Improving function in people with hip-related pain: a systematic review and meta-analysis of physiotherapist-led interventions for hip-related pain

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ABSTRACT

Objective To report the effectiveness of physiotherapist-led interventions in improving pain and function in young and middle-aged adults with hip-related pain.

Design Systematic review and meta-analysis.

Data sources A comprehensive, reproducible search strategy was performed on five databases in May 2019. Reference lists and grey literature were also searched.

Eligibility criteria for selecting studies Population: people aged ≥18 years with hip-related pain (with or without a diagnosis of femoroacetabular impingement syndrome). Intervention(s): physiotherapist-led interventions for hip pain. Comparators: sham treatment, no treatment or other treatment (eg, hip arthroscopic surgery). Outcomes: primary outcomes included patient-reported hip pain and function. Secondary outcomes included physical function measures.

Results 1722 papers were identified. After exclusion criteria were applied, 14 studies were included for analysis. They had varied risk of bias. There were no full-scale placebo-controlled randomised controlled trials (RCTs) of physiotherapist-led treatment. Pooled effects ranged from moderate effects (0.67 (95% CI 0.07 to 1.26)) favouring physiotherapist-led interventions for hip pain. Comparators: sham treatment, no treatment or other treatment (eg, hip arthroscopic surgery). Outcomes: primary outcomes included patient-reported hip pain and function. Secondary outcomes included physical function measures.

Conclusion Physiotherapist-led interventions might improve pain and function in young and middle-aged adults with hip-related pain, however full-scale high-quality RCT studies are required.

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BACKGROUND

Musculoskeletal conditions, such as hip-related pain, are leading causes of pain and disability in the community, and the second largest global contributor to years lived with disability.1 Hip and groin injuries are common in active individuals, for example, accounting for up to 18% of professional male football injuries.2 3 The true prevalence of non-arthritic hip pain in the general population is unknown, however the burden of hip pain is high, with younger adults with hip-related pain reporting poor patient-reported outcome scores for pain, physical activity and quality of life1 4 5 6 at a time of life where work and family commitments are large.

Hip-related pain may be classified into three categories, including femoroacetabular impingement (FAI) syndrome, acetabular dysplasia and other pathology without morphological variants (labral, chondral and ligamentum teres pathology).9 Of these, FAI syndrome is the most commonly diagnosed clinical condition10 and is evident in 49% of people with hip pain.11 Patients with FAI syndrome present with pain, a morphological variant in hip shape on radiographs, with or without intra-articular imaging findings such as labral and/ or chondral pathology,12 and reduced activity and quality of life.13 14

Non-surgical treatment approaches should be the first-line options for musculoskeletal pain conditions (evident from clinical guidelines for osteoarthritis (OA))15 16 and low back pain,17 due to the far greater costs and risks associated with surgery. Establishing the efficacy of non-surgical treatments for hip pain is critical. Physiotherapist-led interventions have the potential to reduce the burden of hip pain, with current evidence guiding physiotherapist-led treatments to target characteristic modifiable physical impairments4 (strength, range of motion, functional task performance, neuromuscular/motor/movement control). At present, the level of evidence supporting the efficacy of physiotherapist-led interventions for hip pain and FAI syndrome is unclear.

Review aim

This systematic review aimed to identify the effectiveness of physiotherapist-led interventions in improving pain and function in young and middle-aged adults who experience hip pain, when compared with sham treatment, no treatment and other treatment. This included non-operative and postoperative patient groups. This review specifically used the participants, interventions, comparators, outcomes (PICO) format.

METHODS

This systematic review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. Literature search criteria and methods were proposed and agreed on by two authors (JK, SC), and were established a priori to minimise selection bias.

Eligibility criteria for selecting studies

Studies were eligible for inclusion if they were reported in English; reported level IV evidence or above; contained human subjects with hip pain; had at least 10 participants in the overall study sample (5 per group in studies with more than one group)
and examined the effectiveness of physiotherapist-led interventions. All quantitative study designs were considered, including randomised controlled trials (RCTs), prospective or retrospective approaches. Studies were excluded if: hip pain was due to hip OA, dysplasia or congenital disorder; greater trochanteric pain syndrome and other conditions that are not related to the hip joint; the study evaluated other therapies that were not physiotherapist-led interventions; the study included populations of children or older adults (aged >50 years) or the study was published as abstract, non-peer-reviewed or was written in a language other than English.

Participants/Population
People aged 18–50 years with hip pain (based on the mean or median age of the study sample), including studies that included a diagnosis of FAI syndrome.

Intervention(s), exposure(s)
Studies reporting physiotherapist-led interventions for hip pain and/or function were included.

Comparator(s)/Control
Studies using sham treatment, no treatment or other treatment (eg, hip arthroscopy surgery) as the comparator/control treatment were included.

Outcomes
Primary outcomes included patient-reported hip pain and function. Secondary outcomes included: hip joint range of motion, hip muscle strength, functional task performance, electromyography (EMG) and motor control, balance and proprioception, biomechanics and gait analysis and other patient-reported outcome measures.

Search strategy
A comprehensive, reproducible search strategy was performed on the following databases from earliest available to 6 November 2017 and was then repeated on 20 May 2019: Medline, CINAHL, Cochrane library, EMBASE and PEDro. Reference lists of included studies were also manually searched for relevant papers. Grey literature, including the Clinical Trials database and the Australia and New Zealand Clinical Trials Registry were searched to identify potential studies that may have been published. Where data were insufficient, authors were contacted and asked to provide missing data. The search terms used PICO format and full search strategy of each database is contained in online supplementary appendix 1. The search strategy was conducted by two reviewers (JK, SC) and used the PICO format, and included:
- **P**=human adults (18–50 years) with hip pain.
- **I**=physiotherapist-led interventions.
- **C**=sham treatment, no treatment, other treatment (eg, surgery).
- **O**=pain, function, other patient-reported outcome measures. Function may include hip joint range of motion, hip muscle strength; measures of functional task performance, EMG, gait analysis.

We also used Web of Science to track the forward and backward citations and reference lists of included studies. The strategy was adapted as appropriate for each database. The full search strategy used is contained in online supplementary appendix 1.

Title, abstract and full-text screening was conducted by two independent reviewers (JK, HH) using Covidence (Veritas Health Innovation, Australia) software. Any disagreements were resolved by a third independent reviewer (KC).

Risk of bias assessment
The Cochrane Collaboration Risk of Bias tool for Clinical Trials was used to appraise risk of bias. Included studies were rated by two independent reviewers (MB, MJS). Any disagreements between reviewers were discussed in a consensus meeting and an independent arbitrator (JK) was employed when consensus could not be met. Agreement between raters was determined using Cohen’s Kappa (κ). If risk of bias was high in >three out of five categories, overall study risk was rated as high, if risk was high in three out of five categories, study risk was moderate and if risk was high in <three out of five categories, overall study risk was rated as low. All studies were included in subsequent analyses, and sensitivity analyses were performed as appropriate.

Data extraction, synthesis and analyses
All potential references were imported into Endnote X7 (Thomson Reuters, Carlsbad, California, USA) and duplicates removed. Data were extracted by two independent reviewers (JK, ABM). Any discrepancies in data extraction were resolved by an independent arbitrator (KC).

Findings were summarised and population characteristics (age, gender, type and description of hip OA, duration of symptoms), and details of outcome measures, length of follow-up and type intervention undertaken were collated. We have reported main findings only for studies where the physiotherapist-led intervention was compared with a comparator/control intervention (RCT design) in order to ensure only higher quality evidence was included.

For studies of RCT design, follow-up scores were compared with the published Patient Acceptable Symptom State (PASS) scores for that outcome (if known) and change scores were compared with the published minimal important change (MIC) score for that outcome (if known). The proportion of people who achieve a PASS from follow-up scores was estimated using previously published methods, incorporating means, SD, sample size and z-scores. Previously published relevant PASS scores include 88 points (Hip Osteoarthritis and disability Outcome Score (HOOS)-pain) and 83 points (HOOS-quality of life (QOL)) 1-year post hip arthroplasty; 58 points (International Hip Outcome Tool (I-HOT)-33) 1–5 years post hip arthroscopy and 98 points (Hip Outcome Score (HOS)-activity of daily living (ADL)) and 94 points (HOS-Sport) 1-year post hip arthroplasty. Previously published MIC scores include 9 points (HOOS-pain), 11 points (HOOS-QOL), 10 points (I-HOT-33) 1–2 years post hip arthroplasty; 15 points (HOS-ADL) 1-year post hip arthroplasty and 28 points (HOS-Sport) 6 months post hip arthroscopy.

Data analyses were conducted by two investigators (AIS and JK). The ‘meta’ package (V.4.9–5), from the R statistical software package (V.3.5.1) was used to calculate relevant effect sizes, produce forest plots and pool data in a meta-analysis where relevant (https://www.r-project.org/). Standardised mean differences (SMD) were calculated for the studies of RCT design, to determine the magnitude of the effect of any interventions within groups or between groups. Where data were deemed statistically and clinically homogenous, meta-analyses were undertaken using a random effects model. In order to undertake SMD calculations in studies where non-normally distributed data were presented, the IQR was calculated. For analysis of outcomes that reported within group (pre-intervention to post-intervention), the
standardised paired difference (SPD) was calculated from the sample size, mean and SD of the difference from pre-intervention to post-intervention time points. An additional requirement for SPD calculation was to account for the within-person correlation (r) between the two time points. If between-limb correlation was not reported, a conservative estimate of r=0.5 was used. Standardised mean/paired difference magnitude was interpreted as: ≥0.8 large effect; 0.5–0.79 moderate effect and 0.2–0.49 weak effect. Where SMDs could not be calculated, study conclusions were presented in tables, and best evidence synthesis was performed. For the best evidence synthesis, evidence was categorised as ‘strong’ if there were multiple high-quality clinical trials or cohort studies; ‘moderate’ if there was either one high-quality clinical trial or cohort study and more than two high-quality case-control studies or pilot clinical trials, or more than three high-quality case-control studies; ‘limited’ if there were either one or two case-control studies or pilot clinical trials, or multiple cross-sectional studies and ‘insufficient’ if there was not more than one cross-sectional study. All data used in calculations of SMDs and SPDs have been shared publicly at Figshare (https://figshare.com/s/d18bcb066f1de48861cf).

RESULTS

Search strategy

The search yielded 1722 titles and abstracts for screening. Sixty-five full texts were screened and 51 were excluded. There were 14 papers in the final analyses. An overview of the study identification process is provided in figure 1. Characteristics of the included studies are presented in table 1. The number of studies excluded along with reasons is provided in online supplementary appendix 2.

Risk of bias

Online supplementary appendix 3 contains the results of risk of bias assessment using the Cochrane Risk of Bias Tool. Agreement between raters occurred on 54 out of 70 items, where κ=0.65, which represents moderate agreement. Following discussion, consensus was obtained for all items. Overall results for the

Figure 1  Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow chart of study inclusion. RCT, randomised controlled trial.

Kemp JL, et al. Br J Sports Med 2020;54:1382–1394. doi:10.1136/bjsports-2019-101690
### Table 1: Summary of included studies

| Study Type | Study Title | Overall Risk Ablation | Inclusion Criteria | Exclusion Criteria | Number of Intervention | Number of Control | Age Mean | Sex (M/F) | BMI Log10 | Intervention Type | Control Type | Other Follow-up | Primary Outcomes | Secondary Outcomes | Included in SMD Calculation? |
|------------|-------------|-----------------------|-------------------|-------------------|-----------------------|-------------------|----------|-----------|-----------|-----------------|---------------|----------------|----------------|-------------------|-----------------------------|
| Pilot RCT  | Efficacy of adding physiotherapy education manual therapy to arthroscopic management of femoroacetabular impingement surgery: a randomized controlled trial | Moderate | Aged >16 years; had history of hip surgery | Hip OA; Tönnis > grade 1; professional athlete; concurrent injury; unable to attend study | 141-6 | 114-3 | 31 (7) | 25 (8) | 12 (3) | 24.6 (22) | 26.2 (22) | 7 PT sessions + 1 preoperative physiotherapy | no therapy allowed | 14 weeks | NA | NA | Y |
| Case series | Physical and functional outcomes following multidisciplinary rehabilitation following orthopaedic surgery: a feasibility study for a cluster randomised controlled trial | High | Men and women with unilateral hip pain, alpha angle > 0° | Not reported | 40 | 40 | 33 (2) | 27/13 | 25.8 (4.5) | 5-hour daily, 3 weeks | Hip ROM and strength, core and trunk muscle function, deep hip stabilizer exercises | NA | 3 weeks | NA | HAGOS subscales | Y |
| Case series | Physiotherapy vs medical therapy for meniscal repair: a single-blind controlled trial | Low | Aged 18–40 years; had history of hip surgery | Hip OA; Tönnis > grade 1; professional athlete; concurrent injury; unable to attend study | 118 | 117 | 33 (7) | 27/13 | 25.8 (4.5) | 5-hour daily, 3 weeks | Hip ROM and strength, core and trunk muscle function, deep hip stabilizer exercises | NA | 3 weeks | NA | HAGOS subscales | Y |
| RCT        | Efficacy of adding physiotherapy education manual therapy to arthroscopic management of femoroacetabular impingement surgery: a randomized controlled trial | Moderate | Aged >16 years; had history of hip surgery | Hip OA; Tönnis > grade 1; professional athlete; concurrent injury; unable to attend study | 141-6 | 114-3 | 31 (7) | 25 (8) | 12 (3) | 24.6 (22) | 26.2 (22) | 7 PT sessions + 1 preoperative physiotherapy | no therapy allowed | 14 weeks | NA | NA | Y |
| Case series | Physiotherapy vs medical therapy for meniscal repair: a single-blind controlled trial | High | Men and women with unilateral hip pain, alpha angle > 0° | Not reported | 40 | 40 | 33 (2) | 27/13 | 25.8 (4.5) | 5-hour daily, 3 weeks | Hip ROM and strength, core and trunk muscle function, deep hip stabilizer exercises | NA | 3 weeks | NA | HAGOS subscales | Y |
| RCT        | Efficacy of adding physiotherapy education manual therapy to arthroscopic management of femoroacetabular impingement surgery: a randomized controlled trial | Moderate | Aged >16 years; had history of hip surgery | Hip OA; Tönnis > grade 1; professional athlete; concurrent injury; unable to attend study | 141-6 | 114-3 | 31 (7) | 25 (8) | 12 (3) | 24.6 (22) | 26.2 (22) | 7 PT sessions + 1 preoperative physiotherapy | no therapy allowed | 14 weeks | NA | NA | Y |
| Case series | Physiotherapy vs medical therapy for meniscal repair: a single-blind controlled trial | High | Men and women with unilateral hip pain, alpha angle > 0° | Not reported | 40 | 40 | 33 (2) | 27/13 | 25.8 (4.5) | 5-hour daily, 3 weeks | Hip ROM and strength, core and trunk muscle function, deep hip stabilizer exercises | NA | 3 weeks | NA | HAGOS subscales | Y |

Continued
| Study                          | Title                                                                 | Study type | Overall risk of bias | Inclusion criteria                                                                 | Exclusion criteria                                                                 | Number (PT/ control) at Baseline | Number (PT/ control) at Follow-up | Age mean (SD) (PT/ control) | BMI mean^2 (SD) (PT/ control) | Intervention type | Control type | Primary end point | Other follow-up | Follow-up | Primary outcomes                                                                 | Secondary outcomes                                                                 | Included in DMD calculation (Y/N) |
|-------------------------------|-----------------------------------------------------------------------|------------|----------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|---------------------------------|---------------------------------|-------------------------------|-----------------------------|---------------------|---------------|-------------------|-------------------------|------------|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|----------------------------------|
| Hunt, et al. 2012             | Clinical outcomes analysis of non-surgical and surgical treatment of patients with clinical indications of prearthritic, intra-articular hip disorders | Case-control | High | Anterior or lateral hip pain; pain on activity; pain associated with mechanical symptoms; pain at rest and on movement; positive anterior hip impingement test, RATER test, log roll or resisted straight leg raise test | Aged ≥50/years (1 year pre-surgical/1 year post surgical), hip OA (≤50% hip grade at ≥ pain ≥30/100) | 272/9 | 272/9 | 3 (15/16/11) | 23/3 | 2/5 | Conservative intervention, patient education, activity modification, directed physical therapy protocol medications | Same as PT plus injection and surgery (patient not satisfied with PT) | 12 months | NA | Numeric pain scale | HHS | VAS |
| Kemp, et al. 2018             | A pilot randomised clinical trial of physiotherapy (standard therapy, no need for arthroscopy) for early hip OA (≤50% hip grade at ≥ pain ≥30/100) | Pilot RCT | Moderate | Aged 18-50/years; ≥4 months hip OA (≤50% hip grade at ≥ pain ≥30/100) | Hip/hand or neck/shoulder/hip/leg pain; surgical complications; planned further surgery in the following 12 months | 107 | 9/6 | 32 (10/11) | 6/4 | 2.63 (5.1) | Surgical intervention; (i) back pain; (ii) hip pain; (iii) knee pain; (iv) shoulder pain; (v) pain of the hand or forearm; (vi) pain of the arm; (vii) pain of the neck; (viii) pain of the shoulder (nine) | Bilateral hernia surgery over 12 weeks, education in the early | 12 months | NA | NA | HOOS | Y |
| Kemp, et al. 2018             | The Physiotherapy for Femoroacetabular Impingement Rehabilitation Study: a pilot randomised controlled trial | Pilot RCT | Low | Aged 18-50/years; ≥6 months, in hip pain (≥30/100), alpha angle ≥50 | Part surgery, significant soft tissue impingement or other disease; physiotherapy within 12 months | 107 | 146 | 37 (8/9) | 5/12 | 2.51 (3.2) | Standardised programme 3×30 min/week 3×30 min supervised gym, 2×HEP (12-week training, 8×30 minutes per session), and 2×gym, 2×week for 6 months | Bilateral hernia surgery over 12 weeks, education in the early | 12 weeks | NA | NA | HOOS | Y |
| Massart, et al. 2019          | Arthroscopic surgery or physical therapy for patients with femoroacetabular impingement systeme | RCT | Low | Military personnel and families, SN and/or lateral hip pain; pain on FABER; no pain on PUBT-FADIR; manual therapy; exercise; education | Hip OA, other concentric hip disease; workers compensation; positive LBP findings; positive HPA; no previous physical therapy within previous 6 months | 40/40 | 332/9 | 31 (7/6) | 21/19 | 2.75 (8.2) | Standardised, supervised PT for 12 weeks, included elements of manual therapy (grip, trunk, manual therapy, education, education | Pragmatic hip arthroscopy surgery, education, limiting lateral decubitus, abdominal compression, abdominal compression | 6 months | 2,12 months | HOOS | Y |
| Palmer, et al. 2019           | Arthroscopic hip surgery compared with physiotherapy and activity modification for the treatment of symptomatic femoroacetabular impingement syndrome: a randomised controlled trial | RCT | Low | Aged 18-40/years, to be referred to secondary or tertiary care. Clinically and radiologically diagnosed FAS (no imaging thresholds used). Instead surgeons will evaluate according to wash morphology. | Physiotherapy in part 1; 2 months, post hip surgery, Hip OA (≤50%), Hip dysplasia (<50/45). | 110/12 | 831/0 | 36 (10/16) | 37/3 | 2.69 (4.8) | Goal based supervised PT up to 12 weeks followed by 5 months. Patient goals supplemented with programme focusing on muscle strength, core stability and movement control. Available at extreme ROM encouraged. | Pragmatic hip arthroscopy surgery, education, limiting lateral decubitus, abdominal compression, abdominal compression | 8 months | NA | HOOS | Y |
| Smoov, et al. 2017            | Does treatment by a specialist physiotherapist produce benefits in young adults with symptoms from femoroacetabular impingement? A pilot project for a randomised controlled trial | Pilot RCT | Moderate | FA diagnosed Surgeon (SN) on X-ray. Aged 18-50/years; groin or lateral hip pain; mechanical symptoms; pain (FABER) | Hip OA (≤50%), Hip dysplasia (<50/45). | 155 | 11/2 | 36/33 | 7/10 | NA | Pragmatic care from a specialist physiotherapist number of sessions allowed. Manual therapy and exercise to address treatment goals. | Routine-care treatment, self-management or exercise previously given | 2 months | NA | NKHS | Y |

Continued
risk of bias assessment are mentioned in table 1. Three studies had a high risk of bias,\textsuperscript{30–32} seven studies had a moderate risk of bias,\textsuperscript{7,33–38} and four studies had a low risk of bias.\textsuperscript{39–41} In the included studies, the overall risk of performance bias (blinding of participants and personnel) and detection bias (blinding of outcome assessors) was high (high in \geq nine studies); the risk of attrition bias (incomplete outcome data) and the risk of selection bias (random sequence generation and allocation concealment) was moderate (high in six to eight studies) and the risk of reporting bias (selective reporting of outcomes) was low (high in \textless six studies).

### Participants

The 14 included studies contained 542 patients (283 men, 259 women) with sample sizes of the physiotherapist-led intervention groups ranging from 8 patients\textsuperscript{38} to 177 patients.\textsuperscript{7} Ten studies were of RCT design. Mean participant age ranged from 27 to 38 years, while the mean body mass index (BMI) ranged from 24.1 to 27.5 kg/m\textsuperscript{2}. Ten studies included participants based on a diagnosis of FAI syndrome.\textsuperscript{8,10,30–32,35–41} with the remaining four studies including subjects based on a diagnosis of hip pain.\textsuperscript{30,32,36,39} Methods used for diagnostic inclusion criteria comprised surgical findings,\textsuperscript{8,28} clinical examination results,\textsuperscript{8,10,14,30–32,35–41} and radiological findings.\textsuperscript{31,35,37,38,40,41} Two studies did not specify how FAI syndrome was diagnosed for inclusion\textsuperscript{31,34} (table 1). One study provided information about level of sports/physical activity,\textsuperscript{31} and no study provided detail about the duration of symptoms.

### Outcomes measured

All included studies used a patient-reported outcome measure (PROM) as the primary outcome measure, but there was large heterogeneity in the PROMs used. The PROMs used included: the IHOT-33, the Copenhagen Hip and Groin Outcome Score (HAGOS), HOOS, the Oxford Hip Score (OHS), the Non-Arthritic Hip Score (NAHS), HOS, the Harris Hip Score (HHS), a pain Visual Analogue Scale (VAS), a Numeric Pain Rating Scale (NPRS), the Hip Sports Activity Scale (HSAS), a Global Rating of Change (GROC) score, the Hospital Anxiety and Depression Scale (HADS), the University of California, Los Angeles (UCLA) activity score, the European Quality of Life-5 Dimensions (EQ-5D) and the 36-item Short Form survey (SF-36) score.

Secondary outcomes measured were mostly measures of physical function, and included: hip muscle strength, trunk muscle strength, standardised hopping tests, measures of performance on a double-leg and single-leg squat, hip range of motion tests, the timed stair climb test and the Y-balance test. The methods used to measure these impairment-based outcomes varied widely between studies. Primary follow-up time points also varied and ranged from 3 weeks\textsuperscript{30} to 2 years.\textsuperscript{8} Most studies undertook a 3-month primary follow-up period (table 1).

### Physiotherapist-led interventions performed

Seven studies included participants who had not undergone hip surgery,\textsuperscript{31,32,35,37–40} while three studies examined physiotherapist-led interventions post hip arthroscopy surgery,\textsuperscript{33,34,36} one study included both postsurgical and non-surgical participants\textsuperscript{39} and three studies compared physiotherapist-led interventions to hip arthroscopic surgery.\textsuperscript{8,42} The duration of physiotherapist-led interventions ranged from 3 weeks\textsuperscript{30} to 5 months.\textsuperscript{30,41}

There was a large variety in the types of physiotherapist-led interventions performed. Nine studies included a strengthening programme,\textsuperscript{7,10,30,34–37,39–41} four studies included stretching/
ROM exercises, eight studies included manual therapy, two studies included cardiovascular and return to sport retraining, two studies included functional retraining and six studies included neuromotor control exercises (table 1). Five studies did not report the interventions in sufficient detail to allow replication of the interventions. The level of evidence was strong, with two high-quality RCTs, and demonstrated considerable variability in within-group change for physical impairments in non-operative patient groups. Nine studies reported the effects of physiotherapist-led interventions on physical impairments on people with hip pain, with SPDs able to be calculated for seven of the nine studies. The level of evidence was limited, with no high-quality, full-scale RCTs included in any of the analyses relating to physical impairments. The impairment measures included hip range of motion, hip muscle strength, depth of squat, balance, trunk endurance, control during single leg squat and hopping performance. Data were not able to be pooled due to heterogeneity between time points and the outcomes measured. The proportion of participants undertaking physiotherapist-led interventions achieving a score greater than the PASS score ranged from 25% to 86%.

Within-group change for physical impairments for physiotherapist-led interventions in non-operative patient groups

Our systematic review evaluated the effectiveness of physiotherapist-led interventions to improve pain and function in young and middle-aged adults experiencing hip-related pain, including those with FAI syndrome. The 14 studies included 7 pilot and 7 RCTs, and demonstrated considerable variability in within-group change for physical impairments, due to heterogeneity between time points and the methods by which outcomes were measured. For hip flexion range of motion, SPDs varied, and ranged from large negative changes (−0.32, 95% CI −0.57 to −0.07) to large improvements (3.85, 95% CI 2.91 to 4.78) following a 6-month intervention comprising targeted trunk strengthening exercise, manual therapy and education. Hip muscle strength was recorded in four studies, with SPDs ranging from weak, non-significant effects (0.09,–0.35 to 0.53) for an 10-week intervention comprising progressive strengthening exercises, to large positive effects (1.08, 95% CI 0.49 to 1.68) following a 3-month intervention comprising stretching and activity modification to large positive change (1.08, 95% CI 0.49 to 1.68) following a 3-month intervention comprising stretching and activity modification following a 6-month intervention consisting of rest, stretching and activity modification to large positive change following a 3-month intervention comprising stretching and activity modification following a 6-month intervention consisting of rest, stretching and activity modification.
Table 2: Summary of results of between-group SMD for primary outcomes of included randomised controlled trials

| Study                                                                 | Titled Journal                                                                 | Baseline M (SD) PT | Baseline M (SD) control | Primary FU M (SD) PT | Primary FU M (SD) control | Other FU M (SD) PT | Other FU M (SD) control | Did primary change score reach MIC? | Proportion of participants with SMD greater than PASS score | PT group change score (primary outcome primary end point) | Control group change score (primary outcome primary end point) | Did primary change score of MIC? | Between-group SMD (95% CI) for primary outcomes (positive favours PT intervention) |
|-----------------------------------------------------------------------|--------------------------------------------------------------------------------|--------------------|-------------------------|---------------------|--------------------------|---------------------|-------------------------|-----------------------------------|---------------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------|--------------------------|--------------------------------------------------------------------------------|
| Grant, et al 2017**                                                  | The Physiotherapy for Femoroacetabular Impingement Rehabilitation Study: a pilot randomised controlled trial | NA/NS 50 (50)     | NA/NS total 30.4 (20)   | NA/NS 60 (20)       | NA/NS total 60 (15)   | NA/NS 48 (20)       | NA/NS total 48 (20)   | No 1/7 (14%)                      | No 1/7 (14%)                                                    | No 1/7 (14%)                                                    | No 1/7 (14%)                                                    | No 1/7 (14%) | 0.54 (0.14 to 0.80)                                                                 |
| Harris, et al 2017                                                   | Movement pattern triggering hip pain in people with chronic hip pain: a feasibility randomised trial | HOOS-Pain 78.2 (12.6) | HOOS-SS 95.1 (3.8)       | HOOS-Pain 79.3 (13.4) | HOOS-SS 95.1 (3.8)    | HOOS-Pain 81.5 (13.2) | HOOS-SS 95.1 (3.8)    | No 1/7 (14%)                      | No 1/7 (14%)                                                    | No 1/7 (14%)                                                    | No 1/7 (14%)                                                    | No 1/7 (14%) | 0.54 (0.14 to 0.80)                                                                 |
| Kemp, et al 2017                                                     | The Physiotherapy for Femoroacetabular Impingement Rehabilitation Study: a pilot randomised controlled trial | HOOS-Pain 76.2 (17.4) | HOOS-SS 95.1 (3.8)       | HOOS-Pain 79.3 (13.4) | HOOS-SS 95.1 (3.8)    | HOOS-Pain 81.5 (13.2) | HOOS-SS 95.1 (3.8)    | No 1/7 (14%)                      | No 1/7 (14%)                                                    | No 1/7 (14%)                                                    | No 1/7 (14%)                                                    | No 1/7 (14%) | 0.54 (0.14 to 0.80)                                                                 |
| 2017                                                                 | Does treatment as a standardised physiotherapy treatment result in improvement in function in young adults with symptoms from femoroacetabular impingement? A pilot project for a randomised controlled trial | NA/NS total 30.4 (20)   | NA/NS total 30.4 (20)   | NA/NS total 60 (20)   | NA/NS total 60 (20)    | NA/NS total 48 (20)   | NA/NS total 48 (20)    | No 1/7 (14%)                      | No 1/7 (14%)                                                    | No 1/7 (14%)                                                    | No 1/7 (14%)                                                    | No 1/7 (14%) | 0.54 (0.14 to 0.80)                                                                 |
| Weight, et al 2016                                                   | Non-operative management of femoroacetabular impingement: a prospective, randomised controlled clinical pilot study | HOS-ADL 73.4 (13.1) | HOS-SS 95.1 (3.8)       | HOS-ADL 73.4 (13.1)  | HOS-SS 95.1 (3.8)     | HOS-ADL 81.1 (20.3)   | HOS-SS 95.1 (3.8)     | No 1/7 (14%)                      | No 1/7 (14%)                                                    | No 1/7 (14%)                                                    | No 1/7 (14%)                                                    | No 1/7 (14%) | 0.54 (0.14 to 0.80)                                                                 |
| 2017                                                                 | Efficacy of adding a physiotherapy rehabilitation programme to arthroscopic management of femoroacetabular impingement syndrome: a randomised controlled trial (UK) | HOOS-QOL 4.8 (5.3) | HOOS-SS 95.1 (3.8)      | HOOS-ADL 73.4 (13.1) | HOS-ADL 81.1 (20.3)   | HOOS-ADL 81.1 (20.3) | HOS-ADL 81.1 (20.3)   | No 1/7 (14%)                      | No 1/7 (14%)                                                    | No 1/7 (14%)                                                    | No 1/7 (14%)                                                    | No 1/7 (14%) | 0.54 (0.14 to 0.80)                                                                 |
| Kemp, et al 2017                                                     | A pilot randomised controlled trial of physiotherapy (manual therapy, exercise and education) for early onset hip osteoarthritis post hip arthroscopy | HOOS-QOL 4.8 (5.3) | HOOS-SS 95.1 (3.8)      | HOOS-ADL 73.4 (13.1) | HOS-ADL 81.1 (20.3)   | HOOS-ADL 81.1 (20.3) | HOS-ADL 81.1 (20.3)   | No 1/7 (14%)                      | No 1/7 (14%)                                                    | No 1/7 (14%)                                                    | No 1/7 (14%)                                                    | No 1/7 (14%) | 0.54 (0.14 to 0.80)                                                                 |
| 2017                                                                 | Hip arthroscopy vs best conservative care for the treatment of femoroacetabular impingement syndrome (UK): a randomised controlled trial | HOOS-QOL 4.8 (5.3) | HOOS-SS 95.1 (3.8)      | HOOS-ADL 73.4 (13.1) | HOS-ADL 81.1 (20.3)   | HOOS-ADL 81.1 (20.3) | HOS-ADL 81.1 (20.3)   | No 1/7 (14%)                      | No 1/7 (14%)                                                    | No 1/7 (14%)                                                    | No 1/7 (14%)                                                    | No 1/7 (14%) | 0.54 (0.14 to 0.80)                                                                 |
| Mansell, et al 2018                                                  | Arthroscopic surgery or physical therapy for patients with femoroacetabular impingement syndrome | HOOS-QOL 4.8 (5.3) | HOOS-SS 95.1 (3.8)      | HOOS-ADL 73.4 (13.1) | HOS-ADL 81.1 (20.3)   | HOS-ADL 81.1 (20.3) | HOS-ADL 81.1 (20.3)   | No 1/7 (14%)                      | No 1/7 (14%)                                                    | No 1/7 (14%)                                                    | No 1/7 (14%)                                                    | No 1/7 (14%) | 0.54 (0.14 to 0.80)                                                                 |
| 2018                                                                 | Arthroscopic surgery compared with physical therapy and activity modification for the treatment of symptomatic femoroacetabular impingement syndrome: a randomised controlled trial | HOOS-QOL 4.8 (5.3) | HOOS-SS 95.1 (3.8)      | HOOS-ADL 73.4 (13.1) | HOS-ADL 81.1 (20.3)   | HOS-ADL 81.1 (20.3) | HOS-ADL 81.1 (20.3)   | No 1/7 (14%)                      | No 1/7 (14%)                                                    | No 1/7 (14%)                                                    | No 1/7 (14%)                                                    | No 1/7 (14%) | 0.54 (0.14 to 0.80)                                                                 |
| Palmer, et al 2019                                                  | Arthroscopic hip surgery compared with physical therapy and activity modification at 12 months follow-up: a randomised controlled trial | HOOS-QOL 4.8 (5.3) | HOOS-SS 95.1 (3.8)      | HOOS-ADL 73.4 (13.1) | HOS-ADL 81.1 (20.3)   | HOS-ADL 81.1 (20.3) | HOS-ADL 81.1 (20.3)   | No 1/7 (14%)                      | No 1/7 (14%)                                                    | No 1/7 (14%)                                                    | No 1/7 (14%)                                                    | No 1/7 (14%) | 0.54 (0.14 to 0.80)                                                                 |

*Data reported as follow-up score rather than change score:
ADL, activity of daily living; ER, external rotation; FABER, flexion-abduction-external rotation test; FANER, flexion-adduction internally rotation test; FTR, follow-up time point; HOOS, Hip Outcome Score; HSAS, Hip Sports and Activity Scale; IHOT, International Hip Outcome Tool; LIF, lower limb; M, mean; SD, SD; SEM, standard error of measurement; SMD, standardised mean difference; VAS, Visual Analogue Scale.
the risk of bias, the outcomes reported and the interventions performed, which limited opportunities for meta-analysis. Included studies had poor transparency in reporting of interventions, inconsistency in PROMs and methods used to measure physical impairments.

Our findings suggest that in people with hip pain, physiotherapist-led interventions may improve function and strength, however the effects on pain and QOL were unclear. There was limited evidence that interventions with targeted strengthening exercise programmes that were at least 3 months duration might have the best effect. Hip arthroscopy surgery had a small positive benefit compared with a physiotherapist-led intervention at 8–12 months. At 24 months, the level of evidence was limited indicating no difference between the hip arthroscopy surgery and physiotherapist-led interventions. Very few of the physiotherapist-led interventions in this review achieved follow-up and change scores that surpassed previously published PASS and MIC scores.

Physiotherapist-led interventions for those who had and had not undergone hip arthroscopy surgery for hip pain primarily comprised exercise therapy, where the types of exercise described included strength training, movement pattern retraining, range of motion exercises and stretching. However, specific details of the programmes were rarely well described. The moderate effect observed for these interventions were hampered by small sample sizes and require full-scale RCTs to confirm findings. Extending the outcome measurement beyond the 3-month mark would determine whether improvements seen would be maintained in the medium-term to long-term. A recent consensus meeting reported considerable discord in the type, duration, intensity and modality of posthip arthroscopy rehabilitation provided by physiotherapists.42 The consensus group suggested that full-scale RCTs are required in order to gain clarification on the composition of optimal postarthroscopic rehabilitation programmes.42

Physiotherapist-led intervention was inferior to hip arthroscopy surgery with small between-groups differences at 12-month follow-up.7 8 41 Not surprisingly, despite the small difference favouring surgery, physiotherapy was far more cost-effective (£155 for physiotherapist-led treatment compared with £2372 for hip arthroscopy).7 Arthroscopic surgery could be recommended as a second-line treatment for patients who have not responded adequately to a physiotherapist-led treatment programme.42 However, the mean effects beyond that of physiotherapy were weak and may not be clinically meaningful.
The within-group improvements for the physiotherapist-led interventions in these studies were modest, with only one study achieving the PASS, and they may not represent optimal treatment.\textsuperscript{18} Further studies might shed more light on the relative effectiveness of surgery and physiotherapy particularly in the medium-term and long-term.\textsuperscript{43}

Multimodal, physiotherapist-led interventions,\textsuperscript{7 8 30 33 34 36–38 40} including exercise therapy combined with manual therapy, medication, activity modification, advice and education, were most commonly studied. Manual therapy is effective when combined with exercise for hip OA,\textsuperscript{44 45} but there is debate whether contemporary physiotherapist-led interventions for musculoskeletal pain should include multimodal treatment additions such as manual therapy.\textsuperscript{42} Further studies are required to confirm whether additional treatment elements, such as manual therapy, impart a greater benefit than exercise-therapy alone for young and middle-aged adults with hip pain.

Physiotherapist-led interventions on physical impairments had variable effects. For hip range of motion, the largest positive effects pre-physiotherapist-led to post-physiotherapist-led treatment were seen following a 3-month intervention strengthening exercise, manual therapy and education.\textsuperscript{40} The greatest
### Table 3  Summary of results of within-group standardised paired differences for physiotherapist-led treatment in non-operative patients (randomised and non-randomised studies)

| Study                  | Title                                                                                     | Within-group SPD (95% CI) for primary outcomes (positive SPD favours postintervention improvement) | Baseline M (SD) PT | Prim FU M (SD) PT |
|-----------------------|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------|------------------|
| **Randomised studies**|                                                                                          |                                                                                                |                   |                  |
| Grant, et al 2017³⁸   | The HAPI ‘Hip Arthroscopy Prehabilitation Intervention’ study: does prehabilitation affect the outcomes in patients undergoing hip arthroscopy for femoroacetabular impingement? | Abduction strength not calculated as follow-up dataset not complete                              | 11.8 (4.8)        | 9.9 (4.8)        |
|                       |                                                                                          | Abduction strength not calculated as follow-up dataset not complete                              | 15.3 (3.3)        | 16.6 (3.3)       |
|                       |                                                                                          | Knee extension strength not calculated as follow-up dataset not complete                        | 37.1 (23.0)       | 49.0 (40.2)      |
|                       |                                                                                          |                                                                                                 |                   |                  |
| Griffin, et al 2018³⁸ | Hip arthroscopy vs best conservative care for the treatment of femoroacetabular impingement syndrome (UK FASHIoN): a multicentre randomised controlled trial |                                                                                                 | 35.6 (18.2)       | 49.7 (25)        |
|                       |                                                                                          |                                                                                                 |                   |                  |
| Harris–Hayes, et al 2016³⁵ | Movement pattern training to improve function in people with chronic hip joint pain: a feasibility randomised clinical trial |                                                                                                 |                   |                  |
|                       |                                                                                          |                                                                                                 |                   |                  |
| Kemp, et al, 2018³⁵   | The Physiotherapy for Femoroacetabular Impingement Rehabilitation Study: a pilot randomised controlled trial |                                                                                                 |                   |                  |
|                       |                                                                                          |                                                                                                 |                   |                  |
| Mansell, et al 2018³⁵ | Arthroscopic surgery or physical therapy for patients with femoroacetabular impingement syndrome |                                                                                                 |                   |                  |
|                       |                                                                                          |                                                                                                 |                   |                  |
| Palmer, et al 2019³⁵  | Arthroscopic hip surgery compared with physiotherapy and activity modification for the treatment of symptomatic femoroacetabular impingement: multicentre randomised controlled trial |                                                                                                 |                   |                  |
|                       |                                                                                          |                                                                                                 |                   |                  |
| Smeatham, et al 2017³⁷ | Does treatment by a specialist physiotherapist change pain and function in young adults with symptoms from femoroacetabular impingement? A pilot project for a randomised controlled trial |                                                                                                 |                   |                  |
|                       |                                                                                          |                                                                                                 |                   |                  |
| Wright, et al 2016³⁵   | Non–operative management of femoroacetabular impingement: a prospective, randomised controlled clinical trial pilot study |                                                                                                 |                   |                  |
|                       |                                                                                          |                                                                                                 |                   |                  |
| Non–randomised studies|                                                                                          |                                                                                                 |                   |                  |
| Coppack, et al 2016³⁵ | Physical and functional outcomes following multidisciplinary residential rehabilitation for prearthritic hip pain among young active UK military personnel |                                                                                                 |                   |                  |

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Continued
hip muscle strength gain was seen with a strengthening exercise programme of 3 months duration,\textsuperscript{40} and largest in hip adductor muscles. Greater hip adductor strength following hip arthroscopy is associated with better hip-related QOL,\textsuperscript{64} suggesting that it may be an important target. However, this was a pilot study, and the most effective type, dose and progression of exercise is unknown. The American College of Sports Medicine\textsuperscript{47} guidelines for exercise prescription contain information about the dosage, volume and progression of exercises that may be useful for clinicians and researchers when developing strength programmes for patients with hip pain. In studies measuring changes in functional task performance, had positive effects\textsuperscript{31,40} with movement retraining and functional exercise programmes. These programmes may improve patient self-efficacy as well as increase the capacity for load, thus enabling participation in more challenging activity. Larger, future studies including evaluating the potential of effect moderators and moderators may provide insight into the most effective physiotherapist-led interventions to improve physical impairments.

Returning to pre-injury sport and activity is important to young and middle-aged people with hip pain, and often the reason they seek surgical and/or non-surgical treatment.\textsuperscript{30,46} However, only two studies in this review had a specific return to sport/return to physical activity component within the physiotherapist-led intervention.\textsuperscript{31} Only 17% of people returned to optimal performance and full sports participation at 33±16 months following hip arthroscopy.\textsuperscript{46} Given the importance of returning to sport in this active patient group and the disappointing rates of returning to optimal performance reported,\textsuperscript{46,48} future studies should incorporate key functional and sporting components.\textsuperscript{49} These could include: valid and consistent definitions of what comprises a successful return to sport and return to activity\textsuperscript{50}; fully powered RCTs that include a specific, targeted return to sport programme throughout the duration of the intervention\textsuperscript{50} and inclusion of return to sport outcomes as a continuum.\textsuperscript{49} Until physiotherapist-led interventions include high-quality return to sport elements, outcomes are unlikely to improve beyond those reported by Ishii et al.\textsuperscript{58}

Transparency and reproducibility are critical when reporting the efficacy of clinical interventions. Guidelines such as the Consensus on Exercise Reporting Template\textsuperscript{51} and Template for Intervention Description and Replication checklist\textsuperscript{52} should be used in all trials reporting interventions to ensure adequate transparency and reproducibility. In addition, describing targeted strengthening interventions should use detailed procedures such as those described by Toigo and Boutellier.\textsuperscript{53} The documentation of adherence to exercise programmes is also critical. Such guidelines allow researchers to evaluate interventions and clinicians to reproduce efficacious interventions in clinical practice. Very few studies used these guidelines to report interventions in the current review. As such, it was not possible to pool findings to complete a meta-analysis, limiting the scope of the review. We recommend that future studies report physiotherapist-led interventions using guidelines such as those described above to maximise transparency and utility of study findings by researchers and clinicians alike.

This review contains several limitations that should be acknowledged. First, the methodological quality of the studies was variable, with only 4/41 (29%) studies considered to have a low risk of bias. In the studies with a higher risk of bias, inflated effect sizes are possible, raising questions about the strength of the findings of these studies. Second, most of the included RCTs were pilot studies and as such were underpowered to detect statistically significant differences between groups. In addition, as there were no fully powered studies comparing physiotherapist-led interventions with sham interventions, adequately powered studies that undertake a head-to-head comparison of physiotherapist-led interventions are required to determine the optimal management strategies for hip pain in young and middle-aged adults. Furthermore, the terminology used to describe hip

| Study | Title | Baseline M (SD) PT | Prim FU M (SD) PT | Within-group SD (95% CI) for primary outcomes (positive SD favours postintervention improvement) |
|-------|-------|-------------------|-------------------|--------------------------------------------------|
| Emara, et al 2011\textsuperscript{11} | Conservative treatment for mild femoroacetabular impingement and improve clinical and biomechanical outcomes | HHS 71(6) | HHS 91(4) | HHS 3.52 (2.65 to 4.38) |
| | | NAHS 72(4) | NAHS 90(5) | NAHS 3.85 (2.91 to 4.78) |
| | | VAS 6 (1) | VAS 3 (1) | VAS 2.94 (2.19 to 3.68) |
| | | Flexion ROM 90.5 (0.4) | Flexion ROM 88.0 (0.5) | Flexion ROM −2.07 (−2.64 to −1.50) |
| | | Extension ROM 4.0 (1.6) | Extension ROM 3.7 (2.2) | Extension ROM −0.15 (−0.47 to 0.17) |
| | | Abduction ROM 37.0 (0.4) | Abduction ROM 36.1 (1.4) | Abduction ROM −0.87 (−1.55 to −0.41) |
| | | Adduction ROM 17.0 (0.7) | Adduction ROM 17.0 (0.9) | Adduction ROM 0.00 (−0.32 to 0.32) |
| | | ER in flexion ROM 28.5 (0.5) | ER in flexion ROM 28.4 (1.2) | ER in flexion ROM −0.09 (−0.41 to 0.23) |
| | | ER in extension ROM 25.3 (0.3) | ER in extension ROM 24.5 (1.0) | ER in extension ROM −0.88 (−1.26 to −0.50) |
| | | IR in flexion ROM 54.0 (4.3) | IR in flexion ROM 51.3 (0.5) | IR in flexion ROM 2.47 (2.34 to 5.29) |
| | | IR in extension ROM 15.8 (0.4) | IR in extension ROM 15.7 (0.7) | IR in extension ROM −0.16 (−0.48 to 0.16) |
| Guenther, et al 2017\textsuperscript{26} | A pre-operative exercise intervention can be safely delivered to people with femoroacetabular impingement and improve clinical and biomechanical outcomes | HOOS Symptoms 56.1 (13.2) | HOOS Symptoms 63.9 (14.6) | HOOS Symptoms |
| | | HOOS−Pain 64.1 (12.3) | HOOS−Pain 72.5 (12.3) | HOOS−Pain |
| | | HOOS−ADL 73.0 (14.4) | HOOS−ADL 83.4 (11.0) | HOOS−ADL |
| | | HOOS−Sport 51.7 (22.2) | HOOS−Sport 63.4 (14.0) | HOOS−Sport |
| | | HOOS−QOL 35.3 (17.2) | HOOS−QOL 42.8 (22.0) | HOOS−QOL |
| | | Abduction strength 1.53 (0.35) | Abduction strength 1.67 (0.34) | Abduction strength 0.39 (−0.07 to 0.84) |
| | | Adduction strength 1.40 (0.38) | Adduction strength 1.53 (0.39) | Adduction strength 0.32 (−0.13 to 0.77) |
| | | Extension strength 1.81 (0.46) | Extension strength 1.93 (0.50) | Extension strength 0.24 (−0.21 to 0.68) |
| | | Flexion strength 1.89 (0.45) | Flexion strength 2.04 (0.43) | Flexion strength 0.33 (−0.12 to 0.78) |
| | | ER strength 0.75 (0.23) | ER strength 0.77 (0.18) | ER strength 0.09 (−0.35 to 0.53) |
| | | IR strength 0.76 (0.36) | IR strength 0.89 (0.36) | IR strength 0.35 (−0.10 to 0.80) |
| | | Timed stair climb test 2.96 (0.66) | Timed stair climb test 2.61 (0.46) | Timed stair climb test 0.57 (0.10 to 1.05) |
| Hunt, et al 2012\textsuperscript{28} | Clinical outcomes analysis of conservative and surgical treatment of patients with clinical indications of pre-arthritis, intra-articular hip disorders | HOUS 61.3±13 | HOUS 76.9±14 | HOUS 1.26 (0.76 to 1.77) |
| | | WOMAC 29.2±16 | WOMAC 13.5±14 | WOMAC 1.01 (0.54 to 1.47) |
| | | NAHS 63.2±14 | NAHS 81.8±12 | NAHS 1.36 (0.84 to 1.89) |

ADL, activity of daily living; ER, external rotation; FU, follow-up time point; HAGOS, Copenhagen Hip and Groin Outcome Score; HHS, Harris Hip Score; HOOS, Hip Osteoarthritis and disability Outcome Score; IR, internal rotation; M, mean; SD, standard deviation; MCS, emotional function subscale; NAHS, Non-Arthritic Hip Score; NFRS, Numeric Pain Rating Scale; NR, not reported; PA, physical activity; PCS, physical function subscale; PT, physiotherapy/physical therapy; QOL, quality of life; ROM, range of motion; SF-12, Short Form-12 Questionnaire; SMD, standardised mean difference; VAS, Visual Analogue Scale.\textsuperscript{40,46}
Summary box

What is already known?
► Hip-related pain is common in young, active adults.
► Non-surgical treatments such as physiotherapist-led treatments should be first-line treatment for musculoskeletal conditions including hip-related pain, but effectiveness of these treatments is unclear.

What are the new findings?
► There is a paucity of literature in this field.
► Physiotherapist-led interventions improve function and strength.
► Effects of physiotherapist-led interventions on pain and quality of life are uncertain.
► Targeted strengthening exercise programmes and at least 3-month duration might have the best effect.
► Hip arthroscopy surgery had a small positive benefit compared with a physiotherapist-led intervention at 8–12 months.
► At 24 months, there was limited evidence suggesting no difference between groups.

CONCLUSION
There were no full-scale RCTs comparing physiotherapist-led interventions with other non-surgical treatments or sham treatments. The risk of bias in included studies, as well as limitations in included study methodology should be considered in the interpretation of the results of this systematic review. Physiotherapist-led interventions may improve pain and function in young and middle-aged adults experiencing hip pain, including those with FAI syndrome. There was limited evidence of larger effects for interventions that included targeted strengthening exercise programmes and were of 3 months duration. Hip arthroscopy surgery had a weak positive effect compared with a physiotherapist-led intervention at 8–12 months. Future full-scale RCTs undertaking a head-to-head comparison of physiotherapist-led interventions for hip pain are required.

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