

Bloomer BA, and Durall CJ. Does the addition of hip strengthening to a knee-focused exercise program improve outcomes in patients with patellofemoral pain syndrome? Journal of Sport Rehabilitation 2014 Oct 29; [Epub ahead of print].

Date: 7-8-15

Critique author: Linda Metzger

Design: Systematic Review and meta-analysis of randomized clinical trials

Objective: To evaluate the effects of adding hip muscle strengthening to a knee-focused strengthening and stretching exercise program to help reduce pain and improve function for individuals with patellofemoral pain syndrome (PFPS).

PICOs:

- **Patients:** Adults with patellofemoral pain syndrome (PFPS)
- **Interventions:** Hip muscle strengthening in addition to a knee-focused strengthening and stretching exercise program
- **Comparison interventions:** A knee-focused strengthening and stretching exercise program alone
- **Outcomes:** Pain and function
- **Study types:** Randomized controlled trials (RCTs)

Study selection:

- Databases included PubMed, The Cochrane Database of Systematic Reviews, Medline, CINAHL Plus, Sport Discus, Alt Health Watch, EBSCOhost, and PsycINFO from 2004 through October 2014 and only English publications were eligible for inclusion.
- Database searching was supplemented by manual searching of the reference lists of potentially eligible articles.
- Studies that directly compared knee-focused exercises alone (strengthening and stretching) to knee-focused exercises combined with hip muscle strengthening exercises in the management of PFPS were included. Outcomes included were pain and function. Studies that only compared knee-focused exercises to hip muscle strengthening exercises were excluded.
- Inclusion criteria for participants included at least 2 clinical signs of PFPS (anterior or retropatellar knee pain during ascending/descending stairs, squatting, running, kneeling, hopping/jumping, and prolonged sitting, and insidious onset of knee pain unrelated to trauma and persistent for at least 4 weeks.
- Participants were excluded if they had other pathological conditions of the knee or hip such as meniscus involvement or arthritis, or previous knee or hip surgery.
- Knee-focused strengthening exercises include squats, lunges, quadriceps sets, step-ups, and terminal knee extension. Knee stretching exercises includes stretches for the hamstrings, iliotibial band, gastrocnemius, and quadriceps.
- Hip muscle strengthening exercises includes exercises for the hip abductors (side-lying and standing hip abduction with Theraband or ankle weights), external rotators (seated external rotation with Theraband), and extensor muscles (hip extension machines).

- For the strengthening exercises, 2-4 sets of 10-15 repetitions should be performed. Stretching exercises should be held for 30 seconds and performed 3 times consecutively a minimum of 3 times a week for 4 weeks.
- All included trials were critically appraised for methodological quality or risk of bias using the 11 item validated PEDro scale. A trial with a score of 6 or more was considered to be high quality consistent with previous reviews.
- As the studies used a variety of different scales to measure comparable outcomes across trials, a unitless measure of treatment effect size was needed to allow the results of the various RCTs to be pooled. Standardized mean differences (SMD) were used to calculate treatment effect sizes, and to obtain a summary estimate. Positive SMD values were used to indicate that the outcome favored the intervention group. A SMD 0.2-0.5 was considered a small effect, 0.5-0.8 a moderate effect, and ≥ 0.8 a large effect.

Results:

- Overall 4 RCTs with a total of 170 participants with PFPS were included in this review. Ages ranged from 17 to 40 years with mean age ranges of 21-25 years. Thirteen (8%) males and 157 (92%) females participated. All 4 studies were RCTs directly comparing knee-focused exercises combined with hip muscle strengthening exercises to knee-focused exercises alone to address PFPS, and one study also included a non-treatment control group.
- All four RCTs were rated as level 1b evidence based on the Centre for Evidence-Based Medicine 2009 criteria.
- In each of the 4 studies, patients with PFPS demonstrated statistically significant improvements in pain and function in response to both the knee-focused exercise program and the combined knee and hip muscle strengthening exercise program. The improvements were significantly greater in the groups that performed hip strengthening exercises in addition to the knee exercises.
- Overall for the 4 pooled studies with 170 participants, there was a moderate statistically significant effect favoring the combined knee and hip strengthening exercise group for improvement in pain (SMD= 0.53) and function (SMD= 0.48).
- In all 4 of the included studies, the addition of hip muscle strengthening to a knee-focused exercise program resulted in superior outcomes in pain and function. For the 4 studies, the effect sizes for pain and function ranged from small (0.25) to large (0.86).
- One study with 54 participants evaluated a 12-month long term follow-up and produced the largest effect sizes among the studies (> 0.80 for pain and function). In this study, Fukuda (2012) reported that both groups improved at the 3- and 6-month follow-ups, but only the knee and hip combined exercise group demonstrated improvements at the 12-month follow-up. The other 3 studies in this review had shorter follow-up periods of 4 to 6 weeks, and also had smaller between group effect sizes for both pain and function.
- Risk of bias was assessed with the PEDro scale for the 4 studies included in the meta-analysis. All 4 were higher quality trials ($> 6/10$), with two studies scoring 7 and two scoring 8 on the PEDro scale that were assessed as 'low risk of bias'.

Authors' conclusions:

- Current high-quality evidence (level 1b evidence) supports the addition of hip muscle strengthening to knee-focused strengthening and stretching for individuals with PFPS to help reduce pain and improve function.
- The pooled results of the meta-analysis of the 4 randomized trials indicates that the addition of hip muscle strengthening to knee-focused strengthening and stretching resulted in greater improvements in pain and function and were more effective than knee-focused exercises alone in patients with PFPS.
- This review supports the addition of hip muscle strengthening to a knee-focused strengthening and stretching program to improve pain and function in patients with PFPS. Although the statistical significance between the 2 exercise interventions (knee-focused versus hip plus knee) was significant in all 4 studies, the effect size in 3 of the studies was small, suggesting that the clinical difference between the 2 exercise regimens may be somewhat nominal.
- Since hip strengthening is beneficial for patients with PFPS, future research should evaluate the impacts of hip strengthening for other common knee pathologies such as osteoarthritis and tendinitis.
- Since the studies in this review included more females than males, further research should study gender differences in outcomes with hip strengthening for treatment of PFPS.
- Further research is needed that focuses on the efficacy of hip extension strengthening for PFPS, since Fukuda (2012) utilized a hip extension machine, and reported the largest improvements in pain and function.
- Fukuda (2012) was the only study that included long-term follow-up, and additional research is needed to study the long-term benefits of exercise interventions in patients with PFPS.

Comments:

- The highest quality trial with the lowest risk of bias provided large effect sizes for both pain and function (0.86 and 0.81) when comparing knee-focused versus hip plus knee exercise regimens.
- The relatively large range of effect sizes for pain and function (0.25 to 0.86) reported from the 4 studies may indicate that considerable uncertainty still remains in determining a real effect size and more importantly whether the effect size is clinically important. On the other hand, all 4 studies showed a positive effect for the addition of hip strengthening for PFPS treatment, adding support for including this treatment modality for patients with PFPS.
- Heterogeneity was not reported in this review and so it is not known if it was assessed or if it was statistically significant for the meta-analysis.
- One strength of this systematic review was that it assessed the methodological quality of each study using the PEDro scale. Applying the Centre for Evidence-Based Medicine 2009 criteria to each RCT to determine the quality of evidence also helped to increase the level of confidence in the results.

- The authors failed to report how many relevant articles were found and retrieved in the original search and who reviewed these articles and determined their eligibility for inclusion.
- It would have been helpful if the authors had included the descriptive data accompanying the forest plots which includes each study's effect sizes and confidence intervals, weight, sample size, and heterogeneity test results for the meta-analysis.
- Since 92% of the population in this meta-analysis were female, the results cannot be generalized to the male gender.

Assessment:

Adequate quality meta-analysis which supports good evidence that the addition of hip muscle strengthening exercises to knee-focused strengthening and stretching exercises results in greater improvements in pain and function and is more effective than knee-strengthening exercises alone in individuals with patellofemoral pain syndrome (PFPS).

Reference:

Fukuda TY, Melo WP, Zaffalon BM, and et al. Hip Posterolateral Musculature Strengthening in Sedentary Women with Patellofemoral Pain Syndrome: A Randomized Controlled Clinical Trial With 1-Year Follow-up. *J Orthop Sports Phys Ther* 2012;42(10):823-830.