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Systematic review

The outcome of hip exercise in patellofemoral pain: A systematic review

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ABSTRACT

Patellofemoral pain (PFP) is one of the most common lower extremity conditions seen in clinical practice. Current evidence shows that there are hip strength deficits, delayed onset and shorter activation of gluteus medius in people with PFP. The aim of this review was to systematically review the literature to investigate the outcome of hip exercise in people with PFP.

Method: AMED, CINAHL, Cochrane, EMBASE, PEDro, Pubmed, Science direct and SPORTDiscus databases were searched from inception to November 2014 for RCTs, non-randomised studies and case studies. Two independent reviewers assessed each paper for inclusion and quality.

Results: Twenty one papers were identified; eighteen investigating strengthening exercise, two investigating the effect of neuromuscular exercise and one study investigated the effect of hip exercise for the prevention of PFP.

Hip and knee strengthening programmes were shown to be equally effective. Limited evidence indicates that the addition of hip exercise to an exercise programme is beneficial. Limited evidence demonstrates that motor skill retraining in a participant group who displayed abnormal hip alignment in running improves pain.

Conclusion: The evidence consistently demonstrated that both hip strengthening and neuromuscular exercise has a beneficial effect on pain and function in people with PFP. Strengthening exercise predominantly addressed abductor and external rotator muscle groups.

A consensus from PFP researchers for standardisation of methodology is recommended to enable meaningful comparison between trials.

1. Introduction

Patellofemoral pain (PFP) is characterised by retropatellar or peripatellar pain associated with activities involving lower limb loading such as running, jumping, sustained sitting, kneeling, ascending or descending stairs, and squatting (Nijs et al., 2006; Davis and Powers, 2010). It is a common musculoskeletal disorder (Witvrouw et al., 2000) and was the most common overuse running injury in a prospective study of 2002 runners, accounting for 37.4% of knee injuries (Taunton et al., 2002). PFP has a reported incidence ranging from 3 to 40% of the population (Callaghan and Selfe, 2007) and females are 2.23 times more likely to develop the condition (Boling et al., 2010). It is not uncommon for patients to have long term symptoms. It was shown that 80% people with PFP who had completed a rehabilitation programme reported pain at a five year follow up, and 74% had reduced their physical activity level (Blond and Hansen, 1998). This may be due to underlying factors that contribute to the development of PFP not being addressed.

It is widely accepted that PFP is a multi-factorial condition (Powers, 2012). There is increasing evidence that proximal factors may be associated with the pathogenesis of PFP. Biomechanical studies have shown that excessive femoral internal rotation in weight bearing leads to increased lateral patellar tracking, reduction in patellofemoral contact area (Huberti and Hayes, 1984; Lee et al., 2003; Li et al., 2004; Salsich and Perman, 2007; Besier et al., 2008) and increased lateral patellofemoral joint stress (Souza et al., 2010). This is proposed to lead to change in the patellofemoral joint articular cartilage, overloading the subchondral bone, causing pain (Powers, 2012).

It has been proposed that there are hip strength deficits in adults with PFP (Rathleff et al., 2014). However, evidence demonstrating

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that reduced muscle strength is accompanied by altered hip kinematics in PFP is conflicting, with some studies showing an association between a reduction in muscle strength with altered kinematics (Souza and Powers, 2009; Nakagawa et al., 2012; Boling and Padua, 2013) and others that there is not (Willson et al., 2008). There is delayed onset and shorter activation of gluteus medius in adults with PFP (Barton et al., 2013) and some evidence to show that altered gluteal muscle activation patterns accompanies altered hip kinematics in PFP (Souza and Powers, 2009; Nakagawa et al., 2012). It follows that both strength and neuromuscular exercises of the gluteal muscles may be important factors to include in the management of PFP.

A recent Cochrane review demonstrated consistent support for exercise in PFP (van der Heijden et al., 2015), but did not include neuromuscular exercise. This review included RCTs and quasi-randomised studies. However, clinical decision making based on evidence based medicine should not be confined to RCTs; all available evidence should be considered and synthesised (Koes and Hoving, 1998; Doherty, 2005). Observational studies with lower rigour but with higher generalisability may be of more clinical value (Milanese, 2011; Berbano and Baxi, 2012) and when properly conducted with rigorous methods can be valuable in clinical research (Sharp, 1998; Grossman and Mackenzie, 2005; Baker, 2011). A more inclusive review of all proximal exercise will aid in the clinical management of PFP.

The aim of this review was to evaluate the effect of hip strengthening and neuromuscular exercise in people with PFP, providing clinicians with information to help plan effective management.

2. Methodology

2.1. Search strategy

A systematic literature search was conducted of the electronic databases AMED, CINAHL, the Cochrane database, EMBASE, PEDro, Pubmed, Science direct and SPORTDiscus from their inception to November 2014. A search strategy from the Cochrane review on exercise therapy on PFP (Heintjes et al., 2003) was used for diagnosis terms and combined with key terms glute or proximal or hip or trunk; and exercise or rehabilitation and strength or endurance or motor control. A secondary search of relevant journals identified from related published research articles was also undertaken. These included Journal of Orthopaedic and Sports Physical Therapy, American Journal of Sports Medicine, British Journal of Sports Medicine and Journal of Sports Rehabilitation.

A search of the grey literature was undertaken using the databases WHO International Clinical Trials registry platform, OpenSIGLE, Zetoc and UK clinical research network study portfolio. Postgraduate theses were searched on the Index to theses database.

Relevant researchers in the field were contacted for information on unpublished research.

The reference list of each article was hand searched to identify additional papers.

2.2. Study eligibility

Full text, English language articles were eligible. Randomised controlled trials (RCTs), non-randomised studies (NRS), cohort studies, case control studies and case studies investigating the effect of strengthening, endurance or neuromuscular exercise at the hip in subjects with patellofemoral pain were included, with at least one measure of pain, function or biomechanical outcome.

2.3. Study types

No restrictions were applied to the types of studies included. All available evidence was considered and synthesised to ensure a comprehensive review.

A patellofemoral pain checklist was used (Table 1), with key inclusion and exclusion criteria for patellofemoral pain diagnosis (Barton et al., 2010). Studies investigating patellofemoral instability or patellofemoral osteoarthritis were excluded. There was no restriction on gender or age limits.

2.4. Review process

Identified studies were downloaded into the bibliographic software programme Endnote Version X5 reference manager (Thomson Reuters). All identified titles and abstracts and subsequent full text articles were screened for eligibility. The final decision about inclusion was made by two independent researchers. A third researcher was consulted if a consensus was not reached. The researchers were not blinded to either source or author.

2.5. Data extraction

Data on the study design; participant characteristics; specific exercise; position; repetitions; frequency; intensity and outcome measures was extracted by two investigators.

2.6. Methodological quality assessment

The PEDro scale (www.pedro.org.au) was used to assess the RCTs and NRS. The observational studies were assessed by appraisal tools from the Critical Appraisal Skills Programme (CASP) (www.casp-uk.net). The Oxford Centre of Evidence Medicine (CEBM) (www.cebm.net) appraisal tool for a case study was used for single case studies. Following the quality assessment a level of evidence was awarded for each of the studies, which was downgraded if there were serious limitations ("The Oxford 2011 Levels of Evidence").

3. Results

The initial search identified 1090 potentially relevant articles, of which 1062 were excluded based on title and abstract (Fig. 1). Full texts of 28 articles were obtained; of these seven were excluded. One study provided detailed data from participants in a previous study; the data from these two papers were combined (Willy et al., 2012a,b; Willy and Davis, 2013). This left 21 papers fulfilling the eligibility criteria.

3.1. Quality assessment

The methodological assessment of the reviewed papers is summarised in Tables 2–4. The scores on the PEDro scale for RCTs ranged between three and nine out of a possible eleven. The main limitation was a lack of blinding of participants and therapists. One study did not meet the PEDro criteria for randomisation as participants were sequentially allocated (Khayambashi et al., 2012). A further study (Baldon et al., 2014) used block randomisation with groups of four, with no stratification.

The three case control studies scored seven and eight on the CASP Case control score out of a possible eleven. All subjects were recruited by convenience sampling. Two studies used an asymptomatic control group (Boling et al., 2006; Ferber et al., 2011). Confounding factors were poorly addressed. Case series studies