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Review

Which is the Best Physical Treatment for Osteoarthritis?

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Abstract: Osteoarthritis (OA) is a degenerative disease of the articular cartilage, and it represents one of the most common causes of disability in the world. It leads to social, psychological and economic costs with financial consequences. Different OA treatments are usually considered in relation to the stage of the disease, such as surgical management, pharmacologic and non-pharmacologic treatments. In relation to mild OA, non-pharmacologic and behavioral treatments are recommended because they are less invasive and better tolerated by patients. All of these treatments used to manage OA are problematic, but solutions to these problems are on the horizon. For this reason, we decided to realize this report because until today, there has been very little information regarding the physical treatment of this important disease to help medical doctors and patients in the choice of the best adapted training to manage pain and disability limitations in patients with OA. The aim of this review is to find some answer in the management of OA through physical therapy treatment. In the present review, we analyze data from the most recent literature in relation to the effects of physical exercise on mild OA. All data suggest that training exercise is considered an effective instruments for the treatment of mild OA. The literature search was conducted on PubMed, using appropriate keywords in relation to exercise and osteoarthritis.

Keywords: osteoarthritis; anaerobic training; aerobic training; flexibility training; aquatic training

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1. Introduction

Osteoarthritis (OA) is a very common musculoskeletal disease all over the world that leads to functional decline and loss in quality of life. Clinically, OA is characterized by joint pain, stiffness and limitation of movement with occasional effusion and variable degrees of local inflammation [1]. Pain in OA is the result of the interplay between structural change and peripheral and central pain processing mechanisms [1]. Understanding the influence of both biological and psychosocial factors in OA is nowadays considered in the assessment and treatment of the disease [1]. A recent study highlighted that pain related to OA should be considered and interpreted in accordance with the patient's psychological status [1,2]. Pain is connected with functions; in fact, the physical movements trigger pain, and in turn, pain causes limitations in physical function [1,3]. OA causes changes in mobility and function, and patients frequently experience physical limitations, difficulties with personal care, work ability and even problems with maintaining their household [1,4]. Histopathologically, OA is a degenerative disease of the articular cartilage associated with hypertrophic bone changes [5–9]. Hyaline cartilage is the typical tissue of the joints, whose optimal homeostasis is essential for the proper functioning of the joints in the body movement. It has an abundant extracellular matrix, mainly composed of collagen type II and the proteoglycan aggrecan, responsible for the viscoelastic and compressive properties of joint cartilage [10–13]. Healthy joint cartilage has a smooth surface, is not vascularized and innervated, so nutrients and signal molecules can reach chondrocytes by diffusion thanks to the high level of hydration of the extracellular matrix. Because cartilage is not vascularized, it has limited capacities for self-regeneration, and when this occurs, the repaired articular cartilage shows reduced mechanical capacities compared to healthy cartilage [14]. As a consequence, only small defects can be repaired by regeneration of articular hyaline cartilage; when wider defects occur, these exceed the repair capacity, and the damage can become permanent [15]. OA is evidence of this condition. OA is due to an imbalance between anabolic and catabolic processes in the cartilage tissue, and it is characterized by a loss of the structure and functionality of articular cartilage; OA progresses when cartilage degradation exceeds reparative processes [15–17]. OA is histologically characterized by changes in the cellular structure of chondrocytes and a loss of proteoglycans [16,18]. Other histological features of OA are related to the synovial membrane that shows cell hyperplasia, thickening, infiltration of inflammatory cells and fibrosis [17,18]. In advanced stages of the disease, the cartilage shows signs of complete rupture [19], so that hyaline cartilage is replaced by fibrocartilaginous, scar-like tissue with fibroblast-like cells [20]. The extent of damage to the articular cartilage depends on the joint area, which can be explained by different loading conditions in distinct regions [21]. The severity of OA is usually graded through different radiographic and/or histomorphometric scores. The Kellgren and Lawrence system provides a score of severity from zero to four: Grade 0, no radiographic features of OA are present; Grade 1, doubtful joint space narrowing (JSN) and possible osteophytic lipping; Grade 2, definite osteophytes and possible JSN on anteroposterior weight-bearing radiograph; Grade 3, multiple osteophytes, definite JSN, sclerosis, possible bony deformity; Grade 4, large osteophytes, marked JSN, severe sclerosis and definite bony deformity [22]. The Kraus' modified Mankin score provides grades from zero to four: Grade 0, normal cartilage; Grade 1, minimal articular damage; Grade 2, articular cartilage damage affecting up to 30% of the articular surface; Grade 3, loss of up to 50% of the articular cartilage; Grade 4, severe loss of cartilage affecting more than 50% of the articular surface [23,24]. The histopathology Osteoarthritis Research Society (OARSI) system provides grades from zero to six: Grade 0, normal articular cartilage; Grade 1, intact surface; Grade 2, surface discontinuity; Grade 3, vertical fissures extending into the mid-zone; Grade 4, erosion; Grade 5, denudation; Grade 6, deformation [25,26]. The rate of progression is related to species and joint localization. Because OA is due to an imbalance between anabolic and catabolic processes in the cartilage tissue, preventive and therapeutic interventions are necessary to improve the regeneration capacities [5,14]. OA treatments differ in relation to the stage of the disease: surgical, pharmacologic, non-pharmacologic and complementary and alternative [6,11,12]. Usually, surgical management is practiced in more severe cases of OA characterized by total loss of mechanical function and excessive pain [6]. Pharmacologic treatment is very common and widespread in most OA cases. Because drugs used in pharmacologic treatment, such as topical analgesics, opioid and non-opioid analgesics, non-steroidal anti-inflammatory drugs, intra-articular steroid and hyaluronic acid injections [27], have often gastrointestinal side effects, non-pharmacologic and behavioral treatments are recommended in the treatment of mild OA (Grade 2). Among all of the above-mentioned treatments, in the present review, we are interested in considering physical exercise as a healthy instrument in the treatment of mild OA to mitigate symptoms and to avoid its progress in the most severe forms. All data suggest that physical exercise is an effective, economic and accessible tool for everyone in OA treatment. Our aim is to find some answer in the management of OA through physical therapy treatment.

2. Materials and Methods

In the present review, we analyzed articles from the recent literature reporting physical treatment as a therapeutic approach for mild OA. We carried out our literature search on PubMed considering the last fifteen years (from 2000 to 2015), and we used 4 sets of key words: (1) endurance training and osteoarthritis; (2) strength training and osteoarthritis; (3) flexibility exercise and osteoarthritis; (4) aquatic exercise and osteoarthritis. Subsequently, our analysis of the selected articles was divided into "anaerobic training", "aerobic training", "flexibility exercise" and "aquatic exercise", to give to the interested readers a schematic overview of the most common and best physical treatments for mild

OA (Table 1). From the literature search, we found approximately 169 papers (clinical trials, narrative and systematic reviews), and we chose only 97 papers considered appropriate for the aim of the review. The other papers, related to the used keywords, have been dismissed as considered outside the scope of the research.

Table 1. Papers considered in the analysis for the different therapy types.

Anaerobic Training
Jiménez, S.C.E.; Fernández, G.R.; Zurita, O.F.; Linares, G.D.; Farías, M.A. *Rev. Med. Chil.* **2014**, *142*, 436–442.
Ageberg, E.; Nilsdotter, A.; Kosek, E.; Roos, E.M. *BMC Musculoskelet. Disord.* **2013**, *14*, 232.
Anwer, S.; Equebal, A.; Nezamuddin, M.; Kumar, R.; Lenka, P.K. *Ann. Phys. Rehabil. Med.* **2013**, *56*, 434–442.
McKnight, P.E.; Kasle, S.; Going, S.; Villanueva, I.; Cornett, M.; Farr, J.; Wright, J.; Streeter, C.; Zautra, A. *Arthritis Care Res. (Hoboken)* **2010**, *62*, 45–53.
Knoop, J.; Dekker, J.; van der Leeden, M.; van der Esch, M.; Thorstensson, C.A.; Gerritsen, M.; Voorneman, R.E.; Peter, W.F.; de Rooij, M.; Romviel, S.; Lems, W.F.; Roorda, L.D.; Steultjens, M.P. *Osteoarthr. Cartil.* **2013**, *21*, 1025–1034.
Burrows, N.J.; Booth, J.; Sturnieks, D.L.; Barry, B.K. *Osteoarthr. Cartil.* **2014**, *22*, 407–414.
Messier, S.P.; Mihalko, S.L.; Beavers, D.P.; Nicklas, B.J.; deVita, P.; Carr, J.J.; Hunter, D.J.; Williamson, J.D.; Bennell, K.L.; Guermazi, A.; *et al. BMC Musculoskelet. Disord.* **2013**, *14*, 208.
Vincent, K.R.; Vincent, H.K. *PMR.* **2012**, *4*, S45–S52.
Foroughi, N.; Smith, R.M.; Lange, A.K.; Baker, M.K.; Fiatarone Singh, M.A.; Vanwanseele, B. *Clin. Biomech. (Bristol, Avon)* **2011**, *26*, 167–174.
Jan, M.H.; Lin, J.J.; Liau, J.J.; Lin, Y.F.; Lin, D.H. *Phys. Ther.* **2008**, *88*, 427–436.
Aerobic Training
Penninx, B.W.; Rejeski, W.J.; Pandya, J.; Miller, M.E.; di Bari, M.; Applegate, W.B.; Pahor, M. *J. Gerontol. B Psychol. Sci. Soc. Sci.* **2002**, *57*, 124–132.
Messier, S.P.; Loeser, R.F.; Miller, G.D.; Morgan, T.M.; Rejeski, W.J.; Sevick, M.A.; Ettinger, W.H., Jr.; Pahor, M.; Williamson, J.D. *Arthritis Rheum.* **2004**, *50*, 1501–1510.
Cochrane, T.; Davey, R.C.; Matthes Edwards, S.M. *Health Technol. Assess.* **2005**, *9*, 1–114.
Fransen, M.; Nairn, L.; Winstanley, J.; Lam, P.; Edmonds, J. *Arthritis Rheum.* **2007**, *57*, 407–414.
Semanik, P.A.; Chang, R.W.; Dunlop, D.D. *PMR.* **2012**, *4*, S37–S44.
Messier, S.P.; Royer, T.D.; Craven, T.E.; O'Toole, M.L.; Burns, R.; Ettinger, W.H., Jr. *J. Am. Geriatr. Soc.* **2000**, *48*, 131–138.
Mangani, I.; Cesari, M.; Kritchevsky, S.B.; Maraldi, C.; Carter, C.S.; Atkinson, H.H.; Penninx, B.W.; Marchionni, N.; Pahor, M. *Aging Clin. Exp. Res.* **2006**, *18*, 374–380.
Brosseau, L.; Wells, G.A.; Kenny, G.P.; Reid, R.; Maetzel, A.; Tugwell, P.; Huijbregts, M.; McCullough, C.; de Angelis, G.; Chen, L. *BMC Public Health.* **2012**, *12*, 1073.
Roddy, E.; Zhang, W.; Doherty, M. *Ann. Rheum. Dis.* **2005**, *64*, 544–548.
Minor, M.A. *J. Rheumatol. Suppl.* **2004**, *70*, 81–86.
Flexibility Training
Paterson, D.H.; Warburton, D.E. *Int. J. Behav. Nutr. Phys. Act.* **2010**, *7*, 38.
Musumeci, G.; Castrogiovanni, P.; Leonardi, R.; Trovato, F.M.; Szychlinska, M.A.; di Giunta, A.; Loreto, C.; Castorina, S. *World J. Orthop.* **2014**, *5*, 80–88.
Musumeci, G. *World J. Orthop.* **2015**, 6, 762–769.
Garber, C.E.; Blissmer, B.; Deschenes, M.R.; Franklin, B.A.; Lamonte, M.J.; Lee, I.M.; Nieman, D.C.; Swain, D.P. *Med. Sci. Sports Exerc.* **2011**, *43*, 1334–1359.
Houston, M.N.; Hodson, V.E.; Adams, K.K.E.; Hoch, J.M. *J. Sport Rehabil.* **2015**, *24*, 77–82.

Table 1. *Cont.*

Flexibility Training
Wang, C.; Schmid, C.H.; Hibberd, P.L.; Kalish, R.; Roubenoff, R.; Rones, R.; McAlindon, T. *Arthritis Rheum.* **2009**, *61*, 1545–1553.
Wang, C.; Collet, J.P.; Lau, J. *Arch. Intern. Med.* **2004**, *164*, 493–501.
Lee, M.S.; Pittler, M.H.; Ernst, E. *Clin. Rheumatol.* **2008**, *27*, 211–218.
Wang, C.; Schmid, C.H.; Hibberd, P.L.; Kalish, R.; Roubenoff, R.; Rones, R.; Okparavero, A.; McAlindon, T. *BMC Musculoskelet. Disord.* **2008**, *9*, 108.
Lee, H.J.; Park, H.J.; Chae, Y.; Kim, S.Y.; Kim, S.N.; Kim, S.T.; Kim, J.H.; Yin, C.S.; Lee, H. *Clin. Rehabil.* **2009**, *23*, 504–511.
Tsai, P.F.; Chang, J.Y.; Beck, C.; Kuo, Y.F.; Keefe, F.J. *J. Pain Symptom Manag.* **2013**, *45*, 660–669.
Shen, C.L.; James, C.R.; Chyu, M.C.; Bixby, W.R.; Brismée, J.M.; Zumwalt, M.A.; Poklikuha, G. *Am. J. Chin. Med.* **2008**, *36*, 219–232.
Song, R.; Roberts, B.L.; Lee, E.O.; Lam, P.; Bae, S.C. *J. Altern. Complement. Med.* **2010**, *16*, 227–233.
Brismee, J.M.; Paige, R.L.; Chyu, M.C.; Boatright, J.D.; Hagar, J.M.; McCaleb, J.A.; Quintela, M.M.; Feng, D.; Xu, K.T.; Shen, C.L. *Clin. Rehabil.* **2007**, *21*, 99–111.
Aquatic Training
Bressel, E.; Wing, J.E.; Miller, A.I.; Dolny, D.G. *J. Strength Cond. Res.* **2014**, *28*, 2088–2096.
Yázigi, F.; Espanha, M.; Vieira, F.; Messier, S.P.; Monteiro, C.; Veloso, A.P. *BMC Musculoskelet. Disord.* **2013**, *14*, 320.
King, M.R.; Haussler, K.K.; Kawcak, C.E.; McIlwraith, C.W.; Reiser Ii, R.F. *Am. J. Vet. Res.* **2013**, *74*, 971–982.
Waller, B.; Munukka, M.; Multanen, J.; Rantalainen, T.; Pöyhönen, T.; Nieminen, M.T.; Kiviranta, I.; Kautiainen, H.; Selänne, H.; Dekker, J.; *et al. BMC Musculoskelet. Disord.* **2013**, *14*, 82.
Valtonen, A.; Pöyhönen, T.; Sipilä, S.; Heinonen, A. *Arch. Phys. Med. Rehabil.* **2010**, *91*, 833–839.
Valtonen, A.; Pöyhönen, T.; Sipilä, S.; Heinonen, A. *Arch. Phys. Med. Rehabil.* **2011**, *92*, 1944–1950.
Rahmann, A.E.; Brauer, S.G.; Nitz, J.C. *Arch. Phys. Med. Rehabil.* **2009**, *90*, 745–755.
Hinman, R.S.; Heywood, S.E.; Day, A.R. *Phys. Ther.* **2007**, *87*, 32–43.
Wang, T.J.; Belza, B.; Elaine Thompson, F.; Whitney, J.D.; Bennett, K. *J. Adv. Nurs.* **2007**, *57*, 141–152.
Lund, H.; Weile, U.; Christensen, R.; Rostock, B.; Downey, A.; Bartels, E.M.; Danneskiold-Samsøe, B.; Bliddal, H. *J. Rehabil. Med.* **2008**, *40*, 137–144.
Wang, T.J.; Lee, S.C.; Liang, S.Y.; Tung, H.H.; Wu, S.F.; Lin, Y.P. *J. Clin. Nurs.* **2011**, *20*, 2609–2622.
Liebs, T.R.; Herzberg, W.; Rüther, W.; Haasters, J.; Russlies, M.; Hassenpflug, J. *Arch. Phys. Med. Rehabil.* **2012**, *93*, 192–199.
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Arnold, C.M.; Faulkner, R.A. *J. Aging Phys. Act.* **2010**, *18*, 245–260.
Lim, J.Y.; Tchai, E.; Jang, S.N. *PMR.* **2010**, *2*, 723–731.
Patrick, D.L.; Ramsey, S.D.; Spencer, A.C.; Kinne, S.; Belza, B.; Topolski, T.D. *Med. Care.* **2001**, *39*, 413–424.
Belza, B.; Topolski, T.; Kinne, S.; Patrick, D.L.; Ramsey, S.D. *Nurs. Res.* **2002**, *51*, 285–291.
Bartels, E.M.; Lund, H.; Hagen, K.B.; Dagfinrud, H.; Christensen, R.; Danneskiold-Samse, B. *Cochrane Database Syst. Rev.* **2007**, *4*, CD005523.

3. Exercise in Mild OA

In mild OA, physical treatment, in addition to alleviating symptoms, such as pain and reduction in articular mobility, may also avoid both the progression of OA and the side effects of pharmacological treatment. Physical treatment is meant as physical activity in the form of a well-defined exercise program that for patients with OA is usually a moderate level of physical activity, 30-min sessions for 3 to 5 days a week, with 40% to 60% oxygen consumption [28]. Accumulating evidence supports exercise training as an effective form of therapy in the treatment of OA symptoms [28–30]; in fact, recent data on different exercise programs reported clear benefits in patients with OA, such as pain relief and improved mobility function [29,31,32]. It is evident that physical exercise has short-term benefits in reducing pain and improving physical function, but it seems that benefits do not persist in the long term without adherence to the exercise program [30,32–34]. Adherence is improved by attention from health professionals, better outcomes and education and behavioral strategies to promote positive lifestyle change and increased physical activities [34,35]. Possibilities regarding physical activities and exercise programs are abundant, so that in the present review, we decide to analyze some of them performed in 52 clinical trials related to patients with OA as suggested in the recent literature that reported different exercise programs, including (1) anaerobic training; (2) aerobic training; (3) flexibility training and (4) aquatic training, that are considered in OA treatments [29].

3.1. Anaerobic Training

Anaerobic training is characterized by an exercise intense enough to trigger lactate formation; in fact, anaerobic metabolism is involved in producing muscle energy, leading to greater performance over a short duration and in high intensity activity. It promotes strength, speed, power and muscle mass. Anaerobic training is often synonymous with strength training that includes brief and strength-based activities, such as sprinting or bodybuilding, whereas aerobic exercise is centered on endurance activities, such as marathon running or long-distance cycling. However, the early stage of all exercise is anaerobic. Strength training is a type of physical exercise specialized in the use of resistance to induce muscular contraction, which builds strength, anaerobic endurance and the size of skeletal muscles. When properly performed, strength training can provide functional benefits in physical well-being, including increased bone, muscle, tendon and ligament strength, improved joint function and reduced potential for injury. Muscle weakness is common in people with OA and is associated with an increased risk of functional limitations and disability [36–42], and there is evidence that muscle weakness contributes to the development and progression of OA [42]. In the elaboration of this present review, we realized that the clinical trials regarding the treatment of mild OA through strength training are very different in their protocols; in fact, they analyze participants with very different characteristics, such as age, sex, severity of OA, duration of the training, and in addition, the strength training is often combined with other clinical practices or physical exercises. In the 10 clinical trials that we analyzed, the sample of participants consists of elderly people with mild or even severe OA. Jiménez and coauthors evaluated muscle strength, fall risk and quality of life of 30 old people (mean age of 78 years) with OA and the effects of strength training (16 weeks) on these variables, and they showed that strength training improved functional tests among participants [43]. Ageberg and collaborators recently reported that neuromuscular training was well tolerated and feasible in patients with severe primary hip or knee OA. In their study, 87 patients (60 to 77 years) with severe primary OA of the hip or knee, awaiting a total joint replacement, underwent neuromuscular training (12 weeks) in groups with individualized level and progression of training. Neuromuscular training improved self-reported outcomes (hip 9% to 29%, knee 7% to 20%) and physical function (hip 3% to 18%, knee 5% to 19%). The improvement in self-reported outcomes was greater for patients with knee OA than hip OA, while the improvement in physical function was greater for patients with hip OA than knee OA. The authors concluded that the neuromuscular training with an individualized approach and gradual progression showed promise for improving patient-reported outcomes and physical function, even in older patients with severe primary OA of the hip or knee [44]. Anwer and collaborator, instead, evaluated the effect of gender on strength gains after a five-week training program that consisted of isometric exercise coupled with electromyographic biofeedback to the quadriceps muscle, concluding that gender did not affect gains in muscle strength; in fact, the 23 female patients with knee OA involved in this clinical trial reported gains in muscle strength with no significant differences compared to male participants [45]. Other authors, such as McKnight *et al.* [46], considered the relative effectiveness of combining self-management and strength training for improving functional outcomes in patients with early knee OA. In their clinical trial, middle-aged adults aged 35 to 64 years with knee OA, pain and self-reported physical disability completed a strength training program, a self-management program or a combined program. Outcomes included both physical function tests (leg press, range of motion, work capacity, balance and stair climbing) and self-reported measures of pain and disability. These authors highlighted benefits from strength training, self-management and the combination program, suggesting that both strength training and self-management are suitable treatments for the early onset of knee OA, even if self-management alone may offer the least burdensome treatment for early OA [46]. Instead, Knoop and collaborators investigated whether strength training, initially focusing on knee stabilization and subsequently on muscle strength and the performance of daily activities, was more effective than an exercise program focusing on muscle strength and performance of daily activities only, in reducing activity limitations in patients with knee OA and instability of the knee joint. The authors concluded that in knee OA patients suffering from knee instability, specific knee joint stabilization training, in addition to muscle strengthening and functional exercises, does not seem to have any additional value [47]. In another clinical trial, Burrows and coauthors determined whether a single bout of strength exercise produced an analgesic effect in individuals with knee OA. Baseline and post-exercise pressure pain thresholds were measured at eight sites across the body, and pressure pain tolerance was measured at the knee; the authors showed that only upper body exercise significantly raised pain thresholds in the knee OA participants, with variable non-significant effects following lower body exercise; pressure pain tolerance was unchanged following both upper and lower body exercise [48]. In their study, Messier and coauthors hypothesized that in addition to short-term clinical benefits, combining greater duration with high intensity strength training could alter thigh composition sufficiently to attain long-term reductions in knee-joint forces, lower pain levels, decreased inflammatory cytokines and slow OA progression. In their clinical trial, the population consisted of 372 older patients (age $\geqslant$ 55 years) with mild-to-moderate medial tibiofemoral OA that underwent either a high-intensity strength training or a low-intensity strength training. The aim of this clinical trial was to provide critically-needed guidance for clinicians in a variety of health professions who prescribe and oversee the treatment and prevention of OA-related complications. Even if Messier's clinical trial only describes the start of their more extensive study, the authors concluded that given the prevalence and impact of OA and the widespread availability of this kind of intervention, assessing the efficacy of optimal strength training had the potential for immediate and vital clinical impact [49]. As is possible to highlight in data from the literature reported above, the variety of protocols of existing clinical trials is clear, and so, it is difficult to make any general conclusions on the effects of strength training on patients with mild OA, being understood that in no case did the strength training show drawbacks and that a reduction in symptoms of OA was always evident. However, in relation to analyzed clinical trials, some general indications on the protocols to be followed in the strength training can be given. Strength training usually uses the technique of progressively increasing the force output of the muscle through a variety of exercises to target specific muscle groups. In strength training, the use of machines or free weights is considered, and it includes resistance load, repetitions, velocity of movement and frequency of sessions per week [30,50]. To begin this kind of training, it is important to assess strength, total knee range of motion, knee pain and the patient's access to exercise equipment [30,50]. In addition, the initial loads and the joint range of motion for the different leg exercises should take into account the patient's tolerance [30,50], and resistance loads could vary from high to low [30,51]. Generally, strength training consists of exercise three days per week, with two to three sets per exercise at eight to 15 repetitions per set [30,50]. During the progression stage, the loads or number of weekly sessions should increase as the patient gains strength and confidence [30,50]. Data from the literature show that muscle strength of the knee flexors and extensors increases with strength training [30,51,52], and improvements in symptoms and function are directly related to exercise intensity [30,50]. Variety in the exercise program should be provided by using different leg exercises or by substituting free weight exercise [30,50], but there is no evidence that one type of strength training is superior to another, so that OA patients should exercise at the intensity, location and using the equipment that they most prefer [42].

3.2. Aerobic Training

Aerobic training includes those physical exercises depending on the aerobic energy-generating process. They are generally represented by light-to-moderate intensity activities, such as walking, jogging, swimming and cycling, supported by aerobic metabolism and that can be performed for extended periods of time. Data from the literature support aerobic training in reducing pain, improving physical performance and preventing disability, relieving joint symptoms and improving function in persons with OA [53–57]. Furthermore, in clinical trials related to aerobic training on OA patients, there is a great variability in the protocols. For example, Messier and collaborators examined the effects of 18-month aerobic walking training programs on static postural stability among 103 older adults with knee OA. Their results suggested that long-term aerobic walking programs significantly improved postural sway in older, osteoarthritic adults, thereby decreasing the likelihood of larger postural sway disturbances [58]. Since depressive symptomatology is sometimes recognized in patients with OA due to their disability, a study by Penninx and coauthors examined the effect of aerobic training on emotional and physical function among older persons (60 years or older) with OA and high or low depressive symptomatology consequent to their pathological condition. Aerobic training both significantly reduced disability and pain and increased walking speed and to an equal extent in persons with high depressive symptomatology and persons with low depressive symptomatology [53]. Interestingly, Mangani and coauthors evaluated aerobic exercise interventions in 435 participants with knee OA (mean age of 68.7 years) in the presence of other clinical conditions, concluding that aerobic training improves physical function in individuals with comorbidity and that, however, aerobic training improves physical function and knee pain independently of the presence of comorbidity [59]. Better results from aerobic training are obtained when it is associated with behavioral intervention, as evidenced in a clinical trial by Brosseau and collaborators, in which an aerobic walking program with or without behavioral intervention was administered to 222 patients with mild to moderate knee OA, and the clinical and quality of life outcomes improved among participants, concluding that OA can be managed through the implementation of a proven effective aerobic walking program [60]. However, the clinical trials on the treatment of OA frequently include both aerobic and strengthening training, and in general, both are associated with improvements in relieving joint symptoms and improving function; even if in some studies, greater pain relief was found with aerobic training, in most cases differences were not significant [57,61].

In most of the 10 clinical trials analyzed by us, aerobic training is focused on short-term interventions (six months), and this is a limit in the evaluation of the superior efficacy of aerobic training in the treatment of OA. Existing studies tend to evaluate predominantly short-term outcomes, which contributes to the relative lack of information [57]. From the analysis of trials, there is evidence for a dose-response effect in interventions with aerobic training, so it is evident that participants with knee or hip OA who performed more exercise have better outcomes [57,62]. Furthermore, the impact of aerobic training alone on the progression of OA has been examined in a few studies, and even if some evidence indicates that physical activity in the treatment of OA can decrease pain, improve function and depression, promote joint health and possibly delay the development of disability in OA, more information is needed to determine the optimal types and dosing of aerobic conditioning [57].

3.3. Flexibility Training

Flexibility is defined as the range of motion performed by a joint and its surrounding muscles during a passive movement in which no active muscle involvement is required to hold the stretch. Joint flexibility may decrease with age, affecting normal daily function; older adults could maintain the ability improving flexibility through stretching exercises [63–65], so that flexibility exercises are often synonymous with stretching training. By increasing the joint range of motion, performance may be enhanced and the risk of injury reduced. When injuries or diseases result in a restricted range of motion of the joints, stretching exercises are used in the rehabilitation context in order to regain "normal" range of motion in the major muscle tendon groups in accordance with individualized goals [66]. Despite the lack of research confirming the health benefits [67], it is common to find in the literature flexibility/stretching training as a presumed "component of fitness" and a beneficial adjunct to other forms of exercise. In fact, in the 14 clinical trials we analyzed, related to OA, the exercises of flexibility/stretching are always part of a wider training program that also includes aerobic and anaerobic training, strength and flexibility or stretching exercises, and therefore, it is difficult to understand how the exercises of flexibility/stretching can affect symptoms and attenuation of OA.

A type of training or physical activity involving stretching and flexibility is Tai Chi. Tai Chi is a traditional Chinese discipline that can be used as a treatment for persons with OA, and it has a greater following among older adults [30,68], perhaps because it is characterized by static or slow movements better tolerated than a more dynamic and fast training. Moreover, for the majority of the aging population, the goals are not related to athletic performance, but rather to daily living activities. Tai Chi enhances flexibility, balance, self-efficacy and also muscle strength, improving physical function and reducing pain, depression and anxiety in patients with chronic conditions of OA [30,69]. In the past two decades, Tai Chi has become very popular all over the world, not just in China, and data from the literature support its efficacy in reducing symptoms of OA [30,70]. From the analysis of clinical trials, we saw that this discipline is increasingly used in the management of mild OA, especially in older individuals. In two different clinical trials, Wang examined the effects of a 12-week Tai Chi program (10 modified forms from classical Yang style Tai Chi) in 40 patients, aged 55 with tibiofemoral OA, and evaluated effects on pain, functional capacity, psychosocial variables, joint proprioception and health status, in order to provide important preliminary data on the physical and psychological effects of Tai Chi for OA, highlighting reduced pain, improved physical function and health-related quality of life of the patients, as well as establishing a rigorous method for testing the mechanisms by which Tai Chi may influence pain, disability and health-related quality of life in people with OA [68,71]. Lee and collaborators evaluated the effects of Qigong training (a component of the Tai Chi discipline, based on stretching) on the quality of life and physical function of patients with knee OA. Forty-four elderly subjects (mean age of 69 years) with knee OA were recruited for this clinical trial, and the Tai Chi Qigong training program consisted of sessions of 60 min, twice a week, for eight weeks. The authors concluded that Tai Chi Qigong training appeared to have beneficial effects in terms of the quality of life and physical functioning of elderly subjects with OA, even if to confirm the efficacy of this training, more rigorous trials were needed [72]. Interestingly, Tsai and collaborators have recently investigated the efficacy of a Tai Chi program in improving pain and other health outcomes in elderly people with cognitive impairment and knee OA, in which subjects attended Sun style Tai Chi classes, three sessions a week for 20 weeks. The authors highlighted that practicing Tai Chi can be efficacious in reducing pain and stiffness also in subjects with cognitive impairment that are generally excluded from clinical trials because many measurement tools require verbal reports that some elderly people with cognitive impairment are unable to provide. Furthermore, no adverse events were found [73]. On the other hand, several authors highlighted the benefits of Tai Chi training in mild OA, but they suggested further investigation to confirm their results. Shen, in a clinical trial, examined the effects of Tai Chi on gait kinematics, physical function, pain and pain self-efficacy in the elderly (40 subjects with a mean age of 64 years) with OA who participated in six weeks of instructed Tai Chi training (1 h/session, two sessions/week); the authors concluded that their findings support that Tai Chi was beneficial for gait kinematics, but a longer term application was needed to substantiate the effect of Tai Chi as an alternative exercise in the management of OA [74]. Song and collaborators investigated the effects of six months of Tai Chi on knee muscle strength, bone mineral density and fear of falling in older women (mean age of 63 years) with OA, and after the six-month study period, subjects in the Tai Chi program had significantly greater knee extensor endurance and significantly greater bone mineral density in the neck of the proximal femur, Ward's triangle and trochanter. However, knee extensor and flexor strength did not differ significantly with respect to the control group. The fear of falling during daily activities reduced significantly more in the Tai Chi group. However, the authors suggested further study with long-term follow-up to substantiate the role of Tai Chi programs in the prevention of falls and related fracture [75].

As reported above, there are several studies testing the effects of Tai Chi in mild OA, but the interpretation of them is limited due to the low levels of adherence, short follow-up and deployment of varying Tai Chi styles [30,76]. Nevertheless, data show positive effects on improvements in pain and function [30,76], so that Tai Chi is often suggested for patients with mild OA.

3.4. Aquatic Training

Aquatic training is considered a potentially effective treatment intervention for people with OA [77], and it is recommended by OARSI, by the American College of Rheumatology (ACR) and by the European League Against Rheumatism (EULAR) as a non-pharmacological method of controlling OA symptoms [78].

The protocols used in the 18 clinical trials that we analyzed were very different from each other. One important difference is related to the aquatic exercise program. There are various types of aquatic exercise, so some trials used the underwater treadmill exercise at a specific speed, frequency and duration [77,79]; in other trials, a progressive aquatic resistance exercise program was used for investigating its effect on mild OA [80] and also on mobility and muscle power after unilateral knee replacement [81,82]; aquatic physiotherapy was another program considered in some trials conducted on patients after total hip or knee replacement surgery to evaluate the effect on the recovery of strength, function and gait speed [83] and also in cases of symptomatic hip OA or knee OA in order to evaluate parameters, such as pain, physical function, physical activity levels, quality of life and muscle strength [84]. Furthermore, the duration of the aquatic exercise program is very variable in the different analyzed trials; in fact, it ranges between six and 20 weeks, although in the majority of the 18 clinical trials, the duration considered in the protocols is 12 weeks [80–82,85–87]. In most of the 18 clinical trials considered by us, the aquatic exercise program was used in cases of mild OA, but as reported above in some of them, the aquatic exercise program was used as post-operative treatment after arthroplasty [81–83,88]. Lastly, the target of patients or participants in the aquatic exercise program was different in the different trials; in fact, older adults [89,90], postmenopausal women [80], overweight and obese individuals [78,84,85,91] or even volunteer participants [87,92,93] were considered in the different trials.

In relation to the highlighted great variability of the protocols used in the different clinical trials that we analyzed, it is difficult to make generalizations about the use of aquatic exercise in OA. Surely, what emerges from our analyses is that this type of treatment, although it does not improve the pathological condition of OA, has good results on the attenuation of the symptoms of the disease. Therefore, even if aquatic exercise for OA seems not to have effects regarding walking ability or joint range of motion, it should be an option for exercise prescription in patients with OA [30,35,94]. Moreover, adherence to aquatic exercise programs is usually very high, and no adverse effects are reported by participants, suggesting that aquatic exercise may be effective in managing symptoms of OA [77].

4. Discussion

In the present narrative review, we showed how mild OA can be managed in order to attenuate symptoms, such as pain, limitation of movement and depression, thus avoiding the use of pharmacological treatment. In particular, physical activity proved to be very useful for both pain mitigation and function of the joints with an increase in both physical and psychological well-being of considerable intensity. Furthermore, physical activity is very useful for both the good maintenance of joint tissue homeostasis and the control of possible inflammatory processes in the joint caused by various accidental conditions. From the data in the literature, there is no clear benefit of one form of training over another for improving pain and function in OA. For example, walking and strength training were equally effective over 18 months in people with mild OA [35,54]. In addition, beneficial effects for pain and function appear to be higher for land-based exercise than for aquatic exercise and higher for aerobic exercise than for strengthening exercise [35,95]. Therefore, for the majority of OA patients, a combination of both general (aerobic fitness training) and local (strengthening) exercises should be optimal to address the spectrum of impairments associated with OA [35,96]. The optimal exercise modality and dosage for mild OA is currently not known [35], and essentially, exercise training should be established taking into account factors such as age, mobility, co-morbidities and preferences [35]. Furthermore, the benefits of exercise training depend on the adherence of patients to the exercise program. With our analysis of the most recent clinical trials, we wished to underline the importance of physical activity in the treatment of mild OA as an effective therapeutic instrument and to give some useful indications to health professionals in managing mild OA. From our analysis of the literature data, it was clear that "physical treatment of OA" is a wide topic, since many parameters can be considered. We considered only a few of them, such as OA grades, age and sex, but a very interesting parameter is also the body mass index (BMI); in fact, the data in the literature show that a high BMI is associated with a higher incidence of OA [97]. Therefore, a topic of great interest for a future analysis, could be the possible effects of the BMI modification as a consequence of long-term physical activity in mild OA.

5. Conclusions

Because there is limited evidence for the higher benefits of one type of training over another in the treatment of mild OA, exercise programs that combine strengthening exercise with exercise that increases flexibility and aerobic capacity seem to be the "best" option to offer to patients with mild OA, taking into account their preferences and tolerance.

In conclusion, what stands out in our analysis about the possibilities of mild OA treatment is that physical activity, whatever the training, gives benefits to treated patients. These benefits are pathophysiological, psychological and regard general well-being, reflected in daily activities. Thus, we acquire an exponentially positive value by establishing a virtuous circle, which leads the patient to prolong the training as he or she feels more capable and less in pain by promoting further improvements in the symptoms of OA. Still today, however, physical activity is considered as a complementary and optional treatment. It is up to health professionals to encourage the use of this possibility as a primary treatment, especially in patients with mild OA that are surely more motivated because they are not yet afflicted with the most severe OA symptoms characterized by a higher degree of pain and disability. With this report, we hope to give the right input to all health professionals who are still hesitant in considering physical activity as a real tool in the treatment of OA.

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