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## Ottawa Panel Evidence-Based Clinical Practice Guidelines for Therapeutic Exercises in the Management of Rheumatoid Arthritis in Adults

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# Ottawa Panel Evidence-Based Clinical Practice Guidelines for Therapeutic Exercises in the Management of Rheumatoid Arthritis in Adults

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*APTA is a sponsor of the Decade, an international, multidisciplinary initiative to improve health-related quality of life for people with musculoskeletal disorders.*

**Background and Purpose.** The purpose of this project was to create guidelines for the use of therapeutic exercises and manual therapy in the management of adult patients (>18 years of age) with a diagnosis of rheumatoid arthritis according to the 1987 American Rheumatism Association criteria. **Methods.** Evidence from comparative controlled trials was identified and synthesized using The Cochrane Collaboration methods. An expert panel was formed by inviting professional stakeholder organizations to each nominate a representative. This panel developed a set of criteria for grading the strength of both the evidence and the recommendation. **Results.** Six positive recommendations of clinical benefit were developed on therapeutic exercises. The efficacy of manual therapy interventions could not be determined for lack of evidence. **Discussion and Conclusion.** The panel recommends the use of therapeutic exercises for rheumatoid arthritis. Further research is needed to determine the efficacy of manual therapy in the management of this disease. [Ottawa Panel Evidence-Based Clinical Practice Guidelines for Therapeutic Exercises in the Management of Rheumatoid Arthritis in Adults. *Phys Ther.* 2004;84:934–972.]

**Key Words:** *Clinical practice guidelines, Epidemiology, Evidence-based practice, Physical rehabilitation, Rheumatology, Rheumatoid arthritis.*

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## Introduction

**R**heumatoid arthritis (RA) is a systemic inflammatory disease that produces a progressive degeneration of the musculoskeletal system.<sup>1</sup> One of the most prevalent chronic conditions, RA is found in approximately 1% of the adult population in the United States.<sup>2-6</sup> In adults, RA is more common among women than men by a ratio of 5:1<sup>6</sup> and is most prevalent among those aged 40 to 60 years. Rheumatoid arthritis is a highly disabling disease associated with high morbidity. Even with appropriate drug therapy, up to 7% of patients are disabled to some extent 5 years after disease onset and 50% are too disabled to work 10 years after onset.<sup>7</sup> Consequently, RA results in considerable direct costs, such as health care expenses, and indirect costs, such as loss of productivity due to morbidity and decreased life expectancy<sup>1</sup>; these combined costs are estimated at 1% of the US gross national product.<sup>8</sup> Impairments, disabilities, and handicaps associated with RA can be devastating, leading to pain, activity restriction, and diminished quality of life, while placing a strain on the health care system and society.<sup>1</sup>

Substantial progress has been made in the medical management of RA over the last decade, but rehabilitation specialists still must provide efficient and effective interventions for their patients. The development of evidence-based clinical practice guidelines (EBCPGs) for rehabilitation of adults with RA will help patients and clinicians choose effective interventions, which is important because the efficacy of rehabilitation interventions in RA management has a direct bearing on the combined costs of the disease.<sup>6</sup> According to Woolf, EBCPGs are “the official statements or policies of major organizations and agencies on the proper indications for performing a procedure or treatment or the proper management for specific clinical problems.”<sup>9</sup>(p1812) The appropriate use of such statements to direct practice has been proven beneficial to the rehabilitation process and patient health outcomes.<sup>10</sup>

The Ottawa Panel was convened to evaluate the evidence for the effectiveness of 10 physical rehabilitation interventions for RA. Physical rehabilitation is a combination of therapeutic exercises, manual therapies, modalities, application of adaptive equipment, education, and re-education for the management of activities of daily living (ADL). The interventions examined by the Ottawa Panel were as follows: (1) acupuncture; (2) assistive devices; (3) bed rest; (4) conservation of energy; (5) electrotherapy, including electrical stimulation, low-level laser therapy, transcutaneous electrical nerve stimulation, and therapeutic ultrasound; (6) manual therapy; (7) patient education; (8) splinting and orthotics; (9) therapeutic exercises, with an emphasis on the intensity of the exercise program; and (10) thermotherapy,

including heat therapy, cryotherapy, and balneotherapy. This article discusses only the evidence related to therapeutic exercises—including specific strengthening exercises and whole-body exercises (eg, general fitness and aerobic conditioning)—and manual therapy.

The target users of these EBCPGs for therapeutic exercises and manual therapy are physical therapists, occupational therapists, physiatrists, orthopedic surgeons, rheumatologists, family physicians, acupuncturists, and patients. The aim of developing the guidelines discussed in this article was to promote the appropriate use of therapeutic exercises and manual therapy in the management of RA.

## Methods

The development process of these EBCPGs was similar to that of the Philadelphia Panel, except that a different target population was used.<sup>11</sup> Briefly, the Ottawa Methods Group (OMG), a group of 9 methodologists with experience in developing EBCPGs, asked professional associations interested in the care of people with RA for suggestions of individuals with both clinical expertise in the management of the disease and familiarity with EBCPGs. From among the suggestions given, the OMG chose 9 experts to serve as panel members. These experts in RA were a rheumatologist, a physiatrist, a physician with experience in evidence-based medicine, a family physician, 3 physical therapists (including one who practiced acupuncture and one involved in clinical research), an occupational therapist, and a patient with RA. The Ottawa Panel consisted of these 9 experts and all members of the OMG.

One OMG member assembled a research and support staff with expertise in meta-analyses, rheumatology rehabilitation interventions, research methods, or the development and assessment of EBCPGs. The OMG then established a priori a set of inclusion criteria for the study designs, subject samples, interventions, and outcomes to allow the research staff to select the most relevant material as evidence of the effectiveness of therapeutic exercise and manual therapy. The OMG also reviewed the inclusion criteria to ensure that the approach to the study selection was reproducible and systematic. This a priori protocol guided separate systematic reviews of the literature for each intervention.

The research staff reviewed articles and created evidence tables for them (see “Clinical Practice Guidelines”), which the 9 clinical experts received in preparation for their meeting with the OMG. These tables were used as the basis for making the recommendations.

## Target Population

Included were studies with samples of adult patients (>18 years of age) with a diagnosis of RA according to the 1987 American Rheumatism Association (ARA) criteria.<sup>12</sup> A patient was said to have RA if he or she satisfied at least 4 of the following 7 ARA criteria: (1) morning stiffness, (2) arthritis of 3 or more joints, (3) arthritis of the hand joints, (4) symmetric arthritis, (5) rheumatoid nodules, (6) serum rheumatoid factor, or (7) radiologic changes.<sup>12</sup> Studies with patients with RA affecting peripheral joints were eligible. Studies with patients with both chronic and acute RA were included in our analysis because patients with both types of RA were included in the different clinical trials studied, sometimes in the same trial. Where possible, however, the recommendations clearly indicate whether the intervention is appropriate for chronic or acute conditions. The recommendations also include classification of functional capacity in patients with RA described as: (I) complete functional capacity with ability to carry out all usual duties without handicaps, (II) functional capacity adequate to conduct normal activities despite the handicap of discomfort or limited mobility of one or more joints, (III) functional capacity adequate to perform only a few or none of the duties of usual occupation or of self-care, or (IV) largely or wholly incapacitated, with the patient bedridden or wheelchair-bound, permitting little or no self-care.<sup>6</sup> When the recommendations do not indicate disease severity or functional severity, it is because the trial on which the recommendation was based did not mention severity (Appendix 1).

Studies of patients with RA who had back or neck problems were excluded because of the numerous and varied associated signs and symptoms. Another reason for not considering spine disorders for this article is that Philadelphia Panel guidelines developed by the same methodologists were recently published for back and neck pain.<sup>11</sup> Studies of patients who had recently had surgery also were excluded. Further exclusion criteria included studies with patients who had one of the following conditions: (1) other rheumatologic or musculoskeletal problems, such as tendinitis, bursitis, or fractures; (2) major medical problems that could interfere with the rehabilitation process or incapacitate functional status; or (3) psychiatric conditions. Studies of subjects without known pathology or impairments also were excluded. The majority of studies included patients with RA at chronic stages (>12 years' duration).

If the study sample contained individuals with mixed arthritic conditions, the study was excluded unless those conditions involved RA and osteoarthritis (OA), in which case the study was included only if the proportion of patients with RA was at least 75%. For further inclusion and exclusion criteria, see Table 1.

## Literature Search

The library scientist developed a structured literature search based on the sensitive search strategy for randomized controlled trials (RCTs)—a strategy recommended by The Cochrane Collaboration<sup>13</sup>—and modifications proposed by Haynes et al<sup>14</sup> to that strategy. The Cochrane Collaboration method minimizes bias through a systematic approach to the literature search, study selection, and data extraction and synthesis. The search was organized around the condition and interventions rather than the outcomes because it was an a priori search. Thus, we had no control over the outcomes the authors decided to measure (see Appendix 2 for an example of the search strategy).

The library scientist expanded the search strategy to identify case-control, cohort, and nonrandomized studies and conducted the search in the electronic databases of MEDLINE, EMBASE, Current Contents, the Cumulative Index to Nursing and Allied Health (CINAHL), and the Cochrane Controlled Trials Register up to December 2002. She also searched the registries of the Cochrane Field of Rehabilitation and Related Therapies, the Cochrane Musculoskeletal Group, the Physiotherapy Evidence Database (PEDro), and the University of Ottawa EBCPGs Web site. Finally, she searched the reference lists of all of the included trials for relevant studies and contacted content experts for additional studies.

In the first round of study inclusion or exclusion, 2 independent reviewers, trained and experienced occupational therapist or physical therapist students, appraised the titles and abstracts of the literature search, using a checklist with the a priori–defined selection criteria (Tab. 1). More junior students were paired with fourth-year occupational therapist or physical therapist students who were experienced with the Philadelphia Panel<sup>11</sup> methodology. Each pair of reviewers was assigned to a specific intervention. Within each pair of reviewers, individuals independently read the title and abstract of each article and created an individual list of all of the articles of the database with a reason for including or excluding each article. If the reviewers were uncertain about a particular article after having read the abstract, they ordered the article and read it in full before making a determination. Before deciding whether to include or exclude the article, a comparison of their individual lists was performed. A senior reviewer who is a methodologist and a clinical expert in arthritis (LB) checked the 2 independent lists of articles and the reason for inclusion or exclusion to determine potential inconsistencies. Eleven percent of the abstracts reviewed needed the consultation of the senior reviewer. For the second round of inclusion and exclusion, the pairs of reviewers retrieved articles selected for inclusion from the first round and independently assessed the full articles for

**Table 1.**  
A Priori Inclusion/Exclusion Criteria for Rheumatoid Arthritis Project<sup>a</sup>

Inclusion	Exclusion
<p><b>Study Designs</b></p> <ul style="list-style-type: none"> <li>• Randomized controlled trial</li> <li>• Controlled clinical trial</li> <li>• Cohort study</li> <li>• Case-control study</li> <li>• Crossover studies</li> <li>• Head-to-head comparison of high- and low-intensity exercise</li> </ul> <p><b>Population</b></p> <ul style="list-style-type: none"> <li>• Outpatients/inpatients</li> <li>• RA of all human joints except cervical, dorsal, and lumbar spine</li> <li>• Patients &gt;18 y of age</li> <li>• Classical or definite RA according to the 1987 American Rheumatism Association criteria<sup>12</sup></li> <li>• Chronic and acute conditions</li> <li>• Mixed arthritic conditions if involving RA and osteoarthritis and if proportion of patients with RA was at least 75%</li> </ul> <p><b>Intervention</b></p> <ul style="list-style-type: none"> <li>• Eligible control groups: placebo, untreated, sham, or routine conventional therapy such as educative pamphlets</li> <li>• Eligible interventions:               <ol style="list-style-type: none"> <li>1. Chiropractic interventions (manipulation, mobilization, manual therapy)</li> <li>2. Intensity of exercise program</li> <li>3. Therapeutic exercises including postsurgery and swimming pool exercises</li> </ol> </li> </ul> <p><b>Outcomes<sup>b</sup></b></p> <ul style="list-style-type: none"> <li>• Absenteeism, return to work</li> <li>• Balance status</li> <li>• Cadence</li> <li>• Coordination status</li> <li>• Costs (economics)</li> <li>• Discharge disposition</li> <li>• Disease activity (including no. of inflamed joints)</li> <li>• Duration of morning stiffness</li> <li>• Edema</li> <li>• Flexibility</li> <li>• Functional status, activities of daily living (self-care activities)</li> <li>• Gait status</li> <li>• Girth, volume</li> <li>• Global patient assessment</li> <li>• Global physician assessment</li> <li>• Inflammation</li> <li>• Joint imaging</li> <li>• Length of stay</li> <li>• Medication intake (if reported)</li> <li>• Muscle force and power</li> <li>• No. of acute-phase reactants (eg, erythrocyte sedimentation rate)</li> <li>• No. of swollen or tender joints</li> <li>• Pain reduction</li> <li>• Patient adherence</li> <li>• Patient satisfaction</li> <li>• Postural status</li> <li>• Quality of life</li> <li>• Radiological damage</li> <li>• ROM, flexibility, mobility</li> <li>• Side effects (if reported)</li> <li>• Stride length</li> <li>• Walking distance</li> <li>• Walking speed</li> </ul>	<p><b>Study Designs</b></p> <ul style="list-style-type: none"> <li>• Case series/case report</li> <li>• Uncontrolled cohort studies (studies with no control group)</li> <li>• Eligible studies with greater than 20% drop-out rates or sample size of fewer than 5 patients per group</li> <li>• Studies where only the abstract was available</li> <li>• Trials published in languages other than French or English</li> <li>• Data (graphic) without a mean and standard deviation</li> <li>• Head-to-head studies</li> </ul> <p><b>Population</b></p> <ul style="list-style-type: none"> <li>• RA presenting back or neck problems</li> <li>• Recent surgery</li> <li>• Arthritis or rheumatic conditions other than RA</li> <li>• Scoliosis</li> <li>• Cancer (and other oncologic conditions)</li> <li>• No known pathology or impairments</li> <li>• Pulmonary conditions</li> <li>• Neurologic conditions</li> <li>• Pediatric conditions (no juvenile arthritis)</li> <li>• Cardiac conditions</li> <li>• Dermatologic conditions</li> <li>• Psychiatric conditions</li> <li>• Multiple conditions</li> <li>• Major medical problems that could interfere with the rehabilitation process or incapacitate functional status</li> </ul> <p><b>Intervention</b></p> <ul style="list-style-type: none"> <li>• Bilateral interventions (if systemic effects)</li> <li>• Multidisciplinary, functional restoration programs</li> <li>• Psychosocial (nonphysical) interventions</li> <li>• Surgery of any joint</li> </ul> <p><b>Outcomes</b></p> <ul style="list-style-type: none"> <li>• Biochemical measures</li> <li>• Postural assessment</li> <li>• Physiological measures, such as electromyographic activity and H-reflex and cardiopulmonary capacity (maximal oxygen uptake)</li> <li>• Psychosocial measures, such as depression, home and community activities, leisure, social roles, and sexual functions</li> <li>• Serum markers</li> </ul>

<sup>a</sup> RA=rheumatoid arthritis, ROM=range of motion.

<sup>b</sup> Authors might have operationalized their concepts differently. For example, range of motion can include joint mobility and proximal interphalangeal joint extension.

inclusion or exclusion in the study. Using predetermined extraction forms, the pairs of reviewers independently extracted data from included articles on the population characteristics, details of the interventions, trial design, allocation concealment, and outcomes. The pairs of reviewers assessed methodological quality using the Jadad scale, a 5-point scale with reported reliability and validity that assigns 2 points each for randomization and double blinding and 1 point for description of withdrawals.<sup>15,16</sup> The reviewers resolved differences in data extraction and quality assessment through consensus with the senior reviewer. This consensus served to support the reliability of data obtained with the article selection process.

### Study Inclusion/Exclusion Criteria

The inclusion/exclusion criteria were based on previous criteria used by the Philadelphia Panel. This list of criteria, which had been created for multiple diagnoses, including back and neck pain, was adapted and approved by the OMG for use with RA (Tab. 1).

All original comparative controlled studies that evaluated the specific intervention in a sample of patients with RA were included: RCTs, controlled clinical trials (CCTs), cohort studies, and case-control studies. (Controlled clinical trials are the same as RCTs except that, according to the Jadad scale, CCTs are either not randomized or poorly randomized.) Crossover studies were included, and, to avoid potential confounders, the data from only the first part of the study (before crossing) were analyzed. (Data from the first part are more specific than data from the second part because once the study patients change from the intervention group to the placebo group, the outcome could be due to either the intervention or the placebo. Thus, such results are not useful for measuring the special effect of each intervention.)

Uncontrolled cohort studies (studies with no comparison group) and case series were excluded, as were eligible studies with greater than 20% dropout rates or a sample size of less than 5 patients per group. Abstracts were excluded because none of the abstracts found had sufficient data for analysis and the full studies of the abstracts could not be obtained from the authors. Trials published in languages other than French and English were not analyzed because of the time and cost involved in translation. Head-to-head studies (that is, the comparison of 2 active interventions, such as therapeutic exercises versus transcutaneous electrical nerve stimulation) were generally excluded in these recommendations. Because we were interested in making a recommendation specifically about therapeutic exercise or manual therapy, we rejected head-to-head studies. At the meeting, the Ottawa Panel recommended that a direct com-

parison of the intervention with either placebo or control was more valid for measuring the specific effect of the intervention. We did include, however, studies with head-to-head comparisons of high- versus low-intensity exercise as highly relevant for rheumatology practice in rehabilitation, especially in the presence of an inflammatory disease such as RA, where the dosage and intensity of therapy could make a difference in pain tolerance and joint damage. For further exclusion criteria, see Table 1.

### Rehabilitation Interventions Related to Therapeutic Exercises and Manual Therapy

Rehabilitation interventions related to therapeutic exercises were identified as specific functional strengthening exercises, whole-body functional strengthening exercises, and physical activity. *Strengthening exercises* were defined as isometric, concentric, eccentric, and isokinetic resistance exercises. *Specific functional strengthening exercises* were defined as strengthening exercises applied to muscles crossing one specific joint or within one specific body part, such as the hand, shoulder, or knee. *Whole-body functional strengthening exercises* were defined as general strengthening exercises applied to muscles crossing many joints or within large body parts involving several joints such as the lower extremity. *Physical activity* was defined as a combination of strengthening and aerobic exercises (ie, therapeutic exercise and activities to increase endurance). *Manual therapy* was defined as passive physiologic and accessory joint movements, muscle stretching, and soft tissue mobilization applied to a specific joint. Definitions provided in this article were written according to the description of therapeutic exercises program in the primary trials included in this review (Appendix 1).

Acceptable comparators were placebo, untreated, or use of educational pamphlets or written instructions for self-management. Concurrent therapies (such as electroanalgesia and medication) were accepted only if provided to both the experimental and control groups. Studies with designs where patients were their own controls, were excluded. No limitations based on methodological quality were imposed a priori; however, the quality of the comparative controlled studies was considered when grading the recommendations resulting from our analysis.

### Outcomes

The primary endpoints for measurement of effectiveness were the validated and reliable outcome measures recommended by the conference on Outcome Measures for Rheumatoid Arthritis Clinical Trials (OMERACT)<sup>17</sup> and by the theoretical framework for rehabilitation application.<sup>18</sup> The outcomes were selected according to the Philadelphia Panel recommendations and were

based on the new proposal of the Canadian Society for the International Classification of Impairments, Disabilities, and Handicaps,<sup>19</sup> which involved the concepts of organic systems and impairment, abilities and disabilities, and life habits and handicap situation. The a priori outcomes were classified according to these concepts:

- (1) organic systems and impairment: number of inflamed joints, number of acute phase reactants (eg, erythrocyte sedimentation rate, which is “a test that measures the rate at which red blood cells settle through a column of liquid”<sup>20</sup>), radiological damage, and side effects;
- (2) abilities and disabilities: pain reduction, muscle force, range of motion (ROM), postural status, and duration of morning stiffness; and
- (3) life habits and handicap situation: global physician assessment, global patient assessment, gait status, walking speed, walking distance, cadence, stride length, functional status, patient adherence, patient satisfaction, length of stay, discharge disposition, quality of life, and return to work.

Studies were included if any one of the aforementioned outcomes was measured. A positive recommendation was made only if a specific intervention was effective for an outcome as measured with a validated scale.<sup>17,18</sup> The Ottawa Panel determined if the measurement was valid, a decision that was based on the existing literature, the outcome measure from OMERACT,<sup>17</sup> and McDowell and Newell’s research.<sup>21</sup> Psychological outcomes such as depression were excluded. For more details, see the list of inclusion/exclusion criteria (Tab. 1).

The inclusion or exclusion of the report was determined by panel consensus. However, as many articles as possible were included to increase the statistical power of the final results. Each result comprised pooled data from studies measuring the same intervention and the same outcome over a similar time period.

### Statistical Analysis

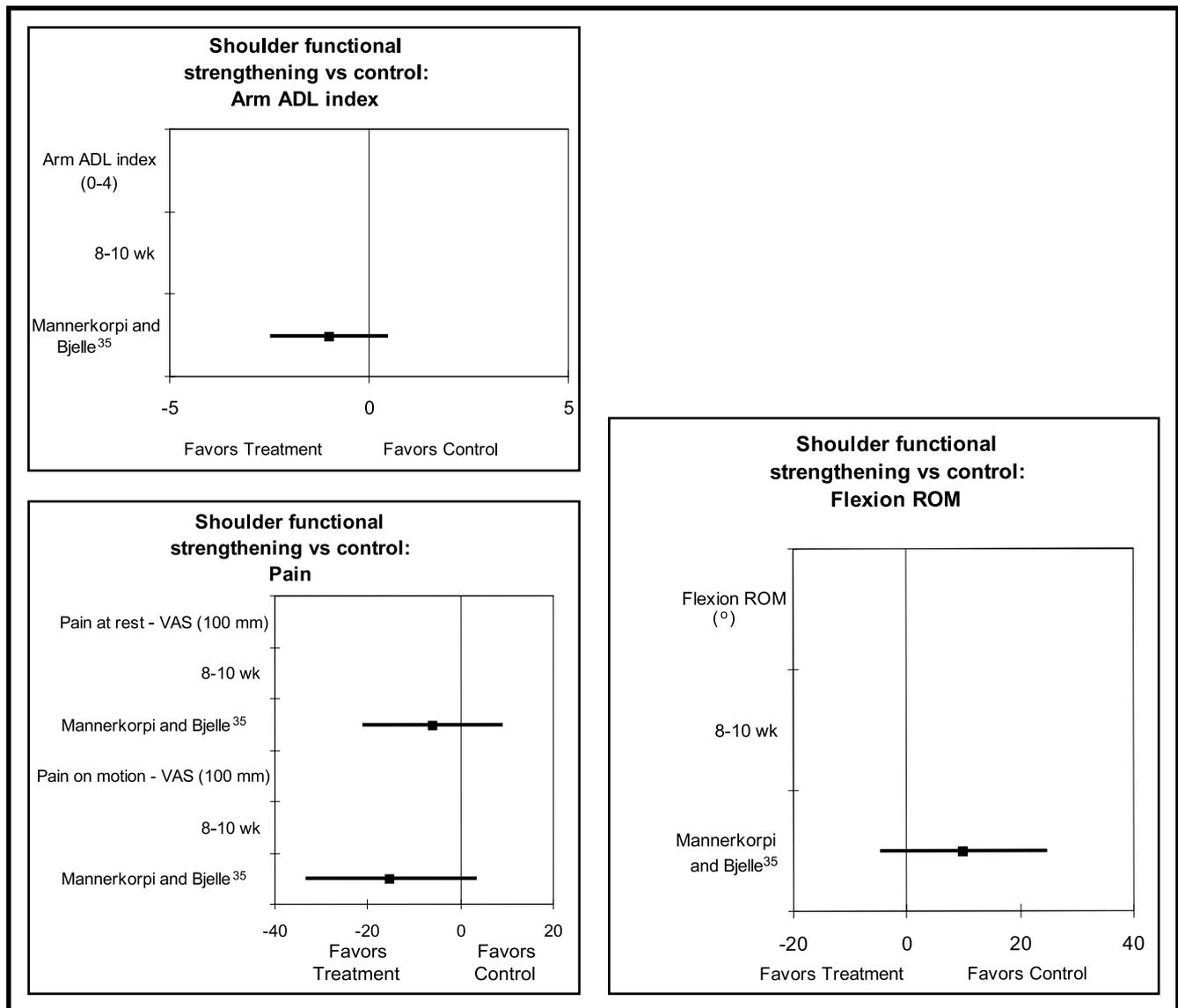
Data were analyzed using Review Manager software.<sup>22</sup> Continuous data, “data with a potentially infinite number of possible values along a continuum,”<sup>23</sup> were analyzed using the weighted mean differences (WMDs) between the intervention and control groups at the end of the study, where the weight is the inverse of the variance. A WMD is “a method of meta-analysis used to combine measures on continuous scales (such as weight), where the mean, standard deviation, and sample size in each group are known.”<sup>23</sup> Dichotomous data, or data with only 2 classifications,<sup>23</sup> were analyzed using relative risks. According to Cochrane, the relative risk is

“the ratio of risk in the intervention group to the risk in the control group. The risk (proportion, probability, or rate) is the ratio of people with an event in a group to the total in the group.”<sup>23</sup>

Heterogeneity (ie, variability or difference between studies<sup>23</sup>) was tested using the chi-square statistic. We tested data heterogeneity among the results of different included studies to make sure that only homogeneous data were pooled together. When heterogeneity was not significant, fixed-effect models were used. A fixed-effect model is a statistical model that stipulates that the units under analysis (eg, participants in a meta-analysis study) are the ones of interest and thus constitute the entire population of units.<sup>23</sup> Fixed-effect models were used to generalize data across the included studies. Random-effects models include both within-study sampling error (variance) and between-studies variation in the assessment of the uncertainty (confidence interval) of a meta-analysis’ results<sup>23</sup> and are more severe than fixed-effect models. Such random-effects models were used when heterogeneity was significant. All figures were created using Cochrane Collaboration methodology<sup>22</sup> ([www.cochrane.org](http://www.cochrane.org)). The square in Figure 1 illustrates the WMD between the 2 groups when comparing them for a specific outcome of interest. The horizontal line represents the standard deviation of the WMD. If the standard deviation line touches the central vertical line of the graph, the confidence interval is 0 and the difference between the 2 groups is not statistically significant. For example, functional status, pain relief, or ROM in flexion for the group receiving shoulder strengthening exercises are not statistically different from those of the control group.

Based on previous studies in the musculoskeletal domain<sup>24</sup> and on consensus,<sup>11</sup> clinical improvement for all interventions studied by the Ottawa Panel was defined as 15% improvement relative to a control. This figure can be justified because it was developed by the Philadelphia Panel, whose members are experts in musculoskeletal practice, and confirmed by another panel (the Ottawa Panel) whose members included specialists in rheumatology and an expert biostatistician.

To determine clinical improvement, the absolute benefit and relative difference in the change from baseline were calculated. Absolute benefit was calculated as the improvement in the treatment group less the improvement in the control group, maintaining the original units of measurement. Relative difference was calculated as the absolute benefit divided by the baseline mean (weighted for the intervention and control groups). For dichotomous data, the relative percentage of improvement was calculated as the difference in the percentage of improvement between the intervention and control groups.<sup>11</sup>



**Figure 1.** Shoulder functional strengthening versus control. ADL=activities of daily living, ROM=range of motion, VAS=visual analog scale.

The recommendations were graded by their level (I for RCTs, II for nonrandomized studies) and strength (A, B, C+, C, or D) of evidence. Evidence from one or more RCTs of a statistically significant, clinically important benefit (>15%) was necessary for a grade A recommendation. A grade B recommendation was given to a statistically significant, clinically important benefit (>15%) if the evidence was from observational studies or CCTs. Evidence of clinical importance (>15%) but not statistical significance earned a grade C+ recommendation. A grade C recommendation was given to those interventions where an appropriate outcome was measured in a study that met the inclusion criteria but no clinically important difference and no statistical significance were shown. Evidence from one or more RCTs of a statistically significant, benefit favoring the control group (<0%: favors controls) resulted in a grade

D recommendation. Details on this grading system were published in the Philadelphia Panel methodology article.<sup>11</sup>

Scales demonstrated to be valid and responsive to change are required to support a positive recommendation (A or B). Outcomes not supported in the scientific literature by an existing validation study but providing useful information in studies—such as morning stiffness duration and palm-to-pulp measurement of finger joint ROM—are insufficient to warrant a grade A or B recommendation.<sup>17,18,25,26</sup>

### Reviewing the Guidelines

The guidelines were sent to the external experts for review. To judge clinical usefulness, the 20 positive recommendations also were sent to 5 practitioners for

feedback. Practitioners were selected from clinical settings in the Ottawa and Toronto regions and were a physical therapist, an occupational therapist, a physiatrist, a family physician, and a rheumatologist, all of whom were currently working with patients with RA. Practitioners were asked 4 questions for each guideline: whether the recommendation was clear, whether the practitioners agreed with the recommendation, whether they felt that the literature search on therapeutic exercises and intensity of rehabilitation was relevant and complete, and whether the results of the trials in the guidelines were interpreted according to the practitioners' understanding of the data. Results of this survey are shown in the "Results" section.

## Results

### Literature Search

The literature search identified 2,280 potential articles on therapeutic exercises for several rheumatic conditions. Ninety of these articles were initially considered potentially relevant based on the selection criteria checklist for RA only. Sixteen of these articles relating to therapeutic exercises met the selection criteria and were included.<sup>27-43</sup> One of the 16 studies had a follow-up study, so we have counted these 2 studies as one (Tab. 2, Appendix 1). The other 74 trials<sup>44-117</sup> were excluded from the final selection for various reasons (Tab. 3). For manual therapy, 862 articles were identified. Four of those articles were initially considered potentially relevant, but none were ultimately included<sup>118-121</sup> (Tab. 4).

### Therapeutic Exercises

The clinical practice guidelines for therapeutic exercises are shown in Appendix 3.

**Summary of trials.** Sixteen trials (n=661 patients) evaluated different types of therapeutic exercises for RA affecting joints of the upper and lower extremities. All trials compared these exercises with a control, but the trials examined different kinds of exercise: (1) shoulder functional strengthening (n=28),<sup>35</sup> (2) hand functional strengthening (n=41),<sup>32</sup> (3) knee functional strengthening (n=35),<sup>36</sup> (4) whole-body functional strengthening (n=312),<sup>28-31,33,38-41,43</sup> (5) whole-body, low-intensity functional strengthening (group) that directly compared exercises with a home instruction program (n=100),<sup>42</sup> (6) physical activity compared with bed rest (n=145),<sup>27,34,37</sup> (7) whole-body, low-intensity (individualized) exercises versus written instructions received by a control group for a home exercise program (n=100),<sup>42</sup> (8) whole-body, high-intensity (group) exercises versus written instruction for a home exercise program (n=100),<sup>42</sup> and (9) whole-body, low-intensity (group) versus whole-body, high-intensity (group) exercises (n=100).<sup>42</sup> Six included trials were RCTs,<sup>30,36,37,41-43</sup>

and 11 trials were CCTs<sup>27-29,31-35,38-40</sup> (Appendix 1). We used the Jadad scale to decide whether a study was an RCT or a CCT.<sup>11</sup>

In all trials, 2 main types of therapeutic exercises were prescribed: (1) muscle-specific functional strengthening exercises that included isometric, concentric, eccentric, and isokinetic resistance exercises and (2) whole-body functional strengthening programs that included general fitness and aerobic conditioning. The programs' durations ranged from 1 week to 6 months, the treatment schedule varied from 1 to 14 times a week, and the length of each exercise session ranged from 30 minutes to 1 hour (Appendix 1). Therapeutic exercises varied also in their extent of supervision (ie, supervised versus not supervised, group versus individual) and in their level of intensity (ie, low versus high).

**Efficacy.** Appendix 1 includes information on the intensity, frequency, and total duration of the exercises, which varied from study to study.

For shoulder functional strengthening versus control (one CCT, n=28),<sup>35</sup> no statistically significant difference or clinically important benefit was observed at 2 months for relieving pain or improving ADL and ROM in patients with chronic RA, functional class I or II, and shoulder pain (Fig. 1). No other outcomes were reported.

Hand functional strengthening versus control (one CCT, n=41)<sup>32</sup> showed no clinically important benefit for patients with chronic RA, functional class II or III, in improving ROM of the proximal interphalangeal (PIP) joint (results not shown) and grip force at 12 weeks (Fig. 2). However, hand functional strengthening did show a statistically significant difference (WMD=-3.10°, 95% confidence interval [CI]=-5.93° to -0.27°) with no clinically important benefit for PIP joint extension at 12 weeks only (Fig. 2).

A clinically important benefit (41% relative difference) was shown in knee functional strengthening versus control (one RCT, n=35)<sup>36</sup> for pain in patients who had seropositive or seronegative inflammatory RA and required long-term medication at 6 weeks (Tab. 5). No clinically important benefit was shown for function; no statistically significant difference was observed in any outcome measured after 6 weeks (Fig. 3).

For whole-body functional strengthening programs versus control (3 RCTs and 6 CCTs, n=312),<sup>28-31,33,38-40,43</sup> clinically important benefits were observed for swollen joints at 2 months (29% relative difference on the Lansbury's joint index),<sup>39</sup> number of sick leaves after 8 years (43%),<sup>39</sup> and quadriceps femoris muscle torque

after 8 years (26%)<sup>39</sup> (Tabs. 6 and 7, Figs. 4a–c) in studies with patients who had RA of functional class I, II, or III. Quadriceps femoris muscle torque (WMD=5.20 N·m, 95% CI=1.29–9.11 N·m) and length of sick leave (relative risk=–0.44 day, 95% CI=0.24–0.81 day) after 8 years obtained statistically significant values (Figs. 4b–c). No clinically or statistically significant benefit was found for any of the other outcomes measured (Tab. 6, Figs. 4a–c).

No clinically important benefit was calculated for global patient (patient's assessment of overall disease activity or impairment) at 3 and 6 months, function measured by the Health Assessment Questionnaire (HAQ) at 3 and 6 months, pain measured on a visual analog scale (VAS) at 3 and 6 months, or number of swollen joints at 3 and 6 months in patients with RA, chronic stage (Tab. 8, Fig. 5) for whole-body, low-intensity functional strengthening exercise programs in supervised groups versus instructions for a home-based program (one RCT, n=100).<sup>42</sup>

For physical activity compared with bed rest (considered by the panel to be a control), one RCT<sup>37</sup> demonstrated a significant difference favoring physical activity (WMD=8.15, 95% CI=4.25–12.05) for improving grip force (17% relative difference) at 3 months in patients with chronic RA (Tab. 9, Fig. 6a). Results for pain relief, function, ROM, and tender or swollen joints or time to walk 15.24 m (50 ft) favored the group receiving bed rest in the same RCT<sup>37</sup> and in 2 CCTs<sup>27,34</sup> featuring the same type of patients (n=145) (Tabs. 9 and 10, Figs. 6a–b).

For low-intensity, whole-body functional exercises (individualized) versus a control group whose participants received instruction in a home-based program (one RCT, n=100),<sup>42</sup> statistically significant differences and clinically important benefits were obtained for change in function at 12 weeks (function=statistically significant at 12 weeks) (30% relative difference; WMD=–0.19, 95% CI=–0.36 to –0.02 [12 weeks]; WMD=–0.08, 95% CI=–0.36 to 0.2 [24 weeks]). Clinically important benefits were obtained for pain relief at 12 weeks (40% relative difference) (Tab. 11, Figs. 7a–b). However, no clinically important effects were observed for change in tender joints, change in muscle force, change in swollen joints, or change in joint mobility at 3 and 6 months (Tab. 11, Figs. 7a–b). Patients had RA in a chronic stage.

Whole-body, high-intensity exercises (group) versus control as described above (one RCT, n=100)<sup>42</sup> demonstrated no clinically important benefit for pain relief, muscle force, swollen/tender joints, joint mobility, or improvement in function (HAQ) at 3 and 6 months in patients with chronic RA (Tab. 12, Figs. 8a–b).

In the same RCT (n=100),<sup>42</sup> low-intensity supervised exercises (group) were compared with high-intensity exercises (group) and showed statistically significant differences and clinically important benefits for pain relief at 24 weeks (21% relative difference; WMD=1.30 cm on a 10-cm VAS, 95% CI=0.20–2.40 cm). Function only showed clinically important benefits at 12 weeks (HAQ; 21% relative difference; WMD=0, 95% CI=–0.21 to 0.21). No clinically important effects were shown for muscle force, swollen/tender joints, or joint mobility at 3 and 6 months for patients with RA in a chronic stage (Tab. 13, Figs. 9a–b).

**Strength of published evidence compared with other guidelines.** Good evidence (level I, RCT) exists that therapeutic exercises, including functional strengthening and low- or high-intensity exercises, relieve pain and improve overall function in patients with RA. The strength of evidence has been graded by the Ontario Program for Optimal Therapeutics,<sup>122</sup> which reported good-quality evidence related to therapeutic exercises (see Appendixes 4 and 5 for previous clinical practice guidelines on therapeutic exercises for RA and for shoulder pain).<sup>123–127</sup>

**Clinical recommendations compared with other guidelines.** The Ottawa Panel concluded that good evidence exists (grade A for pain, function, and grip force; grade B for sick leave and lower-limb muscle force; grade C+ for swollen joints) that therapeutic exercises similar to those mentioned above, including functional strengthening and low- or high-intensity exercises, should be included as an intervention for patients with RA. Therapeutic exercises reduce pain while improving periarticular muscle force, aerobic capacity, and joint mobility (Appendix 4). This recommendation is in concordance with all other existing guidelines<sup>122–125</sup> and with 2 protocols.<sup>128,129</sup>

**Practitioners' response to Ottawa Panel guidelines.** All practitioners surveyed agreed with the recommendations for therapeutic exercises. Two practitioners found the recommendations clear, while one practitioner was confused as to which intervention was effective. The Ottawa Panel responded that interventions with grades A, B, and C+ are effective depending on the specific outcome, and the summaries of the guidelines (see "Clinical Practice Guidelines") were rewritten to clarify this issue. The decision aid available on the University of Ottawa Web site (see below for more details) contributes to the clarity of the clinical application of the individual guideline.

### Manual Therapy

Evidence with acceptable research design, interventions, group comparisons, or outcomes could not be identified to guide the development of recommendations for man-

**Table 2.**Included Studies for Therapeutic Exercises (n=16)<sup>a</sup>

Study	Study Design	Population	Outcomes
Alexander et al <sup>27</sup>	CCT	Adult patients with one of the following: (1) active synovitis or (2) RA of sufficient severity to require bed rest. All patients had definite or classical RA.	No. of patients improving in pain, Ritchie Articular Index, morning stiffness, compound thermography index, and grip force
Eklblom et al <sup>28</sup>	CCT	Chronic RA, class II or III, age 38–63 y	Walk test, up and down stairs
Eklblom et al <sup>29</sup> (follow-up study to the previous study)	CCT	Chronic RA, class II or III, age 38–63 y	Walk test, up and down stairs
Häkkinen and Häkkinen <sup>30</sup>	RCT	Recent onset of RA, adult patients with mean age of 41.6 y (Gr1) and 45.7 y (Gr2)	Ritchie Articular Index, maximum isometric grip force, no. of eroded or inflamed joints, HAQ, pain (VAS), maximum isometric force of trunk extensors and flexors, disease activity score
Harkcom et al <sup>31</sup>	CCT	RA class II, adult patients	No. of inflamed joints, maximum heart rate, aerobic work capacity, grip force, ADL functional status
Hoening et al <sup>32</sup>	CCT	RA class II or III, adult outpatients, mean age 57	Grip force, proximal interphalangeal joint extension
Kirsteins et al <sup>33</sup>	CCT	RA class II or III, age 37–72 y	No. of swollen or inflamed joints, grip force, HAQ, tender joints (Ritchie Articular Index)
Lee et al <sup>34</sup>	CCT	Active RA, severe pain, swelling and tenderness in multiple joints, adult patients	Pain, morning stiffness severity, morning stiffness duration, digital joint circumference, grip force, Ritchie Articular Index
Mannerkorpi and Bjelle <sup>35</sup>	CCT	RA class I or II, adult patients with mean age of 54.7 y (Gr1) and 50.1 y (Gr2)	Pain at rest, pain on motion, arm ADL index, flexion ROM
McMeeken et al <sup>36</sup>	RCT	Sero+ or sero- inflammatory RA, adult patients with mean age of 51.4 y (Gr1) and 49.7 y (Gr2)	Pain, HAQ
Mills et al <sup>37</sup>	RCT	Definite or classical RA, age 19–78 y	Ring size, grip force, 15.24 m (50 ft) walking time, ROM, no. of swollen joints, no. of tender joints
Minor and Hewett <sup>38</sup>	CCT	RA, no pre-existing medical condition, adult patients with mean age of 46 y (Gr1) and 54.8 y (Gr2)	Aerobic work capacity, grip force, shoulder flexion, hands-work capacity evaluation, legs-work capacity evaluation, lift-work capacity evaluation
Nordemar et al <sup>39</sup>	CCT	Classical or definite RA, stage I, II, or III, adult patients with mean age of 56 y (Gr1) and 58 y (Gr2)	Quadriceps femoris muscle torque, rate of perceived exertion, Lansbury's joint index, no. who used sick leave between 1970–1978, x-ray index, walk test
Noreau et al <sup>40</sup>	CCT	RA stage I or II, adult patients with mean age of 49.3 y (Gr1) and 49.4 y (Gr2)	No. of swollen joints, peak extension torque of the quadriceps femoris muscle (force), maximum heart rate, maximum aerobic power
Rintala et al <sup>41</sup>	RCT	RA class I or II, adult patients	Rate of perceived exertion, maximal oxygen uptake, pain (VAS), pain during the test
van den Ende et al <sup>42</sup>	RCT	Chronic RA, age 20–70 y	No. of swollen joints, 15.24 m (50 ft) walk test, disease activity score, HAQ (function), pain (VAS), Ritchie Articular Index (tender joints), patient global (patient's assessment of overall disease activity or improvement <sup>11</sup> ), elbow flexion and extension, palmar and dorsal wrist flexion (joint mobility), hip flexion (joint mobility), ankle plantar flexion (joint mobility), muscle force
Van Deusen and Harlowe <sup>43</sup>	RCT	RA, adult patients with mean age of 55.9 y	Shoulder flexion, shoulder external and internal rotation, lower-extremity flexion, ankle plantar flexion

<sup>a</sup> CCT=controlled clinical trial, RA=rheumatoid arthritis, RCT=randomized controlled trial, Gr1=group 1, Gr2=group 2, HAQ=Health Assessment Questionnaire, VAS=visual analog scale, ADL=activities of daily living, ROM=range of motion.

**Table 3.**  
Excluded Studies for Therapeutic Exercises (n=74)<sup>a</sup>

Study	Reason for Exclusion
Ahern et al <sup>44</sup>	More OA than RA in the population
Andersson and Ekdahl <sup>45</sup>	Predictive study
Banwell et al <sup>46</sup>	No standard deviation
Barracough et al <sup>47</sup>	No control group
Baslund et al <sup>48</sup>	Physiological outcomes
Basmajian <sup>49</sup>	Review
Beals et al <sup>50</sup>	People without known pathology or limitations as a control group
Beaupré et al <sup>51</sup>	More OA than RA in the population
Boström et al <sup>52</sup>	Head-to-head study
Brighton et al <sup>53</sup>	Not the study period or the outcome measurement period of interest
D’Lima et al <sup>54</sup>	More OA than RA in the population
Daltroy et al <sup>55</sup>	Systemic lupus erythematosus and RA in the same population
Dellhag et al <sup>56</sup>	Head-to-head study
Ekblom <sup>57</sup>	Review of different clinical trials
Ekblom et al <sup>58</sup>	Not a clinical trial, baseline measurements only
Ekdahl and Broman <sup>59</sup>	Comparative study
Ekdahl et al <sup>60</sup>	Measurements given in terms of differences
Häkkinen et al <sup>61</sup>	Head-to-head study
Häkkinen et al <sup>62</sup>	Head-to-head study
Hansen et al <sup>63</sup>	Not the study period or the outcome measurement period of interest
Harris and Copp <sup>64</sup>	Patients were their own control
Hart et al <sup>65</sup>	Wrong reference
Haug and Wood <sup>66</sup>	Majority of patients had degenerative joint disease
Helewa et al <sup>67</sup>	Treatment with medication
Hsieh et al <sup>68</sup>	Not a clinical trial
Karten et al <sup>69</sup>	No control group
Kelly <sup>70</sup>	No statistical data
Komatireddy et al <sup>71</sup>	Not the study period or the outcome measurement period of interest
Lee et al <sup>72</sup>	Periarthritis
Lineker and Horn <sup>73</sup>	Review
Lineker et al <sup>74</sup>	No control group
London et al <sup>75</sup>	More OA than RA in the population
Lyngberg et al <sup>76</sup>	Not the study period or the outcome measurement period of interest
Lyngberg et al <sup>77</sup>	Patients were their own control
Lyngberg et al <sup>78</sup>	Not the study period or the outcome measurement period of interest
Machover and Sapecky <sup>79</sup>	No control group
Maloney et al <sup>80</sup>	More OA than RA in the population
McCubbin <sup>81</sup>	Review
Minor <sup>82</sup>	Not a clinical trial
Minor and Brown <sup>83</sup>	More OA than RA in the population
Minor et al <sup>84</sup>	No control group
Minor et al <sup>85</sup>	More OA than RA in the population
Neuberger et al <sup>86</sup>	No control group
Nicholson et al <sup>87</sup>	Not found

(continued)

**Table 3.**Excluded Studies for Therapeutic Exercises (n=74)<sup>a</sup> (continued)

Study	Reason for Exclusion
Nitz and Luparia <sup>88</sup>	Not the study period or the outcome measurement period of interest
Nordesjö et al <sup>89</sup>	People without known pathology or limitations as a control group
Nordström et al <sup>90</sup>	Head-to-head study
Partridge and Duthie <sup>91</sup>	Not the intervention of interest, no exercises involved
Perlman et al <sup>92</sup>	No control group
Petri et al <sup>93</sup>	Medication effects
Rall et al <sup>94</sup>	People without known pathology or limitations as a control group
Raspe et al <sup>95</sup>	Head-to-head study
Romness and Rand <sup>96</sup>	More OA than RA in the population
Sanford-Smith et al <sup>97</sup>	Head-to-head study
Scholten et al <sup>98</sup>	Multidisciplinary
Semble et al <sup>99</sup>	Review
Simon and Blotman <sup>100</sup>	Not a clinical trial
Smith and Polley <sup>101</sup>	Review
Stenström <sup>102</sup>	Head-to-head study
Stenström et al <sup>103</sup>	Head-to-head study
Stenström et al <sup>104</sup>	Head-to-head study
Stenström et al <sup>105</sup>	Not the study period or the outcome measurement period of interest
Suomi and Kocejka <sup>106</sup>	More OA than RA in the population
Suomi and Lindauer <sup>107</sup>	More OA than RA in the population
Suwalska <sup>108</sup>	Not a clinical trial
Tegelberg and Kopp <sup>109</sup>	Ankylosing spondylitis
Tegelberg and Kopp <sup>110</sup>	Ankylosing spondylitis
Templeton et al <sup>111</sup>	No control group
van den Ende et al <sup>112</sup>	Systematic review
van den Ende et al <sup>113</sup>	Head-to-head study
Van Deusen and Harlowe <sup>114</sup>	No numerical value available for the outcome measure
Waggoner and LeLievre <sup>115</sup>	Inadequate outcome: adherence to intervention; no information about exercise program
Wessel <sup>116</sup>	Lack of information; authors contacted
Westby et al <sup>117</sup>	Mixed interventions, with investigation of the effects of medication, not a proper control or comparison group

<sup>a</sup> OA=osteoarthritis, RA=rheumatoid arthritis.

**Table 4.**  
Excluded Studies for Manual Therapy (n=4)<sup>a</sup>

Study	Reason for Exclusion
Deyle et al <sup>118</sup>	OA
Dhondt et al <sup>119</sup>	RCT for spinal condition with RA
Fox and Poss <sup>120</sup>	No statistical data available
Kauppi et al <sup>121</sup>	RCT for spinal condition with RA

<sup>a</sup>OA=osteoarthritis, RA=rheumatoid arthritis, RCT=randomized controlled trial.

ual therapy. To our knowledge, no EBCPGs exist on manual therapy for RA conditions.

## Discussion

From this extensive systematic review, numerous EBCPGs (6 with grade A, B, and C+ recommendations) have been developed for therapeutic exercises for RA, including strengthening exercises and whole-body exercises, with an emphasis on intensity of the exercise program. One or more CCTs have shown that these interventions provide clinically important benefits. More evidence, however, is needed to determine the efficacy of therapeutic exercises and manual therapy in the management of RA (9 primary grade C recommendations for therapeutic exercises and one “insufficient data” for manual therapy). Although no harmful side effects were reported in the original studies, the results of our review seem to suggest some potentially negative effects of intervention. For example, physical activity as compared with bedrest may have negative effects on outcomes such as pain, function, ROM, number of tender or swollen joints, and time to walk 15.24 m (50 ft). The effects of high-intensity exercise on pain also raise concern.

However, as with all such reviews, this review has its limitations. The effectiveness of conservative management of patients with RA is a complex issue,<sup>7</sup> and rehabilitation specialists often use concomitant interventions in their daily practice.<sup>130</sup> For example, interventions such as cryotherapy, wax bath, and electrotherapy are used for pain relief or as treatment preparation before exercise intervention. The use of a single intervention does not reflect the complexity of the global approach adopted by rehabilitation specialists in real-life clinical situations.

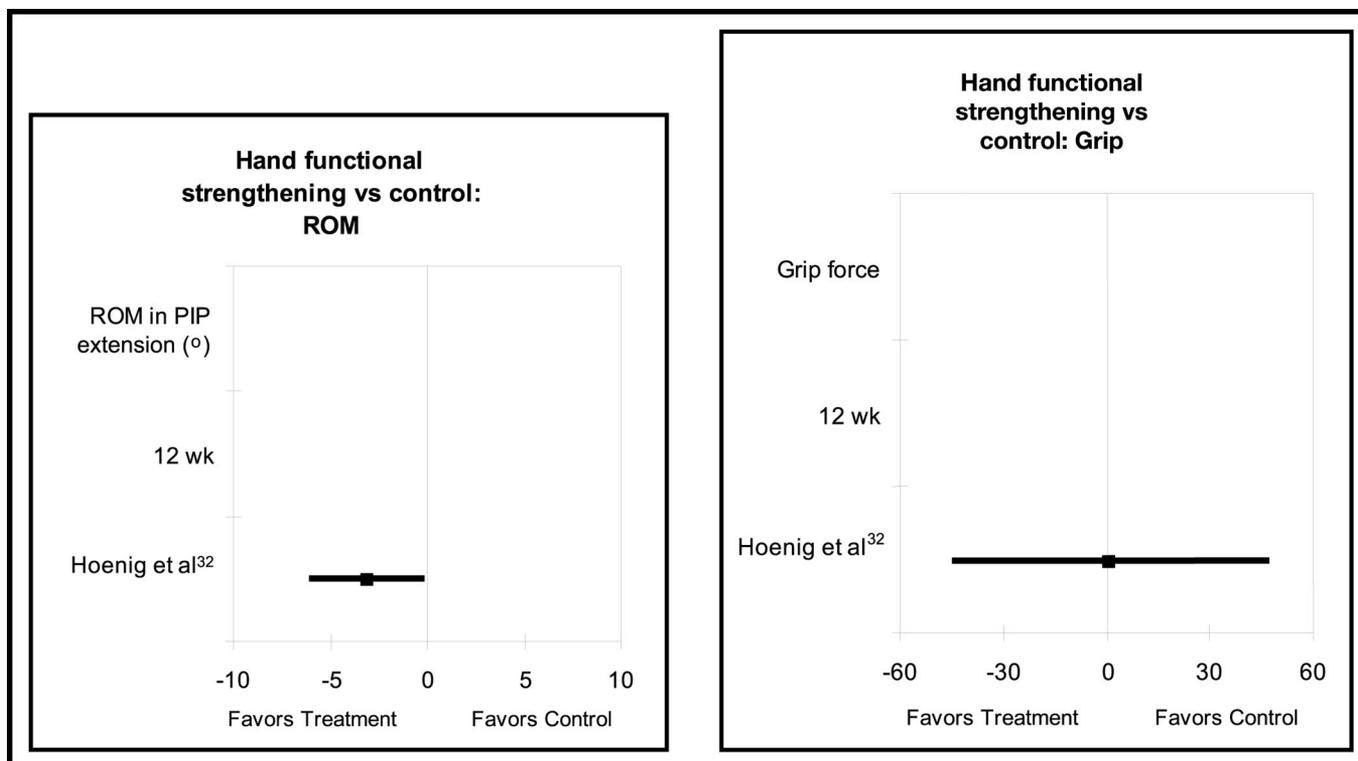
Furthermore, the efficacy of therapeutic exercises for RA is thought to be influenced by a number of factors,<sup>7</sup> including biological, psychosocial, and environmental health indicators.<sup>7,131</sup> Therefore, a multidimensional clinical evaluation is recommended in arthritis management.<sup>122,132</sup> However, it was not possible to examine the effect of possible concurrent therapies such as medica-

tion intake and thermotherapy on the effectiveness of the interventions examined.<sup>133</sup>

The Ottawa Panel EBCPGs for the management of RA generally concur with previous and relatively recent EBCPGs for RA,<sup>122–125</sup> shown in Appendix 4, and with 2 protocols.<sup>128,129</sup> The Philadelphia Panel EBCPGs, on whose methodology those of the Ottawa Panel were based, were developed based on a systematic grading of the evidence determined by an expert panel. In both cases, the evidence was derived from new systematic reviews and meta-analyses conducted by the OMG using The Cochrane Collaboration methodology. The Ottawa Panel comprised several practitioners who verified the guidelines’ applicability and ease of use for practicing clinicians. This additional procedure provides credibility for rehabilitation specialists who intend to use these EBCPGs in their daily practice.

The EBCPGs developed by the Ottawa Panel have some potential limitations due to methodological weaknesses. Although the included trials were selected based on well-established inclusion and exclusion criteria, selection was performed by occupational therapist and physical therapist students. Potential omission of studies due to reviewer inexperience could have led to selection bias. Consultation with a third reviewer (LB) and the use of the panel of senior clinical experts may have compensated in part for this potential methodological flaw. The EBCPGs also are limited by the inclusion and exclusion criteria for the included studies. For example, some reports of RCTs<sup>31–33,36,37,40,41</sup> did not specify if the study sample included individuals in acute or chronic stages of RA. Additionally, some studies lacked details about the specific characteristics of the exercise intervention such as intensity. This lack of specificity<sup>18</sup> could be problematic for future clinical implementation of the guidelines, especially for the whole-body functional strengthening recommendation.

The OMG, however, made sure that the development of the draft EBCPGs prepared for the expert members was in concordance with Appraisal of Guidelines Research and Evaluation (AGREE) criteria.<sup>134</sup> Using AGREE ([www.agreecollaboration.org](http://www.agreecollaboration.org)), 2 trained physical therapists assessed the Ottawa Panel EBCPGs for RA. This tool consists of 6 dimensions measured on a 4-point scale, where 1 represents “strongly agree” and 4 represents “strongly disagree.” The dimensions are: (1) purpose, defined as overall objectives that described the potential impact of a guideline on society and populations of patients; (2) stakeholder involvement, defined as the extent to which the guideline represents the views of its targeted users; (3) rigor of development, which deals with the process used to gather and synthesize the evidence and with the methods to formulate the recommenda-



**Figure 2.** Hand functional strengthening versus control. ROM=range of motion, PIP=proximal interphalangeal joint.

**Table 5.** Knee Functional Strengthening Versus Control<sup>a</sup>

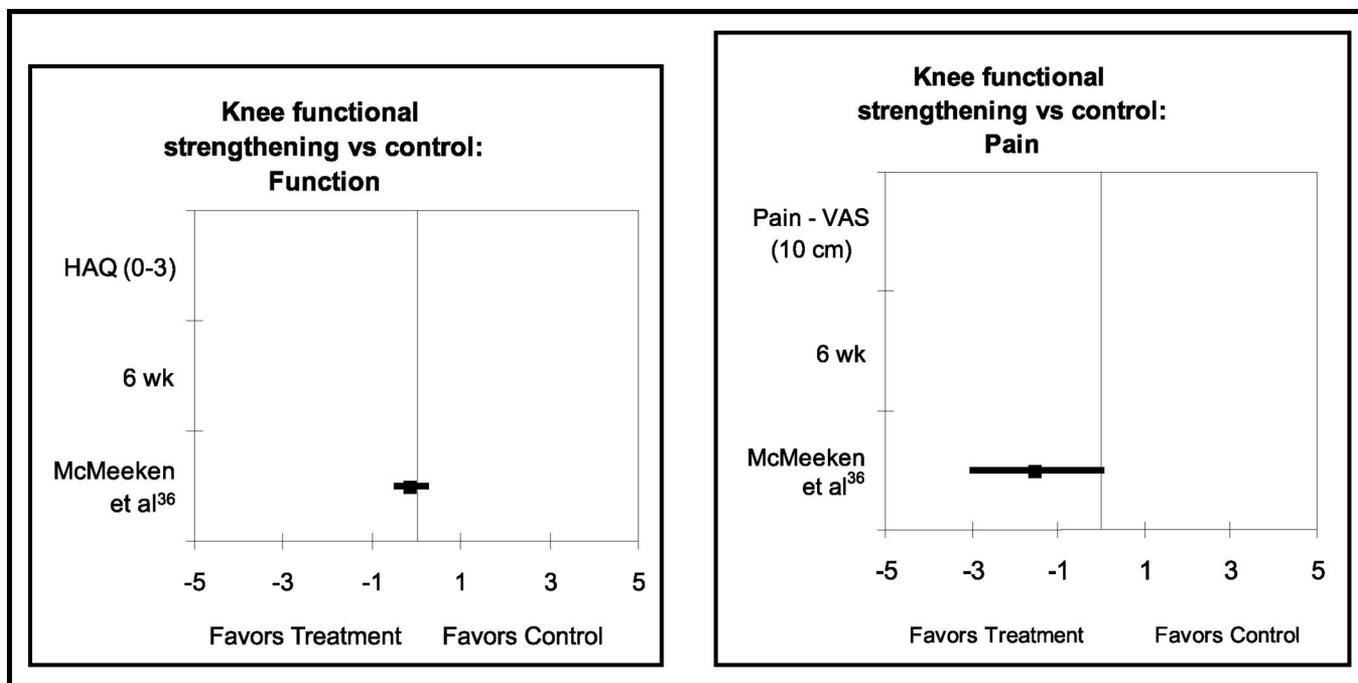
Study	Intervention Group <sup>b</sup>	Outcome	No. of Patients	Baseline Mean	End-of-Study Mean	Absolute Benefit	Relative Difference in Change From Baseline
McMeeken et al <sup>36</sup>	E: exercises	Pain measured with 10-cm VAS	17	4.3	2.4	-1.7	-41%
	C: no intervention	Pain measured with 10-cm VAS	18	4.1	3.9		

<sup>a</sup>In the table, we have included only outcomes for which the corresponding graphs do not provide adequate information. VAS=visual analog scale (0–10, where 10=greatest pain).

<sup>b</sup>E=experimental group, C=control group.

tions and to update them; (4) clarity and presentation, which refers to the language and format of the guideline; (5) applicability, which relates to the likely organizational, behavioral, and cost implications of applying the guideline; and (6) editorial independence, which refers to the independence of the recommendations and acknowledgment of possible conflict of interest from the guideline development group. The EBCPGs obtained a very high score for dimensions 1 (purpose), 2 (stakeholder involvement), 4 (clarity), and 6 (editorial independence), with lower scores for dimensions 3 (rigor of development) and 5 (applicability). On the University of Ottawa School of Rehabilitation Sciences Web page

(<http://www.health.uottawa.ca/EBCpg/english/main.htm>) precise results are currently available, and decision aids with detailed clinical application will soon be available. The rigor of development was low because of poor reporting of side effects and risks, which were not reported in the primary trials and therefore not included in the EBCPGs. The applicability was low, particularly in identifying potential organizational barriers, cost implications, and methods of applying and monitoring the guidelines. After publication, the Ottawa Panel is planning to implement these guidelines in the Arthritis Rehabilitation and Education Program of The Arthritis Society of Ontario.



**Figure 3.** Knee functional strengthening versus control. HAQ=Health Assessment Questionnaire.

### Therapeutic Exercises

The Ottawa Panel concluded that therapeutic exercises, including specific functional strengthening and whole-body functional strengthening, are a beneficial intervention for patients with RA. The benefit may vary, however, according to disease acuity and the time frame during which the outcomes are measured. Clinical benefits are recognized for pain relief, upper-limb (grip) and lower-limb force, and functional status. Other benefits include improved overall function and, of particular importance due to its socioeconomic impact, decreased number of sick leaves. In the presence of an inflammatory disease such as RA, a low-intensity exercise program favors the reduction of pain and an improved functional status as compared with a high-intensity program, which may exacerbate the inflammatory process and the risk of damage to the affected joints. This evidence was not reproduced in noninflammatory diseases such as OA.<sup>135</sup> Physiological changes in plasma opioid concentrations support the reduction of pain observed in patients with RA after exercise.<sup>136–138</sup>

The recommendation for therapeutic exercises is in concordance with all existing guidelines<sup>122–125</sup> and 2 protocols.<sup>128,129</sup> To our knowledge, all systematic reviews<sup>112</sup> and all existing descriptive literature<sup>16,99,133,139–142</sup> support this recommendation. Some subtle variation exists, though, depending on the outcome studied.

Although the Ottawa Panel EBCPGs are based mainly on RCTs, further research investigating the efficacy of therapeutic exercises for patients with RA requires trials of

higher methodological quality. Indeed, a large number of studies failed to meet the inclusion criteria. The overall methodological quality of the included studies underlying the EBCPGs was relatively weak<sup>15</sup> due to the difficulty in masking patients and evaluators for this kind of intervention. This methodological weakness observed in the included RCTs may have caused an overestimation of effect. The impossibility of truly masking patients is a common problem in trials of rehabilitation interventions.<sup>143</sup> Additionally, although we found many RCTs on therapeutic exercises for RA, the authors did not always report the characteristics of the intervention, the characteristics of the sample, and the stage of the disease in a standardized way. Some outcomes studied in the primary trials may not be clinically plausible. For example, it is unclear how therapeutic exercise alone could lead to improvement in joint swelling. To improve methodological quality, future RCTs should use the Morin Theoretical Framework<sup>18</sup> and the CONSORT Model<sup>144</sup> to report not only the characteristics of clinical application, of the sample, and of the disease, but also of the dropouts, the method of randomization, and the use of validated measurements.

Investigators in future studies examining the benefits of therapeutic exercises in the management of patients with RA will need to be more explicit in specifying the characteristics of the implemented exercises and program, including aquatics programs<sup>38,106,107</sup>; the intensity of the exercise; and the progression. In addition, to provide a more judicious evaluation of the benefits, patient-specific information concerning physical impair-

**Table 6.**  
Whole-Body Functional Strengthening Versus Control<sup>a</sup>

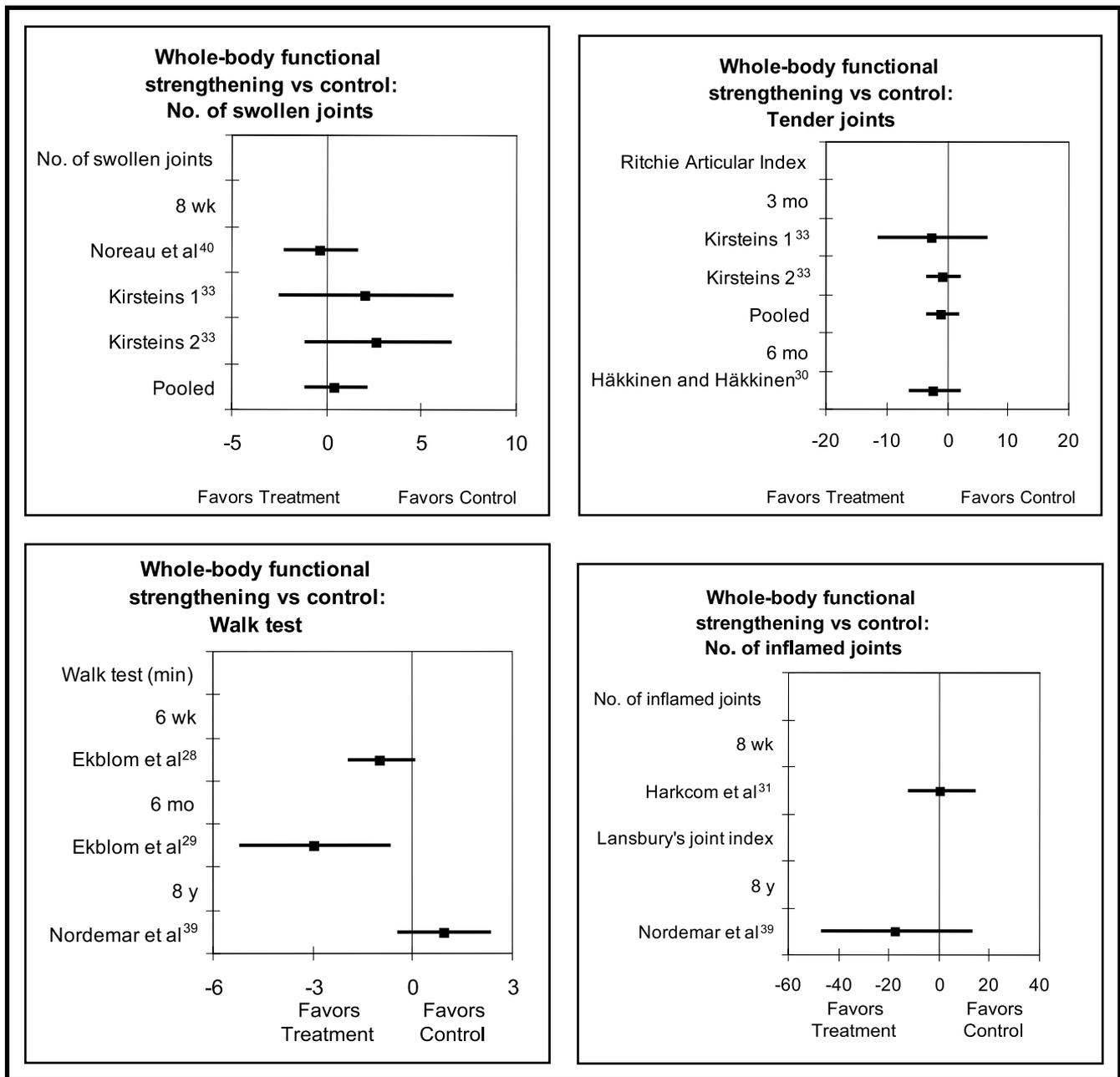
Study	Group	Outcome	No. of Patients	Baseline Mean	End-of-Study Mean	Absolute Benefit	Relative Difference in Change From Baseline
Ekblom et al <sup>29</sup>	E: whole-body functional strengthening	Walk test (minutes) at 6 wk	23	9.36	8.02	-1.14	-12%
	C: no intervention	Walk test (minutes) at 6 wk	11	9.17	8.97		
Van Deusen and Harlowe <sup>43</sup>	E: ROM dance sequence, exercises, and relaxation techniques	Lower-extremity flexion (degrees) at 9 mo	17	Not available	487	34°	Cannot calculate
	C: no intervention	Lower-extremity flexion (degrees) at 9 mo	16	Not available	453		
Minor and Hewitt <sup>38</sup>	E: supervised class of aquatic, low-impact aerobics or walking	Shoulder flexion at 3 mo	17	149	151	-1	-1%
	C: no intervention	Shoulder flexion at 3 mo	19	140	143		
Minor and Hewitt <sup>38</sup>	E: supervised class of aquatic, low-impact aerobics or walking	Shoulder flexion at 12 mo	15	149	152	1	1%
	C: no intervention	Shoulder flexion at 12 mo	17	140	142		
Nordemar et al <sup>39</sup>	E: training	Quadriceps femoris muscle torque (newton-meters)	23	14.5	16.7	3.6	26%
	C: no intervention	Quadriceps femoris muscle torque (newton-meters)	23	12.9	11.5		
Nordemar et al <sup>39</sup>	E: training	Swollen joints: Lansbury's joint index	23	94	59	-26	-29%
	C: no intervention	Swollen joints: Lansbury's joint index	23	85	76		
Nordemar et al <sup>39</sup>	E: training	Swollen joints: Lansbury's joint index	23	6.2	10.2	-2.9	-45%
	C: no intervention	Swollen joints: Lansbury's joint index	23	6.7	13.6		
Nordemar et al <sup>39</sup>	E: training	Walk test (minutes)	23	8.42	8.92	0.69	8%
	C: no intervention	Walk test (minutes)	23	8.16	7.97		

<sup>a</sup>E=experimental group, C=control group.

**Table 7.**  
Whole-Body Functional Strengthening Versus Control<sup>a</sup>

Author	Group	Outcome	No. of Patients Who Improved	Total No. of Patients	Risk Occurrence	Risk Difference
Nordemar et al <sup>39</sup>	E: training	No. of patients who used sick leave	8	23	35%	43%
	C: no training	No. of patients who used sick leave	18	23	78%	

<sup>a</sup>E=experimental group, C=control group.



**Figure 4a.** Whole-body functional strengthening versus control. Joint count=number of actively inflamed joints. Kirsteins 1991-1 is the study reported by Kirsteins et al.<sup>33</sup> Kirsteins 1991-2 was a follow-up study by Kirsteins et al with exactly the same information reported for Kirsteins 1991-1.

ment, functional goals, and standardized outcome measures<sup>17</sup> must be provided.<sup>140</sup>

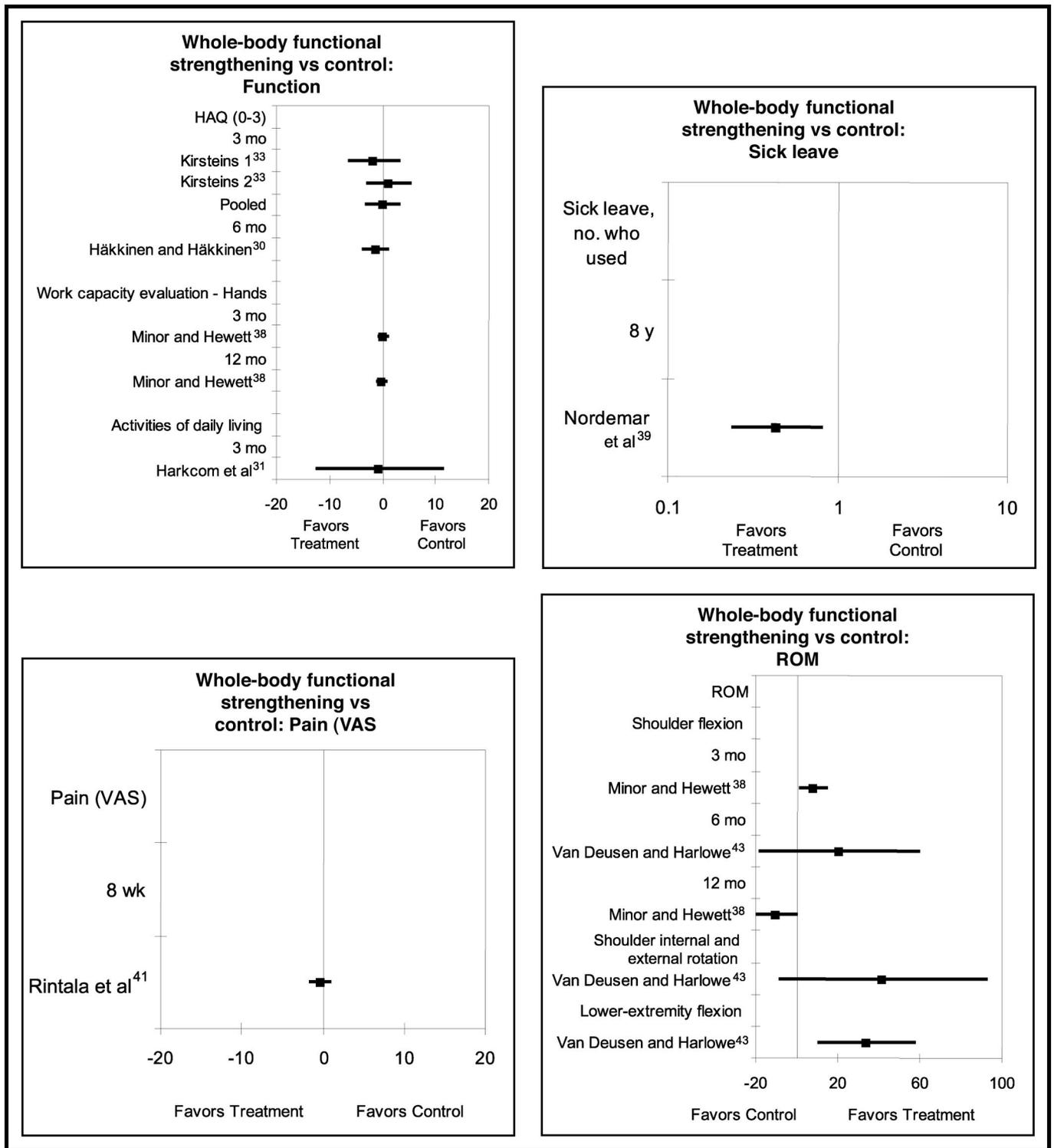
#### Manual Therapy

No studies of manual therapy with acceptable research designs were identified.

#### Implications for Practice

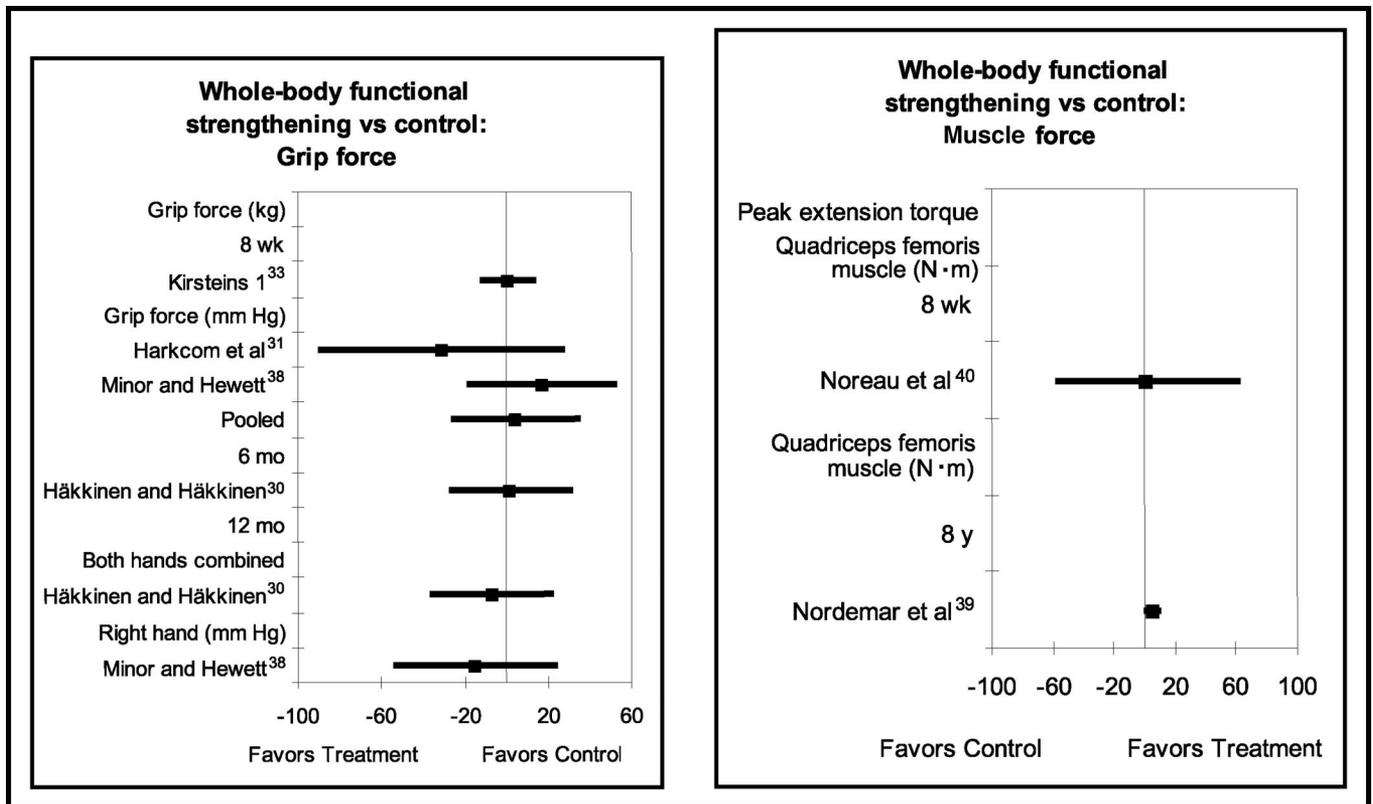
The Ottawa Panel found evidence to recommend and support the use of therapeutic exercises, especially knee functional strengthening, whole-body functional strengthening, general physical activity, and whole-body,

low-intensity exercises, for the management of RA. Conversely, evidence is lacking at present as to whether the use of shoulder and hand strengthening exercises and whole-body, high-intensity exercises or manual therapy should be included or excluded in the daily practice of physical rehabilitation for RA management. It is important to note that the recommendations outlined here are limited by methodological considerations such as the quality of studies in the literature, including the generally poorly reported descriptions of therapeutic exercise programs, and the outcomes in those studies.



**Figure 4b.**

Whole-body functional strengthening versus control. HAQ=Health Assessment Questionnaire, VAS=visual analog scale, ROM=range of motion. Kirsteins 1991-1 is the study reported by Kirsteins et al.<sup>33</sup> Kirsteins 1991-2 was a follow-up study by Kirsteins et al with exactly the same information reported for Kirsteins 1991-1.

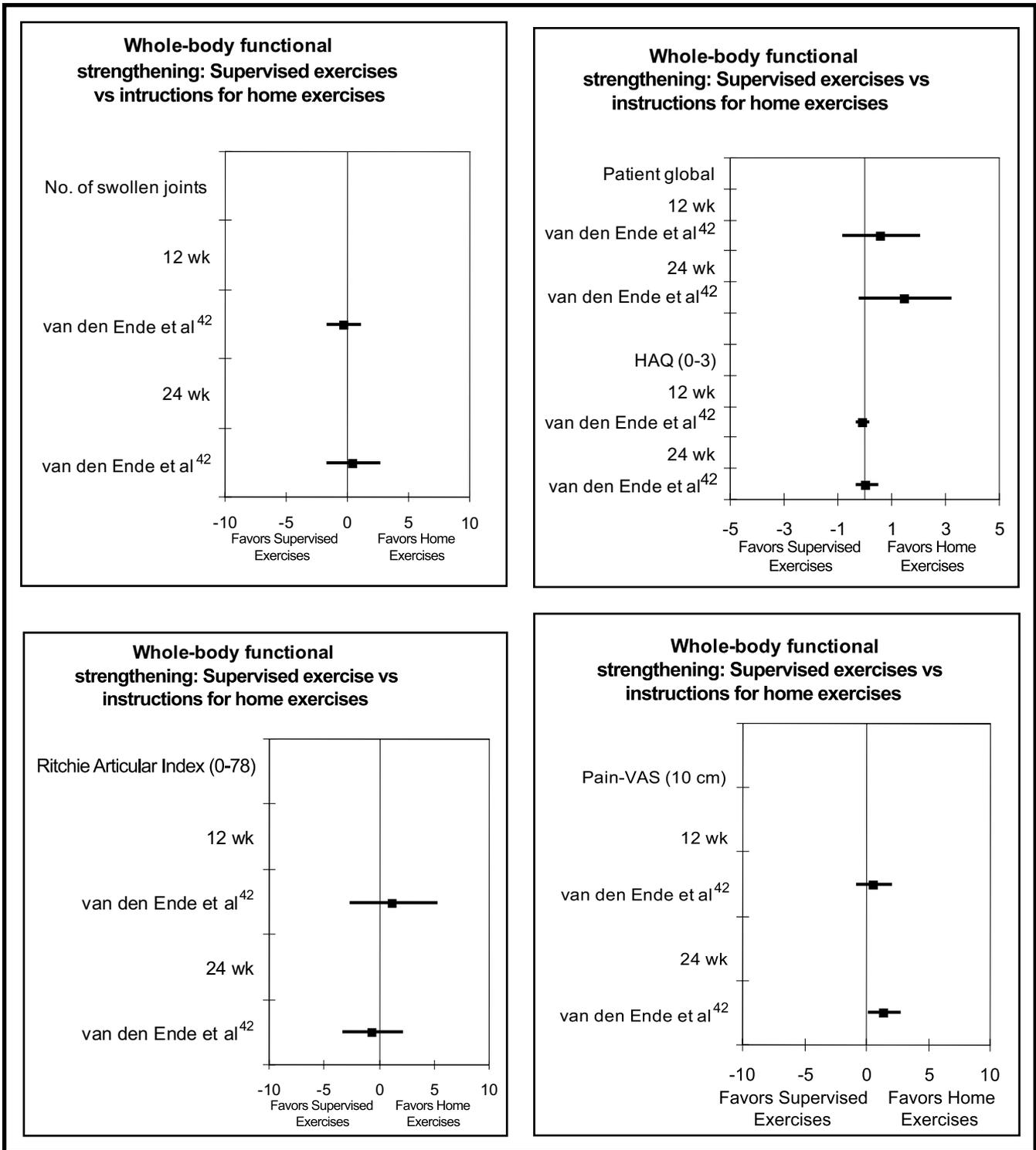


**Figure 4c.** Whole-body functional strengthening versus control.

**Table 8.** Whole-Body Low-Intensity Functional Strengthening (Group): Dynamic Exercises Versus Instructions for Home Exercises<sup>a</sup>

Study	Intervention Group	Outcome	No. of Patients	Baseline Mean	End-of-Study Mean	Absolute Benefit	Relative Difference From Baseline
van den Ende et al <sup>42</sup>	E: dynamic whole-body functional strengthening	Pain measured with 10-cm VAS at 24 wk	25	3.4	4.8	0.2	7%
	C: written instructions for home exercises	Pain measured with 10-cm VAS at 24 wk	25	2.1	3.3		

<sup>a</sup>E=experimental group, C=control group, VAS=visual analog scale (0–10, where 10=greatest pain).



**Figure 5.** Whole-body low-intensity functional strengthening exercises (group): exercises versus instructions for home exercises. HAQ=Health Assessment Questionnaire, VAS=visual analog scale.

**Table 9.**  
Bed Rest Versus Physical Activity at 10 Weeks<sup>a</sup>

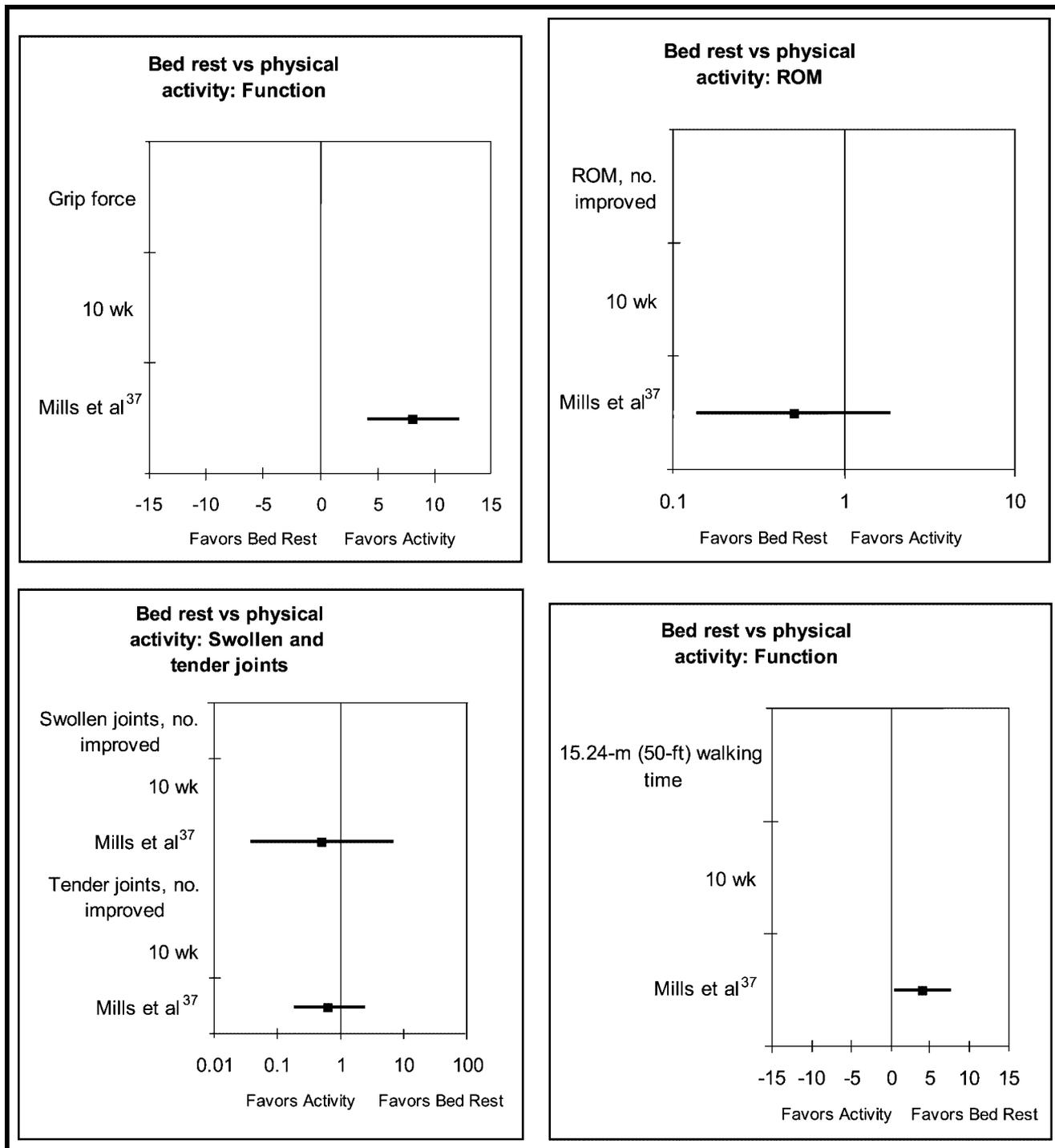
Study	Intervention Group	Outcome	No. of Patients	Baseline Mean	End-of-Study Mean	Absolute Benefit	Relative Difference in Change From Baseline
Mills et al <sup>37</sup>	C: bed rest	No. of swollen joints	20	24.02	25.4	1.45	7% (favors bed rest)
	E: physical activity	No. of swollen joints	22	19.41	19.34		
Mills et al <sup>37</sup>	C: bed rest	No. of tender joints	20	32.45	27.15	-0.53	-1% (favors bed rest)
	E: physical activity	No. of tender joints	22	38.5	33.73		
Mills et al <sup>37</sup>	C: bed rest	Grip force	20	91.05	103.7	-14.78	-17% (favors physical activity)
	E: physical activity	Grip force	22	82.9	110.33		
Mills et al <sup>37</sup>	C: bed rest	15.24-m (50-ft) walking time	20	31.91	20.03	-3.23	-11% (favors bed rest)
	E: physical activity	15.24-m (50-ft) walking time	22	27.83	19.18		

<sup>a</sup>E=experimental group, C=control group.

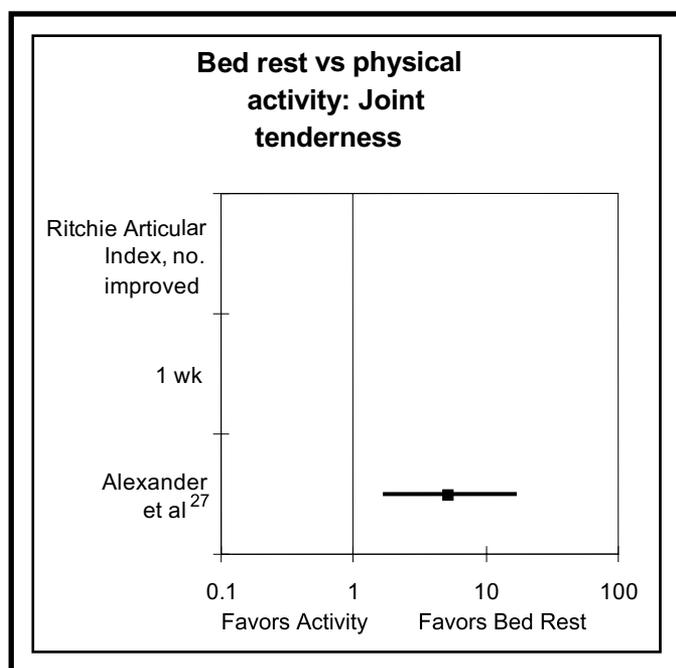
**Table 10.**  
Bed Rest Versus Physical Activity<sup>a</sup>

Author	Group	Outcome	No. of Patients Who Improved	Total No. of Patients	Risk Occurrence	Risk Difference
Alexander et al <sup>27</sup>	C: bed rest	No. of patients who improved on the Ritchie Articular Index	31	36	86%	32% (favors bed rest)
	E: physical activity	No. of patients who improved on the Ritchie Articular Index	21	39	54%	

<sup>a</sup>E=experimental group, C=control group.



**Figure 6a.**  
Bed rest versus physical activity.



**Figure 6b.**  
Bed rest versus physical activity.

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**Table 11.**  
Low-Intensity Exercises (Individualized) Versus Control<sup>a</sup>

Study	Intervention Group	Outcome	No. of Patients	Baseline Mean	End-of-Study Mean	Absolute Benefit	Relative Difference in Change From Baseline
van den Ende et al <sup>42</sup>	E: low-intensity exercise	Pain measured with 10-cm VAS at 12 wk	25	2.4	2.4	-0.9	-40%
	C: instructions for home exercise	Pain measured with 10-cm VAS at 12 wk	25	2.1	3		
van den Ende et al <sup>42</sup>	E: low-intensity exercise	Ritchie Articular Index at 12 wk	25	10.7	10.2	-0.7	-1%
	C: instructions for home exercise	Ritchie Articular Index at 12 wk	25	12.4	12.6		
van den Ende et al <sup>42</sup>	E: low-intensity exercise	Muscle force: isokinetic extension 120°/s (in newton-meters) at 12 wk	25	86	82	3	4%
	C: instructions for home exercise	Muscle force: isokinetic extension 120°/s (in newton-meters) at 12 wk	25	78	75		
van den Ende et al <sup>42</sup>	E: low-intensity exercise	HAQ (0-3 point scale) at 12 wk	25	0.72	0.67	-0.21	-30%
	C: instructions for home exercise	HAQ (0-3 point scale) at 12 wk	25	0.70	0.86		

<sup>a</sup>E=experimental group, C=control group, VAS=visual analog scale (0-10, where 10=greatest pain), HAQ=Health Assessment Questionnaire.

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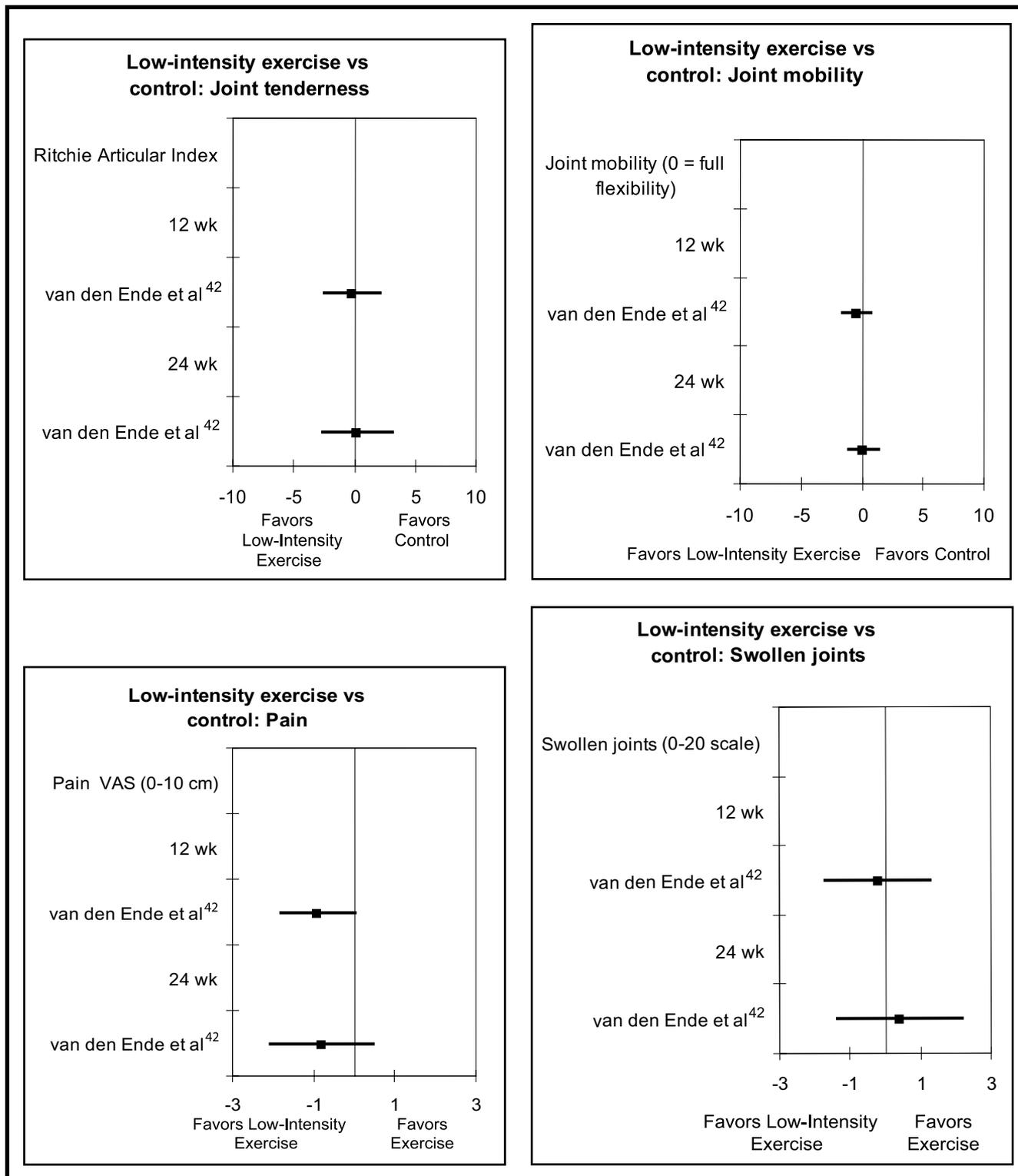
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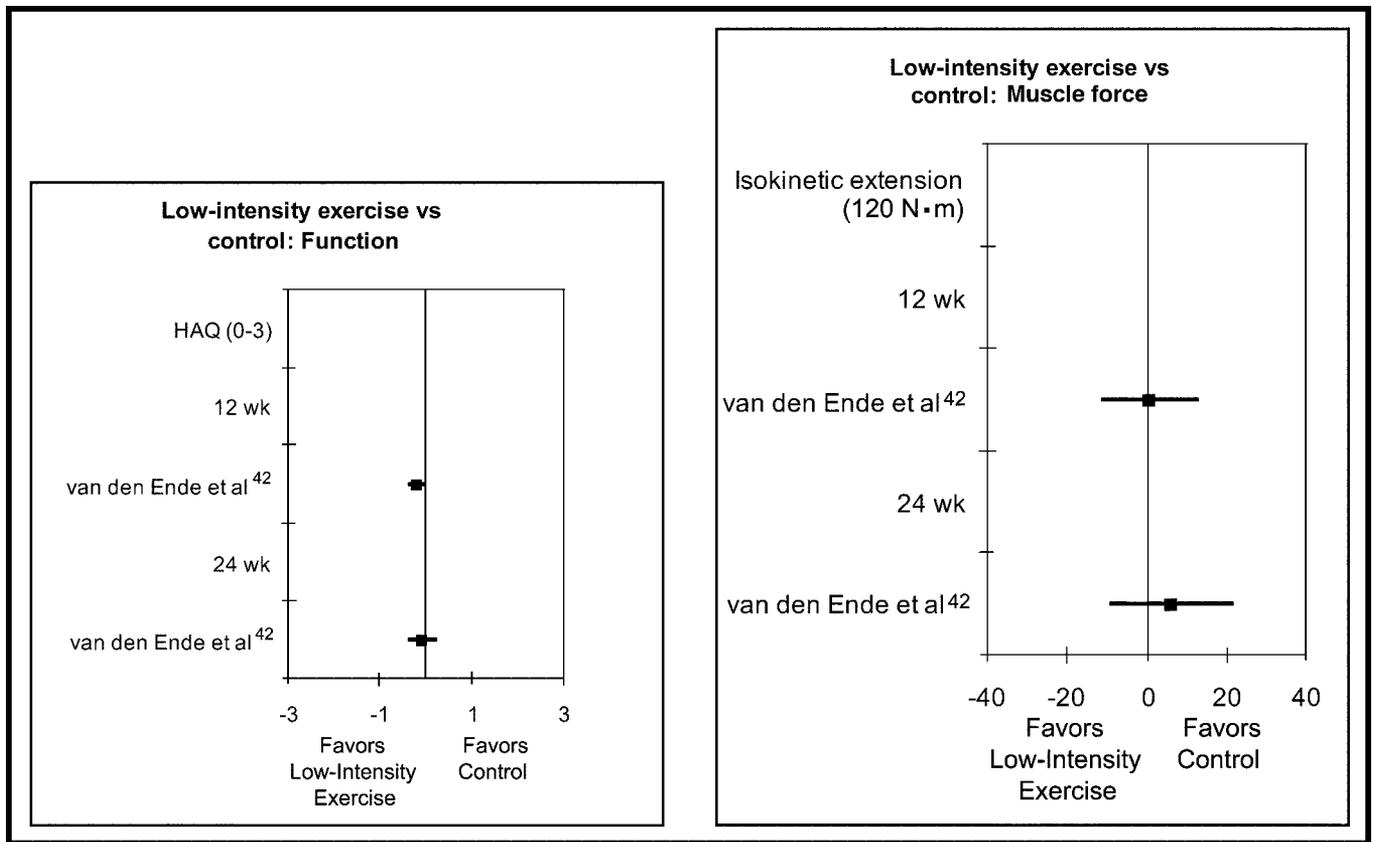
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**Figure 7a.**

Low-intensity exercises (individualized) versus control (written instructions for home exercises).

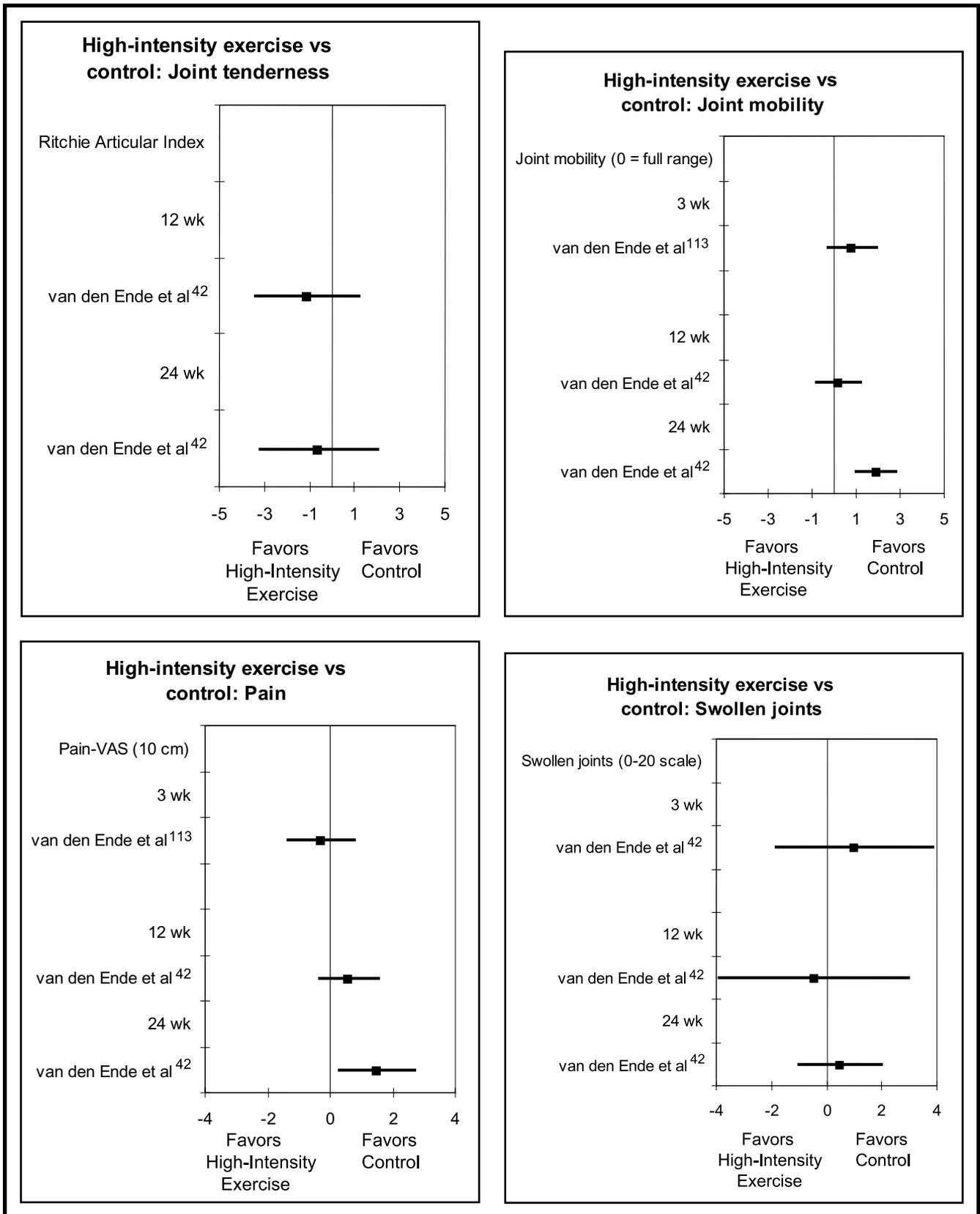


**Figure 7b.** Low-intensity exercises (individualized) versus control (written instructions for home exercises).

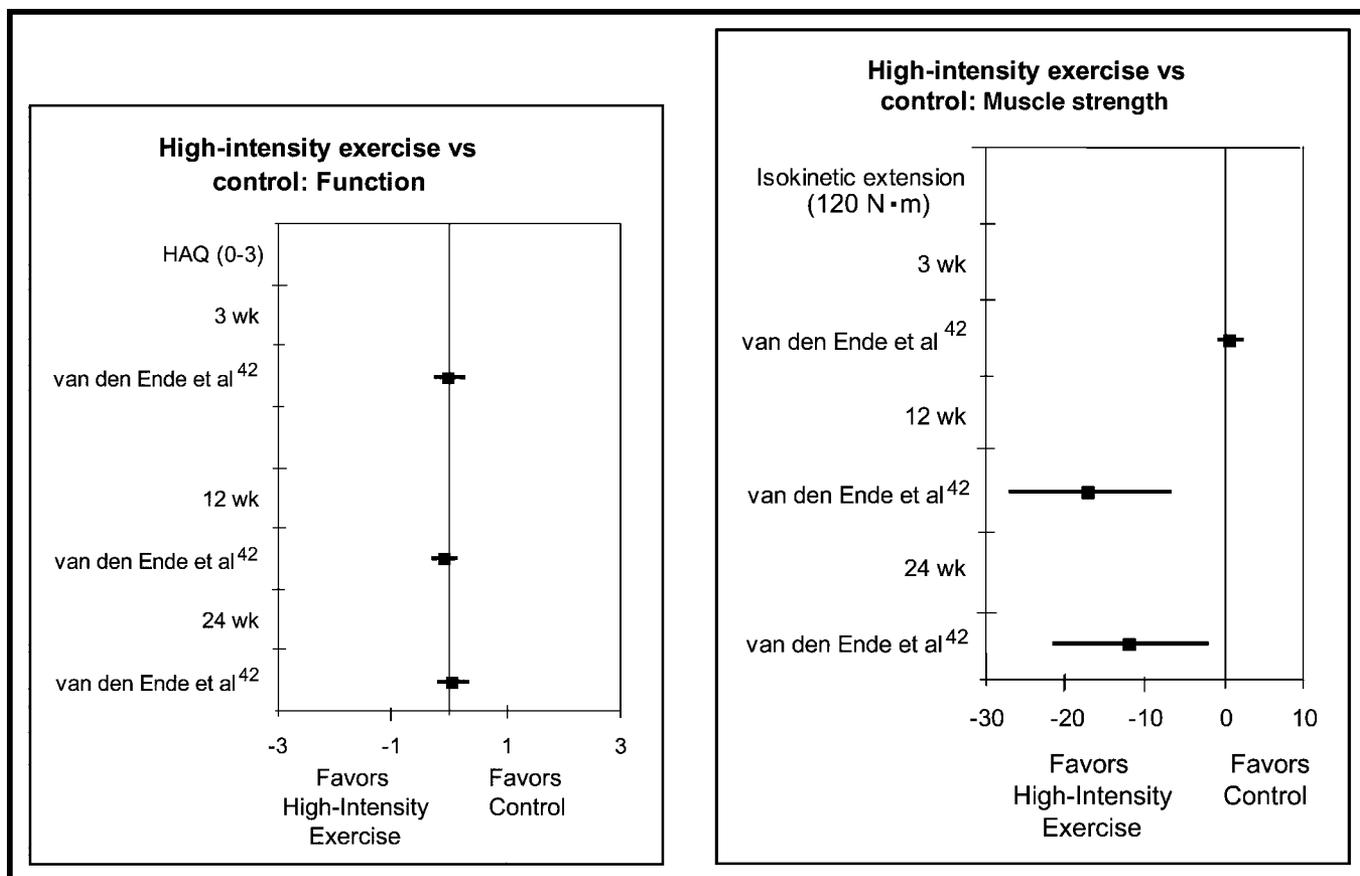
**Table 12.** High-Intensity Exercises Versus Control<sup>a</sup>

Study	Intervention Group	Outcome	No. of Patients	Baseline Mean	End-of-Study Mean	Absolute Benefit	Relative Difference in Change From Baseline
van den Ende et al <sup>42</sup>	E: high-intensity exercise	Pain measured with 10-cm VAS at 24 wk	25	3.4	4.8	0.2	7%
	C: no intervention	Pain measured with 10-cm VAS at 24 wk	25	2.1	3.3		
van den Ende et al <sup>42</sup>	E: high-intensity exercise	Joint mobility at 24 wk	25	10.9	10.8	-0.4	-1%
	C: no intervention	Joint mobility at 24 wk	25	8.6	8.9		
van den Ende et al <sup>42</sup>	E: high-intensity exercise	Muscle force: isokinetic extension 120°/s (in newton-meters) at 12 wk	25	81	87	9	11%
	C: no intervention	Muscle force: isokinetic extension 120°/s (in newton-meters) at 12 wk	25	78	75		

<sup>a</sup>E=experimental group, C=control group, VAS=visual analog scale (0-10, where 10=greatest pain).



**Figure 8a.** High-intensity exercises versus control (written instructions for home exercises). VAS=visual analog scale.

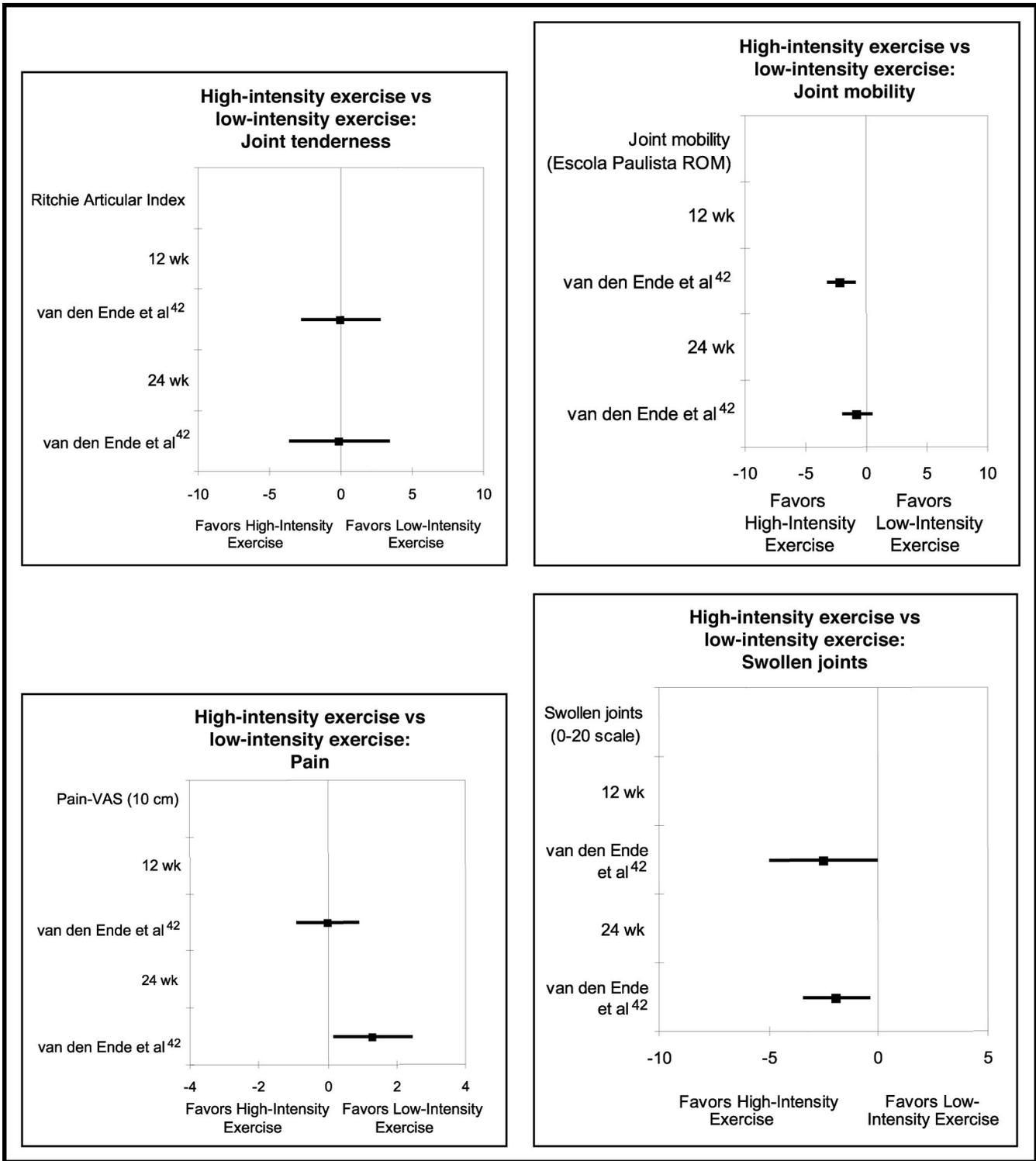


**Figure 8b.** High-intensity exercises versus control (written instructions for home exercises). HAQ=Health Assessment Questionnaire.

**Table 13.** Low-Intensity Exercises (Group) Versus High-Intensity Exercises (Group)<sup>a</sup>

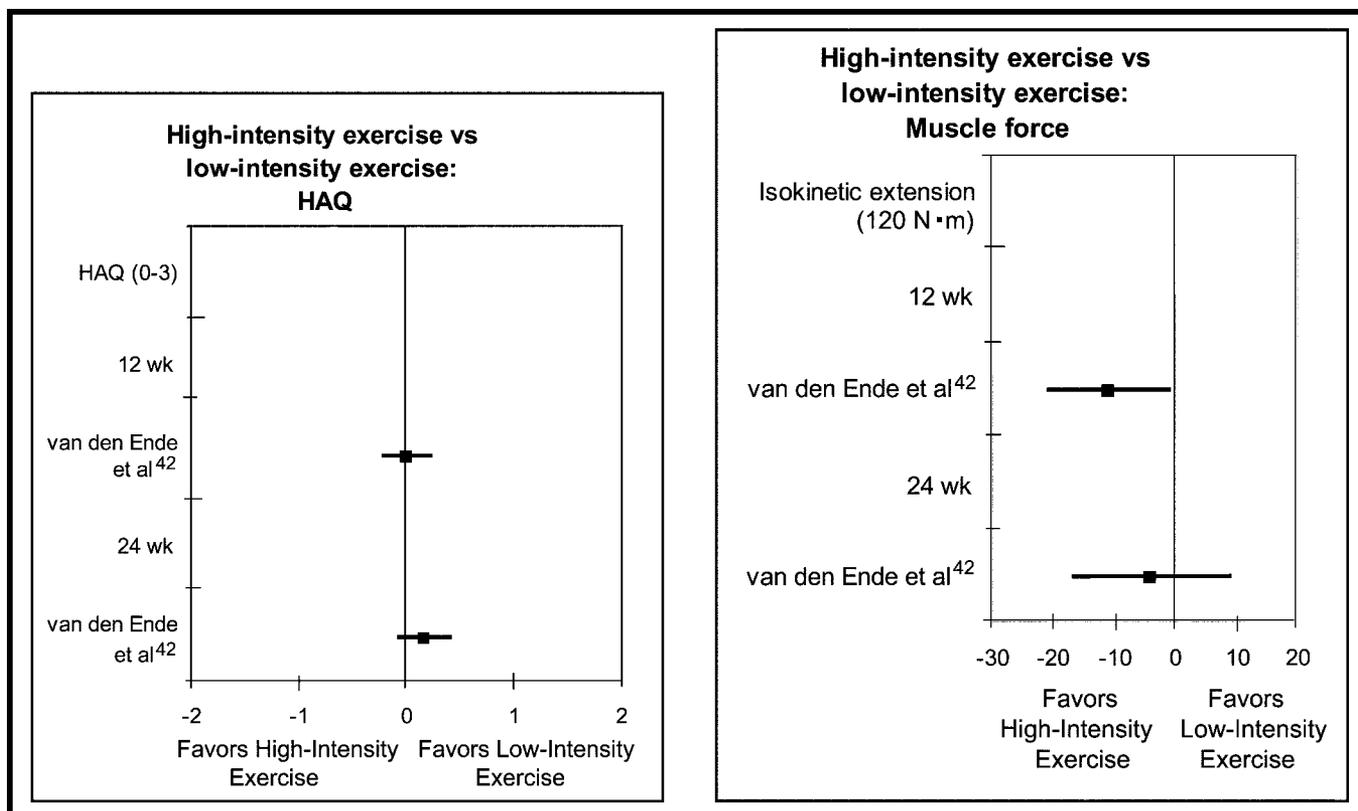
Study	Intervention Group	Outcome	No. of Patients	Baseline Mean	End-of-Study Mean	Absolute Benefit	Relative Difference in Change From Baseline
van den Ende et al <sup>42</sup>	C: high-intensity exercise	Pain measured with 10-cm VAS at 12 wk	25	3.4	3.6	0.2	7%
	E: low-intensity exercise	Pain measured with 10-cm VAS at 12 wk	25	2.4	2.4		
van den Ende et al <sup>42</sup>	C: high-intensity exercise	Pain measured with 10-cm VAS at 24 wk	25	3.4	4.8	1.5	21% (favors low-intensity exercise)
	E: low-intensity exercise	Pain measured with 10-cm VAS at 24 wk	25	2.4	2.3		
van den Ende et al <sup>42</sup>	C: high-intensity exercise	Joint mobility at 24 wk	25	10.9	10.8	-0.7	-7%
	E: low-intensity exercise	Joint mobility at 24 wk	25	8.9	9.5		
van den Ende et al <sup>42</sup>	C: high-intensity exercise	HAQ (0-3 point scale) at 12 wk	25	0.83	0.88	0.16	21% (favors low-intensity exercise)
	E: low-intensity exercise	HAQ (0-3 point scale) at 12 wk	25	0.72	0.61		

<sup>a</sup>E=experimental group, C=control group, VAS=visual analog scale (0-10, where 10=greatest pain), HAQ=Health Assessment Questionnaire.



**Figure 9a.**

Low-intensity exercises (group) versus high-intensity exercises (group). VAS=visual analog scale, ROM=range of motion.



**Figure 9b.** Low-intensity exercises (group) versus high-intensity exercises (group). HAQ=Health Assessment Questionnaire.

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**Appendix 1.**  
Description of Included Trials<sup>a</sup>

Author/ Year	Sample Size	Population Details	Time Since Onset	Age (y)	Intervention	Comparison Group	Concurrent Therapy	Session Frequency and Duration	Follow-up Duration	Quality (R, B, W)
Alexander et al, <sup>27</sup> 1983	CCT Total: 75	Inclusion criteria: patients with one of the following: (1) active synovitis or (2) RA of sufficient severity to require bed rest Gr1: 25F/11M Gr2: 27F/12M	Gr1: $\bar{X}=8$ y, range=0.25–37 y Gr2: $\bar{X}=6.5$ y, range=0.25–20 y	Gr1: $\bar{X}=53$ , range=20–75 Gr2: $\bar{X}=57$ , range=32–75	Gr1: 1 wk of bed rest Gr2: planned activity for 1 wk followed by bed rest for 1 wk	Parallel group (Gr1 and Gr2 were compared throughout the study period, no crossover)	None	Treatments daily for 1 wk	None	0, 0, 0
Eklblom et al, <sup>28</sup> 1975	CCT Total: 34 Gr1: 23 Gr2: 11	Inclusion criteria: patients with nonacute stage of RA and second or third degree of RA	Gr1 and Gr2: $\bar{X}=N/A$ , range=3–18 y	Gr1 and Gr2: range=38–63	Gr1: muscle force training, joint mobility training, and bicycle training Gr2: no exercises (control group)	Parallel group	None	Gr1: 4 times a week Gr2: twice a week 6 wk total	6 mo (see next study)	0, 0, 0
Eklblom et al, <sup>29</sup> 1975	CCT Total: 30 Gr1: 6 Gr2: 12 Gr3: 5 Gr4: 3 Gr5: 4	Inclusion criteria: patients with nonacute stage of RA and second or third degree of RA	Range=3–18 y	$\bar{X}=56$ , SD=6.25	Gr1: physical training (muscle force training, joint mobility training, and bicycle training) 4 times a week for the last 6 mo Gr2: physical training twice a week Gr3: stopped training or trained infrequently Gr4 (control): started to train after the experimentation Gr5 (control): did not train	Parallel group	None	Gr1: 4 times a week for the last 6 mo Gr2: Twice a week Gr3: N/A Gr4: N/A Gr5: N/A 6 mo total	This was a follow-up study done 6 mo after the previous study	0, 0, 1
Häkkinen and Häkkinen, <sup>30</sup> 1994	RCT Total: 39 Gr1: 22 Gr2: 17	Inclusion criteria: patients with recent-onset RA	Gr1: $\bar{X}=0.88$ y, SD=0.79 y Gr2: $\bar{X}=1.54$ y, SD=2 y	Gr1: $\bar{X}=41.6$ , SD=9.9 Gr2: $\bar{X}=45.7$ , SD=10.6	Gr1: muscle force training Gr2: control group; patients maintained their habitual physical activities	Parallel group	Antirheumatic medication for all patients during study period Five patients received a small daily dose (5–7.5 mg) of glucocorticoids	Twice a week for 2 mo and 2–3 times a week for the last 4 mo	None	1, 0, 1
Harkcom et al, <sup>31</sup> 1985	CCT Total: 17 Gr1: 4 Gr2: 3 Gr3: 4 Gr4: 6	Inclusion criteria: patients with RA according to ARA criteria, functional class II RA, and no acute flares of joint symptoms at the time of entry or during the study	Gr1: $\bar{X}=12.2$ y, SD=8.7 y Gr2: $\bar{X}=10.6$ y, SD=5.4 y Gr3: $\bar{X}=5.6$ y, SD=3.7 y Gr4: $\bar{X}=8.8$ y, SD=10.1 y	Gr1: $\bar{X}=51.5$ , SD=3.1 Gr2: $\bar{X}=47.3$ , SD=14.5 Gr3: $\bar{X}=44$ , SD=18.3 Gr4: $\bar{X}=45.1$ , SD=19.3	Gr1: training on ergometer 3 times a week for 12 wk, 15 min a session Gr2: same as Gr1 but 25 min a session Gr3: same as Gr1 but 35 min a session Gr4: no exercises (control group)	Parallel group	None	3 times a week for 12 wk (36 sessions)	None	0, 0, 1

(Continued)

**Appendix 1.**  
Description of Included Trials<sup>a</sup> (continued)

Author/ Year	Sample Size	Population Details	Time Since Onset	Age (y)	Intervention	Comparison Group	Concurrent Therapy	Session Frequency and Duration	Follow-up Duration	Quality (R, B, W)
Hoening et al, <sup>32</sup> 1993	CT Total: 41 Gr1: 11 Gr2: 9 Gr3: 10 Gr4: 11	Inclusion criteria: patients meeting ARA criteria, functional class II or III	$\bar{X}=9.8$ y, SD=N/A	$\bar{X}=57$ , SD=N/A	Gr1: ROM exercises Gr2: resistance exercises Gr3: resistance exercises and ROM Gr4: no exercises (control group)	Parallel group	NSAIDs	Twice a day for 12 wk (24 sessions)	None	0, 0, 1
Kirsteins et al, <sup>33</sup> 1991	CCT Study 1: 42 Study 2: 21	Inclusion criteria: patients with ARA functional class II or III RA who were selected from the private practices of 3 rheumatologists	N/A	Study 1: $\bar{X}=N/A$ , range=37-70 Study 2: $\bar{X}=N/A$ , range=38-72	Gr1: tai chi chuan exercises continued their usual activities but without tai chi chuan exercises	Crossover group	SelfROM exercises	11 wk Gr1: once a week for 10 wk Gr2 and Gr4: no exercises Gr3: twice a week for 10 wk (11-12 sessions)	None	0, 0, 1
Lee et al, <sup>34</sup> 1974	CCT Total: 30 G1: 16 Gr2: 14	Inclusion criteria: patients with active disease, severe pain, swelling and tenderness in multiple joints, and augmentation of erythrocyte sedimentation rate Gr1: 13F/3M Gr2: 12F/2M	Gr1: $\bar{X}=4.4$ y, SD=0.08 y Gr2: $\bar{X}=9.5$ y, SD=2.2 y	Gr1: $\bar{X}=53.2$ , SD=8.40 Gr2: $\bar{X}=56.1$ , SD=8.61	Gr1: bed rest, supervised exercises (gentle, active exercises performed on the bed once daily) (control group) Gr2: free and unsupervised physical activity	Parallel group	100 mg indomethacin	Treatments daily for 4 weeks	None	0, 0, 1
Mannerkorpi and Bjelle, <sup>35</sup> 1994	CCT Total: 28 Gr1: 14 Gr2: 14	Inclusion criteria: patients with RA and shoulder pain who met the criteria of ARA functional class I or II Gr1: 0M/14F Gr2: 0M/14F	Gr1: $\bar{X}=5.4$ y, SD=2 y Gr2: $\bar{X}=5.2$ y, SD=2 y	Gr1: $\bar{X}=54.7$ , SD=7 Gr2: $\bar{X}=50.1$ , SD=10.3	Gr1: shoulder training instructions with exercises Gr2: no exercises (control group)	Crossover group	None	8 wk, 3 times a week	1 wk	0, 1, 1

(Continued)

**Appendix 1.**  
Description of Included Trials<sup>a</sup> (continued)

Author/ Year	Sample Size	Population Details	Time Since Onset	Age (y)	Intervention	Comparison Group	Concurrent Therapy	Session Frequency and Duration	Follow-up Duration	Quality (R, B, W)
McMeeklen et al, <sup>36</sup> 1999	RCT Total: 35 Gr1: 17 Gr2: 18	Inclusion criteria: patients with positive inflammatory RA according to the ARA and with joint disease and with joint disease requiring long-term medication who took > 10 s to perform the TUG Gr1: 2M/15F Gr2: 4M/14F	Gr1: N/A Gr2: N/A	Gr1: $\bar{X}$ =51.4, SD=11.1 Gr2: $\bar{X}$ =49.7, SD=51.3	Gr1: exercises on the KINCOM <sup>b</sup> apparatus Gr2: no exercises (control group)	Parallel group None	None	Every 3 d for 6 wk (14 sessions)	None	1, 1, 1
Mills et al, <sup>37</sup> 1971	RCT Total: 40 Gr1: 18 Gr2: 22	Inclusion criteria: patients with definite or classic RA, subcutaneous nodules, positive rheumatoid factor, soft tissue swelling, fatigability, and weight loss	Gr1 and Gr2: range=2–10 y	Gr1: $\bar{X}$ =53.1, range=19–76 Gr2: $\bar{X}$ =53.6, range=21–78	Gr1: rest program (22 h of bed rest a day for 4 wk followed by 18 h of bed rest a day for the next 6 wk)	Gr2: physical therapy program (patients were permitted activity as desired and encouraged to ambulate)	N/M	10 wk	N/M	2, 0, 1
Minor and Hewitt, <sup>38</sup> 1995	CCT Total: 32 Gr1: 15 Gr2: 17	Inclusion criteria: patients with the intention to exercise in a group setting and no pre-existing medical condition that would preclude moderate exercises Gr1: 0M/15F Gr2: 0M/17F	Gr1: $\bar{X}$ =5.8 y, SD=7.6 y Gr2: $\bar{X}$ =10.4 y, SD=9.1 y	Gr1: $\bar{X}$ =46.0, SD=13.1 Gr2: $\bar{X}$ =54.8, SD=8.4	Gr1: low-impact aerobic exercises in water 3 times a week for 12 wk Gr2: no exercises (control group)	Parallel group None	None	3 times a week for 12 wk (36 sessions)	9 mo	0, 0, 1
Nordemar et al, <sup>39</sup> 1981	CCT Total: 46 Gr1: 23 Gr2: 23	Inclusion criteria: patients with RA according to the ARA criteria, moderate disease activity, and functional stage I, II, or III RA Gr1: 4M/19F Gr2: 4M/19F	Gr1: $\bar{X}$ =16 y, SD=7 y Gr2: $\bar{X}$ =14 y, SD=7 y	Gr1: $\bar{X}$ =56, SD=9 Gr2: $\bar{X}$ =58, SD=10	Gr1: bicycle ergometer (at home and at the hospital, plus strengthening exercises for lower limbs) Gr2: no exercises (control group)	Parallel group Corticosteroid injections as needed	None	1 h daily for 2 wk (in group) plus 30 min daily (alone)	None	0, 0, 1

(Continued)

**Appendix 1.**  
Description of Included Trials<sup>a</sup> (continued)

Author/ Year	Sample Size	Population Details	Time Since Onset	Age (y)	Intervention	Comparison Group	Concurrent Therapy	Session Frequency and Duration	Follow-up Duration	Quality (R, B, W)
Noreau et al, <sup>40</sup> 1995	CCT Total: 29 Gr1: 19 Gr2: 10	Inclusion criteria: patients with confirmed diagnosis of RA of functional class I or II and no acute joint symptoms who were free of unstable cardiovascular disease and able to perform a graded exercise test on a bicycle ergometer Gr1: 7M/17F Gr2: 2M/18F	Gr1: $\bar{X}$ =8.1 y, SD=8.2 y Gr2: $\bar{X}$ =11.0 y, SD=5.1 y	Gr1: $\bar{X}$ =49.3, SD=13 Gr2: $\bar{X}$ =49.4, SD=12	Gr1: warm-up plus aerobic exercises Gr2: no exercises (control group)	Parallel group	Psychologist	12 wk, twice a week (24 sessions)	24	0, 0, 0
Rintala et al, <sup>41</sup> 1996	RCT Total: 34 Gr1: 18 Gr2: 16	Inclusion criteria: patients with definite diagnosis of RA (functional class I or II) with disease duration >6 mo who had not had an operation in the last 6 mo, had no other serious disease, and were medically stable Gr1: 3M/15F Gr2: 2M/14F	N/A	N/A	Gr1: warm-up (12 min), conditioning (35 min), cool-down, and stretching Gr2: no exercises (control group)	Parallel group	None	12 wk	None	1, 0, 0
van den Ende et al, <sup>42</sup> 1996	RCT Total: 100 Gr1: 25 Gr2: 25 Gr3: 25 Gr4: 25	Inclusion criteria: patients with RA (ACR criteria) whose symptoms had been stabilized with medication for 3 mo, who were between 20 and 70 y of age, and who were able to cycle on a home trainer Gr1: 12M/13F Gr2: 9M/16F Gr3: 9M/16F Gr4: 7M/18F	Gr1: $\bar{X}$ =11.5 y, SD=8.4 y Gr2: $\bar{X}$ =8.4 y, SD=5.8 Gr3: $\bar{X}$ =8.6 y, SD=7.1 y Gr4: $\bar{X}$ =11.2 y, SD=9.8	Gr1: $\bar{X}$ =51.1, SD=9.5 Gr2: $\bar{X}$ =47.7, SD=13.6 Gr3: $\bar{X}$ =53.1, SD=12.1 Gr4: $\bar{X}$ =56.1, SD=10.9	Gr1: intensive dynamic group exercises with full weight-bearing and stationary bicycle at high intensity Gr2: group ROM exercises plus isometric group exercises at low intensity Gr3: individualized isometric and ROM exercises at low intensity Gr4: control group, written home individualized instructions for isometric and ROM exercises	Parallel group	None	12 wk, 3–4 times a week (36–48 treatments)	12 wk	1, 0, 0

(Continued)

**Appendix 1.**  
Description of Included Trials<sup>a</sup> (continued)

Author/ Year	Sample Size	Population Details	Time Since Onset	Age (y)	Intervention	Comparison Group	Concurrent Therapy	Session Frequency and Duration	Follow-up Duration	Quality (R, B, W)
Van Deusen and Harlowe, <sup>43</sup> 1987	RCT Total: 39 Gr1: 22 Gr2: 17	Inclusion criteria: ambulatory adult patients with RA, medical recommendations for home rest and exercise use, and no prior ROM dance experience Ratio: Gr1 and Gr2: 32M/7F	$\bar{X}$ =10.92 y, SD=2.17 y	$\bar{X}$ =55.91, SD=2.6	Gr1: daily ROM dance sequence, exercises, and relaxation techniques Gr2: control group, received a brochure that explained the ROM dance program, but no instructions were given	Parallel group	Exercises recommended by a physical therapist (type of exercises N/A)	8 wk, 1 session a day, 7 d a wk	4 mo	1, 0, 1

<sup>a</sup> R=randomization; 2 points maximum (Jadad scale<sup>15,16</sup>); B=blinding; 2 points maximum (Jadad scale<sup>15,16</sup>); W=withdrawals; 1 point maximum (Jadad scale<sup>15,16</sup>); CCT=controlled clinical trial; RA=rheumatoid arthritis; F=females; M=males; Gr1=group 1, Gr2=group 2, etc; N/A=not available; RCT=randomized controlled trial; ARA=American Rheumatism Association; ROM=range of motion; N/M=not mentioned; NSAIDs=nonsteroidal anti-inflammatory drugs; ACR=American College of Rheumatology; TUG=Timed "Up & Go" Test.  
<sup>b</sup> Chatecx Corp, 101 Memorial Dr, PO Box 4287, Chattanooga, TN 37405.

**Appendix 2.**

Literature Search Strategy (Part of a Global Search)

The literature search strategy used was as follows:

- 1 exp osteoarthritis/
- 2 osteoarthritis.tw.
- 3 osteoarthrosis.tw.
- 4 degenerative arthritis.tw.
- 5 exp arthritis, rheumatoid/
- 6 rheumatoid arthritis.tw.
- 7 rheumatism.tw.
- 8 arthritis, juvenile rheumatoid/
- 9 caplan's syndrome.tw.
- 10 felty's syndrome.tw.
- 11 rheumatoid.tw.
- 12 ankylosing spondylitis.tw.
- 13 arthrosis.tw.
- 14 sjogren\$.tw.
- 15 or/1-14
- 16 heat/tu
- 17 (heat or hot or ice).tw.
- 18 cryotherapy.sh,tw.
- 19 (vapocoolant or phonophoresis).tw.
- 20 exp hyperthermia, induced/
- 21 (hypertherm\$ or thermotherapy).tw.
- 22 (fluidotherapy or compression).tw.
- 23 15 and 22
- 24 clinical trial.pt.
- 25 randomized controlled trial.pt.
- 26 tu.fs.
- 27 dt.fs.
- 28 random\$.tw.
- 29 placebo\$.tw.
- 30 ((sing\$ or doubl\$ or tripl\$) adj (masked or blind\$)).tw
- 31 sham.tw.
- 32 or/24-31
- 33 23 and 32

**Appendix 3.**  
Clinical Practice Guidelines

Shoulder functional strengthening (strengthening involving movement useful in daily activities) versus control, level II (CCT, n=28)<sup>35</sup>: grade C for ADL, pain, and ROM at 2 months (no benefit). Patients with chronic RA, functional class I or II, and shoulder pain.

Hand functional strengthening versus control, level II (CCT, n=41)<sup>32</sup>: grade C for ROM and grip force at 3 months (no benefit). Patients with chronic RA, and functional class II or III.

Knee functional strengthening versus control, level I (RCT, n=35)<sup>36</sup>: grade A for pain at 6 weeks (clinically important benefit); grade C for function at 6 weeks (no benefit). Patients with seropositive or seronegative inflammatory RA requiring long-term medication.

Whole-body functional strengthening versus control, level II (CCT, n=312)<sup>28-30,31,33,38-41,43</sup>: grade B for sick leave and lower-limb muscle force at 8 years (clinically important benefit); grade C+ for swollen joints at 2 months. Grade C for the following: pain at 2 months and 8 years; function at 3 and 6 months; ROM at 3, 6, and 12 months; number of inflamed joints at 2 months and 8 years; grip force at 2, 6, and 12 months; leg muscle force at 8 weeks; and walking capacity at 6 weeks and 6 months (no clinically important benefit). Patients with diagnosis of RA and functional class I, II, or III.

\* \* \*

Whole-body, low-intensity functional strengthening exercises (group dynamic exercises) versus instructions for home, level I (RCT, n=100)<sup>42</sup>: grade C for pain, function, swollen/tender joints, and global patient (patient's assessment of overall disease activity or improvement)<sup>11</sup> at 3 and 6 months (no benefit). Patients with RA (chronic stage).

\* \* \*

Physical activity versus bed rest, level I (RCT, n=145)<sup>27,34,37</sup>: grade A for grip force at 3 months (clinically important benefit); grade C for pain, tender joints, function, ROM, swollen joints, and time to walk 15.24 m (50 ft) (no benefit demonstrated). Patients with RA (chronic stage).

Whole-body, low-intensity exercises (individualized) versus control (written instructions for home exercises), level I (RCT; n=100)<sup>42</sup>: grade A for change in function at 3 months (clinically important benefit); grade C+ for pain relief at 3 months (clinically but not statistically important benefit); grade C for changes in tender/swollen joints, joint mobility, and muscle force at 3 and 6 months (no benefit). Patients with RA (chronic stage).

Whole-body, high-intensity exercises (group) versus control (written instructions for home exercises), level I (RCT, n=100)<sup>42</sup>: grade C for pain, function, joint mobility, muscle force, and swollen/tender joints at 3 and 6 months (no benefit). Patients with RA (chronic stage).

Whole-body, low-intensity exercises (group) versus whole-body, high-intensity exercises (group), level I (RCT, n=100)<sup>42</sup>: grade A for pain at 6 months (clinically important benefit favoring low intensity); grade C+ for function at 3 months (clinically but not statistically important benefit); grade C for joint mobility, muscle force, and swollen/tender joints at 3 and 6 months (no benefit). Patients with RA (chronic stage).

**Appendix 4.**  
Previous Clinical Practice Guidelines on Therapeutic Exercises for Rheumatoid Arthritis<sup>a</sup>

Author	Quality of Scientific Evidence	Clinical Recommendations
ACR <sup>123</sup>	N/R	Exercise programs recommended to maintain or improve joint ROM and periarticular muscle force
OPOT <sup>122</sup>	Good-quality evidence	Dynamic exercise improves aerobic capacity, muscle force, and joint mobility without adversely affecting pain relief
APS <sup>124</sup>	Good-quality evidence	Exercise (ROM; stretching and strengthening: isometric, dynamic, and resistance; aerobic) and physical activity are recommended for pain relief
Yasuda <sup>125</sup>	N/R	Aquatic therapy is recommended

<sup>a</sup> ACR=American College of Rheumatology, N/R=not reported, ROM=range of motion, OPOT=Ontario Program for Optimal Therapeutics, APS=American Pain Society.

**Appendix 5.**  
Previous Clinical Practice Guidelines on Therapeutic Exercises for Shoulder Pain<sup>a</sup>

Author	Quality of Scientific Evidence	Clinical Recommendations
The Philadelphia Panel <sup>126</sup>	Fair scientific evidence (level II) for therapeutic exercises for nonspecific shoulder pain	No evidence to include or exclude therapeutic exercises alone for shoulder pain
BMJ <sup>127</sup>	N/R	No evidence that therapeutic exercises combined with manual therapy are effective for shoulder pain

<sup>a</sup> BMJ=British Medical Journal, N/R=not reported.

# Physical Therapy

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## Ottawa Panel Evidence-Based Clinical Practice Guidelines for Therapeutic Exercises in the Management of Rheumatoid Arthritis in Adults

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