Original Article

CLINICAL REHABILITATION

Clinical Rehabilitation
1–14

DOI: 10.1177/0269215517691083
journals.sagepub.com/home/cre
SAGE

The Ottawa panel clinical practice guidelines for the management of knee osteoarthritis. Part one: Introduction, and mind-body exercise programs*

Lucie Brosseau[1], Jade Taki[2], Brigit Desjardins[3], Odette Thevenot[3], Marlene Fransen[4], George A Wells[5], Aline Mizusaki Imoto[6], Karine Toupin-April[7], Marie Westby[8], Inmaculada C Álvarez Gallardo[9], Wendy Gifford[10], Lucie Laferrière[11], Prinon Rahman[12], Laurianne Loew[13], Gino De Angelis[13], Sabrina Cavallo[13], Shirin Mehdi Shallwani[13], Ala' Aburub[13], Kim L Bennell[14], Martin Van der Esch[15], Milena Simic[16], Sara McConnell[17], Alison Harmer[18], Glen P Kenny[3], Gail Paterson[19], Jean-Philippe Regnaux[20], Marie-Martine Lefevre-Colau[21] and Linda McLean[1]

[1]Physiotherapy Program, School of Rehabilitation Sciences, Faculty of Health Sciences, University of Ottawa, Ottawa, Ontario, Canada
[2]Interdisciplinary School of Health Sciences, University of Ottawa, Ottawa, Ontario, Canada
[3]School of Human Kinetics, University of Ottawa, Ottawa, Ontario, Canada
[4]Faculty of Health Sciences, University of Sydney, Sydney, Australia
[5]School of Epidemiology, Public Health and Preventive Medicine, University of Ottawa, Ottawa, Ontario, Canada
[6]UNIFESP, Internal Medicine, Brasilia, Brazil
[7]Children's Hospital of Eastern Ontario Research Institute, Department of Pediatrics, Faculty of Medicine and School of Rehabilitation Sciences, Faculty of Health Sciences, University of Ottawa, Ottawa, Ontario, Canada
[8]Mary Pack Arthritis Program, Vancouver Coastal Health, Department of Physical Therapy, University of British Columbia, Centre for Hip Health and Mobility, Vancouver, British Columbia, Canada
[9]Department of Physical Education and Sport, University of Granada, Granada, Spain
[10]School of Nursing, University of Ottawa, Ottawa, Ontario, Canada
[11]Canadian Forces Health Services Group Headquarters, National Defense, Ottawa, Ontario, Canada
[12]Department of Community Health and Epidemiology, Dalhousie University, Halifax, Nova Scotia, Canada
[13]School of Rehabilitation Sciences, University of Ottawa, Ottawa, Ontario, Canada
[14]Department of Physiotherapy, School of Health Sciences, The University of Melbourne, Melbourne, Australia
[15]Department of Rehabilitation, Reade Centre for Rehabilitation and Rheumatology, Amsterdam, Netherlands, Faculty of Health. ACHIEVE, Centre of Applied Research and School of Physiotherapy, University of Applied Sciences, Amsterdam, Netherlands
[16]Discipline of Physiotherapy, Faculty of Health Sciences, The University of Sydney, Lidcombe, Australia
[17]Department of Medicine, St. Joseph's Health Care Centre, Toronto, Ontario, Canada
[18]Faculty of Health Sciences, Clinical and Rehabilitation Sciences Research Group, University of Sydney, Sydney, Australia
[19]The Arthritis Society, Ottawa Office, Ontario Division, Ottawa, Ontario, Canada
[20]Centre de recherche Epidémiologie et Biostatistique, Hôpital Hôtel-Dieu, Paris, France
[21]Institute of Rheumatology, Department of Medicine and Rehabilitation, Cochin Hospital, Paris, France

*The Ottawa Panel comprises of: 1) The Ottawa Methods Group (Co-authors: Brosseau to Aburub inclusively) & 2) the Experts Panel (co-authors: Bennell to McLean)

Corresponding author:
Lucie Brosseau, Faculty of Health Sciences, School of Rehabilitation Sciences, University of Ottawa, 451 Smyth Road, Ottawa, K1H 8M5, Room: RGN3060, ON. Canada.
Email: Lucie.Brosseau@uottawa.ca

Abstract

Objective: To identify effective mind-body exercise programs and provide clinicians and patients with updated, high-quality recommendations concerning non-traditional land-based exercises for knee osteoarthritis.

Methods: A systematic search and adapted selection criteria included comparative controlled trials with mind-body exercise programs for patients with knee osteoarthritis. A panel of experts reached consensus on the recommendations using a Delphi survey. A hierarchical alphabetical grading system (A, B, C+, C, D, D+, D-) was used, based on statistical significance ($P < 0.5$) and clinical importance ($\geqslant$15% improvement).

Results: The four high-quality studies identified demonstrated that various mind-body exercise programs are promising for improving the management of knee osteoarthritis. Hatha Yoga demonstrated significant improvement for pain relief (Grade B) and physical function (Grade C+). Tai Chi Qigong demonstrated significant improvement for quality of life (Grade B), pain relief (Grade C+) and physical function (Grade C+). Sun style Tai Chi gave significant improvement for pain relief (Grade B) and physical function (Grade B).

Conclusion: Mind-body exercises are promising approaches to reduce pain, as well as to improve physical function and quality of life for individuals with knee osteoarthritis.

Keywords

Therapeutic exercise, mind-body exercises, knee osteoarthritis, clinical practice guideline, recommendations, rehabilitation, rheumatology, management, systematic review

Received: 31 August 2016; accepted: 8 January 2017

Introduction

Osteoarthritis is a disabling joint disease affecting older individuals.[1] Land-based therapeutic exercise is recognized to have clinical benefits for knee osteoarthritis[2] that may also occur in both traditional (i.e., strengthening and aerobic training) and non-traditional (i.e., mind-body training, such as yoga, Tai Chi, etc) exercise programs. In comparison to traditional exercise programs having effects on strength, cardiovascular and respiratory function, mind-body exercises are recognised to have additional physiological, clinical and psychological effects. These specific effects include enhanced muscle function, proprioceptive acuity, balance, flexibility, and coordination with improvements in depression and anxiety symptoms.[3–7] A list of definitions related to mind-body exercise programs can be found in Appendix 1 (supplementary material).

The Ottawa Panel

The proposed Ottawa Panel clinical practice guidelines on osteo-arthritis of the knee are intended to provide the most recent quantitative evidence on short- and long-term benefits of the three types of land-based exercise on the general and joint health of individuals with knee osteoarthritis. Existing high-quality guidelines[8,9] and systematic reviews[5,10–13] on mind-body exercise programs for knee osteoarthritis management have reported contradictory recommendations. For instance, mind-body exercise programs have been weakly recommended[10,14] or recommended[4–6,11,12,15] to improve clinical outcomes, such as pain relief, physical function and quality of life. However, these varying recommendations may be due to different study selection criteria, the use of quantitative methodologies or outdated guidelines.[8,9]

The objective of this specific guideline was to identify effective mind-body exercise programs and provide both healthcare professionals and knee osteoarthritis patients with updated, high-quality recommendations supporting non-traditional land-based exercises for knee osteoarthritis.

Methods

Clinical practice guidelines for land-based therapeutic exercises (supplementary material Figure 3)

were developed based on a process evaluating the evidence (steps 1-3) followed by the creation of the Ottawa Panel recommendations (steps 4-5).[8,9] Steps 1-3 evaluated the existing evidence: ***Step 1*** - updated systematic search strategy and high quality randomised controlled trials' (i.e. trials) selection similar to Fransen et al. (2015)[2] Cochrane systematic review; ***Step 2*** - statistical analysis related to pain relief, physical function and quality of life using the statistical software manager RevMan (version 5.3);[16] ***Step 3*** - calculations of the clinical importance of land-based therapeutic exercises according to the minimal clinically important/relative difference of common validated osteoarthritis outcomes.

Steps 4-5 led to the creation of the Ottawa Panel recommendations: ***Step 4***- draft of clinical practice guidelines' recommendations based on the grading system developed by the Ottawa Methods Group;[17] ***Step 5***- review and approval of the final clinical practice guidelines' recommendations by an Experts Panel composed of health professionals (i.e. clinicians, researchers and a patient with knee osteoarthritis) through an online Delphi questionnaire.[18]

Evaluation of existing evidence

Step 1 – Systematic search and selection

The guidelines were developed based on randomised controlled trials included in Fransen et al. (2015)[2] on exercise for knee osteoarthritis (from inception to May 2013 and updated search from June 2013 to May 2016). This review included studies with a Physiotherapy Evidence Database (PEDro) score $\geqslant$ 6, identified as high quality.[19] Low-quality randomised controlled trials were excluded to avoid flawed conclusions resulting from potential biased methodologies. Data from the studies were retrieved by the Ottawa Methods Group for three specific outcomes: pain, physical function and quality of life. The data were used to calculate the relative difference between baseline and treatment measures to assign an intervention grade to analysed outcomes. A description of the updated search terms and databases used can be found in Appendix 3 (supplementary material). Articles were screened and selected by two independent reviewers (AMI and JT) individually using Covidence, an online systematic review software, based on the inclusion criteria (supplementary material Table 2).

Step 2 – Systematic review: Statistical analysis

The statistical software manager RevMan (version 5.3)[16] was used to analyse the data. After extracting the means, standard deviations and sample sizes from included studies, mean differences for continuous outcomes were calculated. This guideline used the adjusted mean values calculated in primary studies to create recommendations. Figures for analysed results were formatted according to the Cochrane Collaboration methodology.

Step 3 – Systematic review: Clinical importance

The absolute benefit and relative difference in change (%) from baseline compared to end of treatment and/or follow-up were used to calculate the improvement difference in treatment and control groups. The relative difference was calculated by dividing the absolute benefit by the baseline mean (of each group).[20] A clinically important improvement was identified for a guideline only if the relative difference between the intervention and control groups was $\geqslant$ 15%. [17,20–22]

Creation of Ottawa Panel recommendations

Step 4 - Draft Ottawa Panel recommendations

The level and strength of study evidence were assessed to assign a grade to each recommendation. Level I corresponded to randomised controlled trials and level II to controlled clinical trials (CCTs).[20] Positive recommendations comprised of grades A (randomised controlled trial), B (controlled clinical trial or observational) or C+ (randomised controlled trial, controlled clinical

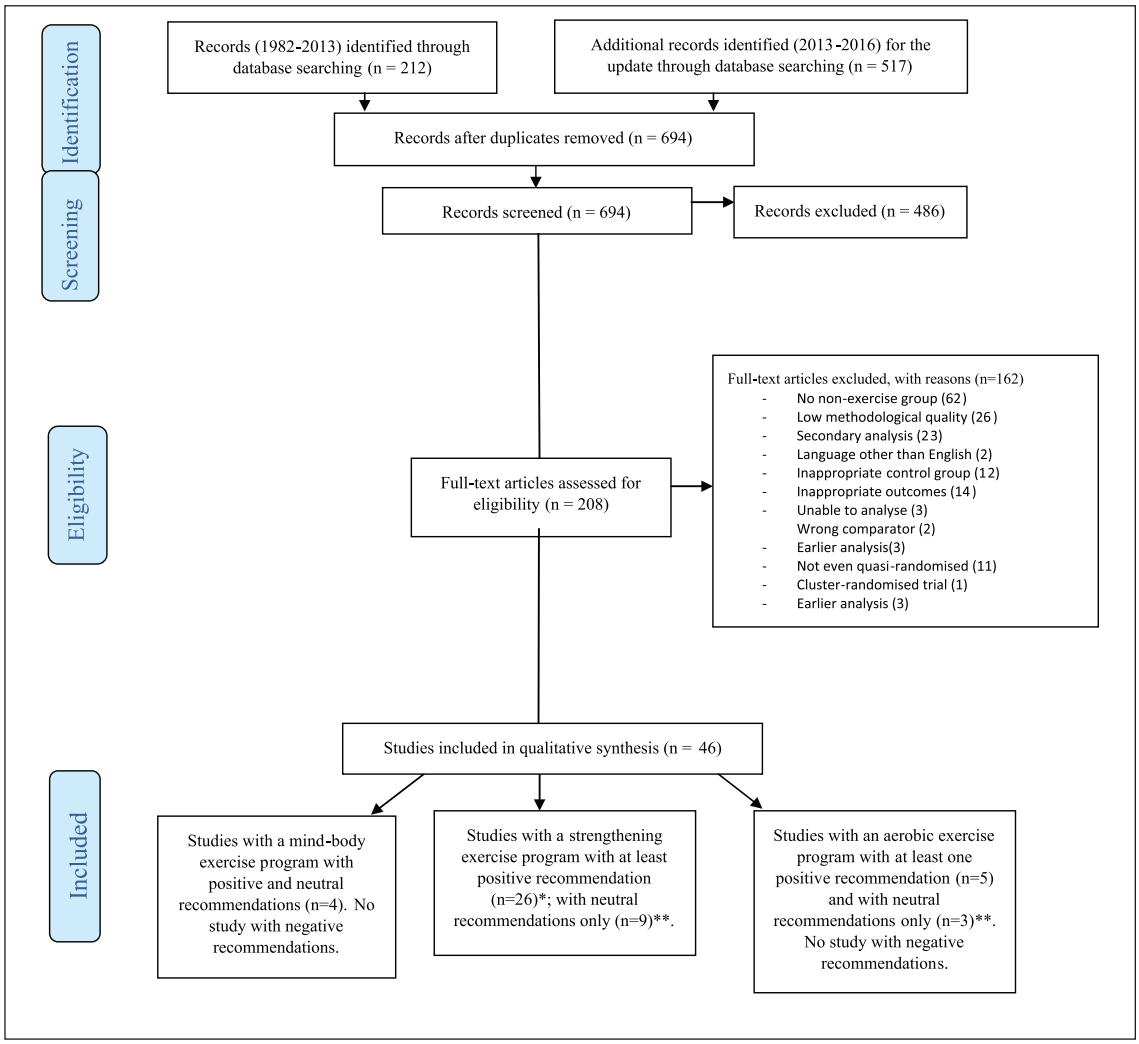

Figure 1. PRISMA flow diagram.
*Out of those 26 strengthening studies, only one of them has a negative recommendation.
**Among studies with neutral recommendations only, the three groups compared in Ettinger 1997 (i.e. strengthening, aerobic and control groups) were categorized into two pairs (i.e. strengthening vs control; aerobic vs control). Thus, there are 46 included studies rather than 47 since Ettinger 1997 was only counted once.

trial, or observational) since they all indicate clinical importance (⩾15%), with the exception of grade C+ which is not statistically significant. Randomisation was verified using the PEDro website for all included studies. All positive recommendations of studies with inadequate randomisation were modified from a grade A to B. Grades were downgraded from A to B or upgraded from D- to D only if the combined sample size for the intervention and control groups was smaller than 100 participants. If the calculated relative difference was less than 15% (no important clinical importance), grades C and D were assigned. Grade C did not favour the intervention or control group whereas grade D favoured the control group. Even though grades D+ and D- represented a clinical

importance favouring the control group, grade D- was considered statistically significant, whereas grade D+ was not considered statistically significant. An example of a graph with the grade of a specific intervention can be found in Figure 2.

Step 5 - Final Ottawa Panel recommendations

All experts completed an online Delphi questionnaire to endorse and determine whether the draft guidelines were in agreement with the recommendations, if they were comprehensible and appropriate for the target population, and whether the literature search was applicable and thoroughly related to mind-body, strengthening and aerobic exercises in the management of knee osteoarthritis. The Delphi process was officially completed once the experts reached an agreement (i.e. accepted guideline recommendations) of ⩾75% or until the law of diminishing returns was applicable.[18]

The Ottawa Panel described the recommendations of included randomised controlled trials following a PICOTS format (population, intervention, comparator, outcomes, time of application and study design) for mind-body exercises (supplementary material Table 2).

Results

This results' section is a summary of steps 1-5 (supplementary material Figure 3).

Step 1- Systematic search and selection

The systematic literature search conducted by Fransen et al.[2] found 212 potential trials. An additional 517 trials were identified in our updated literature search. Once duplicates were removed, a total of 694 articles were screened[2] with 486 articles excluded based on the title and/or abstract (Figure 1). According to the selection criteria, 46 full-text articles were included and 162 articles were excluded for reasons presented in the PRISMA flow diagram (Figure 1) such as inappropriate outcomes (n=14), no non-exercise group (n=62), secondary analysis (n=23), low methodological quality (n=26), inappropriate control group (n=12) and more. The characteristics of excluded studies can be found in Appendix 4 (supplementary material). Thirty five trials leading to at least one positive recommendation were included in the series of three specific guidelines.

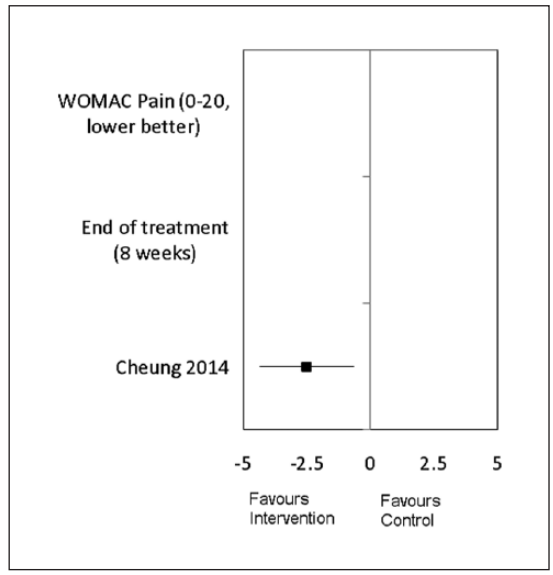

Figure 2. Example graph: Hatha Yoga versus Control (waitlist): Pain Relief (WOMAC).

The 26 trials on strengthening exercise programs[23–48] and five trials on aerobic exercise programs[49–53] are presented in the guidelines on strengthening[54] and aerobic exercise programs respectively.[55] Only four studies have a mind-body exercise program and are the main interest of this paper. These four studies led to positive and neutral recommendations that can be found in the section below entitled "Steps 2 and 3 – Systematic Review: Statistical analysis and clinical importance".

Methodological quality (PEDro scores of included studies). The methodological quality of the four included trials on mind-body exercises[56–59] had PEDro scores between seven and eight out of 10. Additional information on the methodological quality can be found in the characteristics of included studies in Appendix 5 (supplementary material). Appendices, tables and figures for neutral

recommendations are available in the supplementary material.

Characteristics of included randomised controlled trials on mind-body exercise programs. All four included studies were trials[56–59] that included either a yoga or Tai Chi component. These studies included patients clinically diagnosed with knee osteoarthritis. One trial examined a Hatha Yoga exercise program and a waitlist control group.[56] Two trials compared the effect of a Sun style Tai Chi exercise program. One compared it to a waitlist control group[58] and the other with a control group receiving health and cultural information sessions'.[59] Another trial examined the effects of a Tai Chi Qigong program to a waitlist control group.[57] Additional information on the characteristics of included studies can be found in Appendix 5 (supplementary material).

Steps 2 and 3 – Systematic review: Statistical analysis and clinical importance

In order to examine the effectiveness of mind-body exercise programs for knee osteoarthritis management, the statistical and clinical importance were calculated and presented in evidence tables and figures, available online in the supplementary additional material. The evidence tables present the grades, mean and relative differences as well as the absolute benefit for each included trial. The figures visually represent these values used to determine the statistical significance of each outcome (Figure 2). The summary results with at least one positive recommendation are as follows. The following recommendations were approved by the Delphi panelists in regards to content and format:

Hatha Yoga exercise program versus Control (waitlist), level I randomised controlled trial (n = 36, high quality [PEDro score 8/10]).[56]

Positive recommendations:

-Grade B (clinically important benefit demonstrated) for: Pain Relief [WOMAC Pain (0-20)] at 8 weeks **(end of treatment).**

-Grade C+ (clinically important benefit demonstrated without statistical significance) for: Physical Function [WOMAC function (0-68)] at 8 weeks **(end of treatment).**

Neutral recommendation:

-Grade C (no benefit demonstrated) for: Quality of Life [SF-12 MCS (0-100)] at 8 weeks **(end of treatment).**

Tai Chi Qigong exercise program versus Control (waitlist), level I randomised controlled trial (n = 44, high quality [PEDro score 8/10]).[57]

Positive recommendations:

-Grade B (clinically important benefit demonstrated) for: Quality of life [SF-36 (0-100)] at 8 weeks **(end of treatment).**

-Grade C+ (clinically important benefit demonstrated without statistical significance) for: Pain Relief [WOMAC Pain (0-20)] and Physical Function [WOMAC function (0-68)] at 8 weeks **(end of treatment).**

Sun style Tai Chi exercise program versus Control (waitlist), level I randomised controlled trial (n = 97, high quality [PEDro score 8/10]).[58]

Positive recommendation:

-Grade B (clinically important benefit demonstrated) for: Physical Function [WOMAC function (0-100mm) at 12 weeks **(end of treatment).**

Neutral recommendations:

-Grade C (no benefit demonstrated) for: Pain Relief [WOMAC Pain (0-100mm) at 12 weeks **(end of treatment).**

-Grade D (no benefit demonstrated but favouring control) for: Quality of Life [SF-12 MCS (0-100) at 12 weeks **(end of treatment).**

Sun style Tai Chi exercise program versus Control (health education), level I randomised controlled trial (n = 55, high quality [PEDro score 7/10]).[59]

Positive recommendation:

-Grade B (clinically important benefit demonstrated) for: Pain Relief [WOMAC Pain (0-20)] and physical function [WOMAC Physical Function (0-68)] at 20 weeks **(end treatment).**

WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index; SF-12: Short Form 12 item general health questionnaire; SF-36: Short Form 36 item general health questionnaire; MCS: Mental Component Summary.

The summary results with only neutral recommendations are as follows:

Hatha Yoga exercise program versus Control (waitlist), level I randomised controlled trial (n = 36, high quality [PEDro score 8/10]).[56]

-Grade C (no benefit demonstrated) for: Quality of Life [SF-12 MCS (0-100)] at 8 weeks **(end of treatment).**

Sun style Tai Chi exercise program versus Control (waitlist), level I randomised controlled trial (n = 97, high quality [PEDro score 8/10]).[58]

-Grade C (no benefit demonstrated) for: Pain Relief [WOMAC Pain (0-100mm) at 12 weeks **(end of treatment).**

-Grade D (no benefit demonstrated but favouring control) for: Quality of Life [SF-12 MCS (0-100) at 12 weeks **(end of treatment).**

Steps 4 and 5 - Ottawa Panel recommendations

The Ottawa Panel recommendations are listed below. Additional information on the characteristics of included studies can be found in Appendix 5 and 6 (supplementary material).

Hatha Yoga exercise program[56]

Recommendations: The eight-week Hatha Yoga program (60 minute classes once per week, plus 30 minute home program four times per week) for older women with knee osteoarthritis for management for pain relief (WOMAC subscale)[60] at the eight weeks end of treatment measure is **recommended**. Participation in the program is also **suggested** for improved physical function (WOMAC subscale)[60] at end of treatment of eight weeks. There is a neutral improvement for quality of life (SF-12 subscale)[61] at end of treatment of eight weeks.

Tai Chi Qigong exercise program[57]

Recommendations: The eight-week Tai Chi Qigong program (60 minute classes twice per week) for the management of knee osteoarthritis for improved quality of life (SF-36 subscale)[62] at end of treatment eight weeks is **recommended**. The use of the program is also **suggested** for pain relief (WOMAC subscale)[60] and improved physical function (WOMAC subscale)[60] at end of treatment of eight weeks.

Sun style Tai Chi exercise program[58]

Recommendation: The 12-week Sun style Tai Chi exercise program (60 minute classes once per week) for management of knee osteoarthritis for improved physical function (WOMAC subscale)[60] at the end of treatment of 12 weeks is **recommended**. There is a neutral improvement for pain relief (WOMAC subscale)[60] and for quality of life (SF-12 subscale)[61] at the end of treatment of 12 weeks.

Sun style Tai Chi exercise program[59]

Recommendation: The 20-week Sun style Tai Chi exercise program (20 to 40-minute classes three times per week) for the management of knee osteoarthritis for pain relief (WOMAC subscale)[60] and improved physical function (WOMAC subscale)[60] at the end of treatment (20 weeks) is **strongly recommended**.

All four trials[56–59] had modest sample sizes (n <100) and relatively short study durations (⩽ 20 weeks).

The intensity of interventions varied amongst trials. Exercise frequency varied from one to five times a week, while the total duration of exercise sessions ranged from 60 and 180 minutes.

This Ottawa Panel guideline, based on four trials,[56–59] identified a total of eight positive recommendations on pain relief, improved physical function or enhanced quality of life (five with B grades and three with C+ grades).

There were no high-quality trials with negative recommendations in our analysis, but there were neutral recommendations (two recommendations with a grade C; one recommendation with a grade D). A detailed description of studies with positive and neutral recommendations is available in Appendix 6 (supplementary material).

Delphi results. Eight of the 11 (72.7%) experts invited for the Delphi first round replied. Part one of the guideline reporting comprised of six questions in which only question 3 reached a consensus. All other questions in part one ranged from 45% to 65% and did not result in a consensus. Among questions not reaching a consensus, questions two (target population) and four (description of criteria) were the nearest from achieving consensus. In part two (questions 7A-34B), 52 out of 98 questions received ⩾75% consensus for intervention recommendations: 7A, 7B, 8A, 8B, 9A, 9B, 10A, 10B, 11A, 12A, 14A, 14B, 15A, 16A, 17A, 18A, 19A, 20A, 20B, 21A, 21B, 22A, 22B, 23A, 24A, 24B, 25A, 26A, 26B, 27A, 27B, 30A, 30B, 32A, 33A, 33B, 34A, 36A, 37A, 38A, 38B, 40A, 41A, 42A, 43A, 44A, 45A, 46A, 46B, 47A, 48A, 53A.

In the second Delphi round, there was a response rate of 62.6% (five out of eight) and a consensus was reached for all questions included in parts one and two. The first part (questions 1-6) reached an average consensus of 86% with scores ranging from 76% to 96%. The second part (questions 7A-34B) received an average consensus of 88% with scores ranging from 75% to 100%. Even though all questions reached consensus ⩾75%, all corresponding comments were considered for the drafting of the final manuscripts and modifications were made in appendices. Also, one panelist did not answer the round two of the Delphi survey but provided positive feedback on manuscript content via e-mail.

Discussion

This guideline made several positive recommendations on pain relief, improved physical function or enhanced quality of life for mind-body exercise programs (i.e. Yoga and two different Tai Chi (Sun and Qigong styles)).

Findings for quality of life were inconclusive as two of four studies[56,58] had quality of life as a neutral outcome or showed no difference between groups while Lee et al.[57] resulted in a positive (Grade B) recommendation. These differences may partially be explained by the differing time intervals and outcomes measures used to assess quality of life.

Interventions with a frequency of two or more times per week resulted in improved pain outcomes. This is suggested by the contradictory recommendations of two *Sun style Tai Chi exercise programs*[58,59] prescribing identical amounts of weekly exercise (60 minutes) but differing in exercise frequency. Fransen et al.[58] prescribed one exercise session of 60 weekly minutes which led to a neutral recommendation for pain relief while Tsai et al.[59] prescribed three weekly exercise sessions (starting at 20 minutes per session) for a total of 60 weekly minutes. This may suggest that regularity, rather than quantity, has a greater positive effect on pain in adults with knee osteoarthritis.

This guideline recognises Yoga and Tai Chi (Sun and Qigong styles) exercises as promising land-based non-pharmacological interventions for pain relief and improved physical function. Tai Chi Qigong style is recognised for enhancing quality of life amongst individuals with knee osteoarthritis, but careful use is recommended. More randomised controlled trials with adequate sample sizes should be conducted before the Ottawa Panel states stronger recommendations.

Comparisons with previous clinical practice guidelines

Previously published guidelines[4,15] and systematic reviews[5,11–13] on knee osteoarthritis management globally recommended mind-body exercises (i.e. Yoga and Tai Chi exercises) as promising interventions. However, some authors[10,14] have weakly recommended, mind-body exercise programs[10,14] for knee osteoarthritis management. Even though these authors[4,5,10,14,15] used different analytical methods,[8,9] all concluded that there was insufficient supporting evidence.

It is important to further explore non-pharmacological interventions, such as mind-body (i.e., Tai Chi, Yoga), for knee osteoarthritis management to collect data on their long-term benefits and sustainability effects by conducting more rigorous randomised controlled trials. Other mind-body exercises such as Pilates, effective with other rheumatological conditions,[63] should also be studied among individuals with knee osteoarthritis.

Psychological and physiological effects of therapeutic exercises

Yoga and Tai Chi represent promising exercise programs with their positive effect on psychological and physiological outcomes for individuals with knee osteoarthritis pain. Past studies have shown that exercise can reduce pain, both in healthy individuals and in patients suffering of chronic pain.[64] For healthy individuals, long duration activity (>30 minutes) seems to be necessary to trigger exercise-induced hypoalgesia.[64,65] For chronic pain patients, meaningful pain reduction is observed with both high-intensity and low-intensity exercise programs[64,66,67] as seen in Yoga and Tai Chi exercise programs.[56–59]

Psychosocial phenomena can contribute to the beneficial effects of exercise on pain, mood and social interactions.[64,68–70] Yoga and Tai Chi seem particularly associated with psychological improvements including a reduction in stress, anxiety, depression and mood disturbance, and an increase in self-esteem in individuals with chronic pain and arthritic conditions.[71–75] This may also reflect the fact that these programs are generally performed in a group setting.

Limitations

Limitations of the Ottawa Panel Clinical Practice Guideline

This guideline traditionally only focused on the effect of land-based exercise by including high-quality trials comparing a type of single or combined therapeutic exercise program (i.e. mind-body, strengthening and aerobic exercises) to a control group. Head-to-head trials comparing two different types of land-based exercise programs (e.g. mind-body versus strengthening exercises) were not considered in this review due to the large number of existing trials and comparison groups within these trials. This could be examined in future reviews.

The Ottawa Panel recognises that there are advantages and disadvantages of pooling trials. The Ottawa Panel's philosophy is to pool trials if they have homogenous PICOTS (i.e., similar population [e.g., knee osteoarthritis severity], intervention [e.g. type of Tai Chi]; comparator [e.g. waitlist]; outcome measures [e.g., WOMAC pain subscale] and time of application [e.g., six-week end of treatment; one-week follow-up]. Mean difference (MD) is easier to interpret than standardized mean difference[16] which would be necessary when pooling study data with different outcome instruments. Furthermore, many of the comparisons by Fransen et al.[2] were moderately to highly heterogeneous ($I^2 > 58\%$). An advantage of this guideline is the examination of three types of land-based exercises instead of generalizing recommendations on land-based exercise programs.

The included trials measured outcomes such as morning stiffness and range of motion. However, based on the review by Fransen et al.[2], only pain relief, physical function and quality of life (mental component) were considered for this guideline.

Even though the Ottawa Panel methodology did not use the Cochrane Grade approach[16], and while the operationalisation of these concepts is different, the Ottawa Panel is conceptually similar in terms of body evidence and methodological quality. In fact, Cochrane Collaboration uses four levels of quality to assess the body of evidence based on study design compared to the Ottawa Panel which uses six grading levels. For the methodological quality, the Ottawa Panel uses the PEDro scale which is a reliable and validated tool for physical trials[19]. On the other hand, Cochrane Collaboration uses the Cochrane Risk of Bias instrument to assess the methodological quality of included trials, which may not be highly reliable.[76,77]

The Ottawa Panel methodology did not include an in-depth examination of participant retention (drop outs) or adherence to exercise protocol – both of which can influence findings. Adherence to Yoga interventions is variable and associated with pain reduction, improved physical function and quality of life in older adults with lower body mass index.[78] This was taken into account in this guideline.

Limitations of the primary included randomised controlled trials

Despite selecting high-quality trials based on PICOTS criteria,[2] potential biases could have been introduced.

Potential misclassification bias could have occurred within the four included studies,[56–59] because no investigators mentioned using the ACR criteria[79] to confirm osteoarthritis diagnosis and only one trial[57] stated the severity of osteoarthritis in participants (i.e., Kellgren and Lawrence grade II). The four included studies used different criteria to diagnose osteoarthritis, increasing the variability between studies and weakening the generalizability of results.

Mind-body exercise programs seem to be effective and promising for the management of knee osteoarthritis. However, they are heterogeneous for the type of program (i.e. Yoga and Tai Chi: Sun and Qigong styles), dosage (i.e. frequency, program length etc.) and delivery modes (i.e. group, individualised; supervised, non-supervised)[80]. A more thorough reporting of characteristics on the exercise application should be adopted in these four included trials to assess their therapeutic validity and potential clinical replication[81–83]. Fransen et al.[2] pointed out that exercise intensity is not clearly reported in trials examining mind-body exercise effects. Intensity is difficult to quantify and may not be a key aspect of these exercise interventions.

The use of a waiting list control group in trials may overestimate intervention effects because of the strong placebo effect observed in knee osteoarthritis.[84,85] Since study duration of included studies[56–58] is relatively short, it may be acceptable to place them on a waiting list if participants are offered to receive the same mind-body exercise program as the intervention group after study completion, but this does not control for the placebo effect.

Outcome measures (i.e. pain relief) that received conflicting recommendations may be best explained by varying methods of outcome measurements (e.g. WOMAC pain subscale or VAS pain intensity). Potential information bias includes the imprecision of self-reporting outcomes.[86] The inclusion of performance-based physical function measures rather than solely looking at self-reported measures (i.e. WOMAC function subscale) would help address this potential reporting bias.

Mind-body exercises can have beneficial clinical short-term effects on knee osteoarthritis outcome measures. It would be interesting to explore the long-term effects of mind-body exercises on knee osteoarthritis management and whether participants continue practicing these exercises to self-manage their symptoms much after study completion.

This guideline is only based on four trials. These trials[56–59] have relatively modest sample sizes (n<100) and can lead to an overestimation of effect size. The results of these four trials should therefore be interpreted with caution.

Stronger recommendations were limited due to different study designs, comparisons, heterogeneous outcomes and inadequate controls. Future research

should adopt rigorous methods such as using an appropriate placebo (and double-blind procedure), adequate randomisation, a homogeneous and adequate sample size of patients based on rigorous selection and diagnostic criteria to detect clinically important differences with confidence.

We hypothesise that regularity of any type of land-based exercise program seems more important than intensity to improve joint health. For instance, low intensity/low impact mind-body exercises, regularly performed, seems effective for improving joint health (clinical outcomes: pain relief and physical function) and quality of life amongst individuals with knee osteoarthritis.

Mind-body exercise programs (i.e. Yoga and Tai Chi: Sun and Qigong styles) have beneficial short-term effects on pain relief, physical function and quality of life in older adults with knee osteoarthritis when performed **routinely**. The Ottawa Panel found evidence supporting mind-body exercises for knee osteoarthritis management for those who have at least one knee affected by osteoarthritis and have the capacity to complete weight-bearing exercises. Lastly, it would be interesting to explore the long-term effects of mind-body exercise on knee osteoarthritis to determine whether these types of low-intensity land-based exercise can provide significant lifelong benefits for those with knee osteoarthritis.

Clinical messages

- Mind-body exercises are promising approaches to reduce pain, improve physical function and quality of life for patients with knee osteoarthritis.
- A Hatha Yoga program appears to be promising in providing pain relief and improved self-reported physical function.
- Tai Chi Qigong and Sun style Tai Chi are promising in reducing pain and improving self-reported physical function. Tai Chi Qigong also has a positive effect on quality of life.

Acknowledgements

The authors would like to thank Ms. Amanda Min Hui Yen, Ms. Jessica McEwan, Ms. Chantal Potvin, Ms. Rachel Marcotte, Ms. Christine Smith and Ms. Arlanna Pugh for their dedicated work and contribution towards this manuscript.

Conflict of interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This article was funded by the University of Ottawa Research Chair (salary support for graduate students).

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