The role of walking programmes in the conservative management of lower limb osteoarthritis: A review

CJ Minns Lowe*

Abstract

Introduction
People with long-term musculoskeletal conditions such as osteoarthritis are increasing in prevalence, and significantly more likely to be less active than adults without arthritis and are at increased risk of either having or developing further co-morbidity. More than half of adults with arthritis undertake minimal/little walking per week. Walking is popular and can substantially lower the risk of many chronic diseases. This review aims to summarise the available literature regarding the role of walking programmes for people with osteoarthritis.

Materials and methods
PUBMED and the Cochrane library searches were performed to locate articles. Key terms used in PUBMED searches included ‘walking program’, ‘physical activity’ and ‘osteoarthritis’ whilst Cochrane searches included the same search terms without truncation and also by browsing records under ‘osteoarthritis’. Searches were performed in English. Reference lists of identified articles were checked to identify further articles for the review.

Results
Seven studies were identified and included: three randomised clinical trials, two pilot or feasibility studies (one uncontrolled) and two quasi-experimental studies. The study characteristics, including participants, interventions, outcomes and summarised findings, are presented. The theoretical rationales, content and dosages showed wide variation. Compliance rates decreased over time. Attrition rates ranged from 10% to 47%.

Conclusion
Limited evidence currently suggests that walking programmes can safely improve pain and quality of life. Programmes improve function and quadriceps strength in the short term and may have a role in weight management. Short-term improvements in function may not be maintained in the longer term. Such programmes can offer an inexpensive, accessible, flexible treatment and self-management option; however many treatment parameters require further investigation.

Introduction

Physical inactivity increases with advancing age, and there are increased risks of disability, reduced function, chronic disease and falls associated with inactivity in older age. People with long-term musculoskeletal conditions such as osteoarthritis are increasing in prevalence, are significantly more likely to be less active than adults without arthritis and are at increased risk of either having or developing further co-morbidity. Lower limb osteoarthritis is also an important risk factor for another major health problem, falls, which can also impact upon physical activity and functional ability.

Current guidance recommends achieving 30 min of moderate physical activity on five or more days per week, with an acceptance that some physical activity is better than none. These 30 min can also be performed in several bouts of moderate activity, each lasting at least 10 min. Less than one-third of adults have heard of these guidelines and less than a tenth can recall them accurately. The challenge is immense; in the UK, 45% of men in Scotland reported meeting recommended levels, 39% in England, 37% in Wales and 33% in Northern Ireland. Women were less active, with only 33% reporting meeting recommended levels in Scotland, 29% in England, 24% in Wales and 28% (NI). For people with arthritis, a US study revealed that only 27.8% undertook regular physical activity (defined in this study as 20 min a day 5 days a week or 30 minutes a day 3 days a week). More recently, US data indicate that more than half of adults with arthritis do no or little (<90 min) walking per week. Although the definition of arthritis used in this research includes conditions such as rheumatoid arthritis and fibromyalgia, these figures remain concerning.

As commented previously, physical activity can be both a protective factor and a risk factor in the aetiology and prognosis of lower limb osteoarthritis, depending on the level and nature of the activity. Generally walking programmes, including unsupervised ones, are low-risk modes of physical activity even for high-risk patients. A recent review indicated that walking can improve functional status in people with arthritis without exacerbating pain. Walking can substantially lower the risk of many chronic diseases. It is the most popular UK leisure time activity, and NICE guidelines call for the development of walking programmes, utilising NICE guidance for behavioural change, for adults who are insufficiently active. Exercise itself is a core treatment
for osteoarthritis, as re-emphasised this year in updated NICE and OARSI guidelines, which highlight the need for regular exercise and programmes promoting adherence to long-term exercise and the need to promote self-management of osteoarthritis due to increasing senescence. This review aims to summarise the available literature regarding the role of walking programmes for people with osteoarthritis and to provide an overview regarding the extent to which walking programmes might benefit people with osteoarthritis to treat and self-manage this condition.

Materials and methods
A comprehensive review of literature relating to walking programmes for the conservative management of people with osteoarthritis was performed. PUBMED and the Cochrane library searches were performed in July 2013 and September 2013 to locate articles. Key terms used in PUBMED searches included ‘walking programme’, ‘physical activity’ and ‘osteoarthritis’ whilst Cochrane searches included the same search terms without truncation and also by browsing records under ‘osteoarthritis’. The searches were performed in English. The reference lists of identified articles were checked to identify further articles. Articles including multimodal exercise approaches (e.g. specific muscle strengthening exercises) to treatment (with walking programmes being only one component of a larger exercise package) were excluded since it would not be possible to evaluate individual exercise package components. Studies of ‘arthritis’ were included (since osteoarthritis is by far the most common arthritis) unless studies were specifically for people with inflammatory arthritis.

Results
Seven studies were identified and included in the review of pilot or feasibility studies included in the review listed in Table 1 in order of publication date to provide a sequential narrative. Additionally, results regarding study rationales, attrition, adherence and compliance are provided below.

Behavioural theoretical rationale for interventions
The presented rationales to facilitate changes in physical activity are understandably less explicitly presented in earlier studies, unable to draw upon more recent research findings regarding effective strategies to alter behaviours amongst people with osteoarthritis. Martin et al. used education strategies in their study, presenting information on nutrition, healthy eating and the modification of eating behaviours. Evick and Sonel explained to participants why they should do the exercises or walking programme because of benefits regarding pain and functional capacity. Talbot et al. based their design on arthritis self-management education to promote knowledge regarding osteoarthritis and self-management strategies. The Bruno et al. comparison of two walking programmes used a different rationale for each programme. The ‘You can break the pain cycle’ 90-min arthritis pain management presentation aimed to instil the belief that individuals can manage their arthritis and increase utilisation of Arthritis Foundation resources. The ‘Walk with Ease’ walking programme aimed to promote education about physical activity and self-management plus a research-based community-based fitness programme. Callahan et al. subsequently modified the ‘Walk with Ease’ programme, replacing the transtheoretical model of Stages of Change with Social Cognitive Theory and focusing upon participants engaging in motivational strategies.

et al. also used constructs from social cognitive theory to develop self-efficacy by influencing an individual’s confidence in their ability to be physically active. Brosseau et al. used a multifaceted approach combining more than one knowledge translation strategy to try to promote intervention effectiveness. Their behavioural intervention and walking group included goal setting, education and counselling. Their walking group received an education booklet in addition to the walking programme. Their self-directed control group utilised one session to provide participants with an education booklet, log book and pedometer with monetary compensation for log book completion.

Attrition rates
The lowest attrition rates were 10% (9/90, n = 3 from exercise group, n = 2 from the walking group, n = 4 from control group) and 15% (n = 6/40, n = 4 self-management, n = 2 walking group). Next were 21% (n = 100/462) and 22% (n = 8/36, n = 3 prior to interventions, n = 3 in 3-day walking group and n = 2 in 5-day group). Attrition in the Martin et al. study was 36% (n = 18/48, 17 for personal reasons and n = 1 total knee arthroplasty); mean V0,max was lower at entry for non-completers suggesting that initial fitness level may possibly have been a predictor, with completers being less disabled. The highest attrition rates were reported by Brosseau et al. where 100/222 (45%, n = 42 group 1 walking with behavioural, n = 44 group 2 walking, n = 36 self-directed group 3) participants had dropped out by final (18/12) follow-up and Bruno et al. (47%, n = 77/163, n = 70 group 1 pain management, n = 2 walking programme, n = 5 both pain management and walking programme).

Compliance and adherence
Compliance and adherence data were not always reported. Martin et al. gave an approximate rate of

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Table 1 Study characterixstics for studies included in the review (n = 7)

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants (sample size)</th>
<th>Intervention (time of intervention)</th>
<th>Main outcome measures</th>
<th>Summarised results</th>
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<tr>
<td>Martin et al. (2001) Uncontrolled pilot study</td>
<td>48 postmenopausal women (mean 61 + 6 years). BMI &gt; 25 (mean 86.2 + 12.6). Knee pain most days of prior month. Meet ARC clinical and radiographic criteria for knee OA. Able to walk independently (no aids)</td>
<td>6/12 weight loss and walking programme. Weekly hour-long sessions on nutrition, healthy eating, modifying eating behaviour. Prescribed American Heart Association diet. Walking three times a week at a target heart rate of 50–60% of heart rate reserve for 45 min (one supervised session after hourly class, two independently)</td>
<td>Weight, timed up and go test, timed 6-min walk, VO2 max, WOMAC pain, stiffness and function. Measurements pre- and postintervention</td>
<td>n = 30 completed programmes. No adverse effects. Weight loss 5.6 + 4.0 kg. TUG test % change = −16.3 + 16.2, p &lt; 0.001. 6-min walk % change = 9.7 + 10.4, p &lt; 0.001. WOMAC pain average reduction = 44% (p = 0.02) WOMAC stiffness = NS, WOMAC function mean improved = 21% (p = 0.01). Subgroup analyses by BMI found &gt; improvement on performance tests for obese women than overweight</td>
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| Evcik and Sonel (2002) Randomised trial | 90 adults (mean age approximate- ly 56 years) with OA knee (clinically and radiologically assessed grade 4 patients did not enter the study) (F = 56, M = 34) | 3/12 duration. Group 1 (n = 30) = home exercise programme (isometric and isotonic quadriceps exercises) twice a day. Group 2 (n = 30) = walking programme three times a week, beginning with 10 min and progressing to 30 min. Group 3 (=30) = control. Groups 1 and 2 were phoned weekly. All participants advised to lose weight | Pain and function (WOMAC score, Pain VAS), quality of life (Nottingham health profile questionnaire). Assessed preintervention and at 6 months | n = 81 completed follow-up. Groups 1 and 2 WOMAC and VAS had significantly less pain than control group (p < 0.001. NS differences between groups 1 and 2 (p > 0.05). NS between group differences for quality of life, within-group changes were greatest for the walking group (p < 0.001). 3% participants lost weight in group 1, 26% in group 2 and no one in group 3 |

| Talbot et al. (2003) Randomised two-by-three (group by time) control group design | 40 adults (mean age 69.6 + 6.7). Pain in one or both knees most days, radiographic evidence of knee OA, difficulty performing at least one functional activity due to pain (F = 26, M = 8 completers) | Both groups attended arthritis self-manage- ment education 12-h programme. Intervention group received 12-week Walk + Program; individual daily step goals, pedometer use (baseline step count increased by 10% every 4 weeks), Counselling, booklet | Physical activity (Pedometer, Tritrac-R3D accelerometer), quadriceps muscle strength (Kin-Com 125E), functional (100 foot timed walk turn walk, timed stair climb, timed chair rise) Pain (Present Pain Intensity Scale and Pain rating index from MPQ) and adherence. Measurements pre- and postintervention and 3-month follow-up plus functional and arthritis pain measures every 4/52 for 24 weeks | n = 34 completed the programme. Significant time-group interaction (pre- and postintervention) for steps walked; Walk + group = 23% and education only group 16% decrease in daily steps. Similarly, the walk + group showed a 20.1% increase in right knee isometric quad strength whereas the education group a 3.5% strength loss in pre- and post-test analyses. Also, on the 100-foot walk turn test, both groups were faster postintervention and continued to improve for Walk + at 3/12. Analyses did not demonstrate significant differences for the other measures |
Table 1 (Continued)

<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>Participants</th>
<th>Outcome Measures</th>
<th>Results</th>
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<tr>
<td>Bruno et al. (2006)</td>
<td>Quasi-experimental design</td>
<td>163 adults with arthritis (self diagnosed or medical diagnosis) and able to ambulate independently</td>
<td>Self-reported arthritis knowledge, general health, arthritis self-management, confidence about doing things, physical abilities, health distress and how arthritis affects their lives. Performance measures, 6-minute walk test, squat test and timed functional walking test at maximal speed. Group 1 follow-up = pre- and postpresentation, 6/52 and 4-month follow-up. Group 2 follow-up pre/post (6/52) and 4 months</td>
<td>( n = 86 ) completed the study. Survey summary: People self-selecting group 2 showed greater confidence in ability to do things and were less depressed, had lower distress scores and less pain that those who chose to attend group 1. Group 1 post-test improved knowledge scores, not maintained at 6 weeks and increased at 4 months. Group 2 showed an increased time exercising at 6 weeks but not maintained at 4 months. Performance tests—all groups indicated a significant difference in 6-min walk test postintervention but not maintained at 4 months (no specific values presented). No other differences</td>
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<td>Ng et al. (2010)</td>
<td>Feasibility OA diagnosed by physician (men = 11, women = 17), pain, stiffness, crepitus and ADL difficulties for the previous month, able to walk 15 min, able to participate in moderate-intensity exercise</td>
<td>All participants were given 1500 mg glucosamine sulphate for 6/52 for 6/52. Then randomised to 12/52 progressive walking programme ‘Stepping Out’ either 3 or 5 days a week. Programmes aimed to progress step count from at least 1500 steps per walk initially to 6000 steps at the end of the programme (week 18). Consultations, walking guides, log sheets and pedometers were included</td>
<td>Time spent on physical activity (PA) via Active Australia PA questions. WOMAC pain, stiffness, function, self-paced step test, WOMAC pain after lower limb movement test. Measurements at baseline, 6, 12, 18 and 24 weeks</td>
<td>( n = 28 ) completed the programme. No adverse effects attributed to programme. NS differences were found between groups (feasibility study so not powered for this). Mean step count for all participants rose from a mean of 3920 (SD 2441) day 1 of programme to 6683 (SD 3403). Combined group scores (weeks 6–24) showed significant improvements for physical activity (( p &lt; 0.001 )) self-paced step (( p &lt; 0.001 )) WOMAC pain (( p = 0.01 )), stiffness (( p = 0.06 )) function (( p &lt; 0.001 )). Pain after step (( p &lt; 0.001 ))</td>
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<td>Callahan et al. (2011)</td>
<td>Quasi-experimental design</td>
<td>462 adults with self-reported arthritis (instructor-led aged 70.7 + 9.8, 85.4% = F; self-directed aged 64.9 + 11.4 and 88.9% = F).</td>
<td>Patients selected either instructor-led or self-directed 6-week revised Walk with Ease programme</td>
<td>Timed chair stands, turn tests, single-leg stance, walking speed, 2-minute step test, self-report function (PROMIS HAQ score) Pain, stiffness and fatigue (VAS scales). Secondary measures = self-efficacy (ASE and SEPA), attitudes (RAI). Measurements pre- and postintervention plus 1-year follow-up self-report data only</td>
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Table 1 (Continued)

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<th>Results</th>
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<tr>
<td>Brosseau et al. (2012)²², ²³</td>
<td>222 adults with mild-to-moderate OA confirmed by ARC clinical and radiographic/MRI criteria. Pain &gt; 3 months. Able to walk at least 20 min with pain VAS &lt; 3. Able to be an outpatient. Available three times a week for 12/12. Mean age 63.4 ± 8.6. M = 69 (31.1%), F = 153 (68.9)</td>
<td>Randomised to 3 groups: 1. supervised community-based aerobic walking programme (progressive then maintenance) plus behavioural intervention (PACE-ex programme: education, goal setting, counselling, phone support) and education booklet three times a week, walking sessions of 65 min per time, PACE-ex 20 h-sessions. Duration 1 year. 2. Walking programme plus booklet. 3. Self-directed control with only booklet provided (one introductory session). All groups were provided with pedometers and log books</td>
<td>Health-related quality of life (AIMS 2, SF-36). Functional status (WOMAC). Performance outcomes (6-minute walk test, gait speed, timed up and go). Physical Activity (7-day PAR). Measurements at baseline, 3, 6, 9, 12, 15, 18 months) Adherence. Behavioural change (Stanford Score)</td>
<td>122 completed study. NS differences for total adherence between groups. Quality of life, few significant differences between the three groups but these favoured group 1 over 2 and 2 at 12 and 18 months. WOMAC: NS differences between the three groups except for at 18 months favouring group 2 versus group 1 (p = 0.019). NS difference between three groups at 12 and 18 months for 6-min walk test, gait speed, timed up and go, leisure-time physical activities part of 7-day PAR recall. 7-day PAR occupational/domestic activity walking and other activities showed significant difference in mean scores for group 1 at 12 months and 18 months. NS differences for adherence. Stanford scores at 18/12 favoured group 2 over 1 (p = 0.041) and group 3 had the highest means re: confidence about doing things</td>
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NS, nonsignificant; M, male; F, female; WOMAC, Western Ontario and McMaster Universities Arthritis Index; MPQ, McGill Pain Questionnaire; PROMIS HAQ, PROMIS Health Assessment Questionnaire; ASE, arthritis self-efficacy; SEPA, self-efficacy for physical activity; RAI, rheumatology attitudes index; AIMS 2, Arthritis Impact Measurement Scale 2; SF-36, Quality Metric’s SF-36 Health Survey to measure functional health and well-being.

Competing interests: none declared. Conflict of interests: none declared.

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small numbers or quasi-experimental studies incorporating self-selection to treatment arms. Studies were mostly either specifically targeted to diagnosed knee osteoarthritis or broadly inclusive to self-reported arthritis. The sample sizes of knee-specific studies tended to be small. The lack of high-quality randomised clinical trials indicates that a systematic review and meta-analyses to evaluate the effectiveness of walking programmes designed for people with osteoarthritis is currently inappropriate.

As seen in Table 1, the limited amount of evidence generally supports the use of walking programmes to reduce pain following the intervention in the short and longer term. The role of walking programmes to manage pain appears beneficial and worthy of further randomised clinical trials to determine which approaches and dosages are effective. The findings regarding changes in function are more ambiguous: short-term improvements in self-report function scores, walking speed and step count tests and quadriceps strength increases are positive but, in the studies including follow-up times, postintervention improvements may not be maintained at follow-up. Regarding the quality of life, within-group significant differences have been reported following walking programmes (not significant between group differences, no control group in this study). Interestingly, another study found that, while no improvements regarding survey measures were observed for the walking programme group, patients reporting less confidence and higher pain and distress at baseline were less likely to choose to participate in the walking programme than a pain management presentation. In the study comparing self-directed walking (control group) with two supervised walking programmes (with or without behavioural interventions), significant differences were observed in the quality of life at 12 and 18 months favouring the self-directed group. However, this study’s high attrition rate leads the authors to question the validity of the long-term follow-up data. Although initially developed as a control arm, the self-directed group received an intervention of an introductory session, provision of an education booklet, a pedometer, a logbook and monetary compensation for log book completion. Given the performance of this brief intervention compared to the resources and costs involved for the other two interventions, the value of brief walking programme interventions also appears worth further investigation. The potential value of self-directed programmes is also supported by Callahan et al., where HAQ scores were maintained or improved at one year compared to the group patients who lost ground. One walking programme leads to significant weight loss in one study in the short term (no long-term follow-up). This study also reported significant improvement in VO₂ max % change, having incorporated target heart rate within the walking programme. Given these findings are from an uncontrolled pilot study, further research is needed to investigate whether this approach would be of wider benefit to people with osteoarthritis in the longer term.

Content
The review demonstrated that the theoretical rationale, nature and content of walking programmes varies widely—from using target heart rate during walks to walking programmes using pedometers and weekly log sheets, step targets and the discussion of obstacles to walking. Dosage also varied substantially. Supervised walking programmes ranged from 1 h three times a week for 6 weeks to 1 year. The optimal duration of programmes is unknown.

Some programmes are including levels of exercise that are substantially above the levels of physical activity recommended for all adults. Given the challenges involved to increase the levels of physical activity even amongst healthy adults, and given that many people with osteoarthritis demonstrate such low levels of activity, there is perhaps an argument to be made that walking programmes for people with osteoarthritis should initially aim for the minimum recommendations of physical activity to be achieved and maintained.

Safety
Articles stated no conditions or problems arose as a result of the programmes. Some studies did not know why participants dropped out; the possibility exists that participants dropped out because of increased pain or problems related to the intervention. Another study reported that none of the conditions causing dropout were attributed to participation but, as the authors acknowledged, some of the loss to follow-up was attributable to existing conditions being aggravated by the programme—for example ‘pain while walking due to leg length discrepancy’ and ‘pain in knees’. Interestingly, one participant passing a telephone call reported a fall while walking due to leg length discrepancy and a fracture. Another participant passing a telephone call reported a fall due to ‘painlessness’ and another participant reported ‘pains in knees’.

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Attrition, compliance and adherence
Although currently of great interest, walking programmes for people with osteoarthritis have been around over 20 years. Four studies report, seemingly reporting data for the same 102 participants with osteoarthritis of the knee (n = 52), provided promising postintervention results following a multimodal walking and

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strengthening intervention. This seemingly positive start was not maintained: a telephone interview follow-up study found that adherence to the walking programme was low, with no differences between intervention and control groups at 1 year.22

This review also suggests that adherence from, and compliance with, walking programmes is problematic. Attrition rates ranged widely from 10% to 47%. Attrition rates between groups within the studies included in the review seem similar; bar one study20 where attrition was much greater amongst participants selecting to attend a one-off session than those committing to the longer programmes. Longer follow-up durations may have also adversely affected attrition.2,23 Martin et al.17 queried whether the time required for the intervention was a contributing factor to attrition. The dosage and commitment requirements placed upon participants in some of the studies were demanding. It is interesting that the lowest attrition rate is for a study where walking group participants built up to 30-min walking three times a week18, whereas a high attrition rate was seen where walking programme participants could be randomised to attend supervised sessions lasting at least an hour per time three times per week.2,23 Also, this study18 includes a younger group of patients than other studies. Moderate attrition rates were seen where programmes were either self-directed21 or where people could choose between instructor-led or self-directed sessions.22

Adherence and compliance rates were higher earlier in programmes, decreasing over time.2,17,26-22 This might be due to tail off or because progressive interventions reach a point when participants are unwilling or unable to further progress. The number of sessions per week may also be a factor influencing compliance; in the Brosseau et al. study, participants in the walking group three times/week achieved this on average, whereas participants in the five-day group walked fewer than five times/week. Research to determine how low active people with osteoarthritis would prefer to build up their level of physical activity and to build programmes around their views is one possible option.

Generalizability
The studies demonstrated limited generalizability to the wider population of adults with osteoarthritis due to sample size and the methodological approaches and study designs utilised. Some exclusion criteria seemed high. In the Ng et al. study, 221 (86%) of patients eligible to be screened for the study were excluded because they were too active, taking pain medication or were unable to commit to the study’s requirements. The Brosseau et al.2,23 inclusion criteria included participant’s ability to be available three times a week for a year in case they were randomised to the walking programme. This requirement immediately lessens the generalizability of study results to the wider population of people with osteoarthritis—for example, those who are working or have caring or time-consuming commitments. Additionally, to avoid contamination, group 1 were instructed to walk in the mornings and group 2 in the afternoons, again possibly further restricting participation.

Limitations
The current review was not intended to be a definitive or exhaustive systematic review of this topic. Rather, it aimed to start the review process in this area, informing health care professionals and patients by providing an overview of this topic. The review indicates that the lack of high-quality randomised clinical trials in this area would limit the value of undertaking a systematic review at this time. This review aimed to explore the effectiveness of walking programmes in the conservative management of osteoarthritis; an in-depth review of all possible theoretical approaches to promote changes in behaviour was beyond its remit. The review does, however, highlight some of the challenges and issues surrounding increasing levels of physical activity in this population.

Conclusion
The current limited amount of available evidence suggests that walking programmes can improve pain and quality of life, although further research is required before this can be confirmed (particularly for quality of life). Programmes also improved function and quadriceps strength in the short term and may have a role in weight management. Short-term improvements in function may not be maintained in the longer term. Walking programmes are considered safe in this patient group as long as they contain advice regarding flare-ups and progression. Depending on the design of the programme, walking programmes can be an inexpensive, accessible, flexible treatment and self-management option which, given the increasing prevalence of osteoarthritis and aging population, warrant further investigation. Parameters such as dosage, duration and effective strategies to promote long-term adherence and improved levels of physical activity require further study.

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References