Chapter 5

Pain Management in Knee Osteoarthritis

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Additional information is available at the end of the chapter

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Abstract

Osteoarthritis (OA) of the knee is the commonest degenerative joint disease affecting older adults. Risk factors for the knee OA includes female gender, advanced age, overweight, obesity, previous knee injuries, previous knee surgery, and certain jobs that require continuous knee bending. Pain is the major symptom of knee OA and increased pain causes reduced physical function and poor quality of life. In addition to pain, patients may have joint stiffness, knee extensor muscle weakness, and altered proprioception. A multitude of structural, physical, and psychosocial factors influences symptom and severity of pain in knee OA. Rehabilitation of knee OA aims to train the patients in coping strategies, improves physical health, quality of life, and maintains their independence in daily livings. Management of knee OA often requires a combination of pharmacologic and nonpharmacologic treatment approaches.

Keywords: Knee, osteoarthritis, pain, rehabilitation, physiotherapy

1. Introduction

Osteoarthritis (OA) of the knee is a prevalent musculoskeletal disorder causing pain and disability in older population [1]. Worldwide statistics indicates more than 100 million individuals globally affected by OA [2, 3]. The prevalence of OA is expected to double at the end of the year 2020 [4]. The prevalence of symptomatic knee OA in male and female is approximately 40 and 47%, respectively [5]. Evidence of radiographic knee OA in the United States is approximately 19% in adults aged 45 years and older [5]. While male and female are equally affected by OA, it is reported to be more common in young adult male (<45 years) and in the older adult female (>45 years) [6–9].

Risk factors for the knee OA includes female gender, advanced age, overweight, obesity, previous knee injuries, previous knee surgery, and certain jobs that require continuous knee

bending (kneeling and lifting) [10, 11]. Biomechanical factors including, abnormal joint congruity, muscle weakness, mal-alignment, or internal derangement of knee, facilitate the progression of knee OA in those persons, who are susceptible to the development of the knee OA [12, 13]. Lower extremity muscle weakness has vital role in the progression of the knee OA [14, 15]. Previous studies indicate that weaker quadriceps muscle is associated with symptomatic knee OA and weakness of muscles increases the risk of physical disability [14, 15].

Knee OA can be classified either symptomatically or radiographically. The Kellgren–Lawrence (KL) [16] grading scale has been used to diagnose radiographic knee OA. The symptomatic knee OA has been diagnosed clinically followed by radiographic confirmation.

The symptoms of knee OA includes pain, stiffness, limited range of motion, swelling, crepitus, and muscle weakness [17, 18]. Knee pain significantly influences physical function depending on the site of pain and unilateral or bilateral involvement [19]. Knee pain affects variety of activities including the limited ability to use stairs, standing up from the chair, walking on uneven terrain, floor sitting, and squatting [20–22].

Rehabilitation of knee OA aims to train the patients in coping strategies, improves physical health, quality of life, and maintains their independence in daily livings. These goals can be achieved by variety of interventions including, pharmacological approach, physical therapy, education, weight reduction, orthotic, and surgery.

2. Risk factors

There are variety of risk factors including age, gender, occupation, osteoporosis, genetics, nutritional factors, previous injury, knee extensor muscle weakness, and obesity [23, 24]. A recent meta-analysis provides further evidence that increased body mass index (BMI), past knee injury, age, female gender, and hand OA are the major risk factors causing knee OA [11]. The frequency of OA is increased in older population. In the United Kingdom, up to 40% people above the age of 65 years has been suffering from the symptoms associated with knee or hip OA [25]. While male and female are equally affected by OA, it is reported to be more common in the young adult male (<45 years) and in the older adult female (>45 years) [6–9].

A previous study reported some occupational activities, for example, kneeling, high levels of physical activity, farming, and construction work are potential risk factors for developing knee OA [11]. Another study reported double the risk of developing knee OA in individuals whose jobs required carrying and kneeling, or squatting activities compared to individuals whose jobs did not require such physical activities [26]. In addition, jobs which require repetitive task or sports, particularly endurance sports in which joint injuries are common, may predispose OA [27].

Obesity is recognized as major risk factors for mechanical joint damage, particularly in weight-bearing joints, and is often present with sedentary people with knee OA [28, 29]. The risk of incidence and progression of lower extremity OA increases with obesity [30], and the risk of knee OA increases four times more compared with individuals with a BMI of <30 kg/m^2 [31].

Another study reported 83% of the female participants had knee OA who were obese compared to 42% of non-obese control group [32]. In addition, obesity can alter the mechanics of joint and develop inflammation and cause increased pain [33, 34]. Furthermore, increased fat around the quadriceps muscle causes reduced activity of the muscle, resulting in decreased function [35].

Previous studies had reported knee extensor muscle weakness, a major risk factor for knee OA, especially in women [36, 37]. Other studies found knee extensor muscle weakness in people with knee OA compared to control subjects [7, 15, 38]. In addition, Segal et al. [39] reported low risk of symptomatic knee OA in individuals with greater quadriceps muscle strength. The weakness of quadriceps muscle causes reduced functional disability in knee OA [22]. Furthermore, the presence of pain causes disused atrophy which results quadriceps weakness in knee OA [14].

3. Diagnosis of osteoarthritis

The diagnosis of the OA often made clinically, and radiological features confirm the diagnosis. The presence of pain in the knee, morning stiffness lasting over the 30 min, limited movement, crepitus, swelling, and advanced age usually the main characteristics that indicate the diagnosis of knee OA. The narrowing of joint space, sclerosis of subchondral bone, and formation of subchondral cyst and osteophytes are radiological features seen in knee OA [40].

Kellgren and Lawrence [16] have developed a radiological scale to classify knee OA into four grades on antero-posterior view of radiograph taken in standing position. "Grade 0 is defined as no radiographic findings of osteoarthritis, Grade 1 as minute osteophytes of doubtful clinical significance, Grade 2 as definite osteophytes with unimpaired joint space, Grade 3 as definite osteophytes with moderate joint space narrowing, and Grade 4 as definite osteophytes with severe joint space narrowing and subchondral sclerosis" [41]. In addition, the American Rheumatism Association (ARA) has developed a more specific classification system in 1986, known as the American College of Rheumatology (ACR) criteria. These criteria included several validated clinical and radiological features [42].

4. Clinical manifestations

Pain is the major symptom of knee OA, and increased pain causes reduced physical function and poor quality of life [43]. In addition, knee pain causes difficulty in performing activities of daily livings including shopping, household chores, stair climbing as well as participation in social and outdoor activities [44]. Furthermore, pain related to knee OA influences work productivity and employment status [45]. In addition to pain, patients may have joint stiffness, knee extensor muscle weakness, and altered proprioception [46–48]. These symptoms often cause restriction in the ability to get up from the chair, difficulty in walking, and stair climbing [46]. Limping gait, poor limb alignment, and instability are some other features seen in people

with knee OA [49]. A crepitus sound can be heard during movements due to the presence of irregular joint surfaces in knee OA [50].

A multitude of structural, physical, and psychosocial factors influences symptom and severity of pain in knee OA [43, 51, 52]. Although the role of nociceptors in the capsule, subchondral bone, ligaments, and other joint tissues precipitation symptom of pain was established, however, structural deformation in knee OA is not associated with the severity of pain [53]. Previous studies reported that the impairments in the physical and psychological functions are the major predictors of the severity of knee pain. Reduced muscle strength, especially of the quadriceps, is associated with severity of pain and low level of physical function [52, 54]. Psychological impairments such as pain catastrophizing [55], reduced pain coping skills [56], depression [57, 58], anxiety [57], and reduced social participation [58] are also associated with the severity of pain in individuals with knee OA. Furthermore, pain and physical and psychological impairments have shown bi-directional relationships, that is, physical and psychological impairments can influence, and in turn be influenced by severity of pain, results a further reduced physical and mental functioning [59].

5. Rehabilitation

Management of knee OA often requires a combination of pharmacologic and nonpharmacologic treatment approaches [60, 61]. Several clinical guidelines have been published by the scientific society for nonpharmacological treatment approach in knee OA [62–68]. Several randomized, controlled clinical trials have been published showing therapeutic effectiveness of exercise-based approaches, including range-of-motion exercises, aerobic exercise programs, and muscle-strengthening exercises [60, 61, 69, 70]. A previous study reported significant reduction in pain and functional disability scores of the Western Ontario and McMaster Universities (WOMAC) outcome measure following a home exercise program [69]. Another study reported significant reduction in pain following isometric quadriceps exercises for 3 months in knee OA [70]. Stitik et al. [71] had reported a significant reduction in pain intensity following combined use of hyaluronate injections and home exercise program in moderately severe pain in individuals with knee OA. Furthermore, previous randomized controlled studies reported that a simple quadriceps exercise performed at home was effective in reducing pain as well as functional disability [72, 73]. Another study reported a significant reduction in pain intensity and improved function following a simple group education program in patients with knee OA [74].

Passive treatment in the form of physiotherapeutic modalities such as short-wave diathermy, transcutaneous electrical nerve stimulation (TENS), ultrasound and hot packs often used to reduce both acute and chronic pain in knee OA [75]. However, Moffett et al. [76] reported that the short-wave diathermy had no additional benefits than placebo effects when used for 3 weeks in knee OA. In a recent published review, Zeng et al. [77] reported that the interferential current seems to be effective pain relief intervention in knee OA. Furthermore, they recommended that the other electrical stimulation therapy such as TENS, neuromuscular electrical

stimulation, pulsed electrical stimulation, and noninvasive interactive neurostimulation is either uncertain or not appropriate for pain relief in knee OA [77].

Fransen and McConnell published a Cochrane review, in which, land-based therapeutic exercise (aerobic, resistance, stretching, strengthening, and range-of-motion exercises exercises) was compared with the non-exercise control group (home visits, education, waiting list, telephone call, relaxation, no intervention) in patients with hip or knee OA. The results of review indicate a significant reduction of self-reported pain and physical function for therapeutic exercise compared with control group [78]. Quadriceps strengthening is vital for alleviating pain and improving function in individuals with medial compartment knee OA [79]. Previous studies reported a reduced pain and improved function following knee flexors and extensors or hip abductors strengthening in knee OA [80–83]. Recently, a systematic review of 18 randomized controlled trials published, most of the included studies involved home-based exercise of quadriceps or lower extremity strengthening in knee OA. The results of this study indicate a significant reduction of pain and improvements in self-reported physical function following strengthening exercise in knee OA [79]. In another review, aerobic walking or home-based quadriceps-strengthening exercise was compared with a non-exercise control group in patients with knee OA. The results of review indicate both the types of exercise (aerobic walking or home-based quadriceps-strengthening exercise) significantly reduced knee pain compared with control group [84].

Cognitive behavioral therapy (CBT) is a psychological approach to train and enhance pain coping skills and found to be effective in reducing pain and improvement in self-efficacy in patients with knee OA [85–88]. CBT protocol includes three components: (i) patients education about the pain and the effect of pain coping skills on pain reduction, (ii) use of several cognitive and behavioral pain coping skills in a systematic manner, and (iii) the most challenging is to teach the patients how to use learned coping skills in a real-life situations [89]. A meta-analysis published recently had found that CBT is the most common studied psychosocial therapy approach for pain management in patients with arthritis [85]. Other studies recommended the use of pain coping skills training based on CBT, to reduce pain and improve psychological well-being in chronic pain conditions in patients with knee OA [90, 91].

Various other treatment techniques had shown significant effects on pain reduction in knee OA. Hinman et al. [92] reported significant reduction of pain following 3 weeks of therapeutic taping. Mulligan's mobilization with movement (MWM) technique seems to provide immediate pain relief and improved function in patients with knee OA [93]. Previous study recommended the use of laterally elevated wedge insoles inserting inside the shoes in patients with medial compartment knee OA [94]. Another study reported significant relief of pain using laterally elevated wedged insoles compared to neutrally wedged insoles in patients with knee OA [95]. However, other study reported no additional benefits of using braces and orthoses for the management of knee OA [96].

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