

BMJ Open Effect of backward walking training on knee osteoarthritis: protocol of a systematic review and meta-analysis

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To cite: Wu Y, Lei C, Huangfu Z, *et al.* Effect of backward walking training on knee osteoarthritis: protocol of a systematic review and meta-analysis. *BMJ Open* 2020;**10**:e040726. doi:10.1136/bmjopen-2020-040726

► Prepublication history for this paper is available online. To view these files, please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2020-040726>).

Received 21 May 2020
Revised 17 September 2020
Accepted 07 October 2020



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ABSTRACT

Introduction Backward walking (BW) is otherwise known as retrowalking. As opposed to forward walking, BW is a countersequential exercise and is a common method of rehabilitation training and disease-assisted treatment. Studies have shown that BW has a helpful effect on improving lower limb proprioception, gait synergy and improving limb balance. Many studies have concluded that BW can improve the symptoms of patients with knee osteoarthritis (KOA) and can be used for rehabilitation and adjunctive treatment of KOA, but there is a lack of evidence-based medical evidence. This research aims to provide an update to the most recent available evidence on the effect of BW on patients with KOA.

Methods and analyses Electronic databases, such as Ovid/MEDLINE, EMBASE, CINAHL, Scopus, Web of Science and PubMed, will be searched by us. We will include studies identified from citation until 12 May 2020 and will not be restricted by geographical setting. The search will not be limited to the language of the publication, but the study of human subjects. Randomised controlled trials (RCTs) on the BW training of KOA will be included, with outcome measures including pain, knee function or balance function. The quality of included RCTs will be evaluated according to the Cochrane Collaboration's risk of bias tool. A meta-analysis or systematic review will be performed to summarise the effects of BW training. We will perform sensitivity analysis on the sample size of RCTs, meta-regression analysis of the follow-up periods, dosages and baselines of outcome measures, and publication bias analysis.

Ethics and dissemination Ethical approval is not required as this study will not involve confidential personal data. The results of this study will be disseminated through a peer-reviewed journal.

PROSPERO registration number CRD42020185694.

INTRODUCTION

Osteoarthritis (OA) is a common chronic disease that causes disability in the elderly, affecting the joints of the hands, hips, knees and spine, with knee OA (KOA) being the most common.¹ In China, the prevalence of KOA is about 18%, and patients with KOA often experience pain, decreased muscle mass and function, impaired proprioception and body imbalance, all of which can reduce postural stability and increase the risk of falls,

Strengths and limitations of this study

- This review will provide a comprehensive, standardised and extensive search strategy.
- This review will compare the effects of backward walking (BW) training and other traditional sports rehabilitation training on patients with knee osteoarthritis (KOA).
- This review will provide a comprehensive assessment regarding the effect of BW training in patients with KOA.
- The results will help patients with KOA to have more options for rehabilitation training.
- The comprehensiveness and methodological quality of the main studies included in this review may be poor, leading to a significant discount in the reliability of the results.

which places a huge burden on patients and their caregivers.^{2–4} Currently, pharmacological interventions, joint cavity injections and surgery are mostly used to alleviate the clinical symptoms of KOA.^{5,6} With the emphasis on healthy lifestyles, an increasing number of people are opting for exercise interventions to reverse the progression or perform postoperative rehabilitation exercises.^{7,8}

Backward walking (BW) is a universal method of rehabilitation training and adjuvant therapy.⁹ It is confirmed that BW can reduce the symptoms of female patients with patellofemoral pain syndrome by affecting the activity rate of medial femoral oblique and lateral femoral muscle.¹⁰ In addition, BW has a beneficial effect on improving lower limb proprioception, gait synergy and limb balance.^{11–14} Results of a study recommend the use of BW for KOA rehabilitation and adjuvant therapy, because they found that BW can reduce the pain caused by arthritis, optimise joint function and enhance the strength of the quadriceps muscles.¹⁵ However, it has been reported that while walking rehabilitation therapy can improve cardiovascular health in patients with KOA,

it does not make any significant effect on reducing pain symptoms.¹⁶

At present, most researchers believe that BW training may improve the symptoms of patients with KOA and can be used to rehabilitation and adjuvant therapy, but there is still no research to summarise the evidence. Therefore, this study will collect randomised controlled trials (RCTs) in which BW training is used for the rehabilitation and adjuvant treatment of patients with KOA, and conduct a systematic review and meta-analysis to clarify the effect of BW training in patients with KOA.

Objective

The main purpose of this study is to determine the rehabilitation effect of BW training on KOA. We aim to conduct a systematic review and meta-analysis of RCTs to compare BW training with any other rehabilitation therapy (eg, walking forward, manual massage, traditional exercise therapy, etc). The main outcomes are inflammation relief, joint function recovery and adverse events.

METHODS

This protocol will be conducted in accordance with the guideline of Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols (PRISMA) 2015 statement.¹⁷

ELIGIBILITY CRITERIA

Participants

Adults (over 18 years old) suffering from KOA will be the participants in our study. We will not restrict patients from different clinical staging. Age, sex or ethnicity of the enrolled subjects will not be the restriction.

Interventions

The mode of intervention is BW as rehabilitation training with any route, dose or frequency. We also will include trials where BW training is used as an adjunctive therapy to conservative treatments.

Comparators

The comparators are any other rehabilitation therapy (eg, walking forward, manual massage, traditional exercise therapy, etc), or no intervention.

Outcomes

The outcomes will include (1) pain perception, (2) knee function recovery, (3) mobility, (4) improvement movable degree of knee joint, (5) quadriceps strength and (6) adverse events.

Study characteristics

We decide to include RCTs which are more likely to provide unbiased information than other study designs. However, quasi-randomised RCTs (eg, allocation by alphabetical order, medical record number, alternate days of the week or date of birth) and cross-over trials will

also be included. There is no restriction on language or publication status.

We will exclude those that do not have a control group design, do not provide case and control sources, reviews, case or expert experience, animal experiments, nursing records, conference proceedings, repeated publications, incomplete data and collection of unscientific literature.

INFORMATION SOURCES

We will conduct electronic searches through these databases: Ovid/MEDLINE, EMBASE, CINAHL, Scopus, Web of Science and PubMed. The search period ended on 12 May 2020. We will also conduct manual searches of journal volumes/journals and conference proceedings that are not available in electronic search to review references. And contact the author for the full text of the identified literature. We will carry out a 'snowballing' search to find relevant studies from the reference list of included studies and previous systematic reviews. In addition, we will also contact subject experts and authors of the identified research/organisations to obtain relevant researches for inclusion in our review.

Search strategy

Search strategies will be developed using medical subject headings as well as text words associated with terms relevant to 'backward walking', 'knee osteoarthritis' together with 'randomised controlled trial'. The searches will be conducted by two authors independently (YW and CL). [Table 1](#) lists an example of our search strategy.

Study records

Data management

EndNote V.X7 will be used to manage literature search results, and remove duplicate records. All extracted data are stored in a Microsoft Excel spreadsheet.

Selection process

The PRISMA-compliant flow chart will be used to demonstrate the literature selection process ([figure 1](#)), all conducted by two authors (ZH and KS), while the third author (CY) can help resolve any differences. First, the titles and abstracts of all retrieved articles will be reviewed independently, and studies that clearly do not meet the eligibility criteria will be excluded. Then, to determine if they meet the eligibility criteria, each author will further review the full text of the remaining studies. The results will be collated if multiple reports are found in the same study.

Data collection process

Data for all eligible publications will be carefully and independently extracted by two authors (YW and CL) in two copies. Disagreements encountered in the process will be resolved through discussion and, if necessary, can be resolved with the help of a third author (CY). Additional attachments will be sought or study authors will be contacted via email to obtain raw data as well as missing

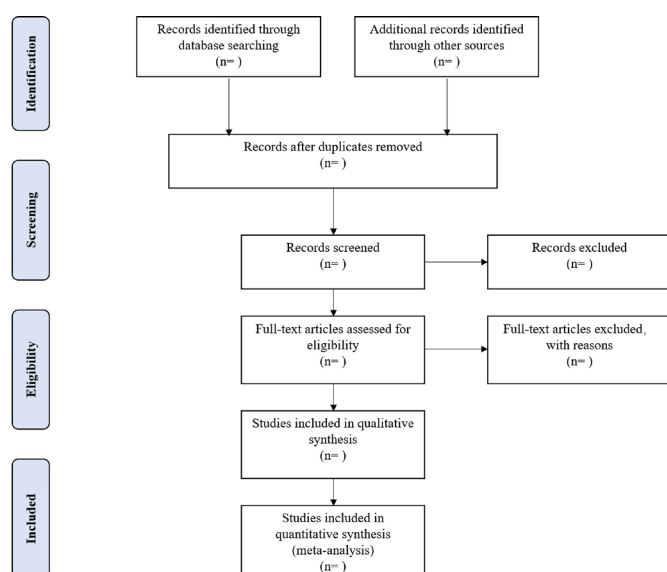
Table 1 Search strategy used in PubMed

No	Search items
#1	Randomized controlled trial.pt
#2	Controlled clinical trial.pt
#3	Randomized.ti,ab
#4	Randomly.ti,ab
#5	Trial.ti,ab
#6	Placebo.ti,ab
#7	Groups.ti,ab
#8	#1 or #2 or #3 or #4 or #5 or #6 or #7
#8	Knee Osteoarthritis.Mesh
#9	Knee Joint.Mesh
#10	Patellofemoral Joint.Mesh
#11	#8 or #9 or #10
#12	backward.ti,ab
#13	Retro.ti,ab
#14	#12 or #13
#15	walking.ti,ab
#16	gait.ti,ab
#17	locomotion.ti,ab
#18	#15 or #16 or #17
#19	#14 and #18
#20	#8 and #11 and #19

data. After sending two request emails within 4 weeks with no response, we will drop the contact.

Data items

The following information will be extracted using a pre-determined data form from each included study: author, year of publication, country of study, sample size, age, sex, disease status, setting, intervention type, intervention


Figure 1 The primary selection process.

dose, follow-up duration, intervention components, measures, key outcomes, other outcomes and estimated intervention effectiveness.

Outcomes and prioritisation

Since soothed knee inflammation and joint function recovery are key outcome indicators after rehabilitation training, the main outcomes of this study will be reduced pain perception and joint function recovery in patients. Reduced pain perception can be assessed through patient self-report questionnaires, such as the Numeric Rating Scale for Pain¹⁵; joint functional recovery is defined as improved mobility and will be assessed through scales and tests, such as the Timed 'Up and Go' test¹⁵ or the Western Ontario and McMaster Universities Osteoarthritis Index.^{15 18}

The secondary outcomes will assess adverse events that occurred during the intervention or during follow-up, including dizziness, anxiety, falls and other adverse events related to exercise training.¹⁹

Risk of bias in individual studies

The risk of bias for each included study will be independently assessed by two reviewers (YW and CL). If there is a disagreement, it will be resolved through discussion or the decision of the third author (CY). The PEDro scale was used to analyse the risk of bias for the included trials.²⁰ The scale included 11 items: (1) eligibility criteria were specified, (2) subjects were randomly allocated to groups (in a cross-over study, subjects were randomly allocated an order in which treatments were received), (3) allocation was concealed, (4) the groups were similar at baseline regarding the most important prognostic indicators, (5) there was blinding of all subjects, (6) there was blinding of all therapists who administered the therapy, (7) there was blinding of all assessors who measured at least one key outcome, (8) measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups, (9) all subjects for whom outcome measures were available received the treatment or control condition as allocated or, where this was not the case, data for at least one key outcome was analysed by 'intention to treat', (10) the results of between-group statistical comparisons are reported for at least one key outcome and (11) the study provides both point measures and measures of variability for at least one key outcome.

Data synthesis

The main outcome indicators involved in this study are mostly continuous variables, a standardised mean difference will be used to express the result. Adverse events will be descriptively analysed, if applicable (for dichotomous outcomes) a risk ratio with 95% CI will be reported. For those who do not clearly present for the data or change values in the literature, we will obtain the original data by contacting the original author. If the contact is unsuccessful, the relevant evidence-based data

calculation formula will be used. The pooled data will be conducted through Stata V.12.0 (StataCorp) with the metan command.

The heterogeneity included in the research results will be analysed by χ^2 test, and the effect model will be selected according to the analysis results. If $p \geq 0.1$ and $I^2 < 50\%$, it indicates that the statistical heterogeneity between the studies is small, and the fixed-effect model can be selected for data combination; if $p < 0.1$, $I^2 \geq 50\%$, it indicates that there may be obvious heterogeneity between the studies then we will choose a random effects model for data merging.²¹ When sufficient data are available, we will perform a subgroup analysis to investigate heterogeneity.

We will perform subgroup analysis based on age, gender, training dose, follow-up time and control group (forward walking training, no treatment or other therapies). In addition, sensitivity analyses will be conducted to examine the robustness of our analysis by omitting specific trials from the overall analysis.

If quantitative synthesis is not applicable, we will perform narrative, qualitative summaries and use sequential text and tables to present the information.

Meta-bias

If 10 or more studies are included in the meta-analysis, a funnel plot will be used to qualify the study effects and the Egger's test will be used for qualitative analysis.²² Reporting bias, if any, will be assessed by comparing the study results with its protocol.

Confidence in cumulative evidence

We will use the Grading of Recommendations Assessment, Development and Evaluation approach to assess the quality of each summarised evidence. The risk of bias, consistency, directness, imprecision and publication bias are the main evaluation indicators of this method. The overall quality of evidence will be rated as high, moderate, low or very low. The evidence evaluation process will be conducted using the GRADEpro online software (<http://grade.pro.org>).²³

Amendments

If there is any modification of the agreement, we will provide the date of modification, explanation and reason for the event of protocol amendments.

Contributors YW and CL contributed to the conception and design of this study protocol. CL registered the protocol with the PROSPERO database. YW and CL edited the draft protocol. The search strategy was developed by CL and YW. ZH and KS will screen titles, abstracts and full-text copies of the studies after the literature search. YW, CL or ZH will extract information of the included studies after screening. KS and YW will check the data entry for accuracy and completeness. CY is the guarantor for this review and will give advice for data analysis and presentation of study result. All the authors drafted and critically reviewed this manuscript and approved the final version.

Funding This study was supported by Scientific Research Project of Sichuan Provincial Health and Family Planning Commission of China (17ZD023) and Science and Technology Plan Projects of Deyang City (2018SZS091).

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not required.

Provenance and peer review Not commissioned; externally peer reviewed.

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