

Should we encourage patients to undergo aquatic-based therapy in their management of osteoarthritis?

Kristen Davies

Kristen is a third-year student at Lancaster Medical School. This article is based on his winning entry to an essay competition, organised by Arthritis Research UK, in musculoskeletal medicine regarding whether hydrotherapy should be used to treat osteoarthritis. See page 108 for news of the local aqua-therapy service.

BACKGROUND

Osteoarthritis (OA) is the most common form of arthritis worldwide and is as limiting as cardiovascular disease. Living with the disease has a series of limiting effects on patients, such as reduced functional ability, poorer body image and poorer emotional well-being. Treatment of the disease currently involves symptomatic control of pain and various exercise programs. Aquatic-based therapy is one of these exercise programs offered to patients. It is not known, however, whether aquatic-based therapy is more beneficial to OA patients than traditional land-based therapy.

INTRODUCTION

OA is a chronic disease characterised by joint pain, usually the hips and knees, limited movement and inflammation localised to the joint without systemic effects. OA involves the entire joint, causing the loss of articular cartilage, development of osteophytes and sclerosis of the subchondral bone, which leads to functional impairments of the affected joint.

The pathophysiology of OA is not completely understood, though it is thought to be more than just a 'wear and tear' phenomenon associated with age. Though ageing may predispose patients to developing OA, it does not necessarily cause the disease and is thought to have a multifactorial aetiology due to a number of external factors, such as muscle weakness and reduced proprioception.⁽¹⁾ Pre-existing factors such as obesity and previous joint injuries also contribute to the likelihood of developing OA.⁽²⁾

The impact of OA is wide, with the potential to cause severe burden to the sufferer and to society. OA is the most common form of arthritis and is one of the major causes of pain and disability worldwide. In terms of limiting activities as daily living, OA is as limiting as cardiovascular disease.⁽³⁾

The disease has a considerable psychosocial impact on the patient, with OA sufferers reporting that their emotional well-being, socio-economic status, relationships, body image and social and functional lives are all handicapped by the condition.⁽⁴⁾ OA sufferers also report more severe handicaps than those who suffer from rheumatoid arthritis.⁽⁴⁾

Treatment of OA currently involves symptomatic control of pain whilst improving their physical capacity, by means such as weight loss, exercise programs and physiotherapy.⁽⁵⁾ Exercise programmes in particular are considered a 'core' and effective part of management.

There are a number of different types of exercise programs available with some approaches such as endurance training, stretching, aerobic and aquatic exercise. Currently, flexibility, strengthening and aerobic exercise are the recommended programs for people with OA,^(6,7) with strengthening therapy in particular found to be beneficial in also reducing pain, as well as improving function in OA patients. Aquatic-based therapy is also recommended, but particularly for those patients who may not be able to tolerate land-based exercises due to the late stage of their disease.^(6,8)

Exercise, particularly strength training, has been shown to have a strong association with functional ability in ageing.⁽⁹⁾ Changes in muscle strength and activation occur normally in ageing, but it is of great importance that adequate muscle strength and activation ability is maintained into later years.⁽⁹⁾ OA causes marked changes in all of the ipsilateral muscles around the joint including decreased strength, muscle mass and force generation. Deficits in quadriceps muscle strength may themselves predispose to the development of knee OA.

Conditioning other muscles around the arthritic joint is important as well, as patients with knee OA have shown to deteriorate more slowly if they have stronger ipsilateral hip abductors.⁽¹⁰⁾

The focus of this essay will be to review aquatic-based therapy for patients with OA of hip or knee, looking particular at its therapeutic effects. The aims are to decide whether aquatic-based therapy has beneficial effects for OA patients and if so, what part of their exercise rehabilitation should it fit into.

WHAT IS AQUATIC-BASED THERAPY?

Aquatic-based therapy, also known as hydrotherapy, involves water heated to 32-36 degrees Celsius. Hotter temperatures are believed to be more advantageous as it is thought to cause muscle relaxation, help reduce stiffness and reduce pain sensation.⁽¹¹⁾ There are variants of hydrotherapy, such as balneotherapy, which utilises various forms of mineralised water treatments, and Kneipp hydrotherapy, which involves pouring water onto the affected joint and then immersing the limb in a hot-or-cold bath in an alternate fashion.⁽¹²⁾ These therapies are usually less widely available, however, as they are usually found in expensive spa resorts in the Western world.

AQUATIC-BASED THERAPY FOR FUNCTIONAL IMPROVEMENT

Aquatic-based therapy is useful due to the reduced weight loading by patients, as the loading on the joints is minimised by the buoyancy of the water, which reduces the stress placed upon the knee joints. The principles of hydrodynamics are important when examining the benefits of aquatic therapy. Drag and turbulence, two aspects of hydrodynamics, correlate to the resistance of the exercise when in the water.⁽¹³⁾ A study in 2001 concluded that drag underwater was also able to provide a specific stimulation of muscles, therefore improving functional capacity.⁽¹⁴⁾ A number of factors, such as the size of the body part, the depth of the pool and the intensity of the activity, determine the effort required, as doubling the speed of the activity in the water will increase drag and thus resistance four times.⁽¹⁵⁾ Resistance can be further increased by including equipment such as flippers. Hydrostatic pressure increases the deeper the immersion in water; and the increase in pressure at certain depths (approximately 1.2m) results in higher pressures of water surrounding the lower limbs than the diastolic pressure in the limb. This difference in pressure therefore aids the venous return reducing oedema around the knee, a distinct advantage compared with land-based exercise.

A number of trials in healthy young adults have used 'progressive loading', where subjects of the trials have to carry a heavier load as the weeks progressed. In one trial, this was done via the use of heavier boots in the later weeks, which lead to an increased drag force which improved dynamic strength of the lower limbs.⁽¹⁵⁾ Another trial compared a specific quadriceps strengthening exercise on land and in water.⁽¹⁶⁾ The movement involved was knee-extension whilst in a sitting position, and sandbags were used as the progressive load. Resistance in the water was also increased through the use of empty bottles attached to the lower leg. As the weeks progressed, the number of bottles increased.

Numerous trials have been conducted comparing aquatic-therapy with non-intervention control groups. Two of these were 12-month trials, which both utilised types of aquatic exercise. One utilised water exercise in public swimming pools, managed to demonstrate increases in strength, flexibility and functional ability compared to the control groups.⁽¹⁷⁾ The other, which did not show any improvement in strength, was thought to be due to less than 60% of the participants not attending the classes as regularly as recommended.⁽¹⁸⁾ The authors also commented that the exercise which they were using in the program may have been 'too gentle' to improve strength. Participants did, however, manage to demonstrate improvement in physical function and a reduction in pain.

Contrasting results occur; however, in trials which have lasted a shorter amount of time. In a 2014 trial, which used a 'waterygym' knee, OA patients found no improvement in pain reduction or locomotion after twelve weeks.⁽¹⁹⁾ An earlier trial, which lasted for only six weeks, found significant improvements in pain, function and hip abductor strength.⁽²⁰⁾ This trial is thought to have been more effective due to the exercises being based on hydrodynamic principles compared to being a general exercise class. The trial, whose exercises included squats and step-ups, found that functional strengthening exercises to be effective in patients with OA. From these trials, there is evidence to suggest that there is potential for aquatic-based therapy to be beneficial to OA patients compared to no intervention at all, especially when the exercise is regular and contains specific strengthening exercises.

A Cochrane Review in 2009, comparing aquatic and land-based therapy, studied six trials and concluded that 'aquatic exercise has some short-term beneficial effects on the condition of OA patients with hip or knee OA or both'.⁽²¹⁾ The review, however, did highlight the small number of randomised controlled trials (RCT) done on these patients and that no trial has assessed the longterm effects of treatment, therefore concluding that aquatic-based therapy may be considered as an 'introductory' programme to exercise for patients who have a particularly disabling OA. Since 2007, a number of trials have emerged comparing aquatic and land-based therapy. Four trials have directly compared aquatic and land-based therapies, all concluding that there is little difference in functional outcomes.⁽²²⁻²⁵⁾ There was, however, a significant difference in pain reduction for the participants who underwent the aquatic-based therapy in three of these trials. A further trial compared OA patients in aquatic-based therapy against gym-class exercises and concluded that the participants in the gym-class exercises achieved better strength.⁽²⁶⁾ The patients in the aquatic group, however, were found to have significant gains in walking speed and distance. Also, a recent trial found that aquatic-based therapy did not lead to a reduced risk of falls in patients with lower-limb OA when compared to a land-based exercise.⁽²⁷⁾

AQUATIC-BASED THERAPY FOR PAIN MANAGEMENT

Pain control is an important part of the management of OA, as it one of the most common symptoms reported by patients and, therefore, one of the main aims of treatment.⁽²⁸⁾ The pain experienced in OA can be for a number of reasons, such as subchondral bony destruction or synovial inflammation.⁽²⁹⁾ The pain caused by OA can inhibit muscle activation and contribute to worsening muscle strength and loading, which in turn reduces functional ability.^(30,31) Considering this, exercise has become a key part of the treatment of OA as strengthening the muscles around the arthritic joint may play a role in improved control of movement through reducing the pain felt.⁽³²⁾ However, pain inhibition is also considered to have an impact in the development of weakness.⁽³³⁾

The effect of buoyancy is thought to reduce pain during exercise, because of the relationship between weight bearing and depth of immersion in water. This perception is supported by findings from a small clinical trial which demonstrated that immersion in water during aquatic exercise restored normal spine stature more effectively than its land-based equivalent.⁽³⁴⁾ The compressive effect of hydrostatic pressure, which occurs with immersion, reduces swelling around the joint, allowing greater movement and reduced stiffness and pain.^(20,35) A Cochrane review which looked into aquatic therapy for OA of the hip and knee concluded that aquatic therapy may decrease the pain felt by OA patients.⁽²¹⁾

Aquatic therapy was an ideal starting point for patients who had previously had problems with land-based exercise due to the pain felt from the advanced stage of OA, a finding supported by three trials which compared aquatic-based therapy vs land-based therapy.⁽²²⁻²⁴⁾ However, a more recent systematic review and meta-analysis concluded that 'there is sound evidence that there are no differences in the pain-relieving effects between aquatic and land-based exercise'.⁽³⁶⁾ The review did, however, find that aquatic exercise did have a small pain-relieving effect compared to no intervention.

An important consideration when using aquatic-based therapy for pain relief for OA patients is the ability to 'over-exercise' due to the reduced pain perception during aquatic exercise. This is due to a reduced perceived workload compared to land-based exercise. However, further research needs to be conducted to determine whether this theory is supported.

BENEFITS OF AQUATIC-BASED THERAPY ON WELL-BEING

Patients with OA can be severely limited and disabled by their condition, preventing them from taking part in normal day-to-day activities. It is reported that the prevalence of clinically significant depression and/or anxiety is 40.7%,⁽³⁷⁾ with level of disability also being greater in patients with depression and/or anxiety. Patients with lower self-reported levels of functioning are also associated with higher anxiety and fear-avoidance beliefs in OA patients.⁽³⁸⁾ Depression itself can independently cause pain, further exacerbating patients problems. Similarly, pain can also lead to depression and anxiety, suggesting that the relationship is bidirectional. Therefore, management strategies should also try and include treatments for both pain and depression.

Few trials have looked at the effects of aquatic-based therapy on mental health in OA patients. One such trial of OA patients evaluated hydrotherapy and Tai Chi classes and reported a significant improvement in depression and stress scales for the patients who underwent hydrotherapy, but not Tai Chi, when measured using a questionnaire of psychological well-being.⁽³⁹⁾

The majority of research to date looking at the impact of aquatic-based therapy and symptoms of depression and anxiety has looked at fibromyalgia patients, where psychological symptoms are used as part of the diagnostic process. A study in 2012 looked at fibromyalgia patients who were treated with hydrotherapy for two months, finding patients to have significantly reduced depression, anxiety, pain, and fatigue and had improvement in terms of sleep quality and physical functioning after treatment.⁽⁴⁰⁾

A more recent trial looking at the use of hydrotherapy for fibromyalgia patients for 30 sessions over 15 weeks found significant improvements in the perception of pain, quality of life and depression symptoms compared to a control group.⁽⁴¹⁾ Other conditions which aquatic-based therapy has been trialled for symptoms of pain and depression include myofascial pain syndrome, where chronic sufferers were treated with 'Whirlpool hydrotherapy', which resulted in significant reductions in pain and anxiety after a two-week treatment.⁽⁴²⁾

SUMMARY OF EVIDENCE

The evidence gathered from RCT, systematic reviews and meta-analyses on the subject of aquatic-based therapy is increasing, though the majority of research focuses on land-based exercises, especially for OA patients. An editorial on the subject of exercise for OA patients commented that questions remain about the type and format of exercise that should be prescribed.⁽⁴³⁾ When considering aquatic-based therapy, extra questions are raised as to whether it is worth the extra expense, how it will be delivered and whether it needs to be delivered in a specialist fashion or on a community scale. The

additional costs associated with aquatic-based therapy may always dissuade its use due to continued strain placed on health budgets,⁽⁴⁴⁾ but more research is required to provide backing for this type of exercise treatment.

Aquatic-based therapy has been found to improve symptoms, increase functional capacity and improve general well-being of OA patients in the majority of studies. The problem is the lack of consistency among results, particularly when comparing aquatic-based therapy with land-based therapy. Future research needs to identify which exercises are the most effective, then implement them with aquatic-based therapy in order to see the benefits for OA patients, and then compare them to conventional land-based therapy to see if the extra cost would reap rewards for patient and doctor alike.

To contact Arthritis Research UK:

Donna Hearnshaw, Engagement and Education Coordinator,
d.hearnshaw@arthritisresearchuk.org

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