Exercise for lower limb osteoarthritis: systematic review incorporating trial sequential analysis and network meta-analysis

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CRD summary

This review concluded that exercise benefits patients with lower limb osteoarthritis and an approach combining exercises to increase strength, flexibility and aerobic capacity was likely to be most effective in the management of this condition. These conclusions appear to be reliable but the included studies have some methodological limitations and analyses showed variation between studies offering a similar intervention.

Authors' objectives

To assess the effectiveness of exercise interventions in relieving pain and improving function in patients with lower limb osteoarthritis

Searching

Nine databases were searched from inception to March 2012. There were no language restrictions. Search terms were presented. Bibliographies of relevant review articles and selected articles were consulted for additional relevant articles.

Study selection

Eligible studies needed to be randomised controlled trials (RCTs) that compared exercise interventions with each other or with a no exercise control arm in adult patients with knee or hip osteoarthritis. Trials of perioperative exercise therapy were excluded. Diagnosis of knee or hip osteoarthritis was according to accepted criteria and could be made clinically or radiographically. Trials needed to include assessment of at least one of self-reported pain and function.

Trials mostly recruited patients from local communities. Most of the trials were in patients with knee osteoarthritis. Exercise interventions included any type of land- or water-based therapeutic exercise regardless of content, duration, frequency or intensity. Maximum length of follow-up ranged from four weeks to 79 weeks (median 15 weeks).

Six reviewers in pairs independently assessed studies for eligibility. Two reviewers independently classified the exercise interventions based on three a priori defined characteristics of exercise interventions in osteoarthritis: to mainly improve strength, flexibility or aerobic capacity/general health. Discrepancies were resolved by discussion.

Assessment of study quality

The Cochrane Collaboration tool for assessing risk of bias was used for quality assessment of the included trials. Trials were rated as unclear, high or low risk of bias. Items assessed included sequence generation, allocation concealment, blinding of outcome assessor, incomplete outcome data and selective outcome reporting.

Six reviewers in pairs independently assessed quality. Discrepancies were resolved by discussion.

Data extraction

Data were extracted to calculate the standardised mean difference (SMD). Authors were contacted for any SMDs that could not be estimated. Effect sizes were classed as small (0.2 to <0.3), medium (0.3 to <0.8) and large (>0.8). Effect sizes relating to pain were back transformed onto a 10cm visual analogue scale (VAS). Effect sizes relating to function were back transformed to a standardised Western Ontario and McMaster Universities disability score ranging from zero to 10.

Six reviewers in pairs independently extracted data. Discrepancies were resolved by discussion.

Methods of synthesis

Trial sequential analysis was conducted to establish the reliability and conclusiveness of the available evidence on exercise. A random-effects Bayesian network meta-analysis was used to compare the relative effectiveness of different exercise interventions. This technique allows for indirect comparison of interventions through a common comparator

where there is little, if any, evidence that compares interventions directly. Checks for consistency of the network and tests for heterogeneity were made. Sensitivity analyses were conducted restricting the network to knee osteoarthritis trials. Meta-regression techniques were used to assess potential sources of heterogeneity: year of publication, number of supervised sessions and duration of follow-up. More details of the methods used were reported in the article.

Results of the review

Sixty trials (8,218 participants) were included in the review. Randomisation was adequate in 60% of the trials, allocation concealment in 42% of the trials, 52% masked outcome assessors, 18% of the trials were at high risk of bias from incomplete data and 88% of the trials had a low risk of selective outcome reporting bias.

Trial sequential analysis showed that as of 2002 enough evidence had been accrued to show significant benefit of exercise intervention over no exercise control for both pain and functional improvement.

There were 13 types of exercise comparisons in the network meta-analysis of the outcome of pain. No comparison had undue influence on the effect estimates in the network. There was no evidence of inconsistency between direct and indirect evidence in the network for the outcomes of pain or function.

The network meta-analysis showed no significant differences in effect estimates between different types of exercise interventions. For pain relief, strengthening, flexibility plus strengthening, flexibility plus strengthening plus aerobic, aquatic strengthening and aquatic strengthening were all significantly more effective than no exercise control. The probability of being the most effective intervention for pain relief was 81% for aquatic strengthening plus aerobic flexibility, 76% for strengthening exercise only and 73% for aquatic strengthening plus aerobic exercise. A combined intervention of strengthening, flexibility and aerobic exercise was also significantly more effective than no exercise for improving limitation in function (SMD -0.63, 95% CrI -1.16 to -0.10). This combination of three types of exercise and aquatic strengthening plus aerobic exercises had the highest probability of being the best overall treatment for function (both 71%).

Further sensitivity analyses were reported.

Authors' conclusions

There is significant benefit of exercise over no exercise in patients with osteoarthritis. An approach combining exercises to increase strength, flexibility and aerobic capacity is likely to be most effective in the management of lower limb osteoarthritis.

CRD commentary

This review had clear inclusion criteria and was based on a search of several sources of studies with no language restrictions. Quality was assessed and risks of bias were presented. The included trials were susceptible to a range of biases. More than one reviewer was involved in the processes of study selection, data extraction and quality assessment which helps to minimise bias and error in these review processes. The involvement of more than one reviewer is helpful when classifying interventions and it should be noted that the robustness of the network analysis is dependent on the validity of the classification.

The analyses appeared to be appropriate to the decision problem. The conclusions of the review appear to be reliable but are subject to several caveats: some uncertainty is introduced by methodological limitations of the included studies; there is a large amount of heterogeneity in several of the outcome analyses; and studies were based primarily on patients with knee osteoarthritis and so may not be generalisable to those with osteoarthritis of the hip.

Implications of the review for practice and research

Practice: The authors stated that the results of the study provided support for guidelines indicating that patients with osteoarthritis should be encouraged to take regular aerobic, muscle strengthening and range of motion exercises.

Research: The authors stated that research was needed to evaluate how best to support patients with lower limb osteoarthritis to adhere to exercise and physical activity, which patients will benefit and whether some modes of delivery and support lead to better outcomes. They also stated the need to determine long-term clinical and cost-effectiveness of exercise interventions for lower limb osteoarthritis and how best to ensure that short-term benefits are maintained over time.

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