**Reviewer's Interpretation of Results and Conclusions:** Online PCST immediately improved pain coping and function, for coping of pain and perceived function, but did not add additional benefits to a subsequent exercise program, despite sustained pain coping improvements for individuals.

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months; (6) physiotherapy treatment or exercises for the back, hip, or knee in past 6 months; (7) any other muscular, joint, or neurological condition affecting lower limb function; and (8) score .21 on depression subscale of the Depression, Anxiety, and Stress Scale.[23]			to 2.9), which remained the case when dichotomized on MCID (PCST 64% vs comparison 57%, odds ratio 0.70, 95% CI 0.34-1.42). Frequency of use of pain coping skills was significantly higher for the PCST group than the comparison group at every time point (mean [95% CI] between-group difference: week 8, 11.5 [5.3-19.7]; week 24, 11.7 [2.9-20.5]; and week 52, 15.3 [4.4-26.2]). Although there were no other significant between-group differences in secondary outcomes (Tables 3 and 4) at week 24 or week 52, there was a significant between-group difference for change in WOMAC function (23.2 units; 95% CI, 26.2 to 20.1) at week 8 favoring PCST, and more participants in this group reported improvement overall and in pain and function at week 8 (Table 4). At 52 weeks walking pain and WOMAC function were better in the control group. Pain: PCST Group 3.3 (2.5) and Control 2.7 (2.4). WOMAC PCST Group 18.7 (12.6) and Control 15.3 (13.5) **Secondary Outcome Measure:** Secondary outcomes were: WOMAC pain subscale,[1] (score range 0 [no pain] to 20 [maximum pain]); global change (1) overall, and in (2) pain, and (3) physical function using 7-point Likert scales (“much worse” to “much better”) measured at weeks 8, 24, and 52; health-related quality-of-life using the Assessment of Quality of Life instrument (AQoLv2, scores from 20.04 [lowest quality] to 1.00 [highest quality][21]); self-efficacy for pain and function using the Arthritis Self-Efficacy Scale (range 1-10, higher scores indicate greater self-efficacy); frequency of use of	

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			pain coping skills using Coping Attempts Scale of the Coping Strategies Questionnaire (range 0-163, higher scores indicate more frequent use); Pain Catastrophizing Scale (range 0-52, higher scores indicate greater levels); psychological health using the Depression, Anxiety, and Stress Scale (DASS-21) (range 0-42, higher scores indicate higher levels); and Physical Activity Scale for the Elderly (range 0 to .400, higher scores indicate greater levels). **Secondary Results for Outcome Measure:** Overall pain and WOMAC pain were better in the control group at 52 weeks. Pain: PCST Group 3.2 (2.3) and Control 2.7 (2.3). WOMAC PCST Group 5.6 (3.5) and Control 4.8 (3.8)	
Beselga et al. 2016 Immediate effects of hip mobilization with movement in patients with hip osteoarthritis: A randomised controlled trial *Man Ther* doi:10.1016/j.math.2015.10.007 PMID: S1356689X15001976 **Study Setting:** Outcome measures were evaluated by a blinded examiner in all subjects prior-to and 5 min after the intervention. **Inclusion Criteria:** The inclusion criteria were: aged over 65 years, and clinical criteria of OA of the hip, established by the American College of Rheumatology	**Initial LOE Based on Study Design:** I **Quality Rating:** High: A double blind randomized placebo controlled trial was conducted, 100% follow-up. Low risk of bias **Final Level of Evidence:** High	**Sample Size:** Total N = 40 MWM group: N = 20 Sham (placebo) group: N = 20 Reference table 1 **Age Description:** MWM group: 78.3 ± 6.1 years Sham (placebo) group male/female: 77.5 ± 6.9 years **Sex Distribution:** MWM group: male/female: 6/14 Sham (placebo) group male/female: 8/12 **Conditions:** Hip OA	**% Follow up:** 100% follow-up **Primary Outcome Measure:** The Numeric Rating Pain Scale (NRPS) was used to measure resting pain intensity. In the preliminary intra-observer reliability study the ICC value obtained for this measurement was 0.89 (95% CI = 0.63 - 0.97) and MDC 0.83 (95% CI = 0.83 - 2.50). **Primary Results for Outcome Measure:** NPRS (0 - 10) Between-group differences in change scores: SMD of -2.0 (95% CI: - 1.3, - 2.5) Between-group effect sizes: 1.9 Reference Table 2 Note: No P vales were provided for	**Reviewer's Interpretation of Results and Conclusions:** Physical therapists may consider using MWM to improve maximal hip flexion and internal rotation ROM and functional performances immediately following treatment. Reported effect sizes were moderate for maximal hip flexion and small for all other outcomes. The results for all outcomes are limited to an intra-session follow-up, 5 minutes following the MWM intervention.

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Exclusion Criteria: Subjects were excluded from the study if they had received lower extremity surgery in the previous 6 months, rheumatoid arthritis, uncontrolled hypertension, mobility aid during walking, a primary neurogenic disorder, advanced osteoporosis, previous physiotherapy treatment to the hip, or inability to understand the instructions and complete the study assessments			between group differences **Secondary Outcome Measure:** Hip flexion and internal rotation ROM was recorded using a universal goniometer, whose validity has been established. In the preliminary intraobserver reliability study the ICC value obtained for this measurement was 0.99 (95% CI = 0.98 - 0.99), and MDC 1.11 (95% CI = 1.11 - 3.60) for hip flexion and for hip internal rotation the ICC was 0.99 (95% CI = 0.96 - 0.99) and MDC 0.55 (95% CI = 0.55 - 1.94). The Timed Up and Go (TUG) test simulates some functional activities of daily living (sitting to standing, walking, and sitting down). In the preliminary reliability study the ICC value obtained for this measurement was 0.99 (95% CI = 0.95 - 0.99) and MDC 1.11s (95% CI = 1.11 - 3.33). The 30s Chair Stand (CS) test is a valid test that assesses the function and strength of the lower limbs. In our preliminary reliability study the ICC value obtained for this measurement was 0.99 (95%CI = 0.97 - 0.99) and MDC 0.55 repetitions (95%CI = 0.55 - 1.66). The 40 m Self Placed Walk (SPW) test is a valid functional test. In the preliminary reliability study the ICC value obtained for this measurement was 0.99 (95%CI = 0.98 - 0.99) and MDC 1.66s (95%CI = 1.66 - 4.71). **Secondary Results for Outcome Measure:** Hip Flexion (º) Between-group differences in change scores: SMD of 11.0 (95% CI: 13.7, 8.2) Between-group effect sizes: 3.0 Hip Internal Rotation (º)	

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			Between-group differences in change scores: SMD of 4.4 (95% CI: 6.4, 2.4) Between-group effect sizes: 1.4 TUG: Time Up & Go test (seconds) Between-group differences in change scores: SMD of -2.7 (95% CI: -0.8, -4.6) Between-group effect sizes: 1.0 CS: 30 s Chair Stand (repetitions) Between-group differences in change scores: SMD of 2.0 (95% CI: 2.8, 1.1) Between-group effect sizes: 1.7 SPW: 40 m Self Placed Walk; (seconds) Between-group differences in change scores: SMD of -11.2 (95% CI: -6.7, -15.7) Between-group effect sizes: 1.5 Reference Table 2 Note: No P vales were provided for between group differences	
Bieler T, et al. 2017 In hip osteoarthritis, Nordic Walking is superior to strength training and home-based exercise for improving function *Scand J Med Sci Sports* PMID: 123995859 **Study Setting:** Fitness center, park, and home **Inclusion Criteria:** Inclusion criteria were home-dwelling 60+-year old individuals with clinical hip OA according to American College of Rheumatology, who were not on a waiting list for hip replacement	**Initial LOE Based on Study Design:** High **Quality Rating:** High **Final Level of Evidence:** High	**Sample Size:** 152 total cohort, 50 NW, 50 ST, 52 HBE **Age Description:** mean age 70 **Sex Distribution:** 49 males/103 females = 68% female cohort	**% Follow up:** 100% **Primary Outcome Measure:** The 30-second Chair stand test **Primary Results for Outcome Measure:** Based on intention-to-treat-analyses improvements [mean (95% CI)] after intervention in number of chair stands were equal in all three groups at 4 months [ST: 0.9 (0.2–1.6), NW: 1.9 (0.8–3.0), HBE: 1.1 (0.1–2.0)] but greater in the NW group [1.4 (0.02–2.8)] than in the ST group at 12 months.	**Reviewer's Interpretation of Results and Conclusions:** Risk of bias is medium to high. No improvement in pain or patient reported outcome measures, only functional tests showed improvement and the improvements although many statistical significant they were not likely greater the MDC (which was not assessed). More people dropped out of the NW than any other group.

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Exclusion Criteria: Exclusion criteria were as follows: (a) symptomatic OA of the knee or the big toe; (b) other types of arthritis; (c) previous hip or knee replacement; (d) previous hip fracture; (e) comorbidity that prevented exercising; (f) treatment related to hip problems within the last 3 months; (g) inability to use public transportation; and (h) performing regular exercise/sports twice or more weekly.			**Secondary Outcome Measure:** 8 foot UG **Secondary Results for Outcome Measure:** Statistical differences exists: at 2 months mean-0.7 (-1.2 to -0.1) 12 months -0.8 (-1.4 to -0.2) between NW-HBE group; and also at 2 months; mean 0.6 (0.1–1.1)*, 4 months mean 0.5 (0.1–0.9)*, and 12 months mean 0.7 (0.2–1.2) for the ST-NW group.	
Bieler et al. 2018 Exercise induced effects on muscle function and range of motion in patients with hip osteoarthritis *Physiother Res Int* PMID: 127287424 **Study Setting:** clinical **Inclusion Criteria:** 60+-year-old patients with clinical hip OA who were not on a waiting list for hip replacement were included **Exclusion Criteria:** Exclusion criteria were (a) symptomatic OA of the knee or the big toe, (b) other types of arthritis, (c) previous hip or knee replacement, (d) previous hip fracture, (e) co-morbidity that prevented exercising, (f) treatment related to hip problems within the last 3 months, (g) inability to use public transportation, and (h) performing regular exercise/sports twice or more weekly.	**Initial LOE Based on Study Design:** I **Quality Rating:** Acceptable- though high attrition in Nordic walking group (30% at 4 months). Follow-up 2-month assessment Nordic walking 36/50 (28% attrition) Strength training 48/50 home exercises 44/50 4-month assessment Nordic walking 35/50 (30% attrition) Strength training 49/50 home exercises 44/50 12-month assessment Nordic walking 29/50 (42% attrition) Strength training 40/50 home exercises 34/50 **Final Level of Evidence:** II	**Sample Size:** 152 subjects in 3 groups. strength training 50 Nordic walking 50 home exercises 52 **Age Description:** Age (years) strength training 69.6 ± 5.4 Nordic walking 70.0 ± 6.3 home exercises 69.3 ± 6.4 **Sex Distribution:** Sex (male/female) strength training: 16/34 Nordic walking 17/33 home exercise16/36 **Conditions:** hip OA	**% Follow up:** 152 subjects - 128 at 4 month follow up (84%) 2-month assessment Nordic walking (NW) 36/50 (28% attrition) Strength training (ST) 48/50 home exercises (HBE) 44/50 4-month assessment Nordic walking 35/50 (30% attrition) Strength training 49/50 home exercises 44/50 12-month assessment Nordic walking 29/50 (42% attrition) Strength training 40/50 home exercises 34/50 **Primary Outcome Measure:** Maximal isometric hip muscle strength measurements were conducted with a handheld dynamometer (JTech Power Track II commander in 122 patients and Lafayette Manual Muscle Tester Model 01163 in 30 patients). External and internal rotators and flexors were	**Reviewer's Interpretation of Results and Conclusions:** Improvements in functional performance are not necessarily conditional on gains in strength and power or ROM for all patients with hip OA.

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			measured with the patient in seated position with hips and knees flexed at 90°. Abductors and adductors were measured with the patient in supine position and the hips in neutral (Bieler et al, 2014). The lever arm was determined as the measured distance from the transducer or force pad to the joint axis of rotation. Maximal isometric thigh muscle strength measurements were conducted with the Good Strength device (Version 3.14 Bluetooth; Metitur Ltd., Finland) with the patient seated with hips flexed at 90° and knees flexed at 60° (Bieler et al, 2014). Muscle power (force x velocity) measurements were conducted with the Leg Extensor Power Rig (Queen's Medical Centre, Nottingham University, UK) and measured during a single explosive unilateral lower limb extension in the seated position (Bassey & Short, 1990; Bieler et al, 2014). Active hip ROM measurements were conducted with a Myrinmeter (ie, a compass with an inclination needle, Lic Rehab Svetsary, Solna, Sweden). External and internal rotation was measured with the patient seated in a straight-back chair with hips and knees flexed at 90° and stabilization belts across the waist and the ipsilateral thigh distally (Croft, Nahit, Macfarlane, & Silman, 1996). Flexion was measured with the patient in supine position and the hips in neutral and stabilization belts applied across the pelvis and the contra-lateral thigh distally (Croft et al, 1996). The Myrinmeter was placed 5 cm above the lateral malleolus respectively	

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			above the lateral femur condyle. We determined the standard error of the measurement in 37 patients with clinical hip OA to be 3.7° for external rotation, 3.4° for internal rotation, and 4.7° for flexion (unpublished data). **Primary Results for Outcome Measure:** No significant between group differences for Hip strength at 4 months between groups. Flexor 9.4 (1.4–17.3) and adductor strength 7.6 (1.3–13.9) was greater in the NW group over the HBE group at 2 months. **Secondary Outcome Measure:** No significant between-group differences were shown for increases of active hip ROM at 4 months. Within groups there was an increase in internal rotation for all groups from baseline at 4 months - ST 2.1 (0.3–3.9), NW 3.2 (0.7–5.6), HBE 2.5 (0.5-4.6) **Secondary Results for Outcome Measure:** Only the NW group demonstrated sagittal plane ROM changes.	
Bieler T, et al. 2022 Exercise in patients with hip osteoarthritis – effects on muscle and functional performance: A randomized trial *Physiother Theory Pract* doi:10.1080/09593985.2021.1923096 PMID: 160241635 **Study Setting:** Sub-study of an observer-blinded, RCT with three parallel groups (n = 152) investigating the effects of 4 months of	**Initial LOE Based on Study Design:** I **Quality Rating:** acceptable- small sample size 47 out of 152 in larger study **Final Level of Evidence:** II	**Sample Size:** 42 participants analyzed with MRI at 4 months, Original 47, 1 lost in RT, 3 lost in NW, 1 lost in HBE. **Age Description:** Mean age of 67.8 years (range 61–79 years) **Sex Distribution:** 30 women and 12 men	**% Follow up:** 42 of 47 identified participants from baseline as sub-study retained at 4 months (89%). **Primary Outcome Measure:** Muscle mass was determined based on MRI. Both thighs evaluated to determine the cross-sectional area quadriceps muscle (QCSA) at baseline and after the intervention	**Reviewer's Interpretation of Results and Conclusions:** Resistance training appeared effective for improving muscle mass, but less effective for improving muscle strength, power, and functional performance.

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supervised RT, supervised NW and unsupervised HBE on functional performance in older adults with hip OA not awaiting THR (Bieler et al, 2017b). **Inclusion Criteria:** Inclusion criteria were 60+-year-old persons with clinical hip OA of one or both hips, according to the American College of Rheumatology (Altman et al, 1991) who were not on the waiting list for THR. **Exclusion Criteria:** Exclusion criteria included (1) symptomatic knee OA; (2) other types of arthritis; (3) previous hip fracture or THR or total knee replacement (TKR); and (4) regular exercise/sports participation more than once a week.		**Conditions:** Thirty-one had unilateral hip OA (68% females) and 11 had bilateral hip OA (82% females). There were no significant differences between the exercise-groups at baseline except for body mass index (BMI) (Table 1). Participants in the sub-study were on average 2.5 years younger (67.8 ± 4.7 years versus 70.3 ± 6.3 years) compared to those in the main study but otherwise similar.	**Primary Results for Outcome Measure:** Muscle mass increased bilaterally following RT, and the increase was significantly higher for the symptomatic/most symptomatic leg (Table 4); and the RT-group showed significantly greater improvements than the NW-group (mean difference (MD) 2.3 cm2; 95% CI [0.6, 3.9], p = .004) and the HBE-group (MD 2.3 cm2; 95% CI [0.8, 3.9], p = .002). **Secondary Outcome Measure:** Functional performance was assessed with 3 recommended tests. The 30-second chair stand test (30sCS) measured the total number of stands from a straight-back chair (seat height 44.5 cm) completed in 30 seconds with arms crossed against the chest. The timed stair climb test (TSC) measured the total time (best of two trials) to ascend and descend a flight of 10 steps (step height 16.3 cm and step depth 35.8 cm) as fast as possible without using the handrail. The 6-minute walk test (6MWT) measured total walking distance completed in 6 min on a 30-m lane **Secondary Results for Outcome Measure:** Muscle strength and power increased following RT, but no between-group differences were found (Table 4). Within-group improvements following RT included the 30sCS and TSC, and the 30sCS and 6MWT following NW (Table 4). Only between-group differences were greater improvements in NW-group compared with HBE-group for the 30sCS (MD 1.8 repetitions; 95% CI [0.2, 3.3]) and the 6MWT (MD 35.1 m; 95% CI [3.5, 66.7]) (Table 4)	

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Ceballos-Laita L, et al. 2019 Effects of dry needling in HIP muscles in patients with HIP osteoarthritis: A randomized controlled trial *Musculoskelet Sci Pract* doi: 10.1016/j.msksp.2019.07.006 PMID: 31352178 **Study Setting:** Not noted but likely clinical setting either hospital or outpatient clinic **Inclusion Criteria:** The clinical criteria of the American College of Rheumatology, a grade II or III Kellgren & Lawrence (K-L) classification in their most recent hip X-rays, 50–70 years of age and presence of at least one active MTrP in the hip muscles **Exclusion Criteria:** The exclusion criteria were: previous lower limb replacement surgery, neurological, vascular or other lower extremity musculoskeletal conditions that affected sensation, gait or functional performance, previous physiotherapy treatment to the hip in the last 3 months, DN contraindications (local infection, bleeding disorders, immune suppression, or significant fear of needles), previous experience of DN technique to maintain blinding of patients or inability to understand the instructions and complete the study assessments.	**Initial LOE Based on Study Design:** I **Quality Rating:** Medium **Final Level of Evidence:** I	**Sample Size:** 30 (15/15 in each group) ratio **Age Description:** 55.0 mean year old for dry needling (DN) group and 58.6 y/o mean for the Sham group **Sex Distribution:** 17/13 male/female ratio DN group (male/female): 8/7 Sham group (male/female): 9/6 **Conditions:** Unilateral hip OA with ACR clinical diagnosis, a grade II or III KL classification and 50-70 years of age and at least one active MTrP in the hip muscles.	**% Follow up:** 100% **Primary Outcome Measure:** VAS (0–10) pain scale **Primary Results for Outcome Measure:** VAS (0–10) base line to end of Rx, within group changes, ES DN 2.1 ± 1.8 0.4 ± 0.8; 0.003; ES (1.2) Sham 1.3 ± 1.6 2.6 ± 2.5; 0.043; ES (−0.6) **Secondary Outcome Measure:** ROM improvement between DN and Sham groups in degrees: mean (CI, p-value) **Secondary Results for Outcome Measure:** IR: 10.8 (15.4–6.2; 0.001) ER: 10.7 (14.0–5.6; 0.001) Flex: 20.4 (27.7–13.0; 0.001) Abd: 6.7 (7.4–3.6; 0.001) Ext: 14.0 (18.7–9.5; 0.001)	**Reviewer's Interpretation of Results and Conclusions:** Pain, hip ROM, and physical function improved after the application of DN in active MTrPs of the hip muscles in patients with hip OA.
Ceballos-Laita L, et al. 2020 Effects of dry needling on pain, pressure pain threshold and psychological distress in patients with mild to moderate hip	**Initial LOE Based on Study Design:** II **Quality Rating:**	**Sample Size:** 30 (15/15) **Age Description:**	**% Follow up:** 100% **Primary Outcome Measure:**	**Reviewer's Interpretation of Results and Conclusions:** Small sample size limits inferences as does short term Rx and follow-up

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osteoarthritis: Secondary analysis of a randomized controlled trial *Complement Ther Med* doi:10.1016/j.ctim.2020.102443 PMID: 32507443 **Study Setting:** Clinic **Inclusion Criteria:** Criteria for inclusion in this study was as follows: (1) age between 50 and 70 years; (2) unilateral primary hip OA according to the clinical criteria of the American College of Rheumatology; (3) hip OA classified as Kellgren-Lawrence (K-L) grade II-III in anteroposterior X-ray and at least one active MTrPs in the hip muscles. **Exclusion Criteria:** Exclusion criteria included: (1) previous surgery in lower limbs; (2) neurological, vascular or other lower limb musculoskeletal pathology; (3) autoimmune disease (eg, Lyme disease); (4) physiotherapy treatments within the previous three months; (5) MTrP therapy experience, to maintain blinding of patients; (6) DN contraindications such as: local infection, bleeding disorders, immune suppression, or significant fear of needles.	Medium **Final Level of Evidence:** I	55.5 (4.7) for DN group, 58.6 (6.6) for Sham DN group **Sex Distribution:** M/F 8/7 for DN and 9/6 for Sham group **Conditions:** Hip OA with ACR criteria and at least KL II or III grade.	Pain intensity measured with a VAS **Primary Results for Outcome Measure:** DN group showed statistically significant improvements with large effect sizes for pain intensity ($p < 0.001$; E.S: 2.7) compared to sham DN group **Secondary Outcome Measure:** Pressure pain threshold **Secondary Results for Outcome Measure:** DN group showed statistically significant improvements with large effect sizes for pressure pain thresholds ($p < 0.05$; E.S: 1.3-1.8) compared to sham DN group	
Ceballos-Laita L, et al. 2021 Effectiveness of Dry Needling Therapy on Pain, Hip Muscle Strength, and Physical Function in Patients With Hip Osteoarthritis: A Randomized Controlled Trial *Arch Phys Med Rehabil* doi:10.1016/j.apmr.2021.01.077	**Initial LOE Based on Study Design:** I **Quality Rating:** High **Final Level of Evidence:** I	**Sample Size:** 45 hip OA **Age Description:** 57.6 **Sex Distribution:** 20/25 male/female ratio	**% Follow up:** 100% **Primary Outcome Measure:** Pain with VAS **Primary Results for Outcome Measure:** Significant difference between groups (F =	**Reviewer's Interpretation of Results and Conclusions:** A bit skeptical, after 3 DN pain, function, and strength improved that much! Need Two-way analysis of variance and post hoc analysis showed significant Group × Time interactions with improvements supporting DN treatment over the other

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PMID: 33567336 **Study Setting:** clinic setting (implied) **Inclusion Criteria:** Inclusion criteria were unilateral primary hip OA according to the ACR criteria,19 a grade II or III Kellgren & Lawrence classification, age between 50-70 years, and at least 1 active MTrP in the hip muscles. Manual palpation was used for identifying active MTrPs **Exclusion Criteria:** The exclusion criteria were neurologic, vascular, or other lower extremity musculoskeletal conditions that affected sensation, gait, or functional performance; previous surgery in the lower limbs; previous physiotherapy treatment for hip OA in the previous 3 months; MTrP therapy experience (to maintain blinding of patients); and DN contraindications			3.88; p = .028, ES = 1.38) **Secondary Outcome Measure:** WOMAC-PF WOMAC-P **Secondary Results for Outcome Measure:** WOMAC-P ((F(2, 42) = 0.361; p < .001, d = 1.86) WOMAC-PF between group differences (F= 42; p<.001, ES 1.90)	groups for intensity of pain after physical function tests (F(2, 42) = 3.879; p = .028, d = 1.38), WOMAC-Pain (F(2, 42) = 0.361; p < .001, d = 1.86), WOMAC-Physical Function (F(2, 42) = 42; p < .001, d = 1.90), TUG (F(2, 42) = 22.427; p < .001, d = 1.29), and 40-meter self-paced walk test (F(2, 42) = 29.808; p < .001, d = 1.22). The analysis also supported DN treatment over the other groups for increasing muscle strength of the hip flexors (F(2, 42) = 29.917; p = .001, d = 2.54), extensors (F(2, 42) = 10.213; p = .001, d = 1.33), abductors (F(2, 42) = 13.015; p < .001, d = 1.84), internal rotators (F(2, 42) = 40.751; p < .001, d = 1.47), and external rotators (F(2, 42) = 13.283; p < .001, d = 1.42). There were no differences between the sham DN and control groups
Ceballos-Laita, et al. 2022 Comparison of dry needling and self-stretching in muscle extensibility, pain, stiffness, and physical function in hip osteoarthritis: A randomized controlled trial *Complement Ther Clin Pract* doi:10.1016/j.ctcp.2022.101667 PMID: S1744388122001359	**Initial LOE Based on Study Design:** I	**Sample Size:** N = 38, 19 in the two groups **Age Description:** DN group = 53.6 (4.3); Stretching group = 55.0 (4.1) - mean/SD **Sex Distribution:** M/F DN 9/10; Stretch 9/10 (M/F) ratio	**Primary Outcome Measure:** Hip muscle extensibility was the primary outcome and was measured using the Ely test, the modified Ober test and the Active Knee Extension test **Primary Results for Outcome Measure:** DN was more effective than self-stretching for improving hip flexor and abductor muscles extensibility (p < 0.05). DN and self-stretching techniques improved hip extensor muscles extensibility, pain, stiffness, and physical function in patients with hip OA (< 0.05). The DN group showed large effect sizes in all the variables (d >	

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Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
			0.8). **Secondary Outcome Measure:** Pain, stiffness, and physical function were the secondary outcomes measured with the WOMAC questionnaire	
Estébanez-de-Miguel E, et al. 2018 Comparison of high, medium and low mobilization forces for increasing range of motion in patients with hip osteoarthritis: A randomized controlled trial *Musculoskelet Sci Pract* doi:10.1016/j.msksp.2018.05.004 PMID: S2468781218301954 **Study Setting:** not stated **Inclusion Criteria:** Unilateral primary hip OA according to the clinical criteria of the American College of Rheumatology (Altman et al, 1991), a grade III Kellgren & Lawrence (K-L) classification in their most recent hip X-rays, mild to moderate pain from hip OA categorized using the WOMAC pain subscale (1–4 as mild pain; 5 to 6 as moderate pain) (Rydevik et al., 2010), and 50 years of age or older. **Exclusion Criteria:** Exclusion criteria were: previous knee or hip joint replacement surgery of the affected joint, neurological, vascular or other lower extremity musculoskeletal conditions that affected sensation, gait or functional performance, contraindications for manual therapy, inability to complete the assessment or attend to all the	**Initial LOE Based on Study Design:** II **Quality Rating:** High: doubled blind randomized controlled trial, 100% follow-up Recommend downgrade from I to II: NO control group **Final Level of Evidence:** II	**Sample Size:** 60 **Age Description:** 63 ± 9.7 years Low force 61.8 ± 9.6 medium force 66 ± 9.5 high force 61.1 ± 9.5 **Sex Distribution:** 58% male overall low force 12 male/8 female medium force 8 male/12 female high force 15 male/5 female **Conditions:** unilateral primary hip OA according to the clinical criteria of the American College of Rheumatology	**% Follow up:** 100 **Primary Outcome Measure:** hip ROM measured by goniometry **Primary Results for Outcome Measure:** The primary outcome measure, hip ROM, was recorded in all patients prior to and 5min after the LADM. Hip ROM in the three planes of motion was collected according the procedure described by Pua et al (2008). In the preliminary intratester reliability study the ICC value obtained for these measurements were: 0.99 (95% CI=0.98–0.99), and MDC95 2.04° for hip flexion, 0.98 (95% CI=0.95–0.99), and MDC95 1.97° for hip extension, 0.93 (95% CI=0.81–0.97), and MDC95 1.43° for hip abduction, 0.98 (95% CI=0.95–0.99), and MDC95 1.38° for hip adduction, 0.98 (95% CI=0.96–0.99), and MDC95 2.35° for hip external rotation and for hip internal rotation the ICC was 0.98 (95% CI=0.95–0.99), and MDC95 2.22°. **Secondary Outcome Measure:** WOMAC pain subscale -- The secondary outcome, pain, was assessed using the self-administered Western Ontario and McMaster Universities (WOMAC) pain subscale. The 100-mm visual analogue scale (VAS) version was used to evaluate	**Reviewer's Interpretation of Results and Conclusions:** Study results support use of high force joint mobilization for improvement in ROM and pain, immediately following treatment. However, this study lacks long term application. Also, the statistical improvements noted in ROM may not be clinically meaningful.

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
sessions of the study, previous physiotherapy treatment to the hip and insufficient understanding of the Spanish language.			hip pain at baseline and after the last treatment session. **Secondary Results for Outcome Measure:** (low-force group: pre =1.6 ± 0.4, post=1.2 ± 0.4, p = 0.002; high-force group: pre = 1.4 ± 0.4, post = 1.1 ± 0.4, p = 0.03). However, no statistically significant differences (p = 0.45) in hip pain were found between the 3 groups after 3 treatment sessions.	
Estébanez-de-Miguel E, et al. 2019 Comparison of high, medium and low mobilization forces for reducing pain and improving physical function in patients with hip osteoarthritis: Secondary analysis of a randomized controlled trial *Musculoskelet Sci Pract* doi:10.1016/j.msksp.2019.03.007 PMID: S2468781219300141 **Study Setting:** not stated **Inclusion Criteria:** To be eligible, participants were required to be over 50 years of age, with unilateral primary hip OA according to the clinical criteria of the American College of Rheumatology (Altman et al, 1991), a grade III Kellgren & Lawrence (K-L) classification in their most recent hip X-rays and a score range of 1–6 in WOMAC pain subscale. **Exclusion Criteria:** Patients were excluded if they reported any neurological, vascular or other lower extremity musculoskeletal conditions that affected sensation, gait or functional	**Initial LOE Based on Study Design:** 1, PT blinded to measurements **Quality Rating:** Recommend downgrade from level I to level II: No control group. **Final Level of Evidence:** II	**Sample Size:** 60 divided into 3 groups of 20 in low, medium and high force groups **Age Description:** Sixty patients with hip OA (mean age 63 ± 9.7 years; 35 male) low force 61.8±9.6 medium force 66±9.5 high force 61.1±9.5 **Sex Distribution:** Low force group 12 male/8 female medium force group 8 male/12 female high force group 15 male/female **Conditions:** To be eligible, participants were required to be over 50 years of age, with unilateral primary hip OA according to the clinical criteria of the American College of Rheumatology (Altman et al., 1991), a grade III Kellgren & Lawrence (K-L) classification in their most recent hip X-rays and a score range of 1–6 in WOMAC pain subscale. Patients were excluded if they reported any neurological, vascular or other lower extremity musculoskeletal conditions that affected sensation, gait or	**% Follow up:** 100% **Primary Outcome Measure:** Western Ontario and McMaster Universities physical function subscale (WOMAC-PF) **Primary Results for Outcome Measure:** There were statistically significant improvements in physical function variables. However between the groups either at baseline nor at the end of intervention (p > 0.05). WOMAC-PF (0–68) Low Force baseline 33.2 ± 11.8 End 27.2 ± 12.1 Medium Force baseline 25.6 ± 14.1 End 19.3 ± 11.8 High Force Baseline 26.9 ± 12.0 End 20.9 ± 9.4 Between group p-values: 0.071 Between group effect size: 0.4 **Secondary Outcome Measure:** the Timed Up & Go test (TUG)	**Reviewer's Interpretation of Results and Conclusions:** With low force TUG changed from fall risk to no fall risk VAS for pain improved for all their forces for functional scales, statistical significance may have been achieved but clinical significance may be questionable.

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
performance; previous knee or hip joint replacement surgery of the affected extremity; contraindications for manual therapy; previous physiotherapy treatment to the hip and inability to complete the assessment or attend to all the sessions of the study. Participants were also excluded if they presented an insufficient understanding of the Spanish language.		functional performance; previous knee or hip joint replacement surgery of the affected extremity; contraindications for manual therapy; previous physiotherapy treatment to the hip and inability to complete the assessment or attend to all the sessions of the study. Participants were also excluded if they presented an insufficient understanding of the Spanish language.	**Secondary Results for Outcome Measure:** There were statistically significant improvements in physical function variables TUG test (seconds) Low Force baseline 13.8 ± 6.1 End 11.2 ± 3.23 (from fall risk to not fall risk) Medium Force baseline 11.6 ± 3.6 End 9.9 ± 3.0 High Force Baseline 10.4 ± 2.8 End 8.6 ± 1.61 (low and medium do not reach MDC) Between group p-values: 0.026 Between group effect size: 0.6	
Fukumoto Y, et al. 2017 Effects of High- and Low-Velocity Resistance Training on Gait Kinematics and Kinetics in Individuals with Hip Osteoarthritis: A Randomized Controlled Trial *Am J Phys Med Rehabil* doi:10.1097/phm.0000000000000640 PMID: 27754998 **Study Setting:** home-based resistance-training program **Inclusion Criteria:** Inclusion criteria were ability to live independently and to walk with or without assistive devices. **Exclusion Criteria:** Participants were excluded if they had undergone total hip arthroplasty (THA), if	**Initial LOE Based on Study Design:** 1 **Quality Rating:** randomization, single-blinding, 32/46 = 69.5% follow up **Final Level of Evidence:** II	**Sample Size:** 32 **Age Description:** HV group: mean: 51.9 years (SD: 7.0) LV group: Mean: 53.1 years (SD: 10.2) p = 0.693 **Sex Distribution:** 100% women **Conditions:** diagnosed with unilateral or bilateral hip OA	**% Follow up:** 39/46 84.8% completed 32/46 data used 69% **Primary Outcome Measure:** Gait kinematic/kinetic data were recorded using a Vicon motion system (Vicon Nexus; Vicon Motion Systems Ltd., Oxford, England) with 7 cameras at a sampling rate of 200 Hz. The recording was synchronized with 2 force plates (Kistler Japan Co., Ltd., Tokyo, Japan) at a sampling rate of 1000 Hz to measure the ground reaction force. **Primary Results for Outcome Measure:** Peak joint angle (degrees) Trunk inclination HV Before 3.2 (2.5) HV after 3.1 (1.9) HV Change −0.1 (−1.2 to 1.0) LV Before: 2.8 (2.6) LV After: 2.3 (1.9) Change 95% CI −0.4 (−1.4 to 0.5) Difference between groups 95% CI 0.3	**Reviewer's Interpretation of Results and Conclusions:** The authors concluded no benefit to the intervention therefore no clinical relevance for changes in walking speed or muscle strength.

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
they had a neurological disorder, cardiovascular disease, or knee, ankle, or back symptoms that limited their function, or if they could not walk 6 m without assistive devices. Participants who had received prior physical therapy or other physical activity program were also excluded in order to eliminate the confounding influence of these programs on walking ability.			(−0.5 to 0.7) 0.Effect Size: 18 Pelvic tilting HV Before 15.6 (4.4) HV after 15.3 (4.1) HV Change −0.4 (−2.2 to 1.5) LV Before: 15.1 (4.3) LV After: 13.1 (3.7) Change 95% CI −1.9 (−4.2 to 0.4) Difference between groups 95% CI 1.6 (−1.3 to 4.5) Effect Size: 0.40 Pelvic oblique HV Before 4.2 (3.1) HV after 5.1 (2.4) HV Change 0.9 (−0.3 to 2.2) LV Before: 4.1 (2.2) LV After: 4.6 (2.4) Change 95% CI 0.4 (−1.1 to 1.9) Difference between groups 95% CI 0.5 (−1.4 to 2.4) Effect Size: 0.19 Hip flexion HV Before 33.6 (4.3) HV after 32.0 (5.3) HV Change −1.6 (−4.1 to 1.0) LV Before: 34.3 (4.8) LV After: 31.6 (5.8) Change 95% CI −2.7 (−5.4 to 0.1) Difference between groups 95% CI 1.1 (−2.5 to 4.8) Effect Size: 0.22 Hip extension HV Before 5.0 (6.4) HV after 6.9 (6.8) HV Change 1.9 (−0.4 to 4.2) LV Before: 4.2 (6.6) LV After: 8.6 (5.6) Change 95% CI 4.4a (1.4 to 7.4) Difference between groups 95% CI −2.5 (−6.2 to 1.2) Effect Size: 0.49 Knee flexion at stance HV Before 11.2 (8.7) HV after 11.3 (7.8) HV Change 0.2 (−2.2 to 2.5) LV Before: 13.4 (6.3) LV After: 13.4 (7.1) Change 95% CI 0.0 (−3.0 to 3.0) Difference between groups 95% CI 0.2 (−3.6 to 3.9) Effect Size: 0.03 Knee extension at stance HV Before −2.9 (6.3) HV after −2.2 (5.5) HV Change 0.7	

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
			(−1.7 to 3.1) LV Before: −5.5 (5.2) LV After: −4.8 (5.4) Change 95% CI 0.7 (−2.4 to 3.7) Difference between groups 95% CI 0.0 (−3.8 to 3.8) Effect Size: 0.00 Knee flexion at swing HV Before 51.3 (10.4) HV after 51.5 (7.8) HV Change 0.2 (−3.0 to 3.3) LV Before: 56.2 (6.5) LV After: 52.9 (7.6) Change 95% CI −3.3 (−7.4 to 0.9) Difference between groups 95% CI 3.4 (−1.7 to 8.5) Effect Size: 0.48 Knee extension at swing HV Before 0.9 (6.2) HV after 1.3 (4.2) HV Change 0.4 (−2.4 to 3.2) LV Before: −2.0 (4.6) LV After: −0.7 (5.6) Change 95% CI 1.3 (−1.2 to 3.7) Difference between groups 95% CI −0.9 (−4.4 to 2.7) Effect Size: 0.18 Ankle dorsiflexion HV Before 15.0 (4.3) HV after 14.2 (4.1) HV Change−0.8 (−2.2 to 0.6) LV Before: 15.9 (4.5) LV After: 17.0 (8.6) Change 95% CI 1.0 (−3.4 to 5.5) Difference between groups 95% CI −1.8 (−6.6 to 2.9) Effect Size: 0.28 Ankle plantarflexion HV Before 20.1 (7.2) HV after 20.0 (8.5) HV Change−0.2 (−2.8 to 2.5) LV Before: 18.7 (6.2) LV After: 19.1 (5.8) Change 95% CI 0.5 (−1.8 to 2.8) Difference between groups 95% CI −0.6 (−3.9 to 2.7) Effect Size: 0.14 Peak joint moment (N·m/kg) Hip abduction HV Before 0.76 (0.09) HV after 0.80 (0.09) HV Change 0.04 (−0.004 to 0.08) LV Before: 0.81 (0.15) LV After: 0.80 (0.16) Change 95% CI −0.01 (−0.08 to 0.05) Difference between groups 95% CI	

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
			0.05 (−0.02 to 0.13) Effect Size: 0.51 Hip flexion HV Before 0.70 (0.20) HV after 0.74 (0.22) HV Change: 0.05 (−0.03 to 0.13) LV Before: 0.66 (0.16) LV After: 0.73 (0.18) Change 95% CI 0.07 (−0.03 to 0.16) Difference between groups 95% CI−0.02 (−0.14 to 0.10) Effect Size: 0.13 Hip extension HV Before 0.42 (0.09) HV after 0.48 (0.16) HV Change 0.05 (−0.01 to 0.12) LV Before: 0.52 (0.19) LV After: 0.52 (0.15) Change 95% CI 0.00 (−0.08 to 0.09) Difference between groups 95% CI0.05 (−0.06 to 0.16) Effect Size: 0.34 Knee flexion at stance HV Before 0.17 (0.17) HV after 0.22 (0.19) HV Change 0.05 (−0.04 to 0.14) LV Before: 0.14 (0.14) LV After: 0.20 (0.15) Change 95% CI 0.07 (−0.03 to 0.16) Difference between groups 95% CI−0.02 (−0.14 to 0.11) Effect Size: 0.09 Knee extension at stance HV Before 0.37 (0.31) HV after 0.38 (0.34) HV Change 0.01 (−0.11 to 0.14) LV Before: 0.37 (0.31) LV After: 0.33 (0.26) Change 95% CI 0.00 (−0.11 to 0.12) Difference between groups 95% CI0.01 (−0.15 to 0.17) Effect Size: 0.05 Ankle dorsiflexion HV Before 0.12 (0.09) HV after 0.11 (0.10) HV Change−0.01 (−0.05 to 0.02) LV Before: 0.08 (0.06) LV After: 0.05 (0.10) Change 95% CI −0.03b (−0.05 t o−0.0002) Difference between groups 95% CI0.02 (−0.03 to 0.06) Effect Size: 0.30 Ankle plantarflexion HV Before 1.20 (0.12) HV after 1.25 (0.10) HV Change 0.05 (−0.02 to 0.11) LV Before: 1.27 (0.16) LV After: 1.33 (0.16) Change 95% CI 0.06 (−0.002 to	

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
			0.13) Difference between groups 95% CI−0.02 (−0.11 to 0.07) Effect Size: 0.15 V **Secondary Outcome Measure:** Walking speed and cadence, stride length, joint angles, and internal joint moments were calculated using the Vicon Clinical Manager software. **Secondary Results for Outcome Measure:** Walking speed (m/s) HV Before: 1.19 (0.15) HV after 1.28 (0.16) HV Change 0.09b (0.01 to 0.16) LV Before: 1.23 (0.19) LV After: 1.31 (0.14) Change 95% CI 0.08 (−0.01 to 0.17) Difference between groups 95% CI 0.01 (−0.10 to 0.12) Effect Size: 0.06 Cadence (steps/m) HV Before: 118.7(8.0) HV after 124.6 (10.2) HV Change 5.9b (0.8 to 11.0) LV Before 121.3 (9.5) LV After:123.8 (8.6) Change 95% CI 2.5 (−2.3 to 7.4) Difference between groups 95% CI 3.4 (−3.4 to 10.2) Effect Size:0.36 Stride length (m) HV Before:1.20 (0.10) HV after 1.23 (0.12) HV Change 0.03 (−0.02 to 0.08) LV Before1.21 (0.12) LV After 1.27(0.11) Change 95% CI 0.06b (0.01 to 0.11) Difference between groups 95% CI −0.03 (−0.09 to 0.04) Effect Size: 0.29	
Josipovic P, et al. 2024 Effects of device-performed and manual hip traction and vibration therapy in older adults with symptomatic hip osteoarthritis: A randomized single-blind controlled trial *J Back Musculoskelet Rehabil* doi:10.3233/BMR-230109 PMID: 37781792	**Initial LOE Based on Study Design:** 1 **Quality Rating:** PEDro, 10/11 **Final Level of Evidence:** 1	**Sample Size:** 30 subjects, 10 in each group, but resulted in Machine group 10 Manual group 10 placebo 8; lost 2 due to covid-19 Out of 62 older adult participants with hip OA initially considered for inclusion, 39	**Primary Outcome Measure:** Harris Hip Score **Primary Results for Outcome Measure:** All the ANCOVA models were statistically significant ($p < 0.001$). On all out come measures except FGA and frequency of drug use, the device-performed TVT and manual TVT group were statistically	**Reviewer's Interpretation of Results and Conclusions:** Since the machine treatment improves functional outcomes compared to placebo it is a viable treatment option. It is similar to manual intervention, but is less physically demanding, therefore may be more sustainable for the therapist

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
Study Setting: recruited from PT Center and a nursing home in Lucija (Slovenia) **Inclusion Criteria:** The candidates were men and women aged 65+ years who had (a) diagnosis of symptomatic primary hip OA and confirmed stage with x-ray classification according to Kallgren and Lawrence[22]; (b) antalgic gait and pain in the groin or hip region for more than 3 months; (c) sufficient cognitive ability to follow simple instructions and understand the purpose of the study (Mini Mental Test 25 points)[23]; and (d) ability to stand and walk independently for 10 minutes (functional ambulation category > 3). MD and radiologist in study team confirmed Hip OA diagnosis **Exclusion Criteria:** Participants were excluded if they (a) had hip surgery within past 6 months; (b) were awaiting or planning back or lower-limb surgery in the next 9 months; (c) had current or past (within 3 months) oral or intra-articular corticosteroid use; (d) had systemic arthritic conditions (such as rheumatoid arthritis); (e) had history of hip or knee-joint replacement or osteotomy on the tested leg; (f) osteoporosis; (g) had other previous hip pathology (such as fracture or cancer on the tested leg); (h) other muscular, joint or neurological condition (stroke, sensory ataxia due to polyneuropathy, parkinsonism, frontal gait disorders due to subcortical vascular		were eligible to enter the study, while 23 did not meet the inclusion criteria. Among the eligible participants, 9 refused to participate in the study. Hence, 30 older adult participants with symptomatic primary hip OA were enrolled. After inclusion into the study and completion of baseline measurements, two participants dropped out of the study due to COVID-19 disease (Figure 1). **Age Description:** Avg age 73 Range (66-88) machine group Avg age 71 range (66-80) Manual group avg age 74 range (66-85) placebo group avg age 73 range (66-88) **Sex Distribution:** Total 24 female, 4 male machine group 9 female, 1 male manual group 8 female, 2 male placebo group 7 female, 1 male **Conditions:** Participants were blinded to group allocation Participants were randomly assigned to groups. There were negligible (and statistically insignificant) differences between the groups in terms of gender, stage of hip osteoarthritis, age, BMI, proportion of bilateral hip pain, hard physical work which aggravates condition, average duration of pain, and the use of analgesics.	significantly superior to the placebo group while they did not statistically significantly differ between themselves effect of group $p < 0.001$, ES = 0.46 machine vs placebo; $p < .005$ manual vs placebo; $p < 0.001$ machine vs manual; 0.141 **Secondary Outcome Measure:** Visual Analogue Scale for pain **Secondary Results for Outcome Measure:** effect of group $p < 0.001$, ES = 0.51 machine vs placebo; $p < 0.002$ manual vs placebo; $p < 0.001$ machine vs manual; 0.188	

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
encephalopathy or disorders associated with dementia) causing pain or affecting lower-limb function; (i) had physiotherapy, chiropractic treatment or exercises for the hip or lumbar spine in the past 3 months; (j) had any medical or physical impairment apart from hip osteoarthritis precluding safe participation in exercise or manual therapy (such as uncontrolled hypertension, or morbid obesity); (k) were walking continuously for more than 30 minutes daily or participating in exercise more than twice a week; (l) were unable to understand or comply with the protocol.				
Király M, et al. 2022 Effects of various types of ultrasound therapy in hip osteoarthritis - a double-blind, randomized, controlled, follow-up study *Physiother Theory Pract* doi:10.1080/09593985.2021.1895386 **Study Setting:** The study was conducted at the Department of Rheumatology in Petz Aladár County Teaching Hospital (H-9025 Győr, Híd u.2.) and at the Musculoskeletal Rehabilitation Department in Zsigmondy Vilmos Harkány Spa Hospital (H-7815 Harkány, Zsigmondy sétány 1.). **Inclusion Criteria:** The study subjects were enrolled in the study if they met the following inclusion criteria: (1) Hungarian Caucasian patients over 50 years of age with clinically and radiologically moderate hip OA (Kellgren-Laurence II–III. stage) as defined by ACR (Altman et al, 1991); (2) chronic hip pain for at least 8 weeks prior to the study; (3)	**Initial LOE Based on Study Design:** 1 **Quality Rating:** 11/11 Pedro Scale randomization, blinding, and 69 of 71 patients completed the study (97.18%) **Final Level of Evidence:** 1	**Sample Size:** Altogether 80 patients were screened, and 71 patients were randomized. Five patients did not meet the inclusion criteria and 4 patients did not wish to participate in the study. All randomized patients had proper insurance. The 71 patients were randomized into four groups. Group 1 included conventional therapy (ie, physical exercise, massage, and balneotherapy) and continuous UST; group 2 included conventional therapy and pulsed UST; group 3 included conventional therapy and UST combined with TENS therapy; group 4 included conventional therapy and sham/placebo UST with the device switched off. Group 1: 21 Group 2: 17 Group 3: 15 Group 4: 18 There were no differences among the groups in terms of age, sex ratio and BMI Pain intensity at baseline was similar	**% Follow up:** 69 of 71 patients completed the study (97.18%) **Primary Outcome Measure:** Pain by VAS **Primary Results for Outcome Measure:** By the end of treatment (Visit 2) and by the end of follow-up (Visit 3) the intensity of pain decreased significantly in all 4 groups; there were no significant differences among the groups at any visit VAS pain (resting) means at baseline (Visit 1), at end of week 2 (Visit 2) and week 14 (Visit 3) for the four study groups. Group 1: patients receiving conventional and continuous ultrasound therapy; Group 2: patients receiving conventional and pulsed ultrasound therapy; Group 3: patients receiving conventional and combined ultrasound plus TENS therapy; Group 4: patients receiving conventional and placebo ultrasound therapy. *p1-2 < 0.05;	**Reviewer's Interpretation of Results and Conclusions:** The results indicate that TENS and US provided additional improvement, but since there was no group that tested TENS and conventional treatment (without US) it is difficult to conclude if the additional improvement is from TENS alone or TENS in combination with US and conventional treatment.

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
pain intensity ≥ 50 mm on the Visual Analogue Scale of 100 mm; and (4) no physiotherapy or local injections (ie, no steroids or hyaluronic acid) administered in the region of the hip joints or into the joint itself within 3 months before starting the study. Patients were allowed to take analgesics or anti-rheumatic drugs during the study; these medications were recorded in their documents. **Exclusion Criteria:** Exclusion criteria included: (1) acute or subacute hip pain for less than 8 weeks; (2) local (intraarticular or periarticular) injection (corticosteroid or hyaluronic acid); (3) physiotherapy within 3 months prior to the study; (4) significant laboratory signs of inflammation; and (5) patients with infections, fever, osteomyelitis, severe osteoporosis, pregnancy, untreated hypertension, heart failure, malignancy, epilepsy, pacemaker or an intracardiac device (ICD).		across all 4 groups **Age Description:** Group 1: mean age: 67.95 years ± 7.74 Group 2: mean age: 65.8 years ± 10.45 Group 3: mean age: 65.9 years ± 9.12 Group 4: mean age: 65.7 years ± 8.77 **Sex Distribution:** Group 1: 4 male 17 female Group 2: 4 male 13 female Group 3: 2 male 13 female Group 4: 4 male 14 female	**p1-3 < 0.05. P1 = visit 1 (baseline) P2 = visit 2 (week 2) P3 = visit 3 (week 14) VAS Group 1: Visit 1 (baseline) 64.38 ± 12.45; Visit 2 (week 2) 44.14 ± 23.92 Visit 3 (week 14) 41.76 ± 26.41; p 1-2 < 0.001; p 1-3 0.001 p 2-3 0.823 Group 2: Visit 1 (baseline) 63.88 ± 14.47 ; Visit 2 (week 2) 37.71 ± 22.96 Visit 3 (week 14) 34.35 ± 30.36; p 1-2 0.001; p 1-3 0.002 p 2-3 0.507 Group 3: Visit 1 (baseline) 61.33 ± 17.78 ; Visit 2 (week 2) 43.07 ± 21.19 Visit 3 (week 14) 31.13 ± 22.26; p 1-2 0.001; p 1-3 0.001 p 2-3 0.099 Group 4: Visit 1 (baseline) 62.94 ± 9.37 ; Visit 2 (week 2) 42.56 ± 20.30 Visit 3 (week 14) 40.22 ± 20.88; p 1-2 <0.001; p 1-3 0.001 p 2-3 0.422 **Secondary Outcome Measure:** Function by WOMAC index (Western Ontario & McMaster Universities Osteoarthritis Visual Analogue 3.0) **Secondary Results for Outcome Measure:** Among other Patient Reported Outcome (PRO) measures, the total score of the three dimensions (pain, stiffness, and physical function) of the WOMAC index increased significantly in each group after the treatment (Visit 2), which was maintained until the 3-month follow-up visit (Visit 3) in groups 2, 3, and 4 (Figure 4). In group 1, the improvement in stiffness	

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
			and physical function compared to baseline was significant at Visit 2 but non-significant at Visit 3. However, pain during movement was significantly less both at visits 2 and 3 vs baseline. In group 2, the WOMAC values increased significantly in all 3 dimensions by both Visit 2 and Visit 3. In group 3, pain during movement and physical function improved significantly only by Visit 3, while stiffness and the total WOMAC score decreased significantly both by visits 2 and 3. In group 4, stiffness, physical function, and the total WOMAC score improved significantly both by visits 2 and 3, however, the decrease of pain during movement was not significant until Visit 3 (Table 3). With respect to WOMAC dimensions, there were no significant differences between any 2 groups at Visit 2 and Visit 3. Baseline pain during movement was significantly higher in group 1 compared to group 4, however, baseline values for stiffness and physical function were not different in the 4 groups. The highest number of patients achieving MCII at week 14 was in the group 3 (73%), but the difference compared to the placebo group was not significant (p = NS). In group 1, only 38% of patients showed MCII, which is less than in the placebo group (Table 2). Out of the 8 domains of SF-36, 6 domains (RP, VT, MH, SF, BP and GH) improved significantly in group 3; 4 domains (RE, VT, BP and GH) in group 4; 3 domains (PF, BP and GH) in group 2; and only one domain (BP) in group 1 by Visit 3. All 4 groups showed significant improvement in the bodily pain domain, and the improvement in the general health domain was significant in 3 groups (Figure	

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
			5 and Tables 3 and 4). Group 1: Visit 1 (baseline) 1314.10 ± 394.54 ; Visit 2 (week 2) 299.57 ± 125.74 Visit 3 (week 14) 309.67 ± 111.23; p 1-2 0.008; p 1-3 0.007 p 2-3 0.104 Group 2: Visit 1 (baseline) 1360.24 ± 384.58 ; Visit 2 (week 2) 328.59 ± 87.94 Visit 3 (week 14) 322.47 ± 133.06; p 1-2 0.003; p 1-3 0.011 p 2-3 0.570 Group 3: Visit 1 (baseline) 1220.33 ± 424.61 ; Visit 2 (week 2) 338.47 ± 87.02 Visit 3 (week 14) 355.40 ± 88.78; p 1-2 0.003; p 1-3 0.015 p 2-3 0.348 Group 4: Visit 1 (baseline) 1211.89 ± 376.26; Visit 2 (week 2) 331.61 ± 10.88 Visit 3 (week 14) 340.78 ± 109.7; p 1-2 0.001; p 1-3 0.025 p 2-3 0.687	
Kovács C, et al. 2016 Effects of sulfur bath on hip osteoarthritis: a randomized, controlled, single-blind, follow-up trial: a pilot study *Int J Biometeorol* doi:10.1007/s00484-016-1158-3 PMID: edssjs.2C163C15 **Study Setting:** Enrollment of outpatients and medical examinations were performed at the Musculoskeletal Rehabilitation Centre in Mezőkövesd, Hungary. Bath treatment was given at the Zsóry Thermal Bath and Spain Mezőkövesd, Hungary. **Inclusion Criteria:** Inclusion criteria included the following: osteoarthritis of the hip based on the ACR criteria (Bierma-Zeinstraet al 1991), adults between 40 and 75 years of age, Kellgren	**Initial LOE Based on Study Design:** 2 **Quality Rating:** 9/11 Pedro **Final Level of Evidence:** 2	**Sample Size:** 44 selected, 41 participated 21 balneotherapy and exercise (22 randomized but 1 refused) 20 exercise only (22 randomized 2 refused) **Age Description:** balneotherapy 59.14 +- 7.55 control 60.66 +- 7.6 **Sex Distribution:** none given **Conditions:** Patients enrolled into the study were randomized by an independent person living in another city by using a computer program and receiving patient data via e-mail. After randomization, an independent person assigned the patients into the appropriate group. Visits were also	**Primary Outcome Measure:** WOMAC Likert 3.1 index -- were completed 3 times during the study: prior to first treatment, at the end of the 3-week treatment course, and 12 weeks later. The WOMAC index is a hip and knee osteoarthritis specific, self-administered questionnaire with 3 dimensions. The total score is the sum of the 3 dimensions. The higher scores indicate more severe impairment (Bellamy et al. 1988; Péntek et al. 1999). **Primary Results for Outcome Measure:** The intention to treat analysis included 20 controls and 21 balneotherapy patients. At 12 weeks, 17 (81%) balneotherapy group patients had Minimal Clinically Important Improvement and 6 (30%) of controls (p = 0.001). Comparing the results of the 2	**Reviewer's Interpretation of Results and Conclusions:** No gender data given so difficult to apply to the entire population. Also researchers not blinded. Statistical evidence supports balneotherapy.

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
Lawrence radiological stages I–III in the joint investigated, at least mild (1 point on the Likert scale) hip pain for a minimum of 5 days a week for at least 3 months. **Exclusion Criteria:** Exclusion criteria were as follows: osteoarthritis of other joint(s) (knee, ankle) in the affected limb, lumbago and sciatica, total hip replacement surgery, any other surgery or previous fracture in the hip joint, subluxation, luxation, rheumatoid arthritis, algodystrophy, fibromyalgia, gout, balneotherapy within the past 6 months, intra-articular corticosteroid treatment of the affected hip joint within 3 months or any other joint within 1 month, hyaluronic acid injection within 6 months, initiation of symptomatic low-acting drugs for osteoarthritis (SYSADOA) within 3 months prior to screening, systemic corticosteroid treatment within 1 month prior to screening, physiotherapy within 1 month ,and balneotherapy within 6 months prior to screening.		performed by an independent investigator. Patients were asked not to tell the investigator which treatment they receive.	groups at the end of treatment, there was a significant difference in the WOMAC stiffness score only, whereas after 12 weeks, the WOMAC pain, stiffness, function, and total scores also showed a significant difference in favor of the balneotherapy group. The difference in MCII at 12 weeks is statistically significant in favour of balneotherapy group (Table 2). Comparing the results of the 2 groups at the end of treatment, there was a significant difference in the WOMAC stiffness score only, whereas after 12 weeks, the WOMAC pain, stiffness, function, and total scores also showed a significant difference. **Secondary Outcome Measure:** EQ-5D quality of life self-administered questionnaire -- were completed 3 times during the study: prior to first treatment, at the end of the 3-week treatment course, and 12 weeks later. EuroQol-5D is a self-administered quality of life questionnaire with 2 parts. The first part consists of questions about 5 quality of life dimensions (EQ-5D index), and the second part is a visual analogue scale (EQ-VAS) on which patients rate their current health-related quality of life state (EuroQol Group 1990). **Secondary Results for Outcome Measure:** After 12 weeks, significant improvement could be detected in the quality of life (EQVAS) (Table 3).	

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
Krauss I, et al. 2020 A 12-week exercise program for patients with hip osteoarthritis has no influence on gait parameters: A secondary analysis of a randomized controlled trial *Gait Posture* doi:10.1016/j.gaitpost.2020.03.001 PMID: 32151918 **Study Setting:** facility and home **Inclusion Criteria:** Inclusion criteria • Age between 18 and 85 years • Osteoarthritis (OA) of one or both hip joint(s) (clinical criteria of the American College of Rheumatology) • The subject gives voluntary consent to study participation after receiving oral and written information about study content and objectives • The subject has the time available to undertake the exercises and attend the measurings • The subject is physically fit for the intervention measure (as ascertained during the examination conducted by the principal investigator). ‘‘Fitness’’ in this setting relates to the physical as well as the psychological condition of the subject. (Subjects will not be excluded if they have one hip endoprosthesis, as long as the contralateral hip is affected by osteoarthritis according to the listed criteria.) • The subject has capacity to consent **Exclusion Criteria:** Exclusion criteria • Unstable anchoring of endoprosthetic hip joint • Hip dislocation	**Initial LOE Based on Study Design:** II **Quality Rating:** Pedro scale 8/11 Randomization, follow up was 185/210, (88%), Blinding of therapists was not possible, subjects in US group were blinded to the fact that the ultrasound was a placebo **Final Level of Evidence:** I	**Sample Size:** Starting: 210 Exercise n = 71 Control n = 69 Placebo US n = 70 At follow up: 185 Exercise n = 64 Control n = 63 Placebo US n = 58 **Age Description:** Exercise 57.8 Control 60.3 Placebo 26.6 **Sex Distribution:** Exercise: 24 women, 40 men Control: 26 women, 37 men Placebo Ultrasound: 22 women, 36 men **Conditions:** randomized subjects in US group were blinded to the fact that the ultrasound was a placebo Treatment allocation to exercise or control was not blinded, as treatment exposure was evident. Assessors and investigators conducting data analysis for secondary outcomes described here were not blinded to treatment allocation	**% Follow up:** 185/210 88% **Primary Outcome Measure:** gait kinematics and spatio-temporal gait characteristics **Primary Results for Outcome Measure:** Baseline measures for gait variables were similar among all experimental groups. Mean baseline values across all groups are outlined in Table 3, as well as the results of group comparisons. Differences between baseline and 12 weeks follow up for each experimental group were not normally distributed in some cases. Only non-parametric statistical tests were applied for these variables, denoted with a superscript K in the last column of Table 3. Mean and median between group differences for joint angles were less than 2° for all variables. No statistically significant between-group effects were detected for any of these variables. Outcome measures related to spatio-temporal gait variables also did not differ significantly between groups.	**Reviewer's Interpretation of Results and Conclusions:** No statistical data to support improvement in data that correlates to fall risk (cadence/walking velocity).

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
after endoprosthetic joint replacement • Further disorders affecting the lower extremities or lower back that require treatment by a physician/therapist and which are not connected to the OA and are currently being treated. • The presence of osteoarthritis in several joints (for example, hip and knee) is NOT an exclusion criterion • Medication or alcohol misuse • Participation in a clinical study in the preceding 4 weeks • Lack of compliance • Acute illness • Use of walking aids • Previous trauma in the hip and pelvis area with accompanying development of secondary osteoarthritis • Known endocrinological causes of hip osteoarthritis • Confirmed metabolic causes of hip osteoarthritis • State after aseptic bone necrosis (Perthes' disease) • Cardiocirculatory disorders or other comorbidities that result in severely restricted everyday physical capacity and that are contraindications to physical exertion (for example, heart failure NYHA III–IV, terminal renal failure stage IV) • Medical exercise therapy, physiotherapy on resistance machines in the preceding 3 months, with a total treatment frequency of more than six units • Systematic group or individual therapy to treat the osteoarthritis (systematic in the sense of a minimum of 1_/week for 30 min or more) in the preceding 3 months • Physical therapy to treat the osteoarthritis (systematic in the sense of regular, prescribed application at least 1_/week) in the preceding 3 months • Newly initiated exercise/movement therapy in the preceding 3 months (sports and movement therapy defined as taking place a minimum				

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
of 1_/week, getting out of breath, minimum duration 30 min) • Corticosteroid injection into the hip joint in the preceding 12 months				
Pawlowska KM, et al. 2020 The impact of mobilization on hip osteoarthritis *J Back Musculoskel Rehabil* doi:10.2322/BRM-181118 PMID: 146011686 **Study Setting:** the Rehabilitation – Cardiological Hospital in Kowanówko (Poland) between April 2014 and February 2015. **Inclusion Criteria:** The inclusion criteria comprised: Age: 55–65; Sex: female; Hip osteoarthrosis identified by a specialist radiology doctor; Hip pain in osteoarthrosis identified during a clinical examination by a doctor, following criteria from the American College of Rheumatology. **Exclusion Criteria:** Not reported.	**Initial LOE Based on Study Design:** II **Quality Rating:** Acceptable: Randomization was performed, no reports of blinding, no true control group. This is a randomized clinical trial versus a control trial. 100% follow-up **Final Level of Evidence:** II	**Sample Size:** N = 57, They were aged between 55–65, with the mean age of 59.7 of both groups. **Age Description:** Experimental (Manual therapy group): 59.9 ± 2.6 years Control group (non-weight bearing exercise group) 59.5 ± 2.7 years **Sex Distribution:** N = 57: males: N = 0, females: N= 57 **Conditions:** Hip osteoarthrosis identified by a specialist radiology doctor; Hip pain in osteoarthrosis identified during a clinical examination by a doctor, following criteria from the American College of Rheumatology.	**% Follow up:** 100% follow-up **Primary Outcome Measure:** Two questionnaires were used to compare treatment efficacy: The Lequesne index of severity of osteoarthritis and The Lower Extremity Functional Scale (LEFS) **Primary Results for Outcome Measure:** Lequesne index of severity of osteoarthritis Mean difference: 3.97 SD: 3.25 P-value: 0.0000 The Lower Extremity Functional Scale (LEFS) Mean difference: 7.21 SD: 7.53 P-value: NO p-value was reported in Table 3 NO confidence intervales were reported with either outcome. **Secondary Outcome Measure:** Before and after the therapy, pain intensity was assessed according to the Visual Analogue Scale (VAS), while the range of hip motion was measured with a plastic goniometer (32 cm) made by echnomex, and the results were recorded using the SFTR method. **Secondary Results for Outcome Measure:**	**Reviewer's Interpretation of Results and Conclusions:** Hip mobilizations increases hip range of motion, decreases pain and improves hip function more than non-weight bearing exercises over the course of 2 weeks. Although there was no p-value provided for the LEFS, the mean difference of 7.21 is a small effect since the MCID is 9 points. The mean difference of 7.21 for the VAS shows a large effect since the MCID ranges from 2-3 points. Even though there were statistically differences with some of the ROM measurements, both active and passive, the mean differences for all groups were under 5°, which is under the inter-rater reliability measure of 5° for using a goniometer. I don't think the ROM results show anything really meaningful to the CPG. There was a statistically significant difference with the Lequesne index. I was not able to find the MCID for the Lequesne index.

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
			VAS (0-10) Mean difference: 7.21 SD: 7.53 P-value: 0.0000 Hip Flexion (degrees) Active ROM Mean difference: 7.77 SD: 7.68 P-value: 0.3411 Passive ROM Mean difference: 7.50 SD: 7.45 P-value: 0.1958 Hip Extension (degrees) Active ROM Mean difference: 2.32 SD: 3.16 P-value: 0.0001 Passive ROM Mean difference: 2.59 SD: 3.16 P-value: 0.0015 Hip Abduction (degrees) Active ROM Mean difference: 3.84 SD: 3.81 P-value: 0.0795 Passive ROM Mean difference: 2.95 SD: 3.79 P-value: 0.0004 Hip Adduction (degrees) Active ROM Mean difference: 1.96 SD: 3.26	

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
			P-value: 0.2810 Passive ROM Mean difference: 1.79 SD: 3.08 P-value: 0.1254 Hip Internal rotation (degrees) Active ROM Mean difference: 2.14 SD: 3.80 P-value: 0.0000 Passive ROM Mean difference: 2.77 SD: 4.04 P-value: 0.0000 Hip External rotation (degrees) Active ROM Mean difference: 2.50 SD: 2.86 P-value: 0.5647 Passive ROM Mean difference: 2.86 SD: 3.14 P-value: 0.9692 NO confidence intervales were reported with any of the outcomes	
Roesel I, et al. 2021 Secondary Analysis of a Study on Exercise Therapy in Hip Osteoarthritis: Follow-Up Data on Pain and Physical Functioning International journal of environmental research and public health doi:10.3390/ijerph18168366 PMID: 34444116 **Inclusion Criteria:** Inclusion criteria	**Initial LOE Based on Study Design:** II **Quality Rating:** Acceptable. No reporting on blinding, greater than 20% of the population did not follow-up by the 6-month follow-up measure. Follow-up measurements were taken at 3 months, 6 months, and 12 months	**Sample Size:** E-C (n = 49) C-E (n = 33) P-E (n = 33) Total N = 115 **Age Description:** E-C: 57 (SD: 10.1) years C-E: 59 (SD: 9.4) years P-E: 56 (SD: 9.2) years	**% Follow up:** 54% follow-up from baseline to 12 months (T12) **Primary Outcome Measure:** In line with the previously published randomized controlled trial for the initial intervention phase between t0 and t3, the primary outcome measure was the bodily pain subscale of the 36-item Short Form (SF-36).	**Reviewer's Interpretation of Results and Conclusions:** The only significant difference between group interventions was for WOMAC stiffness scores for the Exercise-Control group (t3) and the Placebo-Exercise group (t6).

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
- Osteoarthritis (OA) of one or both hip joint(s) - Age between 18 and 85 years - The subject is physically fit for the intervention measure (as ascertained during the examination conducted by the principal investigator). “Fitness” in this setting relates to the physical as well as the psychological condition of the subject. (Subjects will not be excluded if they have one hip endoprosthesis, as long as the contralateral hip is affected by osteoarthritis according to the listed criteria.) - The subject has the time available to undertake the interventions and attend the measurements - The subject voluntarily consents to study participation after receiving oral and written information about study content and objectives **Exclusion Criteria:** Exclusion criteria - Unstable anchoring in case of total hip replacement at the contra-lateral joint, if applying to the subject. - Hip dislocation after total hip replacement at the contra-lateral joint, if applying to the subject. - Further disorders affecting the lower extremities or lower back that require treatment by a physician/therapist and which are not related to OA and are currently being treated. - Previous trauma at the hip or pelvis area with accompanying development of secondary OA. - Known endocrinological causes of hip OA. - Confirmed metabolic causes of hip OA	**Final Level of Evidence:** II	Total N = 115 **Sex Distribution:** E-C: Female/Male: 15 (30.6%) / 34 (69.4%) C-E: Female/Male: 10 (30.3%) / 23 (69.7%) P-E: Female/Male: 14 (42.4%) / 19 (57.6%) Total: Female/Male:39 (33.9%) / 76 (66.1%) **Conditions:** Osteoarthritis (OA) of one or both hip joint(s)	**Primary Results for Outcome Measure:** SF-36 bodily pain Difference C-E and E-C: difference between adjusted means (95% CI): 0.11 (−7.17; 6.96) P-value: 0.977 P-E and E-C difference between adjusted means −3.98 (−11.10; 3.13) P-value: 0.270 **Secondary Outcome Measure:** The Western Ontario McMaster Universities Osteoarthritis Index (pain, function, stiffness) **Secondary Results for Outcome Measure:** WOMAC pain Difference C-E and E-C: difference between adjusted means 3.35 (−2.34; 9.05) P-value: 0.246 P-E and E-C difference between adjusted means 2.07 (−3.65; 7.79) P-value: 0.475 WOMAC function Difference C-E and E-C: difference between adjusted means (95% CI): 2.97 (−1.78; 7.73) P-value: 0.218 P-E and E-C difference between adjusted means 6.41 (1.61; 11.22) P-value: 0.009	

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
- State after aseptic bone necrosis (Perthes' disease). - Presence of OA in several joints (for example, hip and knee) is NOT an exclusion criterion. - Cardiocirculatory disorders or other comorbidities that result in severely restricted everyday physical capacity and that are contraindications to physical exertion (for example, heart failure NYHA III–IV, terminal renal failure stage IV). - Medical exercise therapy, physiotherapy on resistance machines in the preceding 3 months, with a total treatment frequency of more than 6 units. - Systematic group or individual therapy to treat the osteoarthritis (systematic in the sense of a minimum of 1x/week for 30 minutes or more) in the preceding 3 months. - Physical therapy to treat the osteoarthritis (systematic in the sense of regular, prescribed application at least 1x/week) in the preceding 3 months. - Newly initiated exercise/movement therapy in the preceding 3 months (sports and movement therapy defined as taking place a minimum of 1x/week, getting out of breath, minimum duration 30 minutes). - Corticosteroid injection into the hip joint in the preceding 12 months. - Medication or alcohol misuse. - Acute illness. - Use of walking aids. - Participation in a clinical study in the preceding 4 weeks. - Lack of compliance. - Lack of capacity to consent.			WOMAC Stiffness Difference C-E and E-C: difference between adjusted means (95% CI): 5.63 (−2.43; 13.69) P-value: 0.225 P-E and E-C difference between adjusted means 7.05 (−1.08; 15.17) P-value: 0.103	
Rostron Zachary PJ, et al. 2022 Effects of a targeted resistance	**Initial LOE Based on Study Design:** I	**Sample Size:** N=27	**% Follow up:** 100% follow-up, 27 or 27	**Reviewer's Interpretation of Results and Conclusions:**

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
intervention compared to a sham intervention on gluteal muscle hypertrophy, fatty infiltration and strength in people with hip osteoarthritis: analysis of secondary outcomes from a randomised clinical trial *BMC Musculoskeler Disord* doi:10.1186/s12891-022-05907-4 PMID: edssjs.42A0D584 **Study Setting:** Participants were recruited to this embedded study from a single site (Bendigo, Australia) of a larger multi-site double-blinded randomised controlled trial (the GHOst trial – Gluteal exercise for Hip Osteoarthritis), registered 05/07/2017 on the Australian New Zealand Clinical Trials Registry (ACTRN12617000970347). **Inclusion Criteria:** Participants with hip OA (radiologically confirmed unilateral or bilateral hip OA, Grade ≥ 2) were recruited via flyers and online advertising services. After screening for eligibility, participants with mild-to-moderate disability from hip OA were included, as indicated by an Oxford Hip Score (OHS) of 25 to 45, which is a reliable score of patient-reported outcome measures of hip related disability. **Exclusion Criteria:** Participants were excluded if they reported any musculoskeletal or other medical conditions that might be exacerbated by intense exercise or a contraindication to MRI scans. For participants with bilateral hip OA, the affected limb was defined as	**Quality Rating:** High: randomization was utilized, multi-site, double-blind clinical trial, 100% follow up (27 of 27), **Final Level of Evidence:** I	Targeted group: N = 13 Control group: N = 14 **Age Description:** Targeted group (mean, SD): 58.2 ± 10.9 years Control group (mean, SD): 60.1 ± 7.3 years **Sex Distribution:** Targeted group (female, %): 46% Control group (female, %): 50% **Conditions:** Participants with hip OA (radiologically confirmed unilateral or bilateral hip OA, Grade ≥ 2)	**Primary Outcome Measure:** Muscle volume **Primary Results for Outcome Measure:** Change in GMin volume from baseline to post-intervention differed by intervention across both limbs (time x group effect: F1,25 = 5.70, P = 0.025), where GMin volume increased following the targeted intervention in both limbs (pooled MD: 0.06 cm3/kg, 95% CI: 0.01 to 0.11) with moderate effect sizes (affected ES=0.70, contralateral ES = 0.87) Consistent, albeit non-significant patterns were observed with either increases for the targeted group and/or decreases for the sham group across both limbs for all other muscles (time x group effect: F1,25 ≤ 4.05, P ≥ 0.055) with effect sizes as follows: GMed (affected ES = 0.64, contralateral ES=0.47), GMax (affected ES = 0.43, contralateral S = 0.59), TFL (affected ES = 0.94, contralateral ES = 0.40). Although there were no significant changes over time, GMax muscle volume for the affected limb was smaller compared to the contralateral limb across both time points (limb main effect: F1,25 = 15.33, P = 0.001, MD: 0.61 cm3/kg, 95% CI: 0.23 to 0.93). There were no significant differences between limbs for GMin, GMed or TFL. For the affected limb, the increase in GMin volume following the targeted intervention was more pronounced for male participants in contrast to the sham intervention (sex x group effect: F1,23 = 5.32, P < 0.03). Post-hoc analysis indicated	The results of this study showed: (1) an improvement with GMin muscle hypertrophy in both the affected and contralateral limbs: (2) isometric strength in both groups from baseline to 12 weeks for hip external rotation, flexion, extension, abduction and adduction, and (3) Fatty infiltration that did not differ by intervention (time x group effect). Results for improving GMin muscle hypertrophy and improving fatty infiltration (although not significant between groups) likely does not translate into clinical practice. The improvements for isometric muscle strength (although not significant between groups) does translate into clinical practice since the effect sizes ranged from small to large. However, both the targeted and control (sham) groups received exercise and showed improvements in strength over 12 weeks.

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
the most painful hip and the other was designated as the contralateral limb.			an increase in GMin muscle volume for males that were allocated to the targeted gluteal intervention compared to males in the sham intervention with no difference between groups for female participants. No sex differences existed in affected limb for GMed, GMax and TFL muscle volumes in response to the interventions (sex main effect: $F_{1,23} \leq 0.96$, $P \geq 0.34$). **Secondary Outcome Measure:** Fatty infiltration **Secondary Results for Outcome Measure:** The pattern of change from baseline to post-intervention did not differ by intervention (time x group effect: all $P \geq 0.05$) and no significant group or time effects existed for fatty infiltrate in all muscle segments in the affected limb following the targeted intervention. Effect sizes for the difference between baseline and post-intervention observed for all muscles along the entire length of the muscles ranged between ES = 0.32 to 0.47 following the targeted intervention compared to ES = 0.02 to 0.23 for the sham intervention.	
Steinhilber B, et al. 2017 Exercise therapy in patients with hip osteoarthritis: Effect on hip muscle strength and safety aspects of exercise-results of a randomized controlled trial *Mod Rheumatol* doi:10.1080/14397595.2016.1213940 PMID: 27486681 **Study Setting:** The outpatient clinic of the University	**Initial LOE Based on Study Design:** I **Quality Rating:** High: Randomization, Single-blinded (patients) to the treatment applied, follow-up was 93% (201 of 216). Data were analyzed by intention-to-treat with the last observation carried forward. Effect sizes were calculated within the study.	**Sample Size:** A total of 218 hip OA patients (mean age 58.7 years, standard deviation (SD) 10 years; females = 89, males = 129) THu¨Ko: N = 70 CG: N = 68 PUG: N = 70 **Age Description:** THu¨Ko:P (mean (SD)): 58 ± 19 years CG (mean (SD)): 60 ± 9 years	**% Follow up:** follow-up was 93% (201 of 216) **Primary Outcome Measure:** Hip muscle strength (HMS). The Isomed 2000 (D&R GmbH, Hemau, Germany) isokinetic dynamometer was used to measure isometric peak torque for HAB, HAD, HF, and HE. Subjects were placed in a lateral position for HAB/HAD and in a supine position for HF/HE testing. The	**Reviewer's Interpretation of Results and Conclusions:** The Tu¨ bingen exercise therapy approach has shown to have a significant positive effect on hip muscle strength (HMS). Its implementation has shown to be feasible and safe according to the percentage of exercise participation and the absence of sustainable adverse events. There were moderate treatment effects

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
Hospital **Inclusion Criteria:** Inclusion criteria Age between 18 and 85 years Osteoarthritis (OA) of one or both hip joint(s) (clinical criteria of the American College of Rheumatology) The subject gives voluntary consent to study participation after receiving oral and written information about study content and objectives The subject has the time available to undertake the exercises and attend the measurings The subject is physically fit for the intervention measure (as ascertained during the examination conducted by the principal investigator) ''Fitness'' in this setting relates to the physical as well as the psychological condition of the subject. (Subjects will not be excluded if they have one hip endoprosthesis, as long as the contralateral hip is affected by osteoarthritis according to the listed criteria.) The subject has capacity to consent **Exclusion Criteria:** Exclusion criteria Unstable anchoring of endoprosthetic hip joint Hip dislocation after endoprosthetic joint replacement Further disorders affecting the lower extremities or lower back that require treatment by a physician/therapist and which are not connected to the OA and are currently being treated	**Final Level of Evidence:** I	PUG (mean (SD)): 58 ± 10 years **Sex Distribution:** females = 89, males = 129 No other sex distribution information was provided per group. **Conditions:** hip OA patients	angles of the isometric measurements were 0° hip abduction for HAB, 20° hip abduction for HAD, 20° hip flexion for HF, and 40° hip flexion for HE. All measurements (prior and after the intervention period) were conducted at the same time of the day to control for circadian variation in performance. Details regarding standardization and procedures of the applied strength measurements are reported by Steinhilber et al. For each measure of HMS, the mean of both legs was calculated and relativized to subject's body weight (Nm/kg). **Primary Results for Outcome Measure:** Table 2. Isometric hip muscle peak torque between the experimental groups HIP ABDUCTION (Nm/kg) CG Baseline (Mean (SD)): 1.28 (0.36) Post-Intervention (Mean (SD)): 1.28 (0.40) Change (post baseline) (Mean (SD)): 0.00 (0.16) ANCOVA r^2 adj.: 1.30 P-Value: p < 0.0001, (1.26–1.35) PUG Baseline (Mean (SD)): 1.33 (0.38) Post-Intervention (Mean (SD)): 1.33 (0.40) Change (post baseline) (Mean (SD)): 0.00 (0.16) ANCOVA r^2 adj.: 1.31 P-Value: p < 0.0001, (1.27–1.35) THu¨Ko Baseline (Mean (SD)): 1.31 (0.41) Post-Intervention (Mean (SD)): 1.42 (0.44)	(effect sizes ranging from 0.2 to 0.4) of the THu¨Ko group for hip muscle strength compared to the control and placebo groups with a high adherence (90%) to the 12 week exercise program.

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
The presence of osteoarthritis in several joints (for example, hip and knee) is NOT an exclusion criterion Medication or alcohol misuse Participation in a clinical study in the preceding 4 weeks Lack of compliance Acute illness Use of walking aids Previous trauma in the hip and pelvis area with accompanying development of secondary osteoarthritis Known endocrinological causes of hip osteoarthritis Confirmed metabolic causes of hip osteoarthritis State after aseptic bone necrosis (Perthes' disease) Cardiocirculatory disorders or other comorbidities that result in severely restricted everyday physical capacity and that are contraindications to physical exertion (for example, heart failure NYHA III–IV, terminal renal failure stage IV) Medical exercise therapy, physiotherapy on resistance machines in the preceding 3 months, with a total treatment frequency of more than six units Systematic group or individual therapy to treat the osteoarthritis (systematic in the sense of a minimum of 1/week for 30 min or more) in the preceding 3 months Physical therapy to treat the osteoarthritis (systematic in the sense of regular, prescribed application at least 1/week) in the preceding 3 months Newly initiated exercise/movement therapy in the preceding 3 months (sports and movement therapy defined as taking place a minimum of 1/week, getting			Change (post baseline) (Mean (SD)): 0.11 (0.19) ANCOVA r^2 adj.: 1.42 P-Value: p < 0.0001, (1.38–1.46) difference THu¨Ko–CG ANCOVA r^2 adj.: 0.12 Mean (95% CI): (0.05–0.18) P-value: p < 0.001 difference THu¨Ko – PUG ANCOVA r^2 adj.: 0.11 Mean (95% CI): (0.04–0.18) P-value: p < 0.001 difference PUG–CG ANCOVA r^2 adj.: 0.00 Mean (95% CI): (-0.07 – -0.07) P-value: p = 0.996 HIP ADDUCTION (Nm/kg) CG Baseline (Mean (SD)): 1.25 (0.43) Post-Intervention (Mean (SD)): 1.28 (0.46) Change (post baseline) (Mean (SD)): 0.03 (0.20) ANCOVA r^2 adj.: 1.34 P-Value: p < 0.0001, (1.29–1.39) PUG Baseline (Mean (SD)): 1.37 (0.41) Post-Intervention (Mean (SD)): 1.38 (0.42) Change (post baseline) (Mean (SD)): 0.02 (0.22) ANCOVA r^2 adj.: 1.34 P-Value: p < 0.0001, (1.29–1.39) THu¨Ko	

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
out of breath, minimum duration 30 min) Corticosteroid injection into the hip joint in the preceding 12 months			Baseline (Mean (SD)): 1.33 (0.48) Post-Intervention (Mean (SD)): 1.46 (0.49) Change (post baseline) (Mean (SD)): 0.13 (0.22) ANCOVA r^2 adj.: 1.45 P-Value: p < 0.0001, (1.40–1.50) difference THu¨Ko–CG ANCOVA r^2 adj.: 0.11 Mean (95% CI): (0.02–0.19) P-value: p = 0.007 difference THu¨Ko – PUG ANCOVA r^2 adj.: 0.11 Mean (95% CI): (0.03–0.19) P-value: p = 0.006 difference PUG–CG ANCOVA r^2 adj.: -0.00 Mean (95% CI): (-0.09 – -0.08) P-value: p = 0.997 HIP FLEXION (Nm/kg) CG Baseline (Mean (SD)): 1.18 (0.34) Post-Intervention (Mean (SD)): 1.14 (0.34) Change (post baseline) (Mean (SD)): -0.03 (0.16) ANCOVA r^2 adj.: 1.15 P-Value: p < 0.0001, (1.12–1.18) PUG Baseline (Mean (SD)): 1.21 (0.31) Post-Intervention (Mean (SD)): 1.20 (0.32) Change (post baseline) (Mean (SD)): -0.01 (0.13) ANCOVA r^2 adj.: 1.18 P-Value: p < 0.0001, (1.15–1.21)	

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
			THu¨Ko Baseline (Mean (SD)): 1.17 (0.29) Post-Intervention (Mean (SD)): 1.26 (0.33) Change (post baseline) (Mean (SD)): 0.08 (0.14) ANCOVA r^2 adj.: 1.27 P-Value: p < 0.0001, (1.23–1.30) difference THu¨Ko–CG ANCOVA r^2 adj.: 0.12 Mean (95% CI): (0.06–0.17) P-value: p < 0.001 difference THu¨Ko – PUG ANCOVA r^2 adj.: 0.09 Mean (95% CI): (0.03–0.14) P-value: p = 0.002 difference PUG–CG ANCOVA r^2 adj.: 0.03 Mean (95% CI): (-0.03 – -0.09) P-value: p = 0.447 HIP EXTENSION (Nm/kg) CG Baseline (Mean (SD)): 1.68 (0.68) Post-Intervention (Mean (SD)): 1.61 (0.70) Change (post baseline) (Mean (SD)): -0.08 (0.30) ANCOVA r^2 adj.: 1.69 P-Value: p < 0.0001, (1.61–1.76) PUG Baseline (Mean (SD)): 1.87 (0.64) Post-Intervention (Mean (SD)): 1.86 (0.64) Change (post baseline) (Mean (SD)): -0.01 (0.29)	

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
			ANCOVA r^2 adj.: 1.76 P-Value: p < 0.0001, (1.69–1.83) THu¨Ko Baseline (Mean (SD)): 1.74 (0.77) Post-Intervention (Mean (SD)): 1.93 (0.87) Change (post baseline) (Mean (SD)): 0.19 (0.33) ANCOVA r^2 adj.: 1.95 P-Value: p < 0.0001, (1.88–2.03) difference THu¨Ko–CG ANCOVA r^2 adj.: 0.27 Mean (95% CI): (0.14–0.39) P-value: p < 0.001 difference THu¨Ko – PUG ANCOVA r^2 adj.: 0.19 Mean (95% CI): (0.07–0.32) P-value: p = 0.002 difference PUG–CG ANCOVA r^2 adj.: 0.07 Mean (95% CI): (-0.05 – -0.20) P-value: p = 0.339 Table 3. Effect sizes of hip muscle strength between the experimental groups Isometric peak torque measure ES: effect size: 0.1 = small effect, 0.3 = medium effect, 0.5 = large effect. THu¨Ko and CG Hip abduction: 0.3 Hip adduction: 0.2 Hip flexion: 0.4 Hip extension: 0.4 THu¨Ko and PUG	

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
			Hip abduction: 0.3 Hip adduction: 0.3 Hip flexion: 0.3 Hip extension: 0.3 PUG and CG Hip abduction: 0 Hip adduction: 0 Hip flexion: 0.1 Hip extension: 0.1 **Secondary Outcome Measure:** Adherence, dosage and safety of the interventions. **Secondary Results for Outcome Measure:** A total of 64 of 70 subjects completed the ultrasound program with an adherence of 92%. 65 of 70 subjects from the THu¨Ko group completed the exercise program. Adherence (n = 70) to the group sessions was 89% (males 90%, females 89%). According to the exercise logs, adherence to the home-based exercise program was 91% (males 95%, females 88%). Exercise logs further indicated that subjects were able to exercise with the required exercise intensity with low levels of perceived exertion during phase I and higher levels of perceived exertion during phase II and III.	
Svege I, et al. 2016 Long-Term Effect of Exercise Therapy and Patient Education on Impairments and Activity Limitations in People With Hip Osteoarthritis: Secondary Outcome Analysis of a Randomized Clinical Trial *Phys Ther* doi:10.2522/ptj.20140520 PMID: 26678445	**Initial LOE Based on Study Design:** I **Quality Rating:** High: single-blind randomized study, follow-up: 87 of 109 = 80% **Final Level of Evidence:** I	**Sample Size:** N = 109 Exercise Therapy Group (n=55): Control Group (n=54): **Age Description:** Exercise Therapy Group (Mean (SD)): 58.4 (10.0) years Control Group (Mean (SD)): 57.2 (9.8)	**% Follow up:** follow-up: 87 of 109 = 80% **Primary Outcome Measure:** Outcome measures included hip ROM, isokinetic concentric muscle strength of knee and hip flexion and extension. Hip passive ROM in the index joint was measured by use of a half-circle 1-degree	**Reviewer's Interpretation of Results and Conclusions:** In conclusion, exercise therapy in addition to patient education provided no long-term benefits over patient education only for hip ROM, muscle strength, aerobic fitness, and walking capacity, but participants who attended the exercise therapy program reported significantly less

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
Study Setting: university hospital. **Inclusion Criteria:** Inclusion criteria were age of 40 to 80 years, hip pain for 3 months or longer, radiographically verified minimum joint space (in accordance with Danielsson criteria: < 4 mm for people < 70 years old and < 3 mm for people 70 years old), and a Harris Hip Score of 60 to 95 points. In people with bilateral hip OA, the more painful hip was defined as the index joint. **Exclusion Criteria:** Exclusion criteria were total hip replacement (THR) in the index joint, knee pain or knee OA, low back pain, rheumatoid arthritis, osteoporosis, cancer, cardiovascular disease leading to lack of tolerance of exercise, dysfunction in lower extremities, pregnancy, or lack of understanding of Norwegian.		**Sex Distribution:** Exercise Therapy Group (N(%)): Female: 31 (56.4) Control Group (N(%)): Female: 28 (51.9) **Conditions:** people with hip OA	increment plastic goniometer with a movable arm. Isokinetic concentric muscle strength of hip and knee flexion and extension was tested by use of an isokinetic dynamometer (REV9000 [Technogym SpA, Gambettola, Italy] at baseline assessment and 4- and 10-month follow-up assessments; Biodex 6000 [Biodex Medical Systems Inc, Shirley, New York] at 29-month follow-up assessment). **Primary Results for Outcome Measure:** Reference Table 2 Note: Linear mixed model (variance component model) with time and time x group as fixed effects and time as random-effect intercept and slope. P values are for time x group. There were no significant differences for time and group considering 4 month, 10 month, and 29 month for any ROM or isokinetic concentric muscle strength values. **Secondary Outcome Measure:** The Astrand test. Aerobic capacity was assessed by use of the Astrand test, a submaximal bicycle ergometer test. And distance and pain during the Six-Minute Walk Test (6MWT), as assessed with a visual analog scale (VAS). In the 6MWT, participants walked back and forth in a 20-m-long corridor. Participants were instructed to walk as far as possible, without running, over a 6-minute period. The VAS ranging from 0 to 100 mm, with 0 representing no pain and 100 representing extreme pain.	pain during walking at the 10- and 29-month follow-up assessments

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
			Secondary Results for Outcome Measure: Reference Table 2 Note: Linear mixed model (variance component model) with time and time x group as fixed effects and time as random-effect intercept and slope. P values are for time x group. There were no significant differences for time and group considering 4 month, 10 month, and 29 month for Predicted $\dot{V}$O2max (L/min) measured in the Astrand test or the 6 minute walk test distance (meters). For Pain on VAS during 6MWT (0-100 mm) Estimated Mean Difference (95% Confidence Interval) 4 months: -4.4 (-11.3, 2.4) 10 months: -8.5 (-16.1, -0.9) 29 months: -9.3 (-18.1, -0.6) P-value: 0.018	

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
Ceballos-Laita, et al. 2019 Effects of non-pharmacological conservative treatment on pain, range of motion and physical function in patients with mild to moderate hip osteoarthritis. A systematic review *Complement Ther Med*	**Initial LOE Based on Study Design:** I **Quality Rating:** high	**Sample Size:** 12 studies met the inclusion criteria, with 900 subjects **Age Description:** N/A	**% Follow up:** N/A **Primary Outcome Measure:** pain **Primary Results for Outcome Measure:**	**Reviewer's Interpretation of Results and Conclusions:** Manual therapy can help/improve pain, ROM and function in the short term.

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
doi:10.1016/j.ctim.2018.11.021 PMID: S0965229918310793 **Study Setting:** SR many different settings **Inclusion Criteria:** To be included studies had to meet the following inclusion criteria based on the PICOS method: - Population: The population of interest was patients with mild to moderate hip OA without surgical indications, diagnosed with primary OA according to ACR criteria or X-Ray. - Intervention: The interventions of interest were non-pharmacological conservative treatments. - Comparative intervention (Comparison): Comparison interventions of interest included other non-pharmacological conservative treatments, sham techniques, or no intervention. - Outcome(s) of the intervention (Outcome): The studies that measured pain, ROM and/or physical function as primary variables using various methods were selected. - Study design: randomized controlled trials. - Language: studies published into the English, French, or Spanish language were included. **Exclusion Criteria:** Studies were excluded if they: (1) selected patients with secondary hip OA, previous hip surgery, history of congenital/adolescent hip disease; hip pelvic fracture; rheumatoid arthritis,	**Final Level of Evidence:** I	**Sex Distribution:** N/A **Sample Characteristics:** Most studies by PT, but 2 were manual therapy by chiropractors	2 studies showed high quality evidence that MT could relieve pain in the short term **Secondary Outcome Measure:** Function **Secondary Results for Outcome Measure:** High quality of evidence showed that MT could improve function immediately after treatment	

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
ankylosing spondylitis or other rheumatic diseases; or intra-articular hip corticosteroid injection within one month; (2) reported patients with musculoskeletal disorders such as low back pain, neck pain, knee OA or ankle OA; (3) reported patients on waiting list for total hip surgery; (4) used pharmacological or surgical treatment as a primary intervention in any group.				
Geigle PR, et al. 2022 Exercise in the Aquatic Environment for People With Primary Hip Osteoarthritis: A Systematic Review and Meta-analyses *The Journal of Aquatic Physical Therapy* doi:10.1097/pxt.0000000000000012 PMID: 01859447-202205000-00005 **Inclusion Criteria:** Studies were considered eligible for inclusion if they met the following criteria: (1) people with hip OA; (2) adults (older than 18 years); (3) reported aquatic exercise/therapy intervention effects; and (4) outcomes included physical performance or functional performance or health-related QOL. Studies with additional or combined intervention were included if the effect of the aquatic intervention could be separately identified or was considered the main intervention. **Exclusion Criteria:** Articles were excluded on the basis of the following criteria: (1) participants demonstrated other serious comorbid conditions (eg, cancer, fracture in region, rheumatic disease, or neurological disease); (2) aquatic-based exercise was not the main intervention; (3) studies	**Initial LOE Based on Study Design:** I **Quality Rating:** High **Final Level of Evidence:** I	**Sample Size:** 9 publications used in final document 303 total subjects **Age Description:** 68 (+- 9 years) **Sex Distribution:** 76% female (231/303) **Sample Characteristics:** Symptom duration 10.5 +- 10.6 years **Conditions:** people with hip OA	**Primary Outcome Measure:** if LE function, pain, or QOL were intervention outcomes using either objective or self-reported measures. The LE function data included 5 categories: range of motion (ROM), muscle strength, balance, gait, and functional performance outcomes. **Primary Results for Outcome Measure:** LE function (Post-treatment) Postintervention effect on overall outcomes (RCTs and non- RCTs) among the 9 studies appears in Figure 2. A statistically significant increase in LE function levels with intervention existed (P = .00); the SMD was small to moderate (0.29) in magnitude with a low level of heterogeneity (I2 = 0%) (SE = 0.07; 95% CI, 0.18 to 0.43; Z = 2.17), (P = 0.0) Balance: Five RCTs included balance measurements for individuals with hip OA completing a prescribed aquatic exercise program (Figure 3). Four studies demonstrated significant positive balance effect with a combined low moderate SMD of 0.40 (P = .015; variance = 0.001); heterogeneity Q = 7.50).	**Reviewer's Interpretation of Results and Conclusions:** Authors conclusions make sense, but if improvement is not noted by the participant, is the intervention clinically useful (especially with the additional associated costs of maintaining a pool environment)?

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
published more than 15 years ago; (4) published poster or platform presentations were excluded if no available full text; and (5) full text not available in English.			Muscle Performance. Six studies included in the meta analysis (total N = 246) examined the effects of aquatic exercise on muscle strength (Figure 4). Outcomes for strength were positive with an SMD of 0.28 (P = 0.00; SE = 0.08; heterogeneity I2 = 0; 95% CI, 0.12 to 0.44). Range of Motion. Three studies (n = 39) examined ROM or flexibility in patients with hip or knee OA (Figure 5), with SMD equaling 0.50 (P = .00; SE = 0.15; I2 = 0; 95% CI, 0.22 to 0.79). Pain. Five RCTs and 2 cohort studies included pain measurements for individuals with hip OA completing a prescribed aquatic exercise program and demonstrated significant positive pain effect with a moderate SMD of 0.40 (P = .00; SE = 0.12; I2 = 0; 95% CI, 0.11 to 0.57) Gait. Six RCTs and 2 non-RCTs measured changes in gait parameters with low moderate SME of 0.32 (P = 0; SE = 0.90; I2 = 25.3; 95% CI, 0.14 to 0.49) (Figure 7). These measures included the 6-Minute Walk Test (6MWT), an 8-ft Walk Test, a 50-ft Walk Test, and a 10-m Walk Test. Three of the 6RCTs[12,14,15] demonstrated significant positive improvements in gait speed. Rahman et al[16] described a clinically important difference in gait speed, although not statistically significant. Self-reported Function: QOL and Function. Six articles included QOL measurements for individuals with hip OA completing a prescribed aquatic exercise program[11-15] Combined, these studies did not find a	

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
			significant positive QOL effect with a combined low moderate SMD of 0.15 (P = .07; SE = 0.08; I2 = 0; 95% CI, −0.01 to 0.30) Other Self-reported Evidence. In a cohort study with 1-year follow-up, Lin et al[18] found significant improvements in WOMAC physical function scores in the aquatic exercise group (P = .015; ES = 0.45)	
James Khara A, et al. 2021 Reporting of Adverse Events in Randomized Controlled Trials of Therapeutic Exercise for Hip Osteoarthritis: A Systematic Review *Phys Ther* doi:10.1093/ptj/pzab195 **Study Setting:** Various among 14 included studies. **Inclusion Criteria:** The American Physical Therapy Association (APTA) definition of therapeutic exercise[18] was used to conduct a systematic review of randomized controlled trials of therapeutic exercise for managing HOA symptoms. The following search terms for HOA were applied: (hip osteoarthritis OR hip osteoarthritides OR coxarthrosis OR coxarthroses OR ((degenerative joint disease) AND hip)) OR (“osteoarthritis, hip”[Mesh]) OR ((“hip”[Mesh] OR “hip joint”[Mesh]) AND “osteoarthritis”[Mesh]))). This search was combined with the following search terms	**Initial LOE Based on Study Design:** I **Quality Rating:** Acceptable **Final Level of Evidence:** I	**Sample Size:** There were 707 and 436 participants in the exercise intervention and comparison groups, respectively. **Age Description:** Mean age for intervention group was 62.4 years. Mean age for comparison groups were 64.2 years. **Sex Distribution:** Intervention groups were 67% women. Comparison groups were 60% women. **Sample Characteristics:** The majority of studies reported an average body mass index that fell in the “overweight” or “obese” categories. Four studies (26.7%) targeted individuals with end-stage hip OA; otherwise, the disease severity of the sample varied greatly. The median numbers of participants in the therapeutic exercise and comparison arms were 36 (range = 16-70) and 46 (range = 13-65), respectively. **Conditions:** Hip osteoarthritis	**Primary Outcome Measure:** Reporting of Adverse Events (AEs) and Dropouts (DOs). **Primary Results for Outcome Measure:** Nine exercisers from 5 studies and 10 comparison participants from 2 studies gave reasons for DOs that were classified as AEs. This reclassification increased the occurrence of nonserious AEs from 2 exercise arms to 8 exercise arms. One exerciser withdrew due to low back pain that was specifically cited as unrelated to the intervention; therefore this was not reclassified as an AE. Therefore, 41 of 707 exercisers (5.8%) and 10 of 436 comparison participants (2.3%) experienced intervention-related AEs	**Reviewer's Interpretation of Results and Conclusions:** Agree with Author's interpretation.

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
to identify therapeutic exercise interventions: ((“exercise”[Mesh] OR “Physical Fitness”[Mesh] OR “Exercise Therapy”[Mesh]) OR (exercise OR exercise therapy OR therapeutic exercise OR dynamic OR static OR aerobic OR anaerobic OR resistance OR resistance training OR strength OR strength training OR physical therapy OR physical activity OR physical activities OR acute OR isometric OR isotonic OR isokinetic)). Lastly, the following search terms related to AEs were applied: (harm∗ OR “risk of harm∗”OR “adverse event∗”OR “safety” OR “risk”). **Exclusion Criteria:** Study was not a RCT Intervention was not therapeutic exercise Intervention was therapeutic exercise plus modalities Intervention was therapeutic exercise plus drug or diet modification Patients did not have hip OA Mixed diagnostic sample Surgical patients Study not in English				
Lim YZ, et al. 2022 Recommendations for weight management in osteoarthritis: A systematic review of clinical practice guidelines *Osteoarthr Cartil Open* doi:10.1016/j.ocarto.2022.100298 PMID: 36474793 **Study Setting:** NA **Inclusion Criteria:** Nine databases (Ovid MEDLINE, Ovid Embase, Cochrane Library, CINAHL Plus,		**Sample Size:** NA **Age Description:** NA **Sex Distribution:** NA **Sample Characteristics:** NA **Conditions:** This review included summaries of	**Primary Outcome Measure:** Recommendations derived from available guidelines.	**Reviewer's Interpretation of Results and Conclusions:** Agree with authors' interpretation of current CPGs in relation to weight loss or weight management recommendations for individuals with hip OA.

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
PsycINFO, Scopus, PEDro, ScienceDirect and Google Scholar) were searched from January 1, 2010 to March 15, 2022 using MeSH terms, Boolean operators and key words to identify guidelines for the non-pharmacological management of osteoarthritis. The following search strategies were used: (i) MEDLINE [Osteoarthritis AND (Guideline* OR Evidence* OR Best* OR Recommend* OR Protocol*) AND (Weight OR BMI OR Overweight OR Obes* OR Body weight OR Body composition OR Weight reduction programs)] and (ii) other databases [(Osteoarthriti* Guideline* OR Osteoarthriti* Protocol OR Osteoarthriti* Evidence OR Osteoarthriti* Recommend* OR Osteoarthriti* Best*) AND (Weight* OR Body Mass Index (BMI) OR BMI OR Overweight OR Obes* OR Waist circumference)]. Searches were limited to English language. Websites of individual international renowned arthritis societies and organisations (Appendix A) and the Guidelines International Network (GIN) International Guidelines Library were browsed to further identify potentially relevant guidelines. **Exclusion Criteria:** Reports excluded if: updated version was available, targeted towards physical therapy management or surgical management, duplicates, non-English publication.		guidelines with recommendations for Knee OA, Hip OA, or other types of OA.		
Moseng T, et al. 2017 The importance of dose in land-based supervised exercise for people with hip osteoarthritis. A systematic review and meta-analysis	**Initial LOE Based on Study Design:** I **Quality Rating:** high	**Sample Size:** The 12 studies included a total of 1202 participants with hip OA. **Age Description:**	**Primary Outcome Measure:** Pain **Secondary Outcome Measure:** Function	**Reviewer's Interpretation of Results and Conclusions:** Agree with authors' conclusion.

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
Osteoarthritis Cartilage doi:10.1016/j.joca.2017.06.004 PMID: S1063458417310506 **Inclusion Criteria:** Published RCTs conducted among people diagnosed with symptomatic hip OA who had not undergone hip OA related surgery were included. The intervention could be any land-based exercise programs including muscular strengthening, flexibility and/or cardiorespiratory exercises. Studies including a mixed sample of people with hip and knee OA were included if the study authors could provide separate data for the hip OA participants. **Exclusion Criteria:** The control intervention could be no treatment or any treatment that was not exercise related. Thus, studies comparing different types of exercise programs were excluded if they failed to have a control group that did not exercise.	**Final Level of Evidence:** I	The mean age was 66 years. **Sex Distribution:** The average proportion of female participants was 63% (range 41 to 74%). **Conditions:** Hip OA	**Secondary Results for Outcome Measure:** Various patient reported outcome scores	
Sampath KK, et al. 2016 The effects of manual therapy or exercise therapy or both in people with hip osteoarthritis: a systematic review and meta-analysis *Clin Rehabil* doi:10.1177/0269215515622670 PMID: 26701903 **Study Setting:** Centre for Health, Activity, and Rehabilitation Research, School of Physiotherapy, University of Otago, New Zealand.	**Initial LOE Based on Study Design:** I **Quality Rating:** High **Final Level of Evidence:** I	**Sample Size:** 6 articles **Conditions:** Hip OA	**% Follow up:** n/a **Primary Outcome Measure:** Outcome measures of interest include pain and physical function, which belong to the core set of outcomes in osteoarthritis. **Primary Results for Outcome Measure:** Exercise therapy with Control For the outcome of pain, there was high quality evidence of significant difference (SMD −0.27, 95% CI−0.5 to−0.04) between exercise therapy and control. This effect size would be considered small to medium.	**Reviewer's Interpretation of Results and Conclusions:** An exercise therapy intervention provides short-term as well as long-term benefits in terms of reduction in pain, and improvement in physical function among people with hip osteoarthritis. The observed magnitude of the treatment effect would be considered small to moderate.

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
Inclusion Criteria: Randomized controlled trials or controlled clinical trials that involved adults with a clinical or radiological diagnosis of hip osteoarthritis (unilateral and/or bilateral), published in English language were included in this review. Studies that examined osteoarthritis in more than one joint were included when the hip specific data could be extracted Studies investigating the efficacy of manual therapy or exercise therapy or both as one of the interventions were included. The comparator (control) group could be an inert group (GP care, usual care, waiting list, patient education, etc). Exercise therapy including aquatic therapy should have been supervised. Manual therapy should have been provided by a licensed manual therapist including physiotherapist, osteopath and chiropractor. **Exclusion Criteria:** Age, gender and severity of illness were not restricted in this review. However, pre and post hip arthroplasty surgery interventions were excluded. Studies that compared 2 different types of exercise programs, compared exercise therapy with manual therapy, and compared exercise therapy of varying intensity/frequency were excluded.			The demonstrated effect size translated to an improvement of pain of 5 points (95% CI 9 to 1) on a 0 to 100 scale compared with a control group. For the outcome of physical function, there was high quality evidence that exercise therapy was better than control (SMD −0.29, 95%CI−0.47to−0.11). This effect size would be considered small to medium. This effect size translated to an improvement of physical function of 8 points (95% CI 12 to 3) on a 0 to 100 scale compared with a control group. There was high quality evidence from 5 studies (502 participants) that exercise therapy was better than control at follow-up for the outcome of pain (SMD −0.24, 95%CI−0.41 to−0.06). This effect size would be considered small to medium. The demonstrated effect size translated to an improvement of pain of 5 points (95% CI 9 to 1) on a 0 to 100 scale compared with a control group. High quality evidence from five studies (514 participants) indicate that exercise therapy was better than control for the outcome of physical function at follow-up (SMD −0.33,95%CI−0.5to−0.15). This effect size would be considered small to medium. This effect size translated to an improvement of physical function of 8 points (95% CI 12 to 4) on a 0 to 100 scale compared with a control group. Manual therapy with control Data were extracted from two studies that compared the effectiveness of manual therapy with control (supplementary Table 2) and provided post treatment effects on	

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
			117 participants with hip osteoarthritis (Figure 3). For the outcome of pain there was low quality evidence that manual therapy was better (SMD −0.71, 95% CI−1.08 to−0.03) compared to control. This effect size would be considered medium to large. For the outcome of physical function, there was a low quality evidence that manual therapy was better (SMD −0.71, 95% CI−1.08 to −0.33) compared to control. This effect size would be considered medium to large. There was a low quality evidence from 2 studies (116 participants) that manual therapy was better (SMD −0.43, 95% CI−0.8 to −0.06) to control at follow-up. This effect size would be considered medium. There was also a low quality evidence from 2 studies (117 participants) that manual therapy was better (SMD-0.47, 95%C I-0.84 to -0.1) compared to control at follow-up. This effect size would be considered medium. Combined Exercise and Manual Therapy with control Data were extracted from two studies (Table 3) (132 participants) that compared the effects of combined treatment with control at post treatment (Figure 4). There was low quality evidence that combined treatment was better than control for pain (SMD-0.43,95%CI- 0.78to-0.08) and physical function (SMD −0.38, 95%CI− 0.73 to −0.04). These effect sizes would be considered small to medium. There was a low quality evidence from 1 study (44 participants) of no difference in effect of combined treatment compared to	

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
			control at follow-up in terms of pain (SMD 0.25, 95% CI- 0.35 to 0.84) and physical function (SMD 0.09, 95%CI -0.5 to 0.68). **Secondary Outcome Measure:** Quality of life was also an outcome measure of interest. **Secondary Results for Outcome Measure:** Exercise therapy with Control Three included studies provided post treatment effects on quality of life on 335 participants with hip osteoarthritis. No significant difference was detected (SMD −0.06, 95%CI−0.27to0.16). Manual therapy with control Quality of life was not reported in either of the manual therapy studies. Combined Exercise and Manual Therapy with control One study (86 participants) 18 reported that combined treatment was not better than control in improving quality of life at post-treatment (SMD −0.17, 95% CI −0.59 to 0.25).	
Shepherd Mark H, et al. 2022 The influence of manual therapy dosing on outcomes in patients with hip osteoarthritis: a systematic review *J Man Manip Ther* doi:10.1080/10669817.2022.2037193 **Study Setting:** ***Recommend down grade in quality adjusted evidence level. This article does not discuss the details of what interventions or sham interventions were	**Initial LOE Based on Study Design:** II **Quality Rating:** Acceptable **Final Level of Evidence:** II	**Sample Size:** Ten studies were included in the final analyses totaling 768 participants **Age Description:** not reported **Sex Distribution:** not reported **Conditions:** hip OA	**% Follow up:** n/a **Primary Outcome Measure:** Pain **Primary Results for Outcome Measure:** All but one study[46] assessed pain using the visual analog scale (VAS) or the Numeric Rating Scale (NRS) (n = 657 participants). For long-axis distraction dosed MT compared to a control, there was	**Reviewer's Interpretation of Results and Conclusions:** While trends of the research show large within-group treatment effects in the short term, there were varied between-group effect sizes associated with pain, function, and quality of life for MT interventions in those with hip OA. Thus, it is difficult to recommend a specific MT dosage for those with hip OA due to the heterogeneity of MT dosage descriptors. This review demonstrates the need for continued research on specific MT dosing parameters

Hip Pain Mobility Deficits - SR				
Study	**Evidence Rating and Critical Appraisal Score**	**Sample Characteristics**	**Outcome Measures**	**Important Results**
done for the control groups. Small, medium, or large effect sizes were reported in the article; however, no numbers from their calculations were provided. Nor were the standard mean differences (SMD) reported as the articles reported " and a standardized mean difference (SMD) for between-group differences " *** For the purpose There were 2 purposes of this review: (1) to identify the association between MT dosing and outcomes for individuals with hip OA, and (2) to categorize and make recommendations for MT dosing based on effect sizes reported in clinical trials. NOTE: The MT dosing was only reported in a qualitative narrative under the heading "Frequency of intervention". Outcomes were often reported with incomplete MT dosing within the article. Example; ". Studies using medium and high-force graded non-thrust long axis distraction mobilization (LADM) for 10 minutes found medium between-group effect sizes for pain when compared to a control.[13,44]" Looking at the references for 13 and 44 (The Estebanez-deMiguel et all references), the frequency and duration is reported as "3 Sessions x Unknown duration. It is also unclear if the control groups also had hip OA or not. **Inclusion Criteria:** Studies were eligible if they (1) were RCTs, (2) used joint-focused MT approaches and included specified MT dosing parameters such as MT type, direction of force, session			moderate certainty evidence (downgraded 1 level due to risk of bias) that LA-HVLAT mobilization with or without graded mobilization had large within-group effect sizes for pain reduction which remained at 3 months[15,45] and 1 year[45]; however, a small between-group effect size was found when compared to inactive ultrasound[15]. Using LA-HVLAT as a standalone intervention was found to produce medium to large within – and between-group effect sizes for pain while walking that remained at 6 months with moderate-certainty.[1] When using graded non-thrust mobilization compared to a control, there was very low certainty evidence (downgraded due to risk of bias, inconsistency and imprecision of results) that graded non-thrust mobilization resulted in medium to large within-group effects for improvements in pain rating, however, between-group effects were small for pain improvement with and without walking (Tables 2 and 3).[14,15,48] Studies using medium and high-force graded non-thrust long axis distraction mobilization (LADM) for 10 minutes found medium between-group effect sizes for pain when compared to a control.[13,44] For MWM compared to a control, there was moderate-certainty evidence (downgraded 1 level due to risk of bias) that MWM produced large within-group improvements in pain intensity with effect sizes ranging from 1.29 to 4.63 (Table 2).[43,47] Between-group effect sizes remained large for pain in MWM studies when compared to a sham with moderate-certainty (Table 3)	as well as providing effect sizes to aid in determining the potential clinical impact MT may have for patients diagnosed with hip OA. NOTE: The authors stated it is difficult to recommend a specific MT dosage, however, comparing dosages was not the purpose of this study. The purpose, "1) to identify the association between MT dosing and outcomes for individuals with hip OA".

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duration, frequency of intervention, number of sessions and duration of care (operational definitions in Table 1), (3) were published between January 2000 to December 2021, and (4) included participants in the studies that met the clinical or radiographic criteria for hip OA established by the American College of Rheumatology. **Exclusion Criteria:** Due to the variability in MT delivery and to ensure sample homogeneity, studies were excluded if they (1) were not published or translated in the English language, (2) had MT parameters that were not well-defined (missing parameters based on frequency, duration, position, force), (3) only included stretching, soft tissue mobilization, massage, or trigger point dry needling, (4) did not include an outcome measure related to pain, function, and/or quality of life, or (5) included participants who were recruited with hip pain but had no stated diagnosis of hip OA.			**Secondary Outcome Measure:** Range of motion **Secondary Results for Outcome Measure:** The effect of MT on ROM was assessed in 7 of the 10 studies (n = 617 participants).[1,13–15,43,45,48] There was high-certainty evidence (upgraded due to large effect and strong association) showing large within and between-group effect sizes for improved ROM in 4 studies using long-axis distraction (both thrust and graded mobilization) and graded mobilization compared to a control.[1,13,43,48] Three studies showed small between-group effect sizes for improved ROM when using LA-HVLAT compared to a control.[14,15,45] Two of the studies with the smallest between-group effects in ROM had the widest spread for duration of treatment (8 sessions over 8 weeks and 10 sessions over 12 weeks).[14,15] For MWM compared to a control, one study found moderate certainty evidence (downgraded due to risk of bias) that MWM has large between-group improvements in ROM compared to a control in the short term.[43,47]	
Teirlinck CH, et al. 2020 Responders to exercise therapy in patients with osteoarthritis of the hip: a systematic review and meta-analysis *Osteoarthritis Cartilage* doi:10.1016/j.joca.2019.02.544 PMID: S1063458419305862 **Study Setting:** n/a **Inclusion Criteria:** Randomized trials were selected if they		**Sample Size:** 14 studies **Conditions:** All studies included patients with symptoms (clinical hip OA with or without signs of radiological OA) and most studies (12 out of 14) used the ACR (American College of Radiology) criteria (clinical and/or radiological) to include patients.	**% Follow up:** Short term (directly after treatment, 12 trials n = 1178) and long term (6–8 months after treatment, 6 trials n = 519) outcomes was performed. **Primary Outcome Measure:** The OMERACT-OARSI set of responder criteria uses pain, function, and patient global assessment to define response to therapy. All studies looked at pain and function. Only 5 studies also measured global assessment.	**Reviewer's Interpretation of Results and Conclusions:** There was moderate quality evidence in the short term (directly after treatment) and high quality evidence in the long term (6–8 months after treatment) that exercise therapy is effective in patients with hip OA, when compared to no or minimal intervention, considering the OMERACT-OARSI responder criteria, although the magnitude of this effect seems relatively small.

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fulfilled the following criteria: patients were >18 years old with clinical and/or radiological hip osteoarthritis, the intervention was an active form of exercise therapy under supervision of a (physical) therapist, the intervention was not part of a multidisciplinary or multimodal program and was evaluated as a standalone intervention, the intervention in the control group was usual care (eg, medication and/or education), and no treatment or waiting list **Exclusion Criteria:** Studies with control interventions as hot packs, transcutaneous electrical nerve stimulations, and ultrasound were excluded.			**Secondary Results for Outcome Measure:** The meta-analysis showed more responders in the exercise group than in the control group, at short term (12 trials, n = 1178) and long term (6 trials, n = 519), see Figure 2. At short term the percentage of responders was 30% in the exercise group and 16% in the control group (RD = 0.14, 95% CI 0.06–0.22, number needed to treat 7.1, 95% CI 4.5–17). At long term the percentage of responders was 26% in the exercise group and 13% in the control group (RD = 0.14, 95% CI 0.07–0.20, number needed to treat 7.1, 95% CI 5.0–14.3). The quality of the evidence for short term outcome was moderate (downgrading because of inconsistency) and high for long term outcome (no downgrading). Global assessment: In this analysis we only included trials that measured patient global assessment, therefore, the number of responders were calculated according to the full set of OMERACT-OARSI criteria. Only 4 studies could be included in the meta-analysis on short term (474 participants in total) and 3 studies for long term (350 participants in total). Risk difference on short term was higher than in the original analysis, although this difference between the 2 analyses was not statistically significant: RD = 0.20 (95% CI 0.12–0.27, number needed to treat 5.0) and quality of evidence was high (no downgrading). On long term, risk difference stayed the same: RD = 0.13 (0.04–0.21, number needed to treat 7.7),	

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			but quality of evidence was moderate because of imprecision (participants < 400)	
Teirlinck Carolien H, et al. 2023 Effect of exercise therapy in patients with hip osteoarthritis: A systematic review and cumulative meta-analysis *Osteoarthritis and Cartilage Open* doi:10.1016/j.ocarto.2023.100338 PMID: S2665913123000055 **Inclusion Criteria:** We selected randomized controlled trials with the following characteristics: (P) adult patients (>18 years old) with clinical and/or radiological hip osteoarthritis, (I) the intervention was an active form of exercise therapy under supervision of a (physical) therapist, the intervention was not part of a multidisciplinary or multimodal program and was evaluated as a standalone intervention, (C) the intervention in the control group was usual care (like medication and/or education), no treatment or waiting list, and (O) outcomes were pain and/or function and were measured at short term (directly after end of treatment) and/or at long term (6–9 months after end of treatment). Data extraction was done by two review authors (CHT, LMvR or APV) independently of each other using a standardized form. Disagreement was solved by consensus. The following data were collected: patient population (radiologic and/or clinical hip OA, OA severity), type of intervention (land-based, water-based, individual or group treatment, duration, and intensity), control group (usual care, education, no treatment), results (means and standard	**Initial LOE Based on Study Design:** I **Quality Rating:** High **Final Level of Evidence:** I	**Sample Size:** N = 18 articles Patient population. Number of patients per group ranged between 5 and 102 patients. In 7 studies, the smallest group included less than 25 patients. In most trials, patients were diagnosed using the ACR criteria for hip OA: clinical (n = 8), radiological (n = 3), clinical and radiological (n = 3), or unclear (n = 1) OA **Age Description:** adult patients (> 18 years old) **Conditions:** clinical and/or radiological hip osteoarthritis	**Primary Outcome Measure:** Main outcomes were pain and function post-treatment Outcomes. Pain was measured with the following instruments: Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC, n = 6), Hip disability and Osteoarthritis Outcome Score (HOOS, n = 4), Visual Analogue Scale (VAS, n = 4), Numeric Rating Scale (NRS, n = 1), Brief Pain Inventory (BPI, n = 1) and Impact of Rheumatic diseases on General Health and Lifestyle (IRGL, n = 1). Function was measured with the following instruments: WOMAC (n = 8), HOOS (n = 4), IRGL (n = 2), Disability Rating Index (DRI, n = 1), Harris Hip Score (n = 1), Health Assessment Questionnaire (HAQ, n = 1) and 6-min walking test (n = 1). More characteristics of the included studies can be found in Table 1. **Primary Results for Outcome Measure:** A funnel plot was created using function post-treatment as outcome, because most studies reported this outcome (15 studies). The funnel plot did not show apparent evidence of publication bias, see figure A in supplement. Post-treatment, 14 studies reported on pain and 15 studies reported on function. We found a clinically worthwhile effect of exercise therapy on pain (SMD -0.38, 95% CI: 0.55 to 0.22) and this effect was already statistically significant in the first study in 1998 (Figure 2). The effect could not be	**Reviewer's Interpretation of Results and Conclusions:** Exercise therapy for patients with hip OA is effective, but the effect is small and not clearly clinically worthwhile. It is unrealistic that by performing more trials we can establish with certainty that the effect will become clearly worthwhile. We therefore recommend future trials to focus on which patients benefit most from exercise therapy and/or what kind of exercise therapy is most effective.

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deviations) on pain and function post-treatment and at 6–9 months after the intervention. Standard errors or 95% confidence intervals (95% CI) were converted to standard deviations. If only change data were presented, these were extracted. If multiple instruments were used to measure pain or function, we used the instrument that was used by most studies in the analysis. If a trial included hip and knee OA patients and no data for hip OA patients separately were given, we contacted the first author to provide us the data for the analysis. Alternatively, data provided in the Cochrane Reviews were used. **Exclusion Criteria:** Studies evaluating interventions as hot packs, transcutaneous electrical nerve stimulation, ultrasound or likewise were excluded.			classified as clearly clinically worthwhile since the 95% CI did cross the threshold of SMD -0.37. Further studies showed that the direction of the effect estimate is consistent and only resulted in a smaller and more precise effect estimate in the cumulative meta-analysis. Overall, exercise therapy showed an unclear clinical worthwhile effect on function post-treatment (SMD -0.31, 95% CI -0.49 to 0.11), which became statistically significant in 2014 (Figure 4). Long-term outcome, 6 and 7 studies respectively, reported on pain and function at 6–9 months after treatment. We found an overall effect on pain in favor of exercise therapy (SMD -0.23, 95% CI: 0.41 to 0.05) (Figure 3), which became statistically significant in 2013. Exercise therapy showed an effect on function (SMD -0.29, 95% CI: 0.45 to 0.12), and this effect became statistically significant in 2010 (Figure 5). Both effect estimates were regarded as unclear clinically worthwhile effects. The quality of evidence was moderate for function post treatment (downgrading for inconsistency) and high for pain post treatment, pain, and function at 6–9 months after treatment (no downgrading).	

Applied Filters: Study summary is Only Primary and Included