Invited lecture/Scientific contribution

Critical Appraisal of a Systematic Review on Effectiveness of Trunk, Hip and Knee Exercise Programs in Patellofemoral Pain

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Abstract:
Although patellofemoral pain (PFP) is one of the most common musculoskeletal disorders, the clear aetiology behind it remains unknown. One of possible factors could be increased hip adduction and internal rotation caused by weak hip abductors and external rotators. A recent systematic review assessed the effectiveness of trunk, hip and knee exercise programs for pain relief, functional performance and muscle strength in PFP. The aim of our study was to critically evaluate this systematic review using the updated PRISMA checklist. The authors adequately described the relationship between hip and knee muscles and PFP, but insufficiently linked the condition to trunk muscles throughout the review. Overall the methods used were satisfactory, however the methods used to assess risk of bias due to missing results and certainty in the body of evidence for outcomes were not reported and therefore not presented in the results or debated in the discussion. Few discrepancies were found between the text and presented tables. The results of conducted meta-analysis were sufficiently presented in included forest plots or can be accessed through links in the review as publicly available supplementary figures. Possible extraction of data on description of exercises used in programs could further improve the synthesis. The discussion on effectiveness of hip and/or knee exercise programs on pain relief and functional performance was adequate, meanwhile the discussion was insufficient for effect on muscle strength. The review was satisfactorily conducted with few items not reported or reported insufficiently due to discrepancies between the former and updated PRISMA statement.

Keywords: Patellofemoral pain; Exercise programs; Critical appraisal; PRISMA checklist

Citation: Okorn D, Vauhnik R. Critical appraisal of a systematic review on effectiveness of trunk, hip and knee exercise programs in patellofemoral pain. **2023**, 8; 75-81. https://doi.org/10.55295/PSL.2023.I12

1. Introduction

Patellofemoral pain (PFP), characterized by diffuse pain around or behind the patella (Crossley et al., 2016), is one of the most common musculoskeletal disorders (van Middelkoop et al., 2008), accounting for 25–40 % of all cases of anterior knee pain (Décary et al., 2018). The prevalence of PFP is reported to be 23 % in general population and 29 % in adolescents (Smith et al., 2018) and is two times higher in women and athletes than males (Dolak et al., 2011). PFP is aggravated by activities overloading the patellofemoral joint during weight bearing on a flexed knee such as squatting, stair ambulation, jogging/running, hopping/jumping or even prolonged sitting with knees flexed over 90° (Crossley et al., 2016).

Although the clear aetiology behind PFP remains unknown, the condition is thought to be multifactorial (Lankhorst et al., 2012). Both local and nonlocal factors could be included (Lankhorst et al., 2012) in causing the maltracking/altered movement of the patella, which may lead to overload of the patellofemoral joint (Powers et al., 2017). Local factors are associated with imbalances between the vastus medialis oblique and the vastus lateralis as well as impaired quadriceps strength (Cowan et al., 2002; Khayambashi et al., 2014). Nonlocal factors are related to the mechanics of the proximal and distal segments (Powers et al., 2017), including increased hip adduction and internal rotation during weight bearing tasks (Souza & Powers, 2009).

Hip abductors and external rotators are crucial for knee and pelvic stabilization as well as eccentric control of the hip adduction and internal rotation movements during ambulation (Lankhorst et al., 2012; Robinson & Nee, 2007). Weak hip abductors and external rotators supposedly lead to excessive hip adduction and internal rotation, which contributes to altered tibiofemoral and patellofemoral joint kinematics and patellofemoral joint stress (Lee et al., 2003). The reduction in PFP following hip muscle strengthening in allegedly directly related to the improvement of biomechanical changes in the knee area (Fukada et al., 2012).

A systematic review and meta-analysis (Manojlović et al., 2021) on effectiveness of trunk, hip and knee exercise programs for pain relief, functional performance and muscle strength in PFP was recently conducted.

The aim of the review was to assess the effects of exercise programs focusing on training of muscle groups proximal to the knee in patients with PFP. The authors concluded that hip&knee and hip-only exercise programs are most effective in decreasing pain levels and improving functional performance, along with increasing hip abduction and external rotation strength.

The aim of our study was to critically evaluate the aforementioned systematic review.

2. Methods

The critical appraisal of a selected systematic review (Manojlović et al., 2021) was conducted according to the updated Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement (Page et al., 2021) using the PRISMA 27-item checklist. We removed the section "abstract" from the checklist. Additional observations were included in the discussion.

3. Results

Table 1 represents the PRISMA 27-item checklist. In the uttermost right column we filled in the location where certain item from the checklist is reported (the number of the page, figure and/or table) and whether an item is not reported or is reported insufficiently.

Table 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist red – new/changed items in the updated PRISMA statement as compared to the former PRISMA statement; green – adequately reported; orange – insufficiently reported; blue – not reported

Section and Topic	Item	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	Page 1431
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Pages 1431–2
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Page 1432, insufficient
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Pages 1432–3; insufficient
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Page 1432; insufficient
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Page 1432; insufficient
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Pages 1432–3; insufficient
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Page 1433; insufficient
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Pages 1433–4; insufficient
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Page 1433
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Page 1433; insufficient
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Pages 1433–4
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	Pages 1433–4; table 3; insufficient
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Pages 1433–4
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Page 1434
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	Pages 1433–4
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	Page 1434
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	Pages 1434

Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	Not reported
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	Not reported
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Pages 1434–5
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Not reported
Study characteristics	17	Cite each included study and present its characteristics.	Table 2 and 3
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Table 1
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Table 2; Figures2–4; Supplementary Figures 1–2
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Pages 1436, 1443–4; insufficient
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	Pages 1436, 1443–4; Figures 2–4; Supplementary Figures 1–2
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	Same as item 20b
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	Same as item 20b
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	Not reported
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	Not reported
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Pages 1444 and 1446
	23b	Discuss any limitations of the evidence included in the review.	Page 1447
	23c	Discuss any limitations of the review processes used.	Page 1447
	23d	Discuss implications of the results for practice, policy, and future research.	Pages 1446–7
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Not reported
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	Not reported
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	Not reported
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Not reported
Competing interests	26	Declare any competing interests of review authors.	Page 1447
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	Not reported

4. Discussion

We used the updated PRISMA 27-item checklist to conduct the critical appraisal of the selected systematic review by Manojlović et al. (2021). Since the updated PRISMA statement was published in the same year as the mentioned systematic review, the authors could not had followed the new guidelines. Therefore, some differences were expected as they used the former PRISMA statement (Liberati et al., 2009).

The authors adequately presented the existing knowledge on PFP, however they did not sufficiently explain it in the context of their title. The review sets an intention of presenting the effectiveness of training trunk, hip and knee muscles, which they encompassed in a term "muscle groups proximal to the knee". The trunk muscles were mentioned only once in the introduction and the relationship between the trunk muscles and PFP was not explained. The authors, however, clearly stated the objective of the review, yet in further explanation they again did not explicitly include the trunk muscles apart from the broad term "muscle groups proximal to the knee".

The inclusion and exclusion criteria were presented systematically and adequately using the PICOS (population, intervention, comparison, outcomes, study design**)** technique. The outline for the grouping of the studies was presented in the objective of the systematic review. The authors specified all databases and additional sources but not the exact date each source was searched. A common search strategy was presented without mentioning of any filters or limits used.

The authors additionally used several keywords combinations, yet did not specify where and how were they integrated into the search for relevant articles. Information on whether the reviewers worked independently was not included in the description of the selection and data collection processes, although it represents a possible bias of a systematic review. The outcomes were listed but not sufficiently defined as the authors did not specify which methods of measuring maximal voluntary isometric contraction (MVIC) were eligible for inclusion or on the other hand which methods were used in the included studies. They did, however, mention that MVIC was a cause of some heterogeneity since it was reported in different measurement units. Since only randomised controlled trials (RCT) were included in the review, the choice of using PEDro scale for assessment of risk of bias was reasonable.

The PEDro scale was adequately justified and described, but with a missing information that one item of the selected tool does not contribute to the overall score and whether the reviewers worked independently. Additionally, in the methods section, the authors explained the characterization of the study quality as high and low depending on the overall PEDro score. However, in the results section the studies were rated as either of poor, fair, moderate and excellent quality. Because the studies weren't explicitly grouped for each planned synthesis during the eligibility criteria, the comparison against the executed grouping could not had been carried out.

The process for deciding which studies were eligible for each synthesis was not described but could be made out of the Table 3 presenting the description of the exercise programs in each study. The authors sufficiently described and/or presented the synthesis methods but did not report methods used to assess risk of bias due to missing results and methods used to assess certainty (or confidence) in the body of evidence for each outcome.

Item 16b in the section results is newly added to the updated PRISMA checklist, which explains why authors did not list and explain why studies that might had appeared to meet the inclusion criteria were excluded. The outcomes were presented in three synthesis – pain, function and strength.

The characteristics (other variables) of included studies were summarised together and not separately for each synthesis, while the risk of bias was summarised for synthesis on pain and function, but not strength. Because the authors did not assess the risk of bias due to missing results and certainty in the body of evidence for each outcome, they consequently did not present corresponding results. Further investigation into results yielded some additional observations that are not included in the PRISMA checklist.

The authors stated that the information about exercise supervision should be evident from Table 3, however it was true for only one study in Table 2. There was also discrepancy between the text and Table 3 for the information on exercise frequency and progression. When listing the number of studies, which reported other variables such as duration of a

single exercise session and its progression, exercise intensity and breaks between series or blocks, the authors did not cite the studies, while this information was also not evident in tables. Consequently, the reader does not know which studies were implicated. The Tables 2 and 3 that continue through pages 1437 and 1443 do not include the header row in their third part, which impacts their clarity.

If the authors extracted the description of the interventions (the exercises used in each study) both them and the reader could evaluate if the program consists of correct exercises. The fact that a study defines their program as "knee only exercise program" does not mean that the exercises adequately present the program.

The systematic review successfully covered items 23a–d in the discussion section. However, the authors did not comment on the quality of included studies and how that affects the main findings of the review. To support a certain claim in the discussion, the authors mentioned that an included study came to the same conclusion, yet they did not proclaim the study was of poor quality (the lowest in the whole review). The discussion on effectiveness of hip and/or knee exercise programs on pain relief and functional performance was satisfactory, while on the other hand, the discussion was insufficient for effect on muscle strength. The conclusions about muscle strength therefore seemed vague. Despite including trunk muscles in the title, this was not debated in the discussion or mentioned in the conclusions.

Section "other information" is a new section in the updated PRISMA statement and therefore the authors Manojlović et al. (2021) could not add this in to their systematic review and meta-analysis.

5. Conclusions

The systematic review by Manojlović et al. (2021) adequately assessed the effectiveness of hip and/or knee exercise programs for pain relief and functional performance in PFP, however their conclusions on effectiveness for muscle strength were not based on sufficient discussion. The review was satisfactorily conducted according to the PRISMA checklist with few items not reported or reported insufficiently due to discrepancies between the former and updated PRISMA statement.

Funding: No funding was reported.

Conflicts of Interest: The authors declare no conflict of interest.

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