Arthritis and Exercise

THE ESSENTIALS

The role, benefits and outcomes of exercise for hip and knee osteoarthritis and rheumatoid arthritis

Arthritis AUSTRALIA

Arthritis and Exercise: The Essentials

ABSTRACT

Objective

Both in Australia and worldwide, osteoarthritis and rheumatoid arthritis are major causes of disability and chronic pain. Research has established exercise as a safe and recommended treatment for these arthritides. Despite evidence and clinical guidelines, both consumers and health practitioners report confusion and uncertainty around the prescription of, and participation in, exercise.

The purpose of this paper is to provide clear, evidence-based practical recommendations about the role of exercise in the management of osteoarthritis and rheumatoid arthritis as a guide for consumers, health professionals and exercise & fitness professionals. These recommendations will also underpin the development of criteria that can be used to evaluate whether current and proposed community exercise programs are suitable for people with these arthritides.

Methods

Arthritis Australia established an expert advisory panel to guide the process. A narrative review of current literature was conducted, focusing on Cochrane and systematic reviews including meta-analysis of results available up to April 2014.

The paper was drafted by members of the Arthritis Australia's Expert Advisory Panel, and reviewed and revised by all panel members until consensus was reached. Arthritis Australia's Board, Scientific Advisory Committee and Affiliate Healthy Lifestyle Coordinators all reviewed the paper and provided further input.

Results

Five core components of effective exercise programs were identified and explored: assessment; education; exercise prescription; monitoring and reporting; and behaviour change strategies. Evidence for each was reviewed, summarised and practical recommendations made.

Conclusions

Substantial evidence supports the key role of exercise in the successful management of osteoarthritis and rheumatoid arthritis. By compiling evidence-based recommendations on exercise for these forms of arthritis, this document provides a national resource for consumers, health professionals and exercise & fitness professionals to guide exercise prescription and evaluate whether current and proposed community exercise programs are suitable for people with arthritis.

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Arthritis and Exercise: The Essentials

Introduction

Put simply, exercise is good for arthritis.

The strength of the evidence comes in various levels but there is no doubt that people with arthritis can experience improvements in their condition and overall wellbeing by participating in regular, appropriate exercise.

Yet significant confusion about the benefit and safety of exercise for people with arthritis still exists within the community, reflected in the large number of exercise-related calls to our national Arthritis Helpline. Health consumers frequently report fear of exacerbating symptoms, and a lack of knowledge about what to do and how to get started, ultimately resulting in lower than optimal levels of physical activity. Australian GPs have also told us, via our Voice of GP survey [1], that they lack confidence in prescribing the most appropriate exercise for their patients who have arthritis. Recognising this uncertainty, Arthritis Australia has worked with a group of experts to bring together this guide for consumers, health professionals and exercise & fitness professionals.

Its purpose is to provide clear, evidence-based recommendations about the role of exercise in the prevention of arthritis and ongoing management of individuals with the condition. These recommendations will drive the development of criteria that can be used to evaluate whether current and proposed community exercise programs are suitable for people with arthritis.

We hope that by pulling together this information we can offer a significant opportunity for the fitness industry to link with health sector professionals such as physiotherapists and exercise physiologists. For these allied health professionals we believe that creating and strengthening referral pathways into suitable evidence-based exercise programs will greatly assist the overall objective of preventing and managing arthritis and improving the quality of life for people living with the condition.

1. Arthritis: The magnitude of the problem

Worldwide, arthritis is a major cause of disability and chronic pain. In Australia in 2012 there were an estimated 6.1 million people with arthritis and other musculoskeletal conditions, of which 1.9 million have osteoarthritis (OA) and 0.5 million have rheumatoid arthritis (RA). This prevalence is predicted to rise substantially, particularly for OA, as the population ages and rates of obesity increase [2]. By 2032 it is projected that 8.7 million Australians will have arthritis and other musculoskeletal conditions, an increase of 43% [2]. Arthritis and musculoskeletal conditions have been identified by the Australian Government as a National Health Priority Area since 2002 [2].

Osteoarthritis and RA can both be extremely debilitating, with pain and physical dysfunction leading to significant loss of quality of life. People with OA and RA report pain, difficulty performing activities of daily living, sleep problems and fatigue. They present with a range of physical impairments including joint stiffness, muscle weakness, altered proprioception, reduced balance and gait abnormalities. In addition to these, psychological impairments such as depression and anxiety are common. There is no cure for hip or knee OA, and joint replacement surgery is a costly treatment option reserved for severe disease. The direct health care cost of OA and RA combined in Australia in 2012 was estimated at $4.25 billion. In addition to this cost is the significant loss of productivity, carer costs, travel costs and aids [2].

2. The role of exercise for arthritis

Exercise: any physical activity that is planned, structured, repetitive, and purposeful in the sense that the improvement or maintenance of one or more components of physical fitness is the objective. This activity can be supervised or unsupervised, as well as prescribed, advised or self-initiated [3].

All current clinical guidelines [4-8] recommend exercise in the management of hip and knee OA, irrespective of patient age, joint involved, radiographic disease severity, pain intensity, functional levels and co-morbidities. Results of systematic reviews evaluating the effects of exercise are shown in Table 1. A recent systematic review incorporating a trial sequential analysis and network meta-analysis found that since 2002 sufficient evidence has been accrued to show the significant benefits of exercise interventions over no exercise control for lower limb OA [9]. However, most of the evidence about the effects of exercise relates to osteoarthritis at the knee with fewer trials investigating osteoarthritis at the hip. A recent Cochrane review of exercise for OA of the hip found both slight reduction in pain and improved physical function both immediately after intervention, and 3-6 months later [10]. Ten high-quality studies were included in the review, and the effect sizes were considered small for both improvements. Exercise interventions are often not well described in study reports [11]. Given the difficulty in designing a realistic sham for exercise therapy, most trials use a no-treatment or education control comparator with unblinded participants. This is likely to over-estimate the effects, particularly for patient-reported outcomes such as pain and function.

While disease-modifying anti-rheumatic therapy, including the new biologic drugs, can successfully suppress the disease, there is no cure for RA. Clinical guidelines recommend regular participation in exercise alongside pharmacological treatments [12-15]. Exercise therapy is likely to have a role in combating the adverse effects of RA on muscle strength, endurance and aerobic capacity. British Rheumatology Guidelines [13] conclude that exercise is effective not only in improving function but also in reducing the rate of bone loss and the risk of cardiovascular disease. However, while exercise is recommended for RA, the evidence base is still relatively limited (Table 1). For example, the Royal Australian College of General Practitioners Guidelines for RA rate the level of evidence to support the role of exercise in early RA as Level C meaning that there is some evidence but that care should be taken in its application [12]. A 2009 Cochrane review of dynamic exercise programs (aerobic training and/or strength training) in patients with RA, which included 8 trials (575 participants), concluded that there was moderate quality evidence that aerobic training combined with muscle strengthening had a positive effect on aerobic capacity, functional ability and muscle strength [16]. The effect of exercise has not been investigated in early RA and can only be extrapolated from results in established RA [12].

The main goals of exercise in both patients with OA and with RA are to reduce pain, improve physical function and optimise participation in social, domestic, occupational and recreational pursuits [17, 18]. Regular exercise can improve physical impairments associated with arthritis including muscle strength, joint range of motion, proprioception, balance and cardiovascular fitness [9, 19, 20]. Other potential benefits of exercise reported in both populations include improvements in mobility, falls risk, cardiovascular health, body weight, psychological state and cardiometabolic risk factors [21-23]. Although the magnitude of treatment benefits of exercise may be

considered small to moderate, exercise of all types is associated with relatively few side effects compared to simple analgesics and NSAIDs. Furthermore in the case of OA, exercise provides benefits that are similar in magnitude to those of commonly used pain-relieving drugs [24].

Despite the evidence and clinical guideline recommendations it is of concern that exercise levels in populations with arthritis have been reported to be well below optimal. Using the results of three nationwide health surveys in the USA, Hootman et al found that only 24% of those who had arthritis (either OA or RA) were completing the recommended level of physical activity each week [25]. These results highlight the need for strategies to increase uptake of exercise in people with arthritis.

Table 1: Summary of results of systematic reviews investigating the effects of exercise, including effect sizes (95% confidence intervals) for pain and physical function.

Study	Type of exercise	Site of arthritis	Effect size for pain*	Effect size for self-reported physical function*
Fransen et al 2008 [26]	Land based	Knee OA	32 RCTs with 3,616 participants 0.40 (0.30, 0.50)	32 RCTs with 3,719 participants 0.37 (0.25, 0.49)
Juhl et al 2014 [27]	All	Knee OA	47 RCTs with 4,028 participants 0.50 (0.39, 0.62)	35 RCTs with 2,732 participants 0.49 (0.35, 0.63)
Fransen et al 2014 [10]	Land based	Hip OA	9 RCTs with 549 participants 0.38 (0.55, 0.20)	9 RCTs with 549 participants 0.38 (0.54, 0.05)
Hernandez-Molina et al 2008 [28]	All	Hip OA	9 RCTs with 1,234 participants 0.38 (0.68, 0.08)	Not assessed
Hurkmans et al 2009 [16]	Land based aerobic and strengthening	RA	1 RCT with 50 participants 0.53 (1.09, 0.04)	1 RCT with 50 participants 0.54 (1.11, 0.02)
Kelley et al 2011 [30]	Community deliverable exercise	RA, OA and fibromyalgia	31 RCTs 0.37(0.53, 0.21)	26 RCTs 0.37 (0.21, 0.52)

* Effect sizes can be interpreted as [31]:

0.20 Small effect size

0.50 Medium effect size

0.80 Large effect size

3. Core principles of exercise prescription

Four core principles guide the prescription and progression of effective exercise programs [32]:

- Appropriateness
- Specificity
- Exercise load
- Progressive overload

Appropriateness refers to the suitability of the exercise prescription to the individual. A key component to ensuring the exercise prescription is appropriate for an individual is a pre-exercise checklist aimed at identifying any underlying factors or contraindications to exercise [33]. Pre-screening not only ensures the individual is not exposed to inappropriate loads or physical activities, but it also provides an avenue for the referral of individuals with specific medical conditions to an appropriate health professional. Pre-exercise screening is covered in more detail in the following section, *Core components of exercise prescription.*

The **specificity** principle states that the exercise prescription must be relevant to the outcomes for which the individual is pursuing in order to produce a training effect [32]. Specificity can range from improving general fitness to highly specific training with defined outcomes. A thorough baseline assessment in combination with the individual's short- and long-term goals enables the exercise prescription to be specific to the patient's needs and functional goals.

Exercise load refers to the total volume of exercise completed by an individual. The parameters that can be varied to alter exercise load include the exercise intensity, the training frequency, and the training duration. These are determined by the baseline assessment and adjusted periodically according to findings on re-assessment.

Progressive overload is the gradual increase of stress placed upon the body during exercise [32]. An overload is an intensity greater than that encountered on a regular daily basis. Physiological changes can only occur from exercise when an overload is applied [32]. Overload must be progressive to allow optimal adaptation and ongoing functional gains to occur [32].

4. Core components of exercise prescription

4.1 Assessment

Pre-exercise screening for community based exercise programs

When recommending exercise to assist with the management of arthritis, the potential benefits of the treatment must outweigh any possible risks. Exercise prescription must also take into account co-morbidities. As arthritic conditions, particularly OA, are more prevalent in older adults, it is important to recognise that older adults are also the group most likely to have co-morbidities that may include a mental health condition, asthma, diabetes, cardiovascular disease and/or osteoporosis [34]. Given that RA increases the risk of cardiovascular disease [35] and that some medications such as glucocorticoids to treat arthritis can predispose to osteoporosis, younger people with arthritis may also present with co-morbidities.

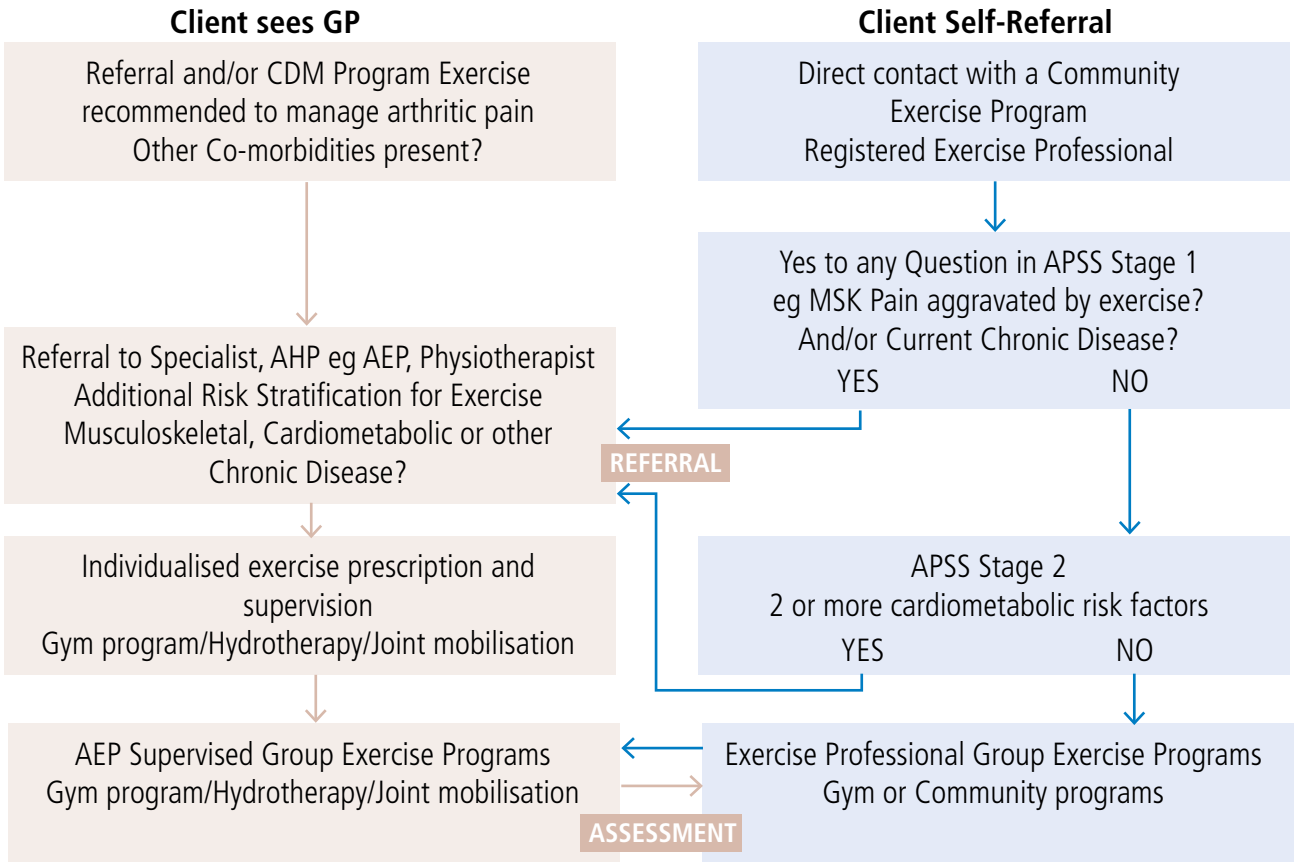
Prior to undertaking supervised exercise in a community-based program, it may be appropriate for participants to undertake a

comprehensive health and injury assessment conducted by a registered exercise or health professional. The Adult Pre-Exercise Screening System (APSS) [33] was developed by Sports Medicine Australia in collaboration with Exercise & Sports Science Australia and Fitness Australia, and has been endorsed by all three industry associations (Figure 1). The APSS is designed to:

- Identify existing medical conditions that may be exacerbated by exercise
- Risk stratify an individual based on their existing cardiometabolic risk factors
- Determine the requirement for a referral to a general practitioner or to an accredited exercise physiologist or physiotherapist
- Establish the recommended exercise intensity for an individual starting exercise

The accredited exercise physiologist or physiotherapist, in consultation with the general practitioner as required, will then undertake additional pre-exercise screening to identify any absolute or relative contraindications for exercise, and then develop an individualised exercise prescription to optimise outcomes while minimising the risk of any potential adverse events.

Figure 1: Pathways for exercise and arthritis programs.



AEP: Accredited Exercise Physiologist
AHP: Allied Health Professional
APSS: Adult Pre-Exercise Screening System
CDM: Chronic Disease Management
GP: General Practitioner
MSK: Musculoskeletal

Outcome measures

The effectiveness of an exercise program can be assessed using patient-relevant, valid, reliable and responsive outcome measures. Participants' pain levels and functional ability can be measured as appropriate. The timeframe for re-assessment will vary but generally an interval of 8 – 12 weeks should provide adequate time for changes to occur, with further assessment performed at 6 and 12 months if possible [36]. It is useful to include both self-reported and performance-based outcome measures to gain an overall picture of any change. Other patient relevant outcomes can also be motivating factors for patients and may in turn aid adherence to exercise programs.

The visual analogue scale (VAS) and numeric rating scale (NRS) are both simple and reliable self-report measures of pain that have been validated and are recommended for use in clinical practice [36-38]. In general, changes of at least 2cm (on a 10cm scale) or 2 units (on a 0 – 10 scale) are needed to represent a clinically relevant amount of change with treatment [39]. A global rating of change scale can also be administered following the exercise program to measure patient-perceived overall change in symptoms and function. Outcome measures are included in Appendix A.

For participants with hip or knee OA, the function subsection of the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) provides a valid and simple measure of self-reported physical function [40]. A change of at least 6 units (out of 68) is considered a clinically relevant amount of change with treatment [41]. For participants with RA, the Disability Index Component of the Health Assessment Questionnaire (HAQ) is a valid and reliable outcome measure recommended by the Outcome Measures in Rheumatology (OMERACT) Group [37, 42].

Physical performance measures

In addition to self-report measures, physical performance measures assess what individuals can actually do rather than what they perceive they can do. Physical performance measures can also determine if the objectives of the prescribed exercise program are being achieved, such as increases in strength, joint mobility or other functional measures. It is recognised that these provide separate information about patient status than self-reported measures and are seen as complementary.

Based upon an international modified Delphi exercise led by a multidisciplinary team that considered the evidence, the Osteoarthritis Research Society International (OARSI) has recently recommended a core set of physical performance measures for use in people with hip and knee OA including following joint replacement [43]. The set comprises the 30-second chair stand test, 40m fast-paced walk test and a stair climb test, with additional tests including the timed up and go and the 6-minute walk (Appendix B).

The six-minute walk test to measure aerobic capacity and hand-held dynamometer measurement of muscle strength are recommended for use with people with RA [42].

4.2 Education

Patient education is an integral part of the overall management of people with arthritis. Qualitative research has found that many patients with arthritis harbour concerns relating to the potential detrimental effects of exercise and perceive specific barriers to uptake and participation [44-48]. Furthermore, due to uncertainties about which exercises to do and how to do them without causing harm, many patients feel they are unable to exercise at all [49]. Table 2 outlines common misconceptions relating to OA, and the corresponding evidence-based statement. Table 3 outlines identified perceptions around RA and exercise, and the corresponding evidence.

Despite evidence showing that educational programs in isolation might have negligible benefits on pain and function, educating patients about their disease, pain mechanisms and treatment options, either in isolation or in combination with exercise, has been shown in a recent meta-analysis [50] to improve participants self-efficacy. Self-efficacy [85] affects some of the factors that predict motivation. According to Bandura (1982), self-efficacy is a self judgment of one's ability to perform a task within a specific domain.

Education can be delivered in various ways, including formal or informal discussion with a health practitioner supplemented by written materials, support groups or web-based programs. When held in a group setting, education sessions may also bring the benefits of peer support, providing social interaction with others with arthritis.

Table 2: Common consumer statements and questions about OA, and the corresponding evidence-based statement [44, 51, 52].

Statement / question about OA	Evidence-based statement
OA is just part of getting older.	OA is not an inevitable part of getting older.
OA is "bone wearing" and exercise is not going to help that.	OA is not just a disease of the cartilage but affects your whole joint including muscles and ligaments.
My x-ray shows severe joint damage therefore I must need a joint replacement.	Joint damage on an x-ray does not indicate how much your OA will affect you.
My joint pain is much worse than my neighbours, and he had severe damage on x-ray, so mine must be terrible.	The symptoms of OA can vary greatly from person to person.
I am too old and my pain is very severe and limiting. Any exercise will make me worse.	Prescribed exercise programs have been shown to be beneficial no matter what your age, joint involved, radiographic severity, pain intensity or functional level.
I do my exercises once a week, so why am I not getting any better?	Exercises only have benefits if you do them regularly (at least 3 times per week according to evidence).
I don't have time to do all of these exercises each day.	Linking your exercises to your other daily activities is a useful way to become more active.
Can I not just manage my pain with pills?	Non-drug treatments have similar benefits for your osteoarthritis symptoms to pain-relieving drugs, but with few unwanted side effects.
I need to rest as much as I can for my joints.	Living a sedentary life could worsen your OA, and also increases your risk of other lifestyle-related diseases such as diabetes and cardiovascular disease.
I need a joint replacement, so there is no point in doing exercises.	Maintaining sufficient muscle strength around the joints is important in reducing pain and maintaining function, and if you require an operation you will benefit from both pre- and post-operative periods of treatment.
I don't have access to the expensive gym and exercise equipment I will need.	Exercises to improve your movement and strength do not require specialised equipment and can be done at home.
I don't like doing exercises with weights, as I will hurt myself.	Your exercise need not include weights. Many different physical activities can be beneficial, including water-based exercise, walking, and group classes.

Table 3: Identified consumer views and queries of the effects of exercise on joint health in RA, and corresponding evidence-based statement [21, 44, 49].

Statement about RA and exercise	Evidence-based statement
My RA has caused damage to my joints, and I worry that exercise will cause more damage.	Exercise has been shown to benefit joint health and may decrease joint inflammation and pain.
What do they mean by exercise and what is safe for me to do?	Exercise encompasses a range of activities; what is suitable for each person must be assessed on an individual basis.
It hurts when I exercise so I have to stop and rest.	Some pain is to be expected with exercise. Working with your health professional to monitor this is the best plan.
What do I do in a 'flare'?	Knowing how to identify a flare, and changing exercise accordingly is best achieved through education.
It is not just my RA; I have heart problems as well. I am scared I will make that worse.	Exercise is particularly important and can be beneficial for those at risk of cardiovascular disease. Prior to commencing exercise you should consult with your doctor.
I am too old and my pain is very severe and limiting. Any exercise will make me worse.	Prescribed exercise programs have been shown to be beneficial no matter what your age, pain intensity or functional level. Use of simple analgesics can give pain relief, to allowing exercise to be undertaken.
I do my exercises once a week, so why am I not getting any better?	Exercises have the most benefits if you do them regularly and more frequently. Guidelines recommend 3 or more times each week.
I don't have time to do all of these exercises each day.	Linking your exercises to your other daily activities is a useful way to become more active.
Can I not just manage my pain with pills?	Exercise has additional benefits for RA symptoms. Increasing strength and mobility improves not only pain but function as well.
Resting all day will help my joints.	Living a sedentary life could worsen your RA, and also increases your risk of other lifestyle-related diseases such as diabetes and cardiovascular disease.
I don't have access to the expensive gym and exercise equipment I will need.	Exercises to improve your movement and strength do not require specialised equipment and can be done at home.

4.3 Exercise prescription

Type of exercise

There are many types of exercise that can be suitable for people with arthritis including muscle strengthening/resistance training, stretching/range of motion, cardiovascular/aerobic conditioning, neuromuscular (weight-bearing, functional) exercise, balance training, yoga, aquatic exercise and tai chi. Few studies have directly compared the effects of different types of exercise but systematic reviews suggest benefits can be gained from a range of exercise types [9, 16, 53] (Tables 4 and 5).

Two recent systematic reviews drew conflicting conclusions regarding whether or not the benefits of exercise are greater with programs combining different types of exercise or with those comprising only one type of exercise in people with OA [9, 27]. Uthman et al [9] found that a combination of strengthening with flexibility and aerobic exercise (either land- or water-based) to be the most effective exercise in lower limb OA (predominantly knee OA studies) and it was the only exercise intervention significantly more effective for both pain and function than the 'no exercise' control. In contrast, Juhl et al [27] found comparable benefits from a range of exercise types, although single-type exercise programs were more efficacious than programs that included different exercise types. The authors suggested that different exercise types could be performed in an overall program but that each session should focus on one type of exercise to maximise benefits. Discrepancies in reporting of exercise program contents may explain the difficulties in reporting on these study findings [11].

Both land- and water-based exercises have been utilised in arthritis populations. Aquatic exercise (or hydrotherapy), which takes place in warm water (typically 32° to 36° Celsius) [54], gives the additional benefit of buoyancy and decreased joint impact. A number of trials have evaluated land and aquatic exercise in both RA and OA groups. Systematic reviews of these trials report comparable positive results for pain and function [53-55], making personal preference and availability of a suitably heated pool the deciding factors when choosing which to use.

Balance exercises have not been demonstrated to improve pain and function in arthritis populations, however there is strong evidence for their role in reducing falls [56, 57], making their inclusion logical when an increased falls risk is identified.

Table 4: Outlines various types of exercise evaluated in clinical trials, and the evidence for the use of different exercise types in people with OA.

Type of exercise	Evidence for people with hip and/or knee OA	Strength of evidence
Muscle strengthening	• Meta-analyses show small to moderate benefits for improving both pain and physical function in knee OA [9] [27, 53, 58]. • Conflicting evidence in hip OA [28, 59, 60]. • Evidence suggests that the specific type of strengthening exercise does not significantly influence outcome. Similar benefits found with isotonic (through range), isometric (without movement) and isokinetic (performed on specific machines) strengthening exercise [61] as well as with strengthening exercise performed in weight bearing or non weight bearing positions [24, 53].	• Strong evidence in knee OA from a large number of trials. • *Silver level evidence in hip OA [62].
Aerobic exercise	• Meta-analyses show small to moderate benefits for improving both pain and physical function in knee OA [9, 27, 53, 58]. • Limited studies in hip OA [59, 60]. • Shown in other populations to have positive effects on psychological impairments such as depressive symptoms [24], which are common in people with OA. • Either land- or water-based aerobic exercise both found to be effective compared to no exercise control [9].	• Strong evidence in knee OA. • Limited and conflicting evidence in hip OA.
Stretching and range of motion	• Stretching in isolation has not been studied; these exercises generally form part of an overall exercise program for OA.	• No evidence as an isolated intervention in knee or hip OA.
Aquatic	• Systematic review of hip and knee OA trials that included 6 trials (800 participants) showed small to moderate effects on physical function and quality of life in the short-term but minor effects on pain [54].	• *Gold level evidence in hip and knee OA [54].
Balance exercise	• No trials specifically addressing balance alone in either people with hip or knee OA. • Evidence of balance exercises in reducing falls found in multiple meta-analyses [56, 57].	• No evidence as an intervention alone. • Evidence for role in improving balance and reducing falls.
Aerobic Walking	• Significant improvements in pain, quality of life and functional status found in knee OA [63]. • Needs to be at an aerobic level above normal activities for optimal benefit, and for at least 30 minutes, 3+ times each week [63].	• Moderate evidence in knee OA. • No evidence in hip OA.
Tai chi	• Recent meta-analyses found tai chi had significant moderate effects on pain, physical function and stiffness [64, 65].	• Moderate evidence in knee OA from several randomised trials, many of low methodological quality.

Levels of evidence defined, as used by the Cochrane Musculoskeletal Group (prior to use of GRADE to describe the overall quality of evidence):
* Tugwell et al (2004) [66]
Gold – at least one RCT with > 50 participants, blinding of participants and assessors, and concealment of treatment allocation
Silver – randomised trials that do not meet the criteria for Gold level
Bronze – one high quality case series, or expert opinion
OR
* Van Tulder et al (2003) [67]
Strong – consistent findings in multiple high quality RCTs
Moderate – generally consistent findings in one high quality RCT, or multiple low quality RCTs
Limited – generally consistent findings in one or more low quality RCTs
No or conflicting evidence – no RCTs available or the results are conflicting.

Table 5: Outlines various types of exercise evaluated in clinical trials, and the evidence for the use of different exercise types in people with RA.

Type of exercise	Evidence for people with rheumatoid arthritis	Strength of evidence
Muscle strengthening exercises	• Systematic reviews, including a Cochrane review showed moderate effects of dynamic exercises (strengthening combined with aerobic exercise) [16, 29].	• Limited number of high quality trials. • No evidence in isolation – combined with aerobic exercise.
Aerobic exercises	• In a Cochrane review, studies of short-term, land-based aerobic capacity training, provide moderate evidence for a positive effect on aerobic capacity with no deleterious effects reported [16].	• Moderate evidence in combination with strengthening exercises. • No evidence in isolation.
Stretching and range of motion exercises	• One systematic review reported positive effects on joint range of motion, pain and joint count found in randomised trials when used in combination with aerobic and strengthening exercises [19].	• Limited evidence, no studies examined in isolation.
Aquatic exercise	• Found to improve aerobic capacity, muscle strength and psychological status in a systematic review of clinical trials, when compared to no exercise intervention [18]. • In a Cochrane review, studies of short-term, water-based aerobic capacity training show limited evidence for a positive effect on functional ability and aerobic capacity [16].	• Limited evidence due to few studies of moderate quality.
Balance exercises	• Cochrane review unsure of the effects as no studies met inclusion criteria [68]. • Evidence of balance exercises in reducing falls found in multiple meta-analyses [56, 57].	• No evidence. • Evidence for role in improving balance and reducing falls.
Walking	• A 2008 systematic review found no randomised controlled trials using walking alone with RA participants [18].	• No evidence as an isolated intervention
Tai chi	• A 2010 Cochrane review including four trials found no clinically important or statistically significant effects on most outcomes including activities of daily living, tender and swollen joint and patient overall rating, but significant benefits on lower limb range of motion and increased enjoyment of exercise. No detrimental effects were reported [69].	• *Silver level evidence
Cycling	• A systematic review found that trials using a cycling intervention reported both increased aerobic capacity, and decreased disease activity after 8 – 12 weeks compared to no exercise intervention [18].	• Limited evidence

Mode of delivery

Exercise can be broadly categorised into three different delivery modes: individual (one-on-one) treatments; class-based (group) programs; and home-based programs. Other common mixed-mode alternatives include combining individual treatment sessions with home-based exercise, and augmenting home exercise with either a class-based program or supervised home visits by a trained health care or exercise professional [70]. The effects of mode of delivery have mostly been investigated in OA.

A Cochrane systematic review that included 32 trials (3616 participants) [26] showed that individual, class-based and home-based programs all achieved beneficial treatment effects in terms of reduced self-reported pain and improved self-reported physical function in people with OA.

Supervision, particularly in the initial stages of a class-based or home-based exercise program, can help promote safe and correct exercise technique, and ensure the dosage of the exercise is appropriate for the patient's physical ability and overall goals of the program. Results from one study [71] showed that augmentation of a home program with an initial 8-week physiotherapist-supervised class exercise program in people with knee OA led to greater improvements in pain and walking function at 12 months follow-up, demonstrating that the short-term addition of exercise classes results in significant symptomatic benefits in the longer term. Recently Juhl et al [27] found a significant relationship between the number of supervised sessions and the pain-relieving benefits of aerobic exercise (but not resistance exercise) for people with knee OA. Indeed for every 10 supervised sessions, the pain relieving benefits increased by an amount comparable with the pain relief obtained with simple analgesia [27].

Exercise load

Exercise programs can differ greatly in terms of their dosage or load by varying the parameters that underlie their design. The parameters that can be varied within the exercise prescription include the exercise intensity, the training frequency, and the training duration, which when combined make up the weekly training load. Regular progressive overload is important to training progression [32]. From a clinical perspective, the optimal dosage of exercise for people with arthritis is unclear as very few studies have directly compared different factors of exercise and loading varies markedly between studies [72]. However, a recent systematic review of the impact of exercise type and dose on pain and disability in knee OA found no impact of intensity or duration of individual sessions on patient outcomes [27]. Exercising three times per week was found to be optimal, with greater exercise intensity not improving the effect of exercise therapy [27].

A pre-exercise assessment should identify the priorities and any relative contra-indications to the initial exercise prescription and determine the components of fitness that require attention for each person. These factors will determine for each individual the mode of exercise recommended, the emphasis for the specific components of the exercise prescription, and the initial exercise loading (intensity, duration and frequency).

The specific guidelines for exercise load, for strength and aerobic training and flexibility in people with arthritis can be derived from evidence in the existing literature on healthy adults, and by consensus statements such as those from the American Geriatrics Society [73] and the American College of Sports Medicine [74]. Exercise prescription must also consider any limitations placed on specific individuals by current disease activity. The training guidelines outlined below are provided as a basis for prescription for apparently healthy individuals.

a. Aerobic training guidelines

Improving aerobic or cardiovascular endurance is an essential component of fitness to reduce cardiovascular strain when performing any continuous activity, such as routine daily tasks, and to improve cardiovascular health. Aerobic physical conditioning activities include brisk walking, aquatic activities, cycling and dance.

When prescribing aerobic exercise, prolonged continuous sub-maximal activities for a total of at least 30 minutes are recommended, which may be broken up into a number of shorter intervals with short rest periods depending on an individual's fitness level, cardiovascular health status or, for patients with arthritic conditions, any limitations due to joint pain [75]. Sessions should be conducted at least 2-3 times per week. For healthy adults, the exercise intensity should be equivalent to a brisk walking pace, but not exceeding a pace that allows the conducting of a normal conversation (this is often referred to as "talking pace"). The Borg Relative Perceived Exertion (RPE) scale [76] can also be used to assess exercise intensity, with a target RPE of between 3-5 being desirable. This can be described as moderate-hard exercise. For individuals starting an aerobic exercise program, an RPE of 3 is desirable and then increasing over a period of months to an RPE of 4-5 (Appendix C). Heart rate during exercise, including use of a portable heart rate monitor, can also be used to determine the appropriate exercise intensity. Of note is that some drugs (eg beta blockers) may invalidate the use of heart rate to assess exercise intensity. A steady heart rate during continuous exercise of between 60-80% age-predicted maximal heart rate (Max HR) is appropriate [74]. The maximum HR can be estimated by the following formula: 220 minus age in years.

b. Strength training guidelines

Based on the basic principles of strength training, if the desired outcome is to increase muscle strength the exercise loading should be of moderate to high intensity, 2 to 3 times per week for at least 8-12 weeks and incorporating regular progressive overload [77]. However, it is not clear whether exercise intensity influences pain and function outcomes in arthritis. In a study of OA patients, both high- and low-intensity strength training matched for total workload produced similar improvements in pain and function [78].

The development of strength in a specific muscle group requires the muscle to be placed under increasing load by working against an external resistance. This may include moving a weight or a pin-loaded exercise machine through a range of movement, pulling against a Theraband, using body weight, or pushing/pulling against the resistance of water in a hydrotherapy class. Pushing or pulling against an immovable object where the muscle length does not change is called isometric exercise, which may be a suitable form of exercise for arthritic patients where joint movement increases pain. A strength training program generally consists of 6-12 exercises for different muscle groups, where each exercise is repeated for 8-15 times (called repetitions), being repeated 2-3 times (called sets), with a rest period between each set of 30-180 seconds. When designing a strength-training program for individuals with arthritic joints the focus of the exercises should be on those muscles that cross the joint in which pain is experienced.

To develop strength effectively, the loading for each exercise should be in the 4-7 range ("moderately strong" to "strong" – Appendix C) on the Borg Scale, modified for resistance exercise. As an individual's strength increases the resistance must be progressively increased to ensure that the intensity is kept within this

desired range. Individuals with OA or RA who experience increased joint pain with higher exercise loadings should discuss with their allied health practitioner whether the exercises or resistance should be changed.

4.4 Monitoring and reporting

Monitoring of participants throughout an exercise program ensures that any symptom changes, increases in pain, or adverse events can be dealt with immediately and appropriately.

Of importance for RA patients when exercising is understanding and appropriately managing fluctuating disease symptoms (flare). Patient education plays a vital role, however this is complicated by a lack of agreement in literature as to the definition of a flare [79]. Flares are common and reflect episodes of increased disease activity beyond normal day-to-day variation. Importantly, flare may mean different things to patients and healthcare professionals. No standardised criteria exist to define or assess flares in RA, and these need to be managed on an individual basis.

Although experiences of pain when exercising may assist decisions about exercise dosage, patients should be advised that it is normal to feel some discomfort or pain during exercise. If necessary, pain medication can be taken 20 minutes prior to undertaking exercise and/or ice packs applied to the joint for 15-20 minutes following exercise. Prior to commencing any exercise program a system should be established for recording and managing any adverse events that may occur, both during a class program and if participants are exercising at home.

4.5 Behaviour change strategies

Participation and adherence

Despite the significant body of evidence to support the use of exercise in managing both RA and lower limb OA, reported long-term benefits have been poor due to rapidly reducing patient adherence. In a longitudinal study with participants with hip and knee OA Pisters et al [80] reported 53% adherence at best, dropping to 36% by 60 months.

Current research in populations with lower limb OA shows that those with higher exercise adherence rates and higher number of exercise sessions attended do experience greater improvements than those who exhibit poor exercise adherence [81]. An RCT of exercise with RA patients found that aerobic capacity and strength gains made during the 12-week program were lost within 12 weeks of the intervention when patients did not continue the exercises [82].

Exercise adherence in people with arthritis is influenced by a complex array of factors, both intrinsic, such as personal experience and individual attributes, and extrinsic, such as social or physical environment (Appendix D) [81, 83]. Given that the barriers to exercise adherence are complex, vary across individuals, and may change over time within a given individual, a flexible, individualised and proactive approach to exercise prescription by health professionals is required. No single strategy to promote exercise adherence will suffice across all people with OA or RA. Health professionals should consider and identify the barriers/facilitators to exercise adherence when recommending or prescribing exercise for people with arthritis. This information can then be used proactively to tailor exercise recommendations and implement strategies to maximise adherence. When barriers to exercise adherence are identified, Appendix E outlines a range of potential strategies that clinicians may consider implementing in discussion with the patient.

Conclusion

Exercise is good for arthritis.

The strength of the evidence varies but there is no debate that people with arthritis can experience improvements in their pain, physical performance and overall wellbeing by participating in regular, appropriate exercise. When used as directed, exercise is a 'drug' with virtually no costs or contra-indications.

Just as clearly however there has been a degree of uncertainty among professionals in health care and associated therapeutic fitness and exercise professionals as to how exercise should be prescribed. And, Australians with arthritis often show reluctance to exercise, perhaps based on concerns that using a joint will worsen their arthritis symptoms.

As the country's peak arthritis body Arthritis Australia has a responsibility to take the lead in education and dissemination of the latest findings on such issues.

In publishing this guide, which brings together evidence-based recommendations on exercise and arthritis, we are providing what we believe will be an invaluable national resource for the fitness industry, health sector professionals and people living with arthritis to link together and ultimately ensure more effective management of arthritis.

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APPENDIX A

Outcome measures

(a) Visual Analogue Scale (VAS)

Place a mark on the following scale to show the average amount of pain felt over the past week in your knee when you are walking.

NO PAIN ..... WORST PAIN POSSIBLE

(b) Numeric Rating Scale (NRS)

Tick the number that indicates the average amount of pain felt over the past week in your knee when you are walking.

NO PAIN	1	2	3	4	5	6	7	8	9	10	WORST PAIN POSSIBLE
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

(c) Global Rating of Change scale (GROC)

Place an "X" in the box that best represents the overall change in your knee since you began the exercise program.

MUCH WORSE	MODERATELY WORSE	SLIGHTLY WORSE	NO CHANGE	SLIGHTLY BETTER	MODERATELY BETTER	MUCH BETTER
☐	☐	☐	☐	☐	☐	☐

APPENDIX B

Description of the core set of physical performance measures for hip and knee osteoarthritis as recommended by the Osteoarthritis Research Society International [43].

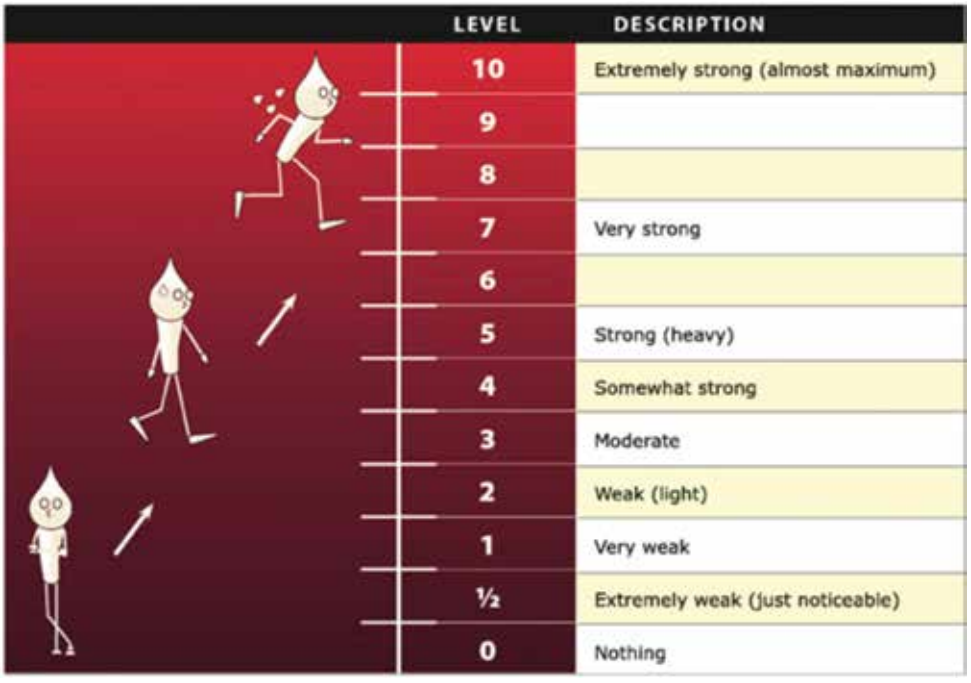
Test	Equipment needed	Description
30-second chair stand test	• Timer/stopwatch. • Straight back chair with a 44cm (17 inch) seat height, preferably without arms.	Maximum number of chair stand repetitions possible in 30 seconds.
40m fast-paced walk test	• Timer/stopwatch. • 10m marked walkway with space to safely turn around at each end. • 2 cones placed. approximately 2m beyond each end of the walkway. • Calculator to convert time to speed.	A fast-paced walking test that is timed over 4 x 10m for a total of 40m. Performed in comfortable footwear.
Stair climb test	• Timer/stopwatch. • Set of stairs.	Time in seconds it takes to ascend and descend a flight of stairs. The number of stairs will depend on individual availability.
Timed up and go	• Stopwatch. • Standard chair with armrests (approx. 46cm (18 inch) seat height with 65 cm (26 inch) arm rest height). • Marked 3m (10 ft) walkway with turn point at end.	Time to rise from a standard armchair, walk as quickly but as safely as possible distance of 3m, turn, walk back to the chair and sit down.
6-minute walk test	• Stopwatch. • Flat, hard-surfaced indoor walkway. • (approx. 30 - 50m) marked with 3m intervals.	The maximum distance that can be walked over a 6-min interval is recorded. Rest periods are allowed but are included in the time.

APPENDIX C

Borg Rating of Relative Perceived Exertion for aerobic exercise [76].

1 - 10 Borg Rating of Perceived Exertion Scale	
0	Rest
1	Really Easy
2	Easy
3	Moderate
4	Sort of Hard
5	Hard
6	
7	Really Hard
8	
9	Really, Really, Hard
10	Maximal: Just like my hardest race

Borg Rating of Relative Perceived Exertion for resistance exercise [76].



LEVEL	DESCRIPTION
10	Extremely strong (almost maximum)
9	
8	
7	Very strong
6	
5	Strong (heavy)
4	Somewhat strong
3	Moderate
2	Weak (light)
1	Very weak
½	Extremely weak (just noticeable)
0	Nothing

APPENDIX D

Checklist of facilitators and barriers influencing exercise behaviour among people with arthritis that may be useful for clinicians to complete during an assessment of patients, prior to prescribing an exercise program [83].

Barriers	THE INDIVIDUAL	Facilitators
Negative	PERSONALITY	Positive
Weak	SELF-IMAGE	Strong
Negative	HEALTH ATTITUDE	Positive
Negative	EXERCISE ATTITUDE	Positive
Weak	MOTIVATION BY ENJOYMENT	Strong
Weak	MOTIVATION BY RESULTS	Strong
Negative	EXERCISE HISTORY	Positive
Little	DISEASE KNOWLEDGE	Substantial
	↓	
	INFLUENCING FACTORS	
Great	PAIN	None
Great	STIFFNESS AND FATIGUE	None
Unsuitable	TYPE OF EXERCISE	Suitable
None	PERCEIVED BENEFITS OF EXERCISE	Great
Poor	QUALITY OF SLEEP	Good
Poor	FAMILY SUPPORT	Great
Poor	PHYSICAL THERAPIST' PROFESSIONAL CARE	Great
Poor	PHYSICIANS' ENCOURAGEMENT	Great
Lack of	TRAINING PARTNER (IF NEEDED)	Existing
Low	SOCIOECONOMIC STATUS	High
Problematic	PERSONAL HYGIENE	No problem
Unfavourable	WEATHER CONDITIONS	Favourable
Little	AVAILABILITY OF EXERCISE CLASSES	Great
Problematic	TRANSPORTATION	No problem

APPENDIX E

Strategies that may be useful in overcoming barriers to exercise in people with arthritis [84].

Barrier	Strategies to consider
Perception that exercise is ineffective or will worsen arthritis	• Education regarding the benefits of exercise, using scientific evidence delivered in a language that the patient can easily understand. • Provide educational support materials (website links, written handouts) that describe the pathology of arthritis. Encourage use of educational resources provided by national arthritis and exercise organisations. • Provide tailored exercise advice with specific individualized exercise prescription and dosage, rather than generic exercise recommendations. • Referral to commence exercise under the supervision of a physical therapist initially. • Encourage incorporation of exercise into daily routines. For example, walking to work or the shops, taking the stairs instead of the elevator, walking the dog, exercising while watching the news on TV etc. • Recommend exercises that are time-efficient and do not require complicated set up of equipment. Aim for home- or work-based exercise programs rather than those that require additional travel to get to a gym or scheduled class.
Lack of motivation	Encourage your patient to plan exercise sessions for the week ahead, and to make "appointments" for exercise in their weekly schedule. Write the "exercise appointments" in a diary or on a calendar. Discuss the benefits of exercise, and set short- and long-term goals that are tailored to the patient. Discuss the importance of exercise with your patient's friends and/or family members and encourage them to participate in the exercise as well. Recommend participation in an exercise group or class. Provide referrals to appropriate group classes in the community.
Lack of access to exercise facilities, transportation	Recommend exercises that require no travel to specialized facilities. Recommend home-based exercises that can make use of body weight for resistance, or prescribe aerobic exercises such as walking programs. Identify inexpensive and convenient facilities available in the local community (such as arthritis exercise groups, walking groups, local swimming pools etc.). Provide your patient with written material including the contact details for these services.
Weather conditions	Provide a range of exercise options that will be possible irrespective of the weather conditions (e.g. indoor cycling, water aerobics, indoor swimming, etc.).
Lack of enjoyment	• Discuss with the patient their preferred exercise options. Tailor the exercise program to the patient's personal preferences and according to past exercise strategies that have been successful for them. • Regularly change the exercise program to minimize boredom. • Listen to music or watch television whilst exercising. • Discuss reward systems, where the patient rewards themselves at regular intervals for ongoing exercise participation or for achieving pre-determined exercise goals.

APPENDIX E continued

Barrier	Strategies to consider
Other health problems	• Tailor the exercise program to consider the impact of other co-morbid conditions, rather than use generic exercise recommendations. Refer the patient to commence exercise under the supervision of a physiotherapist initially. • Ensure other medical conditions are being adequately and appropriately managed.
Forgetfulness	Discuss strategies to help the patient to remember. For example, cue cards around the house; schedule exercise appointments into the calendar or diary; set reminders via email alerts or reminders on smart phones or computers; place exercise sheets on visible locations.
Lack of energy	Reinforce that regular exercise will increase energy over the longer term. While they might feel tired initially, continued exercise will increase energy. Sleep quality will also improve with ongoing exercise, so improved sleeping will also result in reduced tiredness. Discuss the vicious cycle of feeling tired, leading to less physical activity, leading to feeling more tired.
Exercise causes pain	• Conduct a comprehensive physical assessment to determine the body positions, movements and activities that aggravate pain, and use this information to tailor the exercise program. • Supervised exercise sessions initially, with regular monitoring by the patients and clinician regarding changes in pain. • Reassure the patient that it is normal and safe to sometimes feel pain with arthritis exercise. Explain that this does not mean that exercise is harming the joint. • Modify exercise program or modify the dosage in a timely manner to remove any exercises that excessively increase pain. • Smaller durations of exercise with greater frequency may be appropriate. • Consider exercise in aquatic environments rather than land-based.
Lack of confidence in exercise ability	• Referral to a physical therapist in the early stages of exercise. • Supervised exercise sessions or group classes rather than unsupervised exercise. • Provide written exercise handouts and instructions. Video clips or DVDs or photos of the patient performing the exercise with the clinician can be useful. • Spend sufficient time demonstrating the exercises and watching the patient perform the exercises so as to ensure correct technique and to provide feedback. • More regular monitoring may be required, especially when the exercise program is being progressed or the dosage being increased.

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