A systematic review of physical interventions for patellofemoral pain syndrome
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Authors' objectives
To examine the efficacy of non-pharmacological and non-surgical physical interventions for patellofemoral pain syndrome (PFPS).

Searching
MEDLINE, CINAHL and Current Contents were searched from inception to October 2000 for studies in any language. The search strategy (keywords and combinations) was reported in the publication, together with the number of hits in each database. In addition, another database (PEDro) and the reference lists of retrieved articles, conference proceedings and textbooks were also searched.

Study selection
Specific interventions included in the review
Studies that evaluated non-pharmacological, non-surgical physical interventions for PFPS were eligible. The interventions used in the studies included: eccentric quadriceps with or without patellar tape (also used with biofeedback and mobilisation); standard quadriceps with patellar tape or mobilisation; isokinetic quadriceps; elastic knee sleeve with silicone plastic ring; patellar realignment brace; infra-patellar knee strap; pulsed Ga-As laser; sacroiliac joint manipulation; chiropractic joint manipulation; progressive resistance brace; and soft corrective foot orthoses.

Participants included in the review
The studies had to include participants with PFPS. Where reported, the mean age in the included studies varied from 14 to 37 years, with the majority having a mean of 20 to 30 years. Most of the studies required a history of peripatellar or retropatellar pain. One study required arthroscopic evidence of chondromalacia. Studies often excluded participants with previous surgery, and most studies excluded participants with clinical findings of other knee pathologies. Two studies were of women only.

Outcomes assessed in the review
The studies had to adequately describe their outcome assessment. No outcomes were specified. The outcome measures most frequently used were pain scales (various measures, most commonly 10 cm visual analogue scale), disability scales, muscle function, functional evaluations, and clinical evaluations.

How were decisions on the relevance of primary studies made?
One author selected the studies to be included.

Assessment of study quality
No formal quality assessment system was specified, but all the trials were assessed for randomisation, blinding of assessors, blinding of patients, baseline comparability, and the rate of follow-up. The results were systematically reported in the table of study details. The authors do not state how the papers were assessed for validity, or how many of the reviewers performed the assessment.

Data extraction
The authors do not state how the data were extracted for the review, or how many of the reviewers performed the data extraction.
The following data were extracted: inclusion and exclusion criteria; outcome measures; mean age with SD; mean symptom duration with SD; mean baseline pain by treatment group; study design and validity characteristics; details of interventions; and outcome results.

Methods of synthesis
How were the studies combined?
The studies were combined using a narrative approach. Where possible, an effect size for the difference in pain between the treatment groups was calculated with confidence intervals (CIs). Where not possible, the reported p-values were recorded.

Physiotherapy interventions were considered separately to other types of intervention. Studies evaluating the use of particular devices were also discussed individually.

How were differences between studies investigated?
Differences between the studies were discussed in terms of methodological quality factors.

Results of the review
Sixteen controlled trials (n=867) were included: 11 randomised (n=277) and 5 non-randomised (n=590); n ranged from 25 to 113.

Eight studies evaluated physiotherapy, mostly focusing on vastus medialis obliquus retraining by a variety of methods. The duration of treatment was usually 4 to 8 weeks. No studies compared it with a placebo control. There were two further studies of patellofemoral orthoses, four studies of assorted other techniques (i.e. low-level lasers, chiropractic patellar mobilisation, acupuncture, and sacroiliac joint manipulation), and one study each of progressive resistance braces and corrective foot orthoses. The follow-up varied from none to one year. No intervention was associated with a worsening of the symptoms.

Physiotherapy treatments.

Six of the physiotherapy studies compared essentially eccentric exercises with alternative forms of quadriceps strengthening (standard or isokinetic). It was stated that five found an overall better response to the eccentric exercises in terms of all or some of the outcome measures, particularly for functional impairment measures. There were no significant differences between the treatments in terms of the pain effect reported in the review. The two most methodologically-sound randomised controlled trials (RCTs) found contrasting results. A single trial compared physiotherapy with no treatment and found significant difference in pain. It was stated in the results that the evidence indicates that physiotherapy can reduce the pain associated with PFPS, but no actual results of the effect were quoted.

Patellar taping.

Two RCTs failed to find any benefit of taping in addition to physiotherapy, although one employed taping to a lesser extent than would be the case in routine clinical practice.

Patellofemoral orthoses. Two non-randomised trials with significant limitations found no evidence to support the use of these braces in the military setting, in which presumably the trials took place. Their use in other populations has not been evaluated.

Other interventions.

Low-level laser treatment provided no difference in outcome compared with sham laser in a triple-blind study of patients with arthroscopically-confirmed chondromalacia patella. Chiropractic patellar mobilisation showed no statistically-significant difference when compared with placebo in the single study. A 4-week RCT of acupuncture versus no treatment found significantly improved knee function symptoms at 12 months. A blinded RCT of sacroiliac joint mobilisation versus sacroiliac joint assessment was found to significantly decrease immediate quadriceps muscle inhibition, but the trial did not measure pain or function.
Progressive resistance brace.

One non-randomised study compared a programme of high-volume submaximal quadriceps strengthening using a progressive resistance brace with no treatment. This study found a significant improvement in pain, radiological patellar alignment, and function. The authors noted their costliness.

Corrective foot orthoses.

One non-blinded RCT compared the effects of adding corrective foot orthoses with a placebo insole for female patients with rearfoot varus receiving physiotherapy. Patients with the corrective orthoses had significantly less knee pain during aggravating activities.

**Authors' conclusions**
The evidence to support the use of physical interventions in the management of PFPS was limited. There appeared to be a consistent improvement in short-term pain and function due to physiotherapy treatment, but comparison with a placebo group is required to determine efficacy. There was inconclusive evidence to support one form over another, but the results suggested that eccentric quadriceps strengthening might be superior to other forms of strengthening, in relation to functional impairment. The hypothesis that individually tailored treatments to address specific deficits may be more effective than standardised treatments requires evaluation. The results question the usefulness of patellar taping in addition to physiotherapy, but the evidence was insufficient. Due to the low quality and quantity of the current evidence, the use of patellofemoral orthoses, acupuncture, low-level laser, or chiropractic mobilisation also cannot be supported or refuted.

**CRD commentary**
The review addressed a clear question but some prioritisation of outcomes would have been helpful. It employed a satisfactory search strategy. The processes of selection, validity assessment and data extraction were not reported to have been performed by more than one reviewer, allowing a possibility of error or bias to be introduced. The individual study details were well-reported, with the exception that there was a lack of detailed results for outcomes other than pain. The validity assessment of the included trials was reasonable, despite not following a protocol. Issues of small sample sizes could also have been addressed.

The choice of the synthesis method was appropriate, but the lack of detailed results made it difficult sometimes to judge whether all of the conclusions were justified. Overall, the conclusions appeared to follow from the authors' report of the results.

**Implications of the review for practice and research**
*Practice:* The authors state that, based on the available evidence, clinicians would be advised to institute a programme of education, stretching and quadriceps strengthening (including eccentric exercises), and possibly the use of soft corrective foot orthoses, in the conservative management of PFPS.

*Research:* The authors state that placebo-controlled trials are required to confirm or refute the efficacy of physiotherapy interventions. Further research would also be required to reach firm conclusions on other treatments. The positive results obtained with corrective foot orthoses, acupuncture, sacroiliac joint mobilisation, and progressive resistance braces all require more rigorous evaluation.

**Bibliographic details**

**PubMedID**
11403109
Indexing Status
Subject indexing assigned by NLM

MeSH
Adolescent; Adult; Arthralgia /physiopathology /rehabilitation; Disability Evaluation; Evidence-Based Medicine; Female; Femur /physiopathology; Humans; Knee Joint /physiopathology; Male; Muscle, Skeletal /physiopathology; Pain Measurement; Patella /physiopathology; Patient Satisfaction; Physical Therapy Modalities; Recovery of Function; Reproducibility of Results; Treatment Outcome; Weight-Bearing

AccessionNumber
12001001515

Date bibliographic record published
28/02/2003

Date abstract record published
28/02/2003

Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.