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# Non-Operative Management of Hip Osteoarthritis

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## Abstract

**This paper reviews several non-operative and non-pharmacologic management strategies advocated for alleviating the pain and disability experienced by people with hip osteoarthritis. It analyzes whether painful debilitating hip osteoarthritis, which has no effective cure and is often progressive, may be affected positively by non-operative interventions designed to control osteoarthritis pain. Finally, it provides an integrated plan of management for ameliorating hip osteoarthritis pain and disability in light of this knowledge.**

## Keywords

**Hip Osteoarthritis, Intervention, Pain, Rehabilitation, Treatment**

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## 1. Introduction

Osteoarthritis, the most common rheumatic disease [1] [2], is a chronic non-fatal condition with significant social and economic ramifications [1]. Highly prevalent among adults over the age of 75 [3]-[7], the disease, which principally affects the articular cartilage lining of one or more synovial joints [8], often causes unrelenting pain of the hand, knee, hip, foot, acromioclavicular and spinal joints [4] [9]-[11]. When symptomatic, osteoarthritis can consequently be extremely debilitating and can severely impair an individual's ability to function physically without compromise, effort and excessive physical stress [6] [7] [10]. Recent estimates suggest that between 9 and 12 percent of elderly Americans with this condition will experience a decrement in their ability to function at the desired level in the context of their major activities of daily living. Of these individuals, approximately half or 1.5 million people will become totally disabled [6].

Despite its significant impact, there is, as yet, no cure for osteoarthritis [10]. While useful in restoring function and ameliorating pain in severe cases of the disease, osteoarthritis may not be amenable to artificial joint-replacement surgery in all cases. Efforts to reduce pain accompanying the disease using analgesic medication and/or non-steroidal anti-inflammatory drugs (NSAIDs) [1] [11]-[13], frequently prove ineffective [4], have adverse effects on articular cartilage metabolism [14], or a variety of systemic toxic side-effects [15]. Further, since no drug reverses or delays the progression of osteoarthritis [16], their long-term efficacy has been challenged [17]-[20]. Fortunately, an array of adjunctive methods other than medications, or surgery, have the potential to reduce the pain and disability associated with osteoarthritis, with virtually no side effects [18]-[27].

The objective of this paper is to outline the chief characteristics of osteoarthritic joint disease and some pertinent advances in our understanding of the effects of joint mechanics on joint physiology, and to consider how hip osteoarthritis might be managed effectively by a combination of physical and psychoeducational or behavioral therapeutic approaches. The paper describes the chief pathological and clinical features of osteoarthritis, some risk factors for joint destruction, and some conservative non-pharmacological therapies that might ameliorate osteoarthritic pain and disability. Although directed towards a conservative prescription for the management of hip osteoarthritis, one of the most important causes of pain and physical disability in the community [9] [11] [28], the therapeutic rationale outlined should be applicable to other joint sites commonly affected by osteoarthritis, and described elsewhere such as the thumb, fingers, and hands [29]-[32].

## 2. Clinical Pathology of Osteoarthritis

The chief features of osteoarthritic joint change, regardless of joint site, include the presence of focal or complete lesions of the articular cartilage lining the joint. As well, various degrees of bone remodelling within and around the bone adjacent to the articular cartilage lining is common. Other pathological features of the disease may include varying degrees of joint capsular and synovial membrane thickening, joint inflammation, ligament and tendon damage, and muscle pathology and atrophy [12] [33]-[37]. There may also be deleterious disease-associated changes in the arteriol and venous circulation of the osteoarthritic joint capsular tissues and bone, plus abnormalities in the excitability of the nerve endings located in and around the joint tissues [22] [38].

A joint disease of multiple dimensions, which may manifest differently from joint to joint [39], and from one individual to another, the hallmark symptomatic feature of osteoarthritic destruction is pain with joint use. Other signs and symptoms associated with osteoarthritic joint damage include pain and joint stiffness after rest, diminished or excessive joint range of motion, joint tenderness, joint crepitus on motion, variable degrees of joint inflammation, and joint swelling [9] [40]. There may also be a decline in joint stability and overall function, plus evidence of irreversible joint deformity and malalignment, plus decreased muscular strength, endurance and aerobic capacity [41]-[44]. Anxiety, depression, and impaired psychosocial functioning including a negative self-image are also frequent outcomes of osteoarthritis [45] [46]. Also common are impairments of general health, independence and less than optimal vitality [47]. Osteoarthritis is also frequently associated with hypertension and cardiovascular disease comorbidities [43] [48], which may further impair functional capacity. Although not usually fatal, the signs and symptoms of osteoarthritis may become progressively more severe with advancing disease. The disease may consequently reduce the ability of an individual to carry out his or her normal activities of daily living [49] and may limit work capacity and wage earnings quite considerably [50]. In the geriatric years, the disease may compromise quality of life [47] and the ability to live independently and carry out self-care activities [9].

Fortunately, although the abnormal cell-matrix interactions of osteoarthritic cartilage usually result in an overall loss of its compressive stiffness and elasticity [51], recent evidence suggests that as with cartilage cells exposed to cultures devoid of extracellular matrix, cartilage cells in areas of matrix damage divide and may migrate to form cell groups or clones [49] [50] [52] as part of an attempted reparative process [53]. In particular, because mechanical stimuli are essential for the growth and maintenance of cartilage and aberrant mechanical loading can lead to cartilage damage, careful mechanical manipulation of the cell micro-environment may foster tissue reconstitution and reduce matrix damage attributable to degradative enzymes by damaged cartilage cells [27] [53] [54]. This is supported by numerous loading studies ranging from immobilization to excessive weight bearing [54] and others that imply impaired muscle function might foster cartilage damage or render the bone beneath this tissue noncompliant [21] [55].

### 3. What Causes Osteoarthritis?

Although frequently a primary disorder with no known cause, the onset of osteoarthritis is believed to be strongly influenced by age, genetic, hormonal, metabolic and immunological factors [8] [10] [56] [57]. In addition, biomechanical factors such as, obesity, congenital deformities, impaired muscle function [21] [55] [58], aberrant joint loading [54] [59] [60] and trauma [61]-[63] are also thought to be important etiologic factors. Contributing indirectly to osteoarthritic joint destruction processes may be comorbid conditions that reduce or limit participation in regular activities, and debase joint circulation [48] [43]. Fear, anxiety or depressive reactions to stressful life events [4], may also impact upon physical activity levels and movement patterns which foster the disease process. Regardless of systemic or biomechanical mechanisms, behavioral and psychosocial variables can frequently predict the impact of osteoarthritis more strongly than can the extent of damage apparent in the joint [28] [58]. To the extent that the cartilage microenvironment is influenced by the individual's surroundings, the contributory effects of the social and work environment on the disease onset should not be ignored or underestimated.

### 4. Therapeutic Strategies

Given the multiplicity of determinants that may underlie the development of osteoarthritic joint disease, and the considerable potential for cartilage repair that may exist, non-pharmacological and non-operative interventions that carefully consider all possible pathogenic mechanisms may have the potential for reversing the disease process [64]. Even if this does not occur, they may possibly be quite impactful for reducing or minimizing functional limitations and disability, and pain, the health issues of most concern to patients [65].

In particular, since osteoarthritis disease progression is greatly influenced by joint loading mechanisms [62], eliminating the most detrimental forces falling on the joint surface is indicated. As well, improving the ability of the surrounding joint tissues to absorb, distribute and respond to harmful mechanical loading forces more physiologically, is likely to preserve optimal function and longevity of intact articular cartilage tissue, as well as the bone interfaces of affected joints, irrespective of causative mechanism [3] [7] [66]. Encouraging movements that facilitate joint nutrition might also be expected to promote some degree of cartilage repair or reversal of cartilage catabolism, while relieving pain and enhancing quality of life, especially during the early stages of the disease process [59] [60].

Interventions that impact favorably upon joint biomechanics and joint nutrition in this respect include the application of appropriate joint protection strategies, exercise regimens, dietary changes as indicated, and the application of a variety of physical modalities such as electrical muscle stimulation.

Given the chronic nature of the disease, which necessitates having patients assume responsibility for their joint protection strategies and adherence with their treatment programs to maximize function and prevent disability [7], the present review will focus largely on therapies that the individual patient can and should be able to implement independently on a regular basis. Adjunctive therapies which are more passive and may require a therapist for their administration have been described elsewhere and include acupuncture, electroacupuncture, interferential current, laser therapy, manual therapies, shortwave diathermy, ultrasound, infrared radiation, pulsed electromagnetic fields and therapeutic touch [27] [67]-[78].

### 5. Hip Osteoarthritis

At the hip, despite its generally favourable prognosis [66], osteoarthritis of one or both joints, often causes considerable pain in the groin, anterior thigh, buttock and knee regions. In addition, stiffness after rest is common, and as the disease progresses, pain may be present at night, at rest, or following the adoption of a single static postural position for a lengthy period. Joint range of motion commonly decreases over time, and disability may increase, including many functional activities of daily living, such as getting up from a chair may be disturbed. Putting on socks and shoes, walking any distance on level ground, ascending and descending stairs in a reciprocating manner, and getting in and out of a car may all be increasingly challenging as well [79] [80]. Independent foot care, various components of dressing, toileting and bathing, and sexual problems are expected to mirror the disease progression [81] [82].

Other features include associated decrements in walking speed coupled by increases in energy expenditure [83] [84], muscle weakness and muscle pathology [85] [86]. The presence of abnormal muscle function [21]-[87]

and recruitment patterns in this condition can also impair balance and postural control when ambulating, causing recurrent falls [9]. If left untreated, isolated areas of muscle spasm may contribute to the progression of this arthropathy, especially if the joint is loaded repetitively [9], as in occupations such as farming [28]. The degree of handicap associated with hip osteoarthritis is correlated with the prevailing degree of disability and pain along with the social circumstances of the affected individual [10] [88] [89].

## 6. Hip Osteoarthritis Management

Although no specific therapy to halt the progression of hip osteoarthritis has been identified, repeated impact loads, microtrauma and/or abnormal static force concentrations on the articular surface of one or both hips that can cause the condition or contribute to its severity, can be minimized by (1) reducing excessive joint loading, both static and dynamic; (2) diminishing any modifiable contributing factors to abnormal joint loading such as capsular contractures, muscle weakness, and muscle spasm, and anxiety and depression; (3) improving postural control and the individual's ability to function physically, socially, economically and vocationally without fatigue, and at all stages a combination of psycho-educational and physical intervention treatment approaches are appropriate [80].

As with osteoarthritis at other joints, the specific combination of psychoeducational and physical treatment approaches selected to manage the pain and disability of hip osteoarthritis should be based upon, an adequate assessment of the individual's overall physical condition, the stage of the disease, the individual's age, and an understanding of the individual's personal goals. Work, recreational and social activities, as well as family relationships and other factors that might affect the prognosis of the disease, such as level of social support, should also be assessed. The disciplines involved in the individual patient's management program should include physical therapists, occupational therapists, nurses and psychiatrists as well as health educators. In recommending the most suitable types of therapies for the individual patient, the practitioner should consider the availability of resources for their recommendations, as well as the practicality and accessibility of the prescribed management requirements, including, personnel and equipment, as well as their known efficacy.

## 7. Psychoeducational Interventions

Psychoeducational interventions, including both traditional educational or teaching activities and psychologically mediated interventions, are common forms of intervention applied alone, or in combination to help people with hip osteoarthritis to function more ably. This form of intervention aims at improving the life quality, psychological disposition, and individual autonomy of the client in the face of adverse events, and most commonly involves education directed towards self-management of the condition and/or cognitive-behavior therapy approaches [90] [91]. Both approaches emphasize the learning of new skills and the voluntary adoption of appropriate behaviors that may foster more optimal disease self-management. While often focused on the application of information and problem solving, most self-management programs are quite comprehensive and also include training in relaxation and coping skills, and the rehearsal of these skills in the home and work environment [91]-[93]. Cognitive-behavioral therapy usually emphasizes pain control by heightening the individual's understanding of the potentially deleterious interaction of negative emotions and cognitions with the physical aspects of pain. Clients are shown how to apply cognitive restructuring, diversion or relaxation skills to their every day lives [94]. Bradley and Alberts [92] concluded that cognitive-behavioral therapies and the Arthritis Self-Management Program [95] represented well-established treatments for ameliorating pain among patients with osteoarthritis, including hip osteoarthritis. There is also support for the effectiveness of direct social or psychological support as a potent psychobehavioral mediator that may benefit the person with hip osteoarthritis [91] [96] [97].

### 7.1. Education

For people with hip osteoarthritis, education about their condition, and their role in its management, is a vital first step [98] [99] towards lessening their level of functional disability [100] and decreasing their pain [2] [9] [10] [79] [90] [94]. Individuals with hip osteoarthritis receiving self-care education are also expected to visit physicians less often than those who do not, and to have lower drug intakes and drug toxicity [96] [101]-[103]. They may experience an overall improvement in life quality [80] when compared to those receiving no form of

education [90] [94]. As well, adherence to recommendations may be greatly improved by education which enables more appropriate appraisals of the disease and that facilitates the patients' coping, decision making and problem solving abilities [79] [91]. In addition, enhancing patient confidence in their ability to succeed in implementing a self-management program in the face of disease unpredictability is of great potential benefit [100] [104] [105].

A thoughtful educational program using the most up-to-date information may also allay anxiety and improve an individual's attitude towards the disease and its management quite markedly [91] [106]. Providing realistic information about the natural history of the disease and its generally relatively good prognosis are especially important [7] [66] [96]. However, while most traditional educational approaches that have been developed all seem to yield equivalent results [96], tailored and personalized health education interventions, along with those that incorporate behavioral approaches, appear to be more efficacious than generic educational strategies alone, in maximizing the effectiveness of salient health messages for this group [91] [104] [107] [108]. Specifically, active involvement of the patient in their own self-management program through the provision of tailored information and resources can foster the individual patient's self-efficacy for carrying out the prescriptive interventions, which is crucial for securing optimal outcomes [80] [91] [104] [108]-[110]. This behavioral approach is supported by Gecht *et al.* [111] who examined the exercise beliefs and participation in exercise activities of people with arthritis and found that the subject's belief in the benefits of exercise and their self-efficacy for exercise were highly correlated.

It is also supported by the favourable outcomes reported by previous reviewers of arthritis self-management educational programs [21] [90] [94] [95] [101] [103]. This is important because the disease is often very unpredictable [112], and demands strict adherence to the prescribed self-management programs. For those with low literacy readable materials [113], plus personalized booster sessions, relapse prevention interventions, and some form of ongoing personal contact and targeted feedback by an esteemed health professional is recommended [113] [114]. The provision of ongoing professional contact plus regular reassessments can help to foster patient co-operation and prescribed program adherence as suggested by findings of Hopman-Rock and Westhoff [115].

Also important for fostering adherence is the use of patient-provider contracts, enlisting family support, and having patients' record details of their daily progress on a consistent basis [107]. As well, mutual decision making concerning goals of the management program is advocated [7]. A careful initial assessment of the individual patient's health status, concerns, personal values and resources, as well as additional information about the patient's daily routine, home environment, level of family support, and work status can enable the practitioner to provide a program of activities that can optimally reduce pain and promote maximal function [100] [116]-[118].

There is also evidence that receiving personalized professional advice on an ongoing basis according to need, community access to customized mass-produced self-help kits, video or audiotapes, printed matter [119], and educational interventions delivered in group settings has a favorable impact on an individual's self-management ability [91] [97] [104] [107] [114] [120]. Alternately, having external forms of support, such as regular or periodic telephone access to health-care workers, dietary or sexual counsellors to discuss questions and concerns about the disease [118] [121]-[123], as well as having informational leaflets about community resources, can heighten a patient's confidence about their ability to manage their disease.

Clearly, however, hip osteoarthritis patients may vary considerably in their ability and motivation as well as their preparedness to undertake self-management efforts [119]. The identification of arthritis subgroups and interventions that are specifically tailored to accommodate like needs are, however, predicted to enhance participation in, and responsiveness to, pain-coping skills training, exercise interventions, and other formal self-management training programs [124]. Moreover, to promote exercise behaviors, it may be necessary to acknowledge gender differences among men and women with osteoarthritis and to make recommendations accordingly [125].

## 7.2. Cognitively Mediated Interventions

Cognitive-behavioral therapies using the principle of behavior modification to alter negative cognitive processes [91] [126] are found to produce clinically beneficial outcomes among people with osteoarthritis [67] [91] [96] [126], especially if spouse-assisted [127]. Recent findings by Hampson *et al.* [128] also suggest fostering appropriate appraisals about the intensity of the condition can enable individuals with hip joint osteoarthritis to carry out active, rather than passive, coping strategies, which are predictive of depression, and poorer disease outcomes.

Cognitive strategies that can be directed to enhance optimal muscle function, as well as strategies that promote relaxation in general, while not extensively examined with respect to the hip joint per se, may prove beneficial for decreasing pain, improving mood and function [26]. Research by King *et al.* [26] and Rice [129] suggested biofeedback and relaxation techniques can potentially help to reduce the pain experience of walking re-education in those with both early and disabling hip osteoarthritis [130].

The use of voluntary muscle relaxation techniques along with deep breathing exercises to offset any excessive muscle tension may be equally useful in treating acutely painful hip osteoarthritis [93] [102] [131]. In particular, Zimmerman [23] suggested that training patients to voluntarily relax and to consciously adjust any abnormal postural or motion habits might be a useful adjunctive measure for people with chronically painful hip osteoarthritis, because the disease chronicity often results in reactive muscle spasm, poor posture, abnormal joint motion, and further muscle spasm and pain. Zischke [132] supported this viewpoint by demonstrating significantly improved physical and emotional function in those subjects with osteoarthritis who used relaxation strategies as part of their physical treatment programs. This form of intervention is often overlooked though, even in current reports [118], but may be very helpful. Simpson and Dickenson [133] point out emotional upsets frequently result in an exacerbation of those osteoarthritic symptoms, which can further impair function [134].

## 8. Physical Interventions

### 8.1. Joint Rest

While a joint clearly needs regular loading to help maintain its integrity [5] [88], and complete bed rest, with the exception of periods of severe pain, may cause complications [66], and is not advisable [135], efforts to protect an osteoarthritic joint from excessive loading by temporarily unloading it with judicious rests has been advocated [59] [60] [106]. This is especially true if muscles controlling the affected joint fatigue easily, or are in spasm, or if the individual is experiencing inflammation or an acute flare up of the disease. Thus, although elderly arthritic patients automatically tend to rest more on a “worse day”, it may be prudent to advise patients with this condition that specific rest periods of 20 - 60 minutes duration may be of benefit, especially if they have been sleeping poorly and have considerable pain with weight bearing activities [7] [135] [136].

Such rest periods allow the cartilage to rehydrate and an individual with hip osteoarthritis may benefit from positioning themselves in prone or in supine with a pillow under the affected buttock and a 10 - 20 lb weight supported by a sling from the knee to reduce the tendency towards hip flexion contractures [62]. It is possible that traction applied to the affected leg during rest periods may prove beneficial [62]. Although there is little scientific evidence that rest or joint unloading might be effective in preserving or improving the mobility and work capacity of persons with osteoarthritis, relief of pain is usually said to be proportional to the amount of protection from weight bearing [66]. Also, because muscles around a painful joint are thought to fatigue more readily than muscles of a healthy painfree joint, and can work more effectively if they are not fatigued, protection from weight bearing appear to influence the work capacity of individuals with hip osteoarthritis, as well as shock absorption during activities that involve impact loading [116].

Treadwell and Mankin [60] also believe that rest can reduce or minimize joint inflammation and protect an inflamed osteoarthritic joint from further damage. Work by Palmoski *et al.* [137] in animal models lends some support to this belief. For all these reasons, Simpson and Dickenson [133] recommend that local joint rest by splinting to unload the joints or by the use of adaptive devices and aids. They also advise appropriate planning of activities and avoidance of prolonged or repetitive activities.

### 8.2. Assistive Devices and Orthoses

It has been widely reported that people with hip osteoarthritis who have unsteady gait or advanced disease, may improve their functional capacity and acquire some protection from untoward mechanical perturbations of the affected joint through the use of crutches, canes, walkers, splints or braces [5] [7] [82] [88] [96] [102] [106] [138]. It is further believed that footwear designed to absorb shock, shoes that give good support, shoes that have thin non-slip soles, or the use of corrective foot orthotics such as a heel lift in one shoe—if leg lengths are unequal—may prove beneficial, while dress aids, such as a long shoe horn or stocking stretcher, may help to facilitate those daily activities that require bending and reaching [81] [88] [102].

### 8.3. Ergonomic and Environmental Adaptations

A number of adaptations to the home environment such as changing the bedroom location or the type of flooring may further relieve some unwarranted hip joint stresses that could otherwise hasten hip joint damage [80] [96]. Joint protection during functional activities may also be enhanced by the use of raised toilet seats, grab bars next to toilets and in tubs or shower facilities. Arm rests on chairs and higher chairs [81] may also prove beneficial for people with end stage hip osteoarthritis who are not candidates for surgery. Mobility and independence are specifically enhanced by means of a motorized scooter [22] or wheelchair [138]. Similarly, careful assessment and the appropriate modification(s) of an individual's work situation, work schedule and/or recreational activities all impact favorably upon the outcome of their hip osteoarthritis [66] [139] [140].

### 8.4. Appropriate Joint Use

To further limit osteoarthritic hip joint pain attributable to mechanical factors, people with hip osteoarthritis should be advised to avoid prolonged static activities, contact sports, repetitive high impact loading or over-exercising. They should also try to carry out activities as ease and comfortable as possible, and avoid rapid walking [88], sitting with the hip in marked abduction [62], or needless stair climbing.

Hip joint stresses may also be lessened by limiting the weight of loads carried [5] [7], by splitting heavy loads and carrying them separately in each hand, or by carrying loads on the same side as an affected osteoarthritic hip. Exercising in a gravity-reduced environment, such as water or on a bicycle, avoiding stairs, and walking at speeds that do not produce pain is also advised [141].

### 8.5. Weight Control

The maintenance of an optimal body weight or the implementation of a weight reduction program for overweight or obese patients may reduce unwarranted stresses on an osteoarthritic hip joint [9]. While long-term maintenance of weight loss is rarely retained [22] a loss of weight in those who are obese is strongly advocated because this may not only help to decrease pain, but may also improve hip joint rotary mobility which is affected by the magnitude of one's body mass index [142]. Another potential problem related to obesity that could be improved by having a lower body fat content is the rate at which important shock absorbing muscles of the lower limb fatigue absorb peak ground reaction forces that could otherwise destroy articular cartilage [143], or cause greater axial loading than the hip joint can accommodate [144]. Interventions to obviate poor nutritional practices and promote activities that do not damage joints, especially in early life, along with weight-loss programs in adult life, may be especially important in efforts to prevent the disability of hip osteoarthritis [145]. Alternately, while restricted food consumption has not been shown to minimize the development of human hip osteoarthritis, a five-year longitudinal study on the hip joints of dogs [146] recently indicated a greater frequency and severity of osteoarthritis in the *ad libitum*-fed group of dogs, compared to dogs whose feeding was restricted. This finding, although limited in its generalizability, should not be ignored.

### 8.6. Exercise

Findings from several recent clinical trials have shown that in addition to rest and joint protection strategies for ameliorating osteoarthritic pain and disability, short periods of exercise designed to reduce or prevent muscle weakness and atrophy, maintain joint range of motion, and improve endurance is valuable [5] [22] [66] [96] [147]. While the implementation of exercises should not be stressful or injurious to the joints, especially in overweight or hypermobile individuals [34], the once or twice daily performance of 3 - 6 carefully performed active hip range of motion exercises that preserves at least 20° - 30° of hip flexion, full extension and abduction is necessary for facilitating gait [62]. In addition to promoting or maintaining joint range of motion actively, passive stretching of the capsule [66], muscles and joint [24] has been shown to restore joint range of motion in hip osteoarthritis. An additional finding of note was that the stretch on the tightened adductor longus muscle led to muscle hypertrophy and to an increased muscle glycogen content, increasing substantially the work capacity of the individual. Careful stretching exercises carried out on a bed, in a warm pool to increase range of motion, exercises done on a firm board sprinkled with powder to decrease friction and with the use of a foot support that rolls on casters and continuous passive motion exercises may be of further benefit [25] [62] [148]. The inactivation of myofascial trigger points in the hip area followed by home stretching exercises [149] may also be helpful

in relieving the stress concentration of contractures which might affect cartilage adversely and cause pain and impaired joint metabolism and stiffness [22]. Stretching exercises that improve joint range of motion also improve the ability of muscle to contract more rapidly and absorb unexpected impacts more effectively [22].

Since joint stiffness, pain, disability and muscle weakness are related in patients with hip osteoarthritis [150], a sensible approach to reducing hip joint pain and promoting hip function should also include a series of carefully graded non-weight bearing isometric strengthening exercises carried out on a daily basis to improve hip abductor and hip extensor muscle strength [80] and endurance [66]. Once muscle spasm and any evidence of joint inflammation have subsided, these exercises might be progressed to painfree isotonic exercises with 2 - 5 lb. weights performed thrice weekly.

Well designed non-weight bearing or partial weight bearing low-impact walking and conditioning exercises performed within the limits of pain and motion on a stationary bicycle, or in a warm pool (temperature 30°C - 34°C) [151], plus dancing, golfing, Tai-Chi, yoga and swimming exercises in water [62] [80] [102] [141] [151]-[155], have all been shown to promote functioning in those with no signs of acute inflammation. Additionally, to foster maximal functional ability, and prevent unexpected falls and fall injuries [156], optimizing the flexibility and strength of all muscle groups needed for good posture, walking, rising to standing and lifting, including upper and body segment rotary movements is equally helpful [116]. The re-education of postural control and balance is critical [66] because falls, which can cause further traumatic hip joint damage, are so common in people with hip osteoarthritis [9].

Conversely, unsupervised participation in non-medical health spas and fitness programs, high velocity land or water activities should be discouraged, as should high impact or contact sporting activities. Participation in carefully graded and supervised exercise programs specifically designed for people with arthritis, or hobbies that are adapted to an individuals' condition and do not aggravate symptoms or increase hip contact pressures unduly, should be encouraged.

Unfortunately, with few exceptions, there is little evidence to support the valuable role of exercise in hip osteoarthritis. What evidence does exist suggests that less improvement will occur with hip osteoarthritis than with knee osteoarthritis in response to exercise alone [157].

## 9. Physical Modalities

In addition to the use of joint sparing techniques, adaptive devices, ergonomic adaptations and exercises designed to lessen pain, the emphasis on pain reduction in osteoarthritis and its independent association with locomotor disability [158] has led to the widespread use of a number of pain-relieving therapeutic modalities. Some of these modalities have not been shown to be more effective than placebo [66] [159] [160]. However, to relieve pain transiently and to aid muscle relaxation particularly during an acute flare of the disease, and to treat associated inflammatory conditions such as bursitis or tendonitis, the benefits of ice therapy or transcutaneous electrical stimulation [66] cannot be discounted in the absence of any related empirical studies.

In mild sub-acute or chronic disease phases, such modalities, including hydrotherapy to facilitate therapeutic exercise and ambulation [161], plus shortwave diathermy and ultrasound applications, which are less effective for relieving pain than for increasing tissue temperature of deep articular structures, may help to facilitate joint mobilization and stretching procedures needed to maintain or increase hip joint range of motion [66] [161]. However, in the absence of well-designed controlled trials, the selection of any modality may have to be made empirically on an individual basis and in accordance with any safety risk [161].

## 10. Conclusions

Osteoarthritis, the most common form of arthritis, causes immeasurable suffering and pain in the older population. Generally, considered a progressive disease of one or more joints with multiple origins, efforts to minimize the rate of progression and severity using pharmacologic and/or surgical approaches are not always successful.

Management strategies designed with a view of optimizing joint physiology and joint integrity that take into consideration all potential contributing factors and pathological implications of the prevailing structural damage and dysfunction of the individual case can, however, be effective in relieving pain, restoring function and enhancing a patients' ability to live independently, even in the face of ongoing joint destruction processes [138] [154]. Careful diagnostic assessments and well planned conservative management programs for the individual patient are found to markedly improve quality of life when compared to the absence of any well-designed self-

management treatment program [36]. This suggests that the inordinate costs and magnitude of osteoarthritic disability could be markedly reduced by careful intervention, especially by well tailored and targeted secondary preventive strategies.

To be optimally effective, such strategies should be implemented at the earliest possible point in time and be continued throughout the life course of the patient, as required. A team approach with the patient playing an active role in their own self-care is highly recommended, as is a multi-component therapeutic program. Precautions to avoid unrealistic treatment goals that can lead to frustration, depression, misunderstanding, and inappropriate withdrawal from activities and family and consideration of the patient's social, emotional and psychological needs, are also essential for the achievement of optimal outcomes. Also, because excessive loading of a painfree but affected osteoarthritic joint can potentially cause further joint damage if the protective pain reflex is inhibited [17], or if a sensory deficit prevails [14], it may be necessary to caution patients not to increase their activities of daily living unduly over any treatment period. Patients may also need to avoid carrying out rapid impact loading activities, even if they do experience pain relief, as this could negate potential treatment benefits. Finally, as at other joints, at the hip, it is recommended that both the physical and the psychological status of the patient be assessed periodically to determine dosage and menu of recommendations, and emphasis should be placed on improving self-management skills and adherence to programmatic recommendations.

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