Rehabilitation in osteoarthritis

Osteoarthritis is a major public health problem. In addition to pharmacological and surgical therapies, nonpharmacological therapies, including, but not restricted to, education and self-management, regular telephone contact, referral to a physical therapist, aerobic, muscle strengthening and water-based exercises, weight reduction, walking aids, knee braces, footwear and insoles, thermal modalities, and transcutaneous electrical nerve stimulation or acupuncture, are of primary importance in the management of osteoarthritis. The objective of this article is to review basic and current concepts of nonpharmacological management of osteoarthritis, with a special focus on exercise intervention.

KEYWORDS: exercise physical therapy ▪ nonpharmacological treatment ▪ osteoarthritis ▪ rehabilitation

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Osteoarthritis (OA) is a chronic disease characterized mainly by complex, multifactorial joint degeneration [1]. The prevalence of OA increases with age and eventually leads to joint stiffness, progressive deformity and functional impairment, which, in turn, negatively affect the individual's quality of life [2,3]. The two most affected locations for pain and physical disability in adults are the hips and the knees. Owing to its worldwide prevalence, OA represents a huge burden for both individuals and public health resources [4].

Treatment of OA of the knee and the hip is directed towards reducing joint pain and stiffness, maintaining and improving joint mobility, reducing physical disability and handicap, improving health-related quality of life, limiting the progression of joint damage, and educating patients regarding the nature of the disorder and its management [5,6]. More than 50 modalities of nonpharmacological, pharmacological and surgical therapy for knee and hip OA are described in the medical literature.

The objective of this article is to review basic concepts and recommendations of rehabilitation in patients with OA, with a special focus on exercise intervention.

Current guidelines & recommendations

Over the last decade, several scientific societies have produced guidelines for the management of hip, knee and hand OA to improve quality and effectiveness of patient care [5,7–10].

The last Osteoarthritis Research Society International (OARSI) guidelines recommend a combination of nonpharmacological and pharmacological modalities of therapy for the optimal management of patients with hip or knee OA [5,7]. Recommendations cover the use of 12 nonpharmacological modalities: education and self-management, regular telephone contact, referral to a physical therapist, aerobic, muscle strengthening and water-based exercise, weight reduction, walking aids, knee braces, footwear and insoles, thermal modalities, and transcutaneous electrical nerve stimulation or acupuncture.

The European League Against Rheumatism (EULAR) guidelines also recommend the combination of nonpharmacological and pharmacological treatment modalities for an optimal management of hip or knee OA [8,9]. These guidelines state that nonpharmacological treatment of hip or knee OA should include regular education, exercise, appliances (e.g., sticks and insoles) and weight reduction.

The Ottawa Panel found evidence to recommend and support the use of therapeutic exercises (on their own or combined with manual therapy), especially strengthening exercises and general physical activity, for patients with OA; particularly for the management of pain and improvement of functional status [11]. However, these recommendations are limited by methodological considerations.

At the level of the hip, the American Physical Therapy Association recommends the use of patient education to teach appropriate activity modification, exercise and weight reduction in overweight patients [10]. They also advise functional, gait and balance training, as well as manual therapy procedures. Finally, they

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recommend the use of flexibility, strengthening and endurance exercises in patient with hip OA.

In practice, the application of these recommendations is quite difficult. To determine how French general practitioners prescribe nonpharmacological modalities of OA treatment in daily practice, a four-point questionnaire (systematically, frequently, rarely, never) was developed [12]. The questionnaire was given to 3000 general practitioners. Weight reduction recommendations (76%), joint sparing (71.7%), physical activity development (61.7%), rehabilitation (57.8%) and self-exercise (46%) were the more frequently prescribed nonpharmacological modalities. Sticks (36%), insoles (35.6%), bed relief (25.4%) and knee bracing (10.5%) were far less regularly proposed. The main recommended physical activities were walking (84.3%), swimming (74.3%), cycling (47%) and water gymnastics (40.4%). Finally, 68.4% of general practitioners recommended a systematic analgesic consumption, while a nonsteroidal anti-inflammatory drug prescription was proposed by only 30.5% and nonsteroidal anti-inflammatory drug treatment, before or after physical activities, by 19 and 9.3%, respectively.

From the physical therapist's point of view, 99% of those in a UK survey stated that they would use therapeutic exercise for the OA patient population, with strengthening exercises being favored over aerobic exercises [13]. Although nearly all physical therapists would monitor exercise adherence, only 12% would use an exercise diary. A total of 76% of physical therapists would provide up to five treatment sessions, and only 34% would offer physical therapy follow-up after discharge. However, another survey in the UK, among physical therapists, highlighted uncertainty regarding potential benefits of exercise for knee OA: only 56% largely/totally agreed that knee problems due to OA are improved by local exercise [14].

Systematic reviews & meta-analyses of rehabilitation approaches to OA

Some systematic reviews and meta-analyses on the effectiveness of various nonpharmacological therapies for patients with OA have been published. The most frequent systematic reviews have been performed on exercise therapy.

For patients with knee OA, the last Cochrane review, which includes 62 trials, showed that physical exercises have beneficial effects, with a standardized mean difference of 0.40 (95% CI: 0.30–0.50) on pain and 0.37 (95% CI: 0.25–0.49) on physical function [15]. There were marked variabilities across the included studies in participants' characteristics, symptom duration, intervention assessments and study methodology. The authors concluded that the magnitude of the treatment effect was small, but comparable to estimates reported for nonsteroidal anti-inflammatory drug treatments. In another meta-analysis, with a special focus on land-based exercises and including 32 studies, the results showed a standardized mean difference of 0.40 (95% CI: 0.30–0.50) for knee pain and 0.37 (95% CI: 0.25–0.49) for physical function [16]. Interestingly, the mode of the treatment delivery (individual treatments, exercise classes, home programs) was not significantly associated with the magnitude of the treatment benefit. However, the magnitude of the treatment effect was significantly associated with the number of directly supervised occasions provided and study methodology (assessor blinding, adequate allocation concealment). Among other nonpharmacological modalities, a very recent Cochrane review suggests that therapeutic ultrasound may be beneficial for patients with knee OA [17]. However, owing to the low quality of the evidence, the authors are uncertain regarding the magnitude of the effects on pain and function. Electrical stimulation therapy may provide significant improvements for knee OA, as reviewed by the Cochrane group in 2002, but further studies are required to confirm whether the statistically significant results shown in these trials will translate to important clinical benefits [18]. Another Cochrane review showed that a brace and a lateral wedge insole could have small beneficial effects, but the heterogeneity was high among the studies [19]. For the transcutaneous electrostimulation, the Cochrane review showed that it is not effective for pain relief [20]. However, the systematic review is generally inconclusive, hampered by the inclusion of only small trials of questionable quality. Finally, an overview of systematic reviews, published in 2007, including 23 systematic reviews on physical therapy interventions for patients with knee OA, showed that there is high-quality evidence that exercise and weight reduction reduce pain and improve physical function in patients with OA of the knee [21]. There is moderate-quality evidence that transcutaneous electrostimulation reduces pain and that psychoeducational interventions improve psychological outcomes. For other interventions and outcomes, the quality of evidence is low or nonexistent in systematic reviews.

At the level of the hip, the Cochrane review, combining the results of five randomized control trials, demonstrated a small treatment effect of exercise therapy on pain, but no benefit in terms of improved self-reported physical function [22]. Obviously, the limited number and the small sample size of the randomized controlled trials restrict the reliability that can be attributed to these results. However, another meta-analysis, including nine trials, showed a beneficial effect of exercise on pain with an effect size of -0.38 (95% CI from -0.68 to -0.08; p = 0.01), but with a high heterogeneity among trials [23] caused by one trial consisting of an exercise intervention that was not administered in person. Removing this study left eight trials (n = 493) with similar exercise strategies (specialized hands-on exercise training, all of which included at least some elements of muscle strengthening), and demonstrated exercise benefits with an effect size of -0.46 (95% CI from -0.64 to -0.28; p < 0.0001).

Future perspective & current debates on the concept of rehabilitation

Nonpharmacological management of OA, especially with exercise, has been shown to be effective in eliciting small-to-moderate significant improvements on quality of life, joint function, muscle power, strength and functional performance in OA subjects. However, the optimal training modalities required are still debated and need further research.

Physical exercise: should it be supervised by a physical therapist?

Two well-designed studies describe a comparison of directed and undirected programs of physical exercise. McCarthy *et al.* compared the effects of a home-based program of exercises with an 8-week program directed by a physiotherapist and associated with a home-based exercise program [24]. The directed exercise group had a significantly better SF-36® score at 2 and 6 months than the nondirected exercise group, but not at 12 months, except for the pain sub-scale score. Deyle *et al.* compared the effectiveness of treatment in knee OA of some supervised exercises and techniques of manual therapy with a home-based program of exercises [25]. The two groups showed significant improvement in Western Ontario and McMaster University Arthritis Index (WOMAC) score (pain and physical function) at 4 weeks. At 1 year, both groups still showed significant improvement from baseline scores without differences between groups. Satisfaction at 1 year was significantly better in the supervised exercise group. This group also used fewer analgesics.

It should also be pointed out that physiotherapists could also, besides the supervision of exercises, provide payients with or direct them to other physical therapy interventions for OA, which could include joint mobilization, physical modalities (e.g., heat, cold, electrical stimulation and ultrasound), gait training, and the combination of these interventions with behavioral strategies and patient education [26]. The interest of supervised exercises combined with physical therapy modalities has not yet been fully investigated.

Should we take into account muscle strength & proprioception?

Some studies have reported that patients with knee OA are 20–40% weaker in relative quadriceps strength compared with control subjects [19–21]. However, fewer data are available regarding the strength of other lower-limb muscles in OA. Different factors contribute to the reduction of muscle strength in OA [27], such as muscle fiber atrophy, reduced ability to activate muscle fibers, pain or kinesiophobia. The reduction of muscle strength in OA is associated with the reduction of muscle cross-sectional area [28]. Some evidence suggest that quadriceps weakness precedes the onset of knee OA and, thus, could increase the risk of disease development, particularly in women [27]. Proprioception is essential for the coordinated activity of muscles. Some studies have reported a link between proprioception impairment and physical function or pain [25–28]. However, other researches have failed to establish a link between proprioception and function [28–30]. Moreover, researches indicate that muscle strength can be improved by means of a strengthening program (supervised programs or home exercise programs) in people with knee OA [30]. Many studies have focused on the quadriceps muscle [31–34], but an improvement of hamstrings and hip muscles after exercise has also been reported [35–38]. The magnitude of strength progression was influenced by the mode of training and patient compliance.

A randomized study reported significant improvements in proprioception following an exercise program [39] but, interestingly, another randomized study demonstrated that the addition of kinesthesia and balance exercises to a strengthening program did not offer any additional improvement in proprioception capacity beyond that offered by a strengthening program alone [31]. A meta-analysis reported no evidence

that the type of strengthening exercise (isometric, isotonic or isokinetic) influences the outcome [30]. It is likely that the magnitude of the load, pattern of loading throughout the range-of-motion exercise and volume mechanical work performed are more important for increasing strength than the resistance apparatus on which exercise is performed [27].

What is the optimal intensity, frequency & duration of the exercise program?

The intensity, frequency and duration of the exercise program may modify outcomes, but the literature is unclear and insufficiently documented. Different studies have reported improvements after 8- or 12-week programs in patients with knee OA. High-intensity training might result in greater strength gains than low-intensity training but could potentially overload the joint and exacerbate symptoms such as pain and swelling [27]. An interesting study compared the effects of 8 weeks of high- and low-intensity knee strengthening exercise on 102 subjects with knee OA. The two groups performed a similar overall volume of mechanical work. Authors reported that both strengthening programs were beneficial for muscle strength, function, pain and walking time. The effect sizes were larger for high-resistance strength training but were not significantly different overall.

Weight-bearing versus nonweight-bearing exercise

A recent meta-analysis showed that land-based therapeutic exercise has at least short-term benefit in reducing knee pain and improving physical function in patients with knee OA [16]. However, it is unclear which modalities (i.e., weight-bearing vs nonweight-bearing) are most effective. A study by Jan *et al.* found that simple weight-bearing exercise (WBE) and non-WBE, performed over 8 weeks, improved function, pain and knee strength, compared with no exercise [32]. This demonstrates that easy-to-perform exercise can benefit patients with OA. WBE had few additional benefits over non-WBE, suggesting that both types of exercise are effective. However, compliance to therapy was high in this randomized control trial and could be quite different in clinical practice. A combination of WBE and non-WBE would increase the diversity of therapy and possibly improve compliance [33]. The long-term benefits of both WBE and non-WBE are unknown. From a practical perspective, the key point is that exercise is effective in knee OA, whatever the modality.

What is the added value of integrated rehabilitation programs?

Besides exercise therapy, education/self-management interventions (SMIs) can be useful for patients with OA [34]. SMIs help people understand and cope with their condition, minimize its effects, and adopt healthy lifestyles and behaviors. The content of SMIs varies but generally includes advice and education about healthy lifestyles (regular exercise/physical activity, healthy eating and weight control), simple pain management techniques, joint protection, problem solving and planning skills. Exercise and SMIs are frequently delivered separately. Many SMIs describe the benefits of exercise and encourage exercise but do not have a participatory exercise component, whereas the patient education element of exercise regimens focuses solely on getting people to exercise rather than wider aspects of self-management. Theoretically, the individual effects of exercise and SMIs might be additive, so programs combining exercise with SMI could maximize the benefits from both physical and educational approaches [34]. However, few people will benefit if this produces complex, unworkable rehabilitation programs [35]. More simple, effective and efficient interventions that improve functioning and can be delivered to a large number of people are needed [36].

How important is adherence to therapy?

Exercise and physical activity require the active participation of patients and, as such, their effects are proportional to the patient's level of adherence. Indeed, patient compliance is a relevant factor in determining outcome from exercise therapy [27]. Several studies have shown significant differences in outcome response after an exercise program based on the number of completed sessions. The literature demonstrates that adherence to short-term supervised exercise programs, defined as programs that last anywhere from 1 to 12 months, ranges from 68 to 93% [26]. Long-term rates of adherence to exercises that require more extensive lifestyle changes are lower, in the range of 25–50%. With advancing age, adherence to exercise diminishes and is lower still among older adults with arthritis [26].

To improve adherence, the French Society for Physical and Rehabilitation Therapy (SOFMER), has provided clinical practice guidelines based on a systematic literature review, a practice survey and a validation by a multidisciplinary panel of experts. They state that, regardless of the type of exercise, the program

should be tailored to exercise capacity and pain level. Patient adherence can be improved by explaining the expected results to the patient, asking the patient to keep a self-evaluation diary, conducting long-term evaluations (by phone or mail), and providing follow-up visits. Interestingly, patient selection could also be of primary importance to improve adherence as exercise programs are more likely to succeed in specific groups of subjects. For example, it has been suggested, from a prospective cohort study, that absence of depressive symptoms, female gender, a history of complementary medicine and low co-morbidity were the most stable predictors of a successful response to rehabilitation interventions [37].

Finally, a survey among physical therapists in the UK showed that, although exercise adherence was deemed important, it was seen as the patient's, not the therapist's, responsibility [14].

Individual or collective group exercise?

Adherence to group exercises could be better than with individual exercises because with the former meetings are regular, which could improve motivation. However, according to clinical practice guidelines, the superiority of collective over individual exercises is not proven [38].

Conclusion & future perspective

Nonpharmacological management of OA is important and should be combined with pharmacological treatment. Future studies seem necessary to investigate optimal training modalities (e.g., volume, duration, type and combination) required to reach significant improvements of quality of life, joint function, muscle power, strength and functional performance in OA subjects. The combination and the potential added value of pharmacological and nonpharmacological treatment need to be better investigated.

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Executive summary

Current guidelines & recommendations

- All current guidelines recommend a combination of nonpharmacological and pharmacological modalities of therapy for the optimal management of patients with hip or knee osteoarthritis.
- In practice, the application of these recommendations is quite difficult.

Evidence-based approach of rehabilitation

- Physical exercises have beneficial effects on pain and physical function.
- For other nonpharmacological modalities, such as education and self-management, regular telephone contact, referral to a physical therapist, aerobic, muscle strengthening and water-based exercises, weight reduction, walking aids, knee braces, footwear and insoles, thermal modalities, and transcutaneous electrical nerve stimulation and acupuncture, the quality of the evidence is, at best, modest.

Optimal training modalities required

- The optimal intensity, frequency and duration of the exercise program are still debated. However, exercises seem effective in knee osteoarthritis, whatever the modality.
- Adherence to nonpharmacological treatment, especially exercise, is necessary.

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