

Knee Osteoarthritis (OA) is the degenerative disease of the articular cartilage of the knee leading to bone on bone irritation that causes symptoms such as inflammation, swelling, stiffness and pain. (David Dugdale, 2014). The knee is a common place for OA to occur as it is a weight bearing joint on the end of two long levers and is often exposed to shear force through daily activity such as walking and squatting.

Exercise-based rehabilitation programs have long been considered the cornerstone in conservative management of knee OA and have been praised for their ability to reduce inflammation, address factors that predispose a patient to knee OA and improve overall health status. (Page, Hinman & Bennell, p. 145, 2011). Predisposing factors addressed in exercise programs include being overweight, having a history of repetitive joint use such as an athlete, having a previous knee injury and having poor alignment of the knee such as a valgus or varus positioning. (Fernandes, p. 1125, 2015). Current protocol includes strengthening and aerobic exercise individualized to the patient along with education on lifestyle and promotion of a healthy exercise regime, diet and pacing initiative for everyday activities. (Page, Hinmann & Bennell, p. 146, 2011).

Meta-analyses and systematic reviews have provided the evidence-based foundation of knee OA exercise protocols adopted today, however, reviewing these findings and implementing the most recent knowledge is imperative in improving the health and wellbeing of each individual sufferer of knee OA. For the critical analysis of the current literature on knee OA exercise programs, databases searched included Cochrane Libraries, EBSCO, PubMed and Google Scholar. Systematic reviews of exercise programs were analysed and articles inclusive of knee OA and exercise-based therapy were hand selected for review.

Many studies have focussed on knee OA as it is the most common form of OA. In collection of recent systematic reviews and meta-analysis, the amount of exemplary studies supporting land-based knee OA exercises, specific muscle strengthening exercises, proprioceptive activities with stress on specifying a program to an individual's own body imbalance is clearly signified.

Bennell & Hinman (p. 6, 2011) collate the current evidence for exercise base therapy as being the most effective component in conservative management of knee OA. The main benefits cited from exercise therapy in knee OA include pain reduction, physical function improvement and optimised participation in social, domestic, occupational and recreational pursuits. (Bennell & Hinman, p.7, 2011). Muscle strengthening has been quoted in the literature as a key component to addressing pain, loss of function and range of motion in knee OA. Land-based exercise was been consistently shown in the literature to decrease pain and increase physical function. (Frasen & McConnell, p. 1, 2009). In this, it was also stated that increased supervision or group-classes of land-based exercise correlated with overall efficacy. (Frasen & McConnell, p.2, 2009). Supervision significantly improved results across a range of specific muscle strengthening exercises, those varying from simple quadriceps muscle strengthening programs to truncal muscle strengthening, balance co-ordination and lower limb strength training. (Bennell & Hinman, p.7, 2011). Clinical trials of strengthening exercise have spanned isometric, isotonic, isokinetic, concentric, concentric/eccentric and dynamic modalities. (Bennell & Hinman, p.8, 2011). Specific muscle strengthening exercise has been shown to improves strength, pain and physical function through creating muscle balance that in turn assists co-ordination and normalises motions. (Bennell & Hinman, p.8, 2011). In conjunction with this, aerobic fitness is also highlighted as important in increasing activity level. A recent randomised

control trial found that knee OA test subjects undertaking a warm up exercise consisting of 10 minutes on an ergonomic reclined bike at moderate intensity compared to a control group without showed significant improvement in pain reduction and overall opinion on level of disability from knee OA. (Henriksen, Klokke, Graven-Nielson, Bartholdy, Schjodt, Jorgenson, Bandak, Danneskiold-samsøe, Christensen & Bliddal, 2014). In accounting for aerobic exercise, 12 trials reviewed revealed land-based exercise on reclining bikes or incremental walking produced reduced joint tenderness, increased respiratory capacity and function status. (Bennell & Hinman, p.8, 2011).

In the case of aquatic aerobic exercise and strength based training, little robust and valid evidence from clinical trials supports its efficacy when compared to the immense positive results seen in land-based exercise. It is however implicated as an effective modality for initial use in strength and aerobic exercise as studies show it is beneficial in reducing exercise induced joint pain. (Hinman, Nicolson, Dobson & Bennell, 2015). Another review that collated 40 random control trials found evidence that supports this finding, stating non-weight bearing exercise both aerobically and strength targeted has shown better results in reducing pain in the short term or initial stages of knee OA rehabilitation. (Tanaka, Osawa, Kito & Moriyama, 2015). The findings of this systematic review also stated that weight-bearing exercise with or without muscle strengthening is effective in reducing pain. (Tanaka et al., 2015).

Despite surmounting evidence of individual benefits of each type of exercise, there is still no clear indication over what exercise is the gold standard treatment for knee OA. It is suggested that reviewing a patient as an individual is the best way of prescribing a specific exercise program. (Bennell & Hinman, 2011). This involved examining the patients physical form, as well as taking into account their level of motivation and access to equipment, for example, evidence in hydrotherapy is limited because many patients are unwilling to commit financially, are fearful of water or don't have the means to access facilities. (Bennell & Hinmann, 2011).

In review of the aforementioned exercise modalities and prescription considerations, a general outline for exercise prescription from clinical evidence of the current literature can be seen in appendix 1.

These principles are mirrored in the current EULAR (The European League Against Rheumatism) and extended upon in a more exhaustive protocol that draws upon lifestyle factors that influence knee OA and its disabling features. This includes an element of activity pacing, education on diet and exercise, use of appropriate footwear and the implications for use of assistive technology such as walking aids and grip apparatus'. (Fernandes et al, 2015). The EULAR protocol can be seen in appendix 2.

In reviewing the current literature of efficacy of exercise prescription for rehabilitation and pain management specific to knee OA it has been established that there is a vast array of encouraging clinical evidence. The findings of many Cochrane reviewed RCT's suggests the validity of these findings are significant, whilst numerous peer-reviewed journals solidify this clinical knowledge. From this evidence, exercise therapy is acknowledged and solidified as a key pillar in the conservative management of knee OA.

Appendix 1.

Summary of evidence-based recommendations for exercise in knee and hip OA based on Roddy et al.²⁶.

Proposition

Both strengthening and aerobic exercise can reduce pain and improve function and health status

There are few contraindications to prescription of exercise

Prescription of both general (aerobic fitness training) and local (strengthening) exercises is recommended

Exercise therapy should be individualized and patient-centred taking into account factors such as age, co-morbidity and overall mobility

To be effective, exercise programs should include advice and education to promote a positive lifestyle change with an increase in physical activity

Group exercise and home exercise are equally effective and patient preference should be considered

Adherence is the principle predictor of long-term outcome from exercise

Strategies to improve and maintain adherence should be adopted

Effectiveness of exercise is independent of presence or severity of X-ray findings

General guidelines for training parameters in people with OA pain, as developed by the American Geriatrics Society.³⁰

| Exercise type | Intensity | Volume | Frequency |
|--|---|---|------------|
| Flexibility: static stretching initially | Stretch to subjective sensation of resistance | 1 stretch/muscle group; hold 5–15 s | Once daily |
| Flexibility: longer term goal | Stretch to full range of motion | 3–5 stretches/muscle group; hold 20–30 s | 3–5/week |
| Strengthening: isometric | Low-moderate: 40–60% MVC | 1–10 submax contractions/muscle group; hold 1–6 s | Daily |
| Strengthening: isotonic | Low: 40% 1 RM | 10–15 reps | 2–3/week |
| | Mod: 40–60% 1 RM | 8–10 reps | |
| | High: >60% 1 RM | 6–8 reps | |
| Aerobic | Low–mod: 40–60% of VO ₂ max/HRmax RPE: 12–14 = 60–65% VO ₂ max | Accumulation of 20–30 min/day | 2–5/week |

1 RM = one repetition maximum; MVC = maximal voluntary contraction; RPE = rating of perceived exertion; HRmax = age-predicted heart rate maximum; VO₂ max = maximal aerobic capacity.

(Bennell & Hinman, p. 7-6, 2011).

Appendix 2.

EULAR recommendations for the non-pharmacological core management of hip and knee OA

Recommendation

1. In people with hip or knee OA, initial assessments should use a biopsychosocial approach including:
 - A) physical status (including pain; fatigue; sleep quality; lower limb joint status (foot, knee, hip); mobility; strength; joint alignment; proprioception and posture; comorbidities; weight
 - B) activities of daily living
 - C) participation (work/education, leisure, social roles)
 - D) mood
 - E) health education needs, health beliefs and motivation to self-manage
2. Treatment of hip and/or knee OA should be individualised according to the wishes and expectations of the individual, localisation of OA, risk factors (such as age, sex, comorbidity, obesity and adverse mechanical factors), presence of inflammation, severity of structural change, level of pain and restriction of daily activities, societal participation and quality of life
3. All people with knee/hip OA should receive an individualised management plan (a package of care) that includes the core non-pharmacological approaches, specifically:
 - A) information and education regarding OA
 - B) addressing maintenance and pacing of activity
 - C) addressing a regular individualised exercise regimen
 - D) addressing weight loss if overweight or obese
 - E) reduction of adverse mechanical factors (eg., appropriate footwear)
 - F) consideration of walking aids and assistive technology
4. When lifestyle changes are recommended, people with hip or knee OA should receive an individually tailored programme, including long-term and short-term goals, intervention or action plans, and regular evaluation and follow-up with possibilities for adjustment of the programme.
5. To be effective, information and education for the person with hip or knee OA should:
 - 1a, mixed 8.4 (7.7 to 9.1)
 - A) be individualised according to the person's illness perceptions and educational capability
 - B) be included in every aspect of management
 - C) specifically address the nature of OA (a repair process triggered by a range of insults), its causes (especially those pertaining to the individual), its consequences and prognosis
 - D) be reinforced and developed at subsequent clinical encounters;
 - E) be supported by written and/or other types of information (eg, DVD, website, group meeting) selected by the individual
 - F) include partners or carers of the individual, if appropriate.
6. The mode of delivery of exercise education (eg, individual 1 : 1 sessions, group classes, etc) and use of pools or other facilities should be selected according both to the preference of the person with hip or knee OA and local
 - A) 'small amounts often' (pacing, as with other activities)
 - B) linking exercise regimens to other daily activities (eg, just before morning shower or meals) so they become part of lifestyle rather than additional events
 - C) starting with levels of exercise that are within the individual's capability, but building up the 'dose' sensibly over several months
7. People with hip and/or knee OA should be taught a regular individualised (daily) exercise regimen that includes: overall exercise:
 - A) a strengthening (sustained isometric) exercise for both legs, including the quadriceps and proximal hip girdle muscles (irrespective of site or number of large joints affected)
 - B) aerobic activity and exercise
 - C) adjunctive range of movement/stretching exercisesAlthough initial instruction is required, the aim is for people with hip or knee OA to learn to undertake these regularly on their own in their own environment

8. Education on weight loss should incorporate individualised strategies that are recognised to effect successful weight loss and maintenance*—for example:
A) regular self-monitoring, recording monthly weight
B) regular support meetings to review/discuss progress
C) increase physical activity
D) follow a structured meal plan that starts with breakfast
E) reduce fat (especially saturated) intake; reduce sugar; limit salt; increase intake of fruit and vegetables (at least '5 portions' a day)
F) limit portion size;
G) addressing eating behaviours and triggers to eating (eg, stress)
H) nutrition education
I) relapse prediction and management (eg, with alternative coping strategies)

9 .
A) The use of appropriate and comfortable shoes is recommended.
B) Recommendation rejected: a lateral-wedged insole could reduce symptoms in medial knee pain.

10 Walking aids, assistive technology and adaptations at home and/or at work should be considered, to reduce pain and increase participation—for example:
A) a walking stick used on the contralateral side, walking frames and wheeled 'walkers'
B) increasing the height of chairs, beds and toilet seats
C) hand-rails for stairs
D) replacement of a bath with a walk-in shower
E) change to car with high seat level, easy access and automatic gear change

11. People with hip or knee OA at risk of work disability or who want to start/return to work should have rapid access to vocational rehabilitation, including counselling about modifiable work-related factors such as altering work behaviour, changing work tasks or altering work hours, use of assistive technology, workplace modification, commuting to/from work and support from management, colleagues and family towards employment.

(Fernandes et al., p.1131, 2015).

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