Maximizing Success In Osteoarthritis Care: Benefits Of A Comprehensive Management Approach

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Citation

Abstract
Osteoarthritis (OA) is a progressive condition that causes significant disability and impairment. In 2005, arthritis affected nearly 60% of Americans aged 65 years and older. The American College of Rheumatology, the American Geriatrics Society, and the American Pain Society have published guidelines on management of mild to moderate OA. These organizations advocate use of a comprehensive management program, which includes nonpharmacologic modalities (eg, education, use of assistive devices) as the cornerstone of therapy and pharmacologic intervention, such as over-the-counter or prescription analgesia, in patients needing pain relief. The purpose of this article is to outline a comprehensive management program for patients with an established diagnosis of mild to moderate OA of the hip or knee, which can be initiated by primary care providers and then collaboratively maintained by the patient and healthcare practitioners. Strategies to improve patient compliance with the program are described so that maximum benefit can be derived from the comprehensive approach.

INTRODUCTION
SUCCESS OF CURRENT APPROACHES TO OSTEOARTHRITIS MANAGEMENT AND RATIONALE FOR A NEW APPROACH

Arthritis is one of the most prevalent chronic health problems and the leading cause of disability in the United States. Osteoarthritis (OA), the most common form of arthritis in the United States, makes simple movements and activities of daily life painful and difficult to perform. The Centers for Disease Control and Prevention (CDC) estimates that in 2005, self-reported arthritis or other chronic joint symptoms affected approximately 21.4 million Americans aged 65 years and older (approximately 60% of individuals in this age range). This estimate is expected to reach 41.1 million by 2030, at which time individuals aged 65 years and older are expected to comprise 20% of the US population (up from 12.9% in 2005). Despite increasing awareness of the negative effects of obesity on health and OA in particular, overweight or obese, especially among the elderly, is increasing. Data from the National Health and Nutrition Examination Survey (NHANES) collected between 1999 and 2000 show that 64.5% of the US population is overweight, including 30.5% classified as obese. Men and women aged 60 to 74 years had the highest prevalence of obesity, accounting for 36% and 40% of all obese subjects, respectively.

Because there is no known cure for OA, management goals include pain control and anti-inflammatory treatment when needed, improvement of health-related quality of life (HR-QOL) and level of physical function, and avoidance of treatment side effects. The American College of Rheumatology (ACR) recommends that hip or knee OA be managed by the use of a comprehensive approach, which includes nonpharmacologic and pharmacologic therapies (Table 1).
Similar recommendations are endorsed by the American Geriatrics Society (AGS) and by the American Pain Society (APS). Participation in socio-behavioral self-management programs is one way to implement nonpharmacologic and cost-effective strategies such as exercise, weight loss, and proper nutrition, which have been demonstrated to improve the health status of patients with OA. However, fewer than 2% of patients with OA in the United States have participated in such programs. OA experts who attended a National Institutes of Health (NIH) conference titled “Stepping Away from OA: Prevention of Onset, Progression, and Disability of Osteoarthritis” believe that the reason why socio-behavioral programs have not been widely used is because they have not been implemented within the healthcare system. These programs may be made more effective if they are eventually integrated into medical care and recommended by healthcare providers to patients with OA. Additionally, patients’ acceptance of their own limitations may help them achieve a positive outlook on their progress and motivate them to participate in a comprehensive approach, thus helping them meet the goals of therapy.

Unfortunately, not all pain caused by OA can be eliminated by nonpharmacologic methods. Acetaminophen, because of its proven efficacy in relieving mild to moderate joint pain in patients with OA, its safety profile, and its low cost, is the drug of choice for initial therapy. In patients whose pain is not relieved with adequate doses of acetaminophen, traditional nonsteroidal anti-inflammatory drugs (NSAIDs), cyclooxygenase (COX)-2 inhibitors, nonacetylated salicylates, or topical analgesics may be used. The purpose of this article is to outline the structure of and provide evidence for a comprehensive program to manage OA with activity, nutrition, weight loss, and pharmacologic therapy, and to identify strategies to improve patient compliance with the program to derive maximum benefit from the comprehensive approach.

**ROLE OF ACTIVITY IN OSTEOARTHRITIS MANAGEMENT AND PREVENTION**

For patients with OA, physical activity has been demonstrated to improve pain, physical function, QOL, and strength. Quadricep weakness is a characteristic common to many patients with OA, and it is believed to be caused by disuse atrophy secondary to joint pain. A study of 107 patients with knee OA demonstrated that muscle weakness mediates the relationship between avoidance of activity and physical disability (Figure 1), leading to a continual decline in physical function. However, one study of 462 volunteers aged 65 years and older determined that quadricep weakness may be present in patients who have radiographic evidence of OA but who have not yet developed knee pain, suggesting that quadricep weakness also may be a risk factor for knee pain, disability, and progression of joint damage. Therefore, muscle weakness may function as both a risk factor for and a consequence of knee pain, disability, and joint damage.
Figure 2

Figure 1: Pain experienced by patients with osteoarthritis causes them to avoid activity, which leads to muscle weakness, contributing to the instability of the affected joints and increasing the level of disability and pain. This cycle continues, causing sequentially greater disability (reproduced from reference 14, with permission).

Fortunately, several studies have demonstrated that patients with OA can safely participate in exercise regimens designed to improve flexibility, muscle tone, and endurance, and that these exercises may improve pain, physical function, and QOL. In a study that evaluated the effect of strength training on pain, physical function, and knee extension strength, 46 adults aged 55 years or older with knee OA were randomized to 1 of 2 programs, which lasted 4 months and consisted of either home-based progressive strength training or nutrition education. Study personnel provided 12 home visits for patients in the strength-training group and 7 visits for patients in the nutrition group. The strength-training program, performed 3 times per week in the patient's home, consisted of 5 exercises with 20-pound progressive ankle weights and 2 exercises using body weight for resistance. In the strength-training group, investigators observed improvements in self-reported pain and physical function (P=.01), physical performance measures (P≤.04), and affected leg strength (P=.001), compared with the attention control group. In a less supervised study, 786 patients aged 45 years or older with self-reported knee pain received home-based strength training with or without the use of elastic bands. Patients were contacted monthly by telephone, or there was no intervention. Even with little supervision, a 12% reduction in pain was observed in the strength-training group, compared with the control group (P=.001).

Studies involving aerobic exercise and strength training also have been conducted. One study evaluated the effect of an aerobic exercise program, a resistance exercise program, and a health education program in 439 adults with knee OA aged 60 years or older. After 18 months, the patients in the aerobic exercise and resistance exercise groups had approximately 10% lower mean score on a physical disability questionnaire and a knee pain questionnaire (P≤.02 for all comparisons), and they scored better on measures of physical function than the patients in the health education group.

Physical activity and an increase in quadriceps strength appear to have a positive impact on knee pain and disability in most patients with OA. However, epidemiological data suggest that patients with stronger quadriceps and malaligned or lax knee joints are at greater risk for structural progression. In 237 patients with knee OA, high quadriceps strength (defined as maximal torque measured during movement greater than 47.3 ft-lb [median strength of right lower limbs in the sample]) in patients with malaligned knees was associated with an increase in the likelihood of OA progression (P=.03). Similar results were observed in patients with high laxity knee joints (P=.003). Care should be taken to ensure that patients with malaligned or lax knee joints do not experience further joint damage as a result of increased quadriceps strength.

INFLUENCE OF NUTRITION ON OSTEOARTHRITIS

Nutrition is an important part of a comprehensive approach to OA management, which should include weight loss for overweight patients and attention to intake of nutrients possibly associated with positive outcomes in patients with OA to prevent further structural progression and to maximize mobility and QOL. People who are overweight are at a higher risk of developing knee OA (and possibly hip or hand OA) than are people who maintain normal weight. Even a modest weight loss of approximately 5 kg will reduce the risk of knee OA by 50% within 10 years. In addition, the intake of certain nutrients such as vitamins C and D may alter the progressions of symptoms and structural damage in OA.

LINKING NUTRITION, EXERCISE, AND WEIGHT LOSS

Obesity increases the incidence and progression of knee OA. In the Framingham cohort, higher body mass index (BMI) and weight gain were associated with increased risk for development of OA during a follow-up period of approximately 10 years. In 354 patients, those with a
higher BMI (>25.4 kg/m^2) were at a greater risk for incident radiographic knee OA, compared with patients with a lower BMI (<22.7 kg/m^2). Higher BMI also was associated with increased risk of structural progression of OA in the same study population. Carrying extra weight may increase the risk of structural progression more in OA patients with moderately malaligned knees, compared with patients with neutral or severely malaligned knees. One explanation for this observation is that increased loading from extra weight concentrates on a focal area in malaligned knees, whereas this same increased loading is distributed more evenly in neutral knees. Severely malaligned knees, however, may already be damaged to such an extent that the extra weight does not affect the risk of structural progression of OA.

There have been several studies suggesting that knee pain is more common in overweight individuals. Among patients who underwent meniscal resection in the past, more overweight individuals reported knee pain. Similarly, in a study of forestry employees in Finland, being overweight was also a risk factor for developing knee pain.

The Arthritis, Diet, and Activity Promotion Trial (ADAPT) evaluated overweight and obese patients aged 60 years or older with knee pain, radiographic evidence of knee OA, and self-reported physical disability. Patients were assigned to 1) dietary intervention aimed at achieving and maintaining a 5% weight loss for 18 months; 2) a 3-day-per-week exercise regimen consisting of a 15-minute aerobic phase, a 15-minute resistance training phase, another 15-minute aerobic phase, and a 15-minute cool-down phase; 3) diet and exercise; or 4) healthy lifestyle training that provided attention, social interaction, and health education. Only those patients assigned to the diet and exercise group exhibited significant improvements in self-reported physical function and knee pain, 6-minute walk distance, and stair-climb time, compared with patients in the healthy lifestyle control group (P≤.05 for all outcomes) (Figure 2). The combination of weight loss and exercise may provide better improvement in knee OA than either one of them alone.

**ROLE OF NUTRITIONAL SUPPLEMENTS**

It is hypothesized that metabolic processes that take place in joints (eg, production of reactive oxygen species by cells in the cartilage and synovium, and collagen, chondrocyte, and bone metabolism) may be affected by antioxidants, vitamin D, and certain types of fatty acids. Therefore, dietary manipulation may lead to a decrease in pain, a prevention of disability, and an improvement in QOL in patients with OA.

Adequate vitamin D levels may be important in patients with OA because vitamin D is necessary for normal bone and cartilage metabolism. In a small number of studies, low levels of vitamin D have been associated with increased risk of progression of knee OA and joint-space narrowing in hip OA. In 75 of 556 participants with knee OA in the Framingham Study who had complete knee radiography and vitamin D serum level assessments, risk for progression of knee OA and joint-space narrowing in hip OA. In 75 of 556 participants with knee OA in the Framingham Study who had complete knee radiography and vitamin D serum level assessments, risk for progression of knee OA and joint-space narrowing in hip OA. In 75 of 556 participants with knee OA in the Framingham Study who had complete knee radiography and vitamin D serum level assessments, risk for progression of knee OA and joint-space narrowing in hip OA.

* P≤.05 vs healthy lifestyle group.

WOMAC = Western Ontario and McMaster Universities Osteoarthritis Index.
the hip 8 years later. More recently, it was shown that, during a 30-month period, correction of serum vitamin D levels improved pain and physical function in patients with knee OA.  

There is less evidence for vitamin C, but one epidemiological study showed that a higher consumption of vitamin C (ie, approximately 2 times the recommended daily allowance) decreased the risk of structural progression of OA and of the development of knee pain when compared with lower intake of vitamin C.  

Aside from several vitamins, there is some suggestion that fatty acids may play a role in OA. In one study, 164 patients with knee or hip OA were randomized to receive a mixture of avocado and soybean oil or placebo for 6 months. They were then observed for 2 months after the treatment period. Patients in the active treatment group scored better on Lequesne's functional index (P<.001), reported less severe pain (P=.003), and consumed fewer NSAID doses than patients in the placebo group (P=.54). Ex vivo studies have shown that supplementation with omega-3 fatty acids may reduce proteoglycan loss, decrease collagenase and metalloproteinase activity, and decrease expression of inflammatory mediators. However, there are no epidemiological or clinical trial data investigating the effect on OA of consumption of omega-3 fatty acids. 

In summary, nutrition and exercise are important in the management of OA. Practitioners may consider encouraging OA patients to maintain adequate intake of vitamin D through dietary habits or supplementation. The combination of weight loss and exercise is more effective at improving physical function and reducing pain than weight loss or exercise alone. 

**DRUG THERAPY FOR RELIEF OF OSTEOARTHRITIS PAIN**

The primary goal of pharmacologic intervention in OA management is pain control. Pharmacologic intervention should be initiated as an adjunct to nonpharmacologic modalities when they fail to control the symptoms of OA. Guidelines for the management of OA pain recommend acetaminophen at doses of up to 4000 mg per day as first-line therapy for relief of mild to moderate OA pain because of its proven efficacy, safety, and cost. This recommendation is based on the results of clinical trials demonstrating the comparable ability of acetaminophen and certain NSAIDs to relieve knee pain. In a double-blind, randomized trial, Bradley and colleagues showed that 4 weeks of treatment with acetaminophen 4000 mg/d resulted in relief of knee pain in 184 patients with OA, which was comparable to relief caused by ibuprofen 1200 mg/d and ibuprofen 2400 mg/d. Subsequent to the publication of treatment guidelines by the ACR in 2000, results of a randomized, parallel-group, double-blind, 6-week trial comparing the efficacy and safety of rofecoxib (12.5 or 25 mg/d), celecoxib (200 mg/d), and acetaminophen (4000 mg/d) in 382 patients with OA of the knee demonstrated that pain relief in the rofecoxib 12.5 mg/d, celecoxib, and acetaminophen groups was comparable. Rofecoxib 25 mg/d (no longer commercially available) was the most effective treatment. 

Patients should be strongly encouraged and reminded not to exceed the recommended doses of any of these medications. To avoid inadvertently ingesting more than the recommended dose of acetaminophen, patients should be advised to carefully read the labels of other over-the-counter (OTC) or prescription pain medications because many combination products contain acetaminophen. Patients with preexisting liver disease may be given acetaminophen for pain relief, and those who consume more than 3 alcoholic drinks per day should be reminded to consult a physician before beginning a regimen of acetaminophen or any other pain reliever. Recent data provide reassurance that alcoholics can take up to 4 g per day of acetaminophen without added risk. 

If OA pain does not respond to maximum doses of acetaminophen, patients may need to consult their primary care provider for a reevaluation of their condition. Traditional NSAIDs or COX-2 inhibitors have been shown to be effective for OA pain and are recommended as second-line drugs for the treatment of mild to moderate OA. Alternatively, several nonsystemic therapies, including topical analgesics (eg, NSAIDs, capsaicin), are available for patients with OA who do not respond to acetaminophen or who do not wish to take systemic therapy. NSAIDs have been estimated to cause dyspepsia in 15% to 40% of patients, and peptic ulcers have been identified at endoscopy in 25% of long-term NSAID users. However, not all endoscopically identified ulcers are symptomatic. Patients who are treated with an NSAID are at risk for developing reversible renal failure if they have reduced renal perfusion, such as that caused by increased age, hypertension or congestive heart failure, or diuretics or angiotensin-converting enzyme (ACE) inhibitors. COX-2 inhibitors may have an advantage over traditional NSAIDs because
they may cause a lower incidence of gastrointestinal adverse events.\textsuperscript{48-51} Like traditional NSAIDs, COX-2 inhibitors may cause renal toxicity.\textsuperscript{52-55} Both traditional NSAIDs and COX-2 inhibitors have been associated with increased risk for thrombotic cardiovascular events.\textsuperscript{56-59} This association led to the addition of a black-box warning to the labels of prescription NSAIDs and celecoxib regarding myocardial infarction, ischemic stroke, and gastrointestinal bleeding. Traditional NSAIDs, COX-2 inhibitors, and acetaminophen have all been associated with increases in blood pressure.\textsuperscript{60-63} The gastrointestinal risks of NSAIDs and COX-2 inhibitors may be minimized by screening patients for risk factors and recommending appropriate prophylactic measures (Table 2).\textsuperscript{61}

**Figure 4**

Table 2: A clinician's guide to NSAID therapy options according to cardiovascular and gastrointestinal risk status (adapted from reference 61, with permission)

<table>
<thead>
<tr>
<th>Cardiac vascular risk</th>
<th>NSAID gastrointestinal risk</th>
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</thead>
<tbody>
<tr>
<td>No cardiovascular risk (no aspirin)</td>
<td>Lowest possible dose of traditional NSAID</td>
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<td></td>
<td>Or</td>
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<td></td>
<td>Lowest possible dose of traditional NSAID plus misoprostol or PPI</td>
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<td></td>
<td>Or</td>
</tr>
<tr>
<td></td>
<td>Consider non-NSAID therapy</td>
</tr>
<tr>
<td>Cardiovascular risk (consider aspirin)</td>
<td>Lowest possible dose of traditional NSAID plus if a traditional NSAID is used</td>
</tr>
<tr>
<td></td>
<td>Or</td>
</tr>
<tr>
<td></td>
<td>Misoprostol or PPI if it is prescribed</td>
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<td></td>
<td>Or</td>
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<td></td>
<td>Consider non-NSAID therapy</td>
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**BENEFITS OF A COMPREHENSIVE APPROACH TO OSTEOARTHRITIS**

A comprehensive management program for OA, such as the one depicted in Figure 3, includes nonpharmacologic and pharmacologic interventions to relieve pain and improve QOL and physical function. This is why the ACR, the leading authority in OA management, recommends use of nonpharmacologic interventions as the cornerstone of OA management, with pharmacologic interventions recommended for those whose OA symptoms are not adequately controlled by nonpharmacologic intervention.\textsuperscript{2}

**Figure 5**

Figure 3: In the comprehensive OA management program pictured, a patient with mild to moderate OA and his or her primary care physician work together to implement physical activity, nutrition, weight loss, and pharmacologic therapy into the patient's lifestyle to improve symptoms of OA and to prevent structural progression. If the patient's OA progresses or if pain persists, the physician should reevaluate the patient and may readjust the components of the comprehensive management plan or consider referral to a rheumatologist or orthopedist.

The measures outlined in this comprehensive management program for OA are intended for patients with mild to moderate OA. When these measures fail to adequately manage the OA, patients should be referred to a rheumatologist or orthopedist for further evaluation and initiation of a more rigorous management program. Physical therapy consultations are recommended for all patients with OA of the hip as part of their comprehensive management program, regardless of severity.\textsuperscript{2}

**Potential barriers to effective implementation of a comprehensive OA management program include limited physician and other healthcare provider time and low comfort level with exercise and nutritional counseling; unrealistic patient expectations of a “magic bullet” that will cure or otherwise treat the condition; and poor patient compliance with lifestyle modification (ie, diet and exercise). The comprehensive management program outlined herein is a proactive approach that emphasizes patient involvement and early intervention to establish healthy habits early in the course of OA (ie, while symptoms are still mild to moderate in severity). This program can be initiated by a primary care provider. The patient and the provider together can monitor the progression of the disease and initiate pharmacologic and nonpharmacologic modalities for**
symptom management, as needed. When acetaminophen or OTC NSAIDs no longer control the pain, the patient’s condition should be reassessed and initiation of prescription analgesics may be considered. An important component of the comprehensive program is education for patients on the limitations they can expect to encounter as their OA progresses. Knowledge and acceptance of these limitations may help patients achieve a positive outlook on their progress, and may motivate them to participate in the program, thus helping them meet their treatment goals. Early adoption of healthy behaviors may improve patient compliance with the regimen, thus potentially prolonging the time until pharmacologic intervention becomes necessary.

CONCLUSIONS
OA is a progressive and debilitating condition that hinders activities of daily life and causes significant disability, especially among older individuals. Several prominent organizations dedicated to improving the health and lives of patients with OA (eg, the American College of Rheumatology, American Geriatrics Society, and American Pain Society) advocate a comprehensive management program for OA, which includes nonpharmacologic modalities as the cornerstone of therapy and pharmacologic intervention in patients needing pain relief. However, data suggest that adoption of and adherence to such a comprehensive management program is poor. It is recommended that a comprehensive OA management program be initiated within the healthcare system and recommended to patients by their healthcare providers. The program outlined herein is designed to be initiated by a healthcare provider for patients with mild to moderate OA of the hip or knee, and then to be carried out by the patient in collaboration with his or her provider. With appropriate education, including information on the progressive nature of OA and realistic expectations of what the management program could accomplish, patients should be adequately prepared to participate in management of their OA. Patients and their primary healthcare providers should be able to manage OA before it progresses beyond the mild to moderate stage, and before consultation with a rheumatologist, orthopedist, or orthopedic surgeon becomes necessary. Early adoption of healthy behaviors, such as increased activity, weight loss, and proper nutrition, is expected to improve patient compliance, to prolong the time until pharmacologic intervention and specialist referrals become necessary, and to reduce dependence on analgesia.

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