

# DIAGNOSIS AND MANAGEMENT OF UNICOMPARTMENTAL KNEE OSTEOARTHRITIS

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## INTRODUCTION

Osteoarthritis (OA) is the most common joint disorder in the world. Radiographic evidence of OA is seen in the majority of people by 65 years of age, and in about 80% of those aged over 75 years (1). OA of the knee, the principal joint to be affected, is a common clinical problem: 2% of the United States population over seventeen years of age and 10% of people over sixty-five years of age have clinically relevant arthritis of the knee (2). Arthritis of the knee causes pain and restricts activity, and patients with arthritis are twice as likely to seek medical care as are their peers without arthritis (3). The risk of disability due to knee OA alone is as great as that due to cardiac disease and greater than that due to any other medical disease in the elderly (4).

The most common symptom of arthritis of the knee is pain confined to the affected compartment(s), which may be associated with swelling, effusion, instability, impingement, crepitus, stiffness, and malalignment. Radiographic findings of knee arthritis may include joint space narrowing, squaring of the femoral condyle, subchondral sclerosis, intercondylar spurring, joint line osteophytes, and varus or valgus malalignment of the affected limb (5).

The etiology of OA is multifactorial and various risk factors are known to increase the susceptibility to OA. These include heredity,

obesity, reproductive variables, age, hypermobility, and mechanical factors like joint trauma, abnormalities of joint shape, and various occupations and activities (1). Although age is the strongest risk factor for OA, it is not possible to see OA as a form of premature aging. Various differences can be set between osteoarthritis and aging.

The medial compartment of the knee is overall more affected than the lateral compartment of the knee. "Unicompartmental" arthritis of the knee is a degenerative condition characterized by abnormal articular cartilage in the medial part of the tibiofemoral joint, which may be associated with meniscal disruption, ligamentous instability, and limb malalignment. The most common symptom is pain confined to the medial compartment, which may be associated with other symptoms of OA (6).

## Natural History

The specific cause of degenerative arthritis of the knee is not clear, but when it occurs in an active patient, it is generally progressive (7, 8). Trauma is frequently a cause of the degenerative process, which results in the deterioration of articular cartilage and symptomatic degenerative arthritis (6). The degenerative process may include articular cartilage damage (chondrocytes and matrix), meniscal damage, ligament damage, and joint incongruity.

Angular malalignment may contribute to the development and progression of unicompartmental arthritis of the knee by overloading the medial aspect of a tibiofemoral joint with abnormal articular cartilage. The spectrum of articular cartilage damage can range from minimal to severe. Small, superficial, focal defects of articular cartilage that are not associated with the symptoms should be distinguished from extensive, full-thickness cartilage defects associated with symptomatic degenerative arthritis (9).

The location and size of articular cartilage defects determine the severity of symptoms and the need for treatment (9). When an articular cartilage lesion is less than 2 to 3 cm<sup>2</sup> in area, or a lesion has good peripheral cartilage support (shoulders), it may take several years before degenerative arthritis develops. Minas and Nehrer (9) suggested that articular cartilage defects in which the exposed subchondral bone is not supported by a peripheral cartilage border are often symptomatic and deteriorate more quickly. Symptomatic lesions of articular cartilage often progress with age, and treatment of isolated chondral or osteochondral defects may decrease or minimize the development of degenerative arthritis.

### Diagnosis and Evaluation

In the diagnosis of osteoarthritis the most widely used criteria were developed by the American College of Rheumatology (10) (Table I). History and physical examination can provide useful clues about pain, stiffness, joint line tenderness, meniscal damage, ligamentous instability, and malalignment associated with unicompartmental arthritis of the knee.

Radiographic evaluation is an essential component in the diagnosis and follow-up of knee OA. Several radiographic grading systems are proposed. Most epidemiologic systems propose the simple Kellgren-Lawrence system, which was first described in 1957. This system assigns one of five grades (0 to 4) at various joint sites (knee, hip, hand and spine) according to sequential appearance of osteophytes, joint space loss, sclerosis, and cysts (1) (Table II). Ahlback's grading system is the most widely used one currently (1) (Table III).

**Table I:** The American College of Rheumatology diagnostic criteria for knee OA

Clinical	
1. Knee pain for most days of the prior month	1,2,3,4
2. Crepitus on active joint motion	or
3. Morning stiffness ≤ 30 min in duration	1,2,5
4. Age ≥ 38 years	or
5. Bony enlargement of the knee on examination	1,4,5
Clinical and radiographic	
1. Knee pain for most days of the prior month	1,2
2. Osteophytes at joint margins (radiograph)	or
3. Synovial fluid typical of OA (laboratory)	1,3,5
4. Age ≥ 40 years	or
5. Morning stiffness ≤ 30 min	or
6. Crepitus on active joint motion	1,4,5,6

**Table II:** Kellgren-Lawrence radiographic grading system for OA (1).

Grade	Classification	Description
0	Normal	No features of OA
1	Doubtful	Minute osteophyte, doubtful significance
2	Minimal	Definite osteophyte, unimpaired joint space
3	Moderate	Moderate diminution of joint space
4	Severe	Joint space greatly impaired with sclerosis of subchondral bone

**Table III:** Ahlback grading system for OA.

Grade	Description
Stage I	Joint space narrowing
Stage II	Joint space obliteration
Stage III	Minor bone attrition
Stage IV	Moderate bone attrition
Stage V	Severe bone attrition
Stage VI	Subluxation

Radiographs made in the anteroposterior plane with the patient bearing weight as well as lateral, tangential patellofemoral, and tunnel views allow objective evaluation of the three compartments of the knee (Fig. 1) Radiographic sensitivity with regard to showing deterioration of the articular cartilage may be improved by making posteroanterior views with the patient bearing weight and with the knee flexed 40° to evaluate the posterior aspects of the femoral condyles and tibial plateau, especially in the lateral compartment. Radiographs of the hip, knee, and ankle made on one long film with the patient

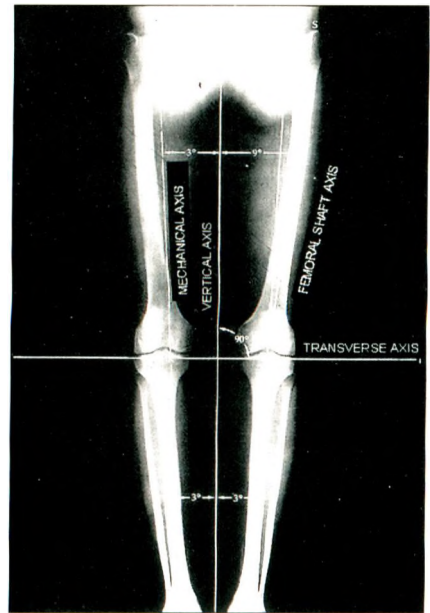
**Table IV:** Treatment alternatives for unicompartmental osteoarthritis

1. Conservative management
a. Non-Pharmacological treatment
i. Patient Education
ii. Weight Loss
iii. Exercise and Physical Therapy
iv. Support Devices and Braces
v. Footwear Modification and Orthotics
b. Pharmacological Treatment
i. Topical Agents
ii. Intraarticular Therapy
1. Corticosteroid injections
2. Intra-articular hyaluronate
iii. Oral Medications
1. Analgesic medications
2. Non-steroidal anti-inflammatory drugs
3. Opioid analgesics
iv. Adjunct Therapies
1. Nutritional Supplements
2. Other agents
2. Operative Management
a. Arthroscopy
b. Osteotomy
c. Unicompartmental Knee Arthroplasty
d. Total Knee Arthroplasty



**Fig. 1:** Plain AP view of a medial unicompartmental osteoarthritis patient

standing allow calculation of the static mechanical axis and identification of any angular deformity of the involved limb. (Fig. 2) The mechanical axis is determined by a line drawn from the center of the femoral head to the center of the knee joint and a line drawn from the center



**Fig. 2:** Various axis of the knee joint

of the knee joint through the center of the ankle joint. A mechanical axis of 0° to 3° of varus is considered to be within normal limits. Generally, a varus or valgus deviation of =10° is associated with symptoms of unicompartmental arthritis (6). Dynamic gait analysis can provide additional information about ligamentous insufficiency and malalignment. Before a specific treatment is selected, inflammatory arthritides should be excluded as a cause of unicompartmental arthritis.

In clinical practice, quantitative assessment is very important for both establishing the current status, detecting the change in status and also for quantification of response to therapy. In the "performance-based" assessment for patients with knee OA, we can use 50 foot walk time. In addition, WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index) and Lequesne Index can be applied in the follow up of these patients (11).

### Conservative Management of Knee Osteoarthritis

The objectives of management are; educating the patients, alleviating pain, improving function, decreasing disability and preventing the progression of the disease and its consequences. Current treatments aim at

decreasing the symptoms by several methods: Non-pharmacological treatments, pharmacological treatments and invasive interventions. (Table III) Various guidelines on the management of knee OA have been published. (3,4,9,12) Recent clinical research suggests a variety of agents that may alter the course of OA. Possible "disease modifying agents" are glucosamine, enzyme inhibitors (tetracyclines, metalloproteinase inhibitors), bisphosphonates, diacerein, cytokine inhibitors, and cartilage repair.

**Non-Pharmacological Treatment Patient Education**

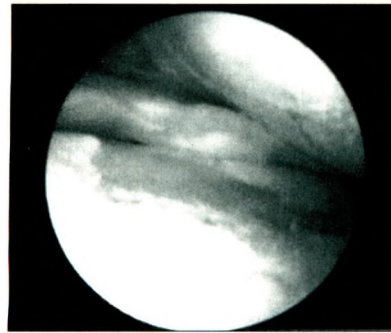
Patients should be given an education on their knee OA. The severity of their condition, various treatment options, necessary lifestyle changes, progression of the disease should be discussed with a language understandable to the patients. Additionally, the psychosocial factors may actually affect and modulate the perception of pain and related disability. Therefore, reassurance and counseling may minimize the influence of psychosocial factors.

**Weight Loss**

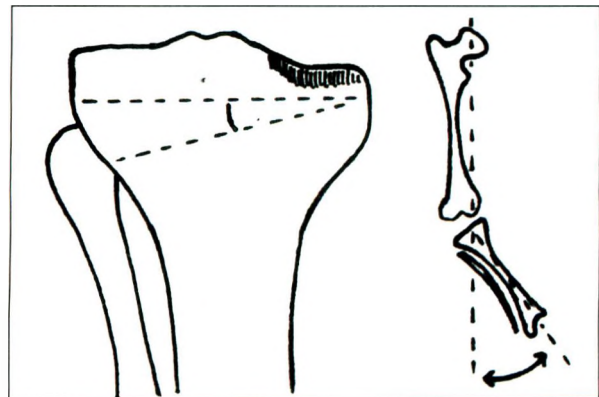
The reduction of joint reaction forces and symptoms of degenerative arthritis by a decrease in body mass is a fundamental concept in the management of arthritic joints (12). Obesity is an independent risk factor for the development of osteoarthritis in the knee, and this association is higher for women than for men (13). Weight loss by obese women decreases the risk of the development of degenerative arthritis.

**Exercise and Physical Therapy**

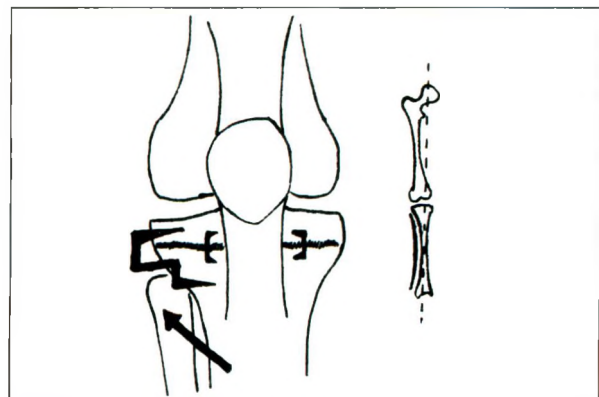
Exercise, as an adjunct to weight reduction, has value in the treatment of an arthritic knee. Stretching to prevent contracture, maintain range of motion, increase muscle strength, and increase dynamic stability of the knee can reduce symptoms associated with an arthritic knee. Quadriceps muscle weakness is common among patients with degenerative arthritis of the knee and may be a risk factor for this disease. Physical therapy modalities, such as cold treatment, hydrotherapy, superficial (hot packs, infrared, paraffin) or deep heat modalities (ultrasound, short wave diathermy), electrotherapy (transcutaneous electrical nerve stimulation),



**Fig.3:** Arthroscopic view of the medial compartment of the knee in a unicompartmental osteoarthritic patient



**Fig.4a:** Schematic drawing of a preoperative condition of a unicompartmental osteoarthritic knee



**Fig.4b:** Postoperative schematic drawing of a patient after high tibial valgus osteotomy

iontophoresis, and massage can help to reduce the symptoms.

**Support Devices and Braces**

Support devices can significantly reduce the loading in an arthritic joint and thus decrease the pain associated with it. During a period of acute exacerbation of symptoms in a knee with degenerative arthritis, ambulatory support devices, such as a cane, one or two crutches can help a patient to remain active in the presence of a painful, swollen knee.

Three types of knee braces are commercially available for treatment of a knee with degenerative arthritis: compression knee sleeves, supportive knee braces, and unloading knee braces (6). These may minimize swelling and provide a feeling of increased support and warmth about the knee without changing limb alignment, joint stability, or mechanical function. Supportive knee braces include hinged braces (for varus-valgus instability), anterior cruciate insufficiency braces (for anteroposterior and rotatory instability), and patellofemoral braces (for patellofemoral malalignment or instability). Unloading braces are designed to apply a varus or valgus force at the knee and relieve pain during activity by distracting the joint space of the involved compartment during weight-bearing and activity (14).

#### **Footwear Modification and Orthotics**

Well-padded, energy-absorbing shoe soles or orthotic devices can decrease the load across the knee joint during heel strike. Deformities leading to limb malalignment can exacerbate tibiofemoral arthritic symptoms. Orthotic correction and supportive, adaptive footwear with a medial longitudinal arch support, a calcaneal cushion, and a rigid last can improve alignment of the foot (6).

Heel and sole wedges can realign the foot 5° to 10° in either the varus or the valgus plane. With a lateral wedge and insole, the shift in alignment reduces medial joint-space loading (15) (Figure 3) When knees with medial unicompartamental arthritis were treated with a lateral heel and sole wedge, more than half of the knees showed good or excellent results after four to twenty-four months of treatment (16).

#### **Pharmacological therapies**

##### **Topical Agents**

Topical applications of nonsteroidal anti-inflammatory drugs (NSAIDs) and capsaicin can be used in OA, and are well tolerated by the patients. Some randomized clinical trials reported a significantly higher benefit of NSAID gels or topical preparations over placebo (4). Topical capsaicin results in reversible desensitization of the nociceptive C fibers by acting on VR-1 vanilloid receptors.

Some patients with unicompartamental arthritis of the knee report improvement with use of topical

analgesics (e.g., methyl salicylate, capsaicin, and nonsteroidal creams) as either adjunctive treatment or monotherapy (12).

##### **Intraarticular Therapy**

Acute exacerbations of knee OA presenting with pain, swelling, and effusion can be treated with aspiration of the knee joint and intra-articular injection of long acting corticosteroid preparations. Corticosteroid injections can be combined with a local anesthetic medication. However, corticosteroid injections can increase the risk of articular cartilage damage, and they should not be repeated more than three or four times a year (6). In addition, depot formulations are prepared as crystals for a prolonged action, and they may induce a crystalline arthritis.

Intra-articular hyaluronate reduces the symptoms of OA and is intended to provide viscosupplementation in the arthritic knee. It is administered as 3-5 weekly intraarticular injections. Their preparations vary in molecular weight from 0.5 to 6 million kDa. Because of a limited half life within the joint, they exert a short term lubricant and a biomechanical effect. It has also been suggested that hyaluronan therapy may alter the progression of arthritis of the knee and may decrease inflammation of the synovial membrane compared with that associated with corticosteroid injections (17). Short-term studies have suggested that there is no advantage of hyaluronic acid viscosupplementation has no advantage over nonsteroidal anti-inflammatory drugs in the treatment of an arthritic knee. The use of hyaluronic acid in older patients and patients with severe disease provided longer-lasting relief of symptoms than did intra-articular corticosteroid injections. More information on the appropriate use of this treatment is expected from prospective, double-blind, placebo-controlled studies.

##### **Oral Medications**

Analgesic medications like paracetamol are the initial medications used to treat knee OA. These medications are effective in relieving pain, they are associated with a low incidence of side effects, and they are inexpensive (6). NSAIDs should be considered in patients unresponsive to paracetamol. NSAIDs are the most commonly used drugs in the treatment of OA of the knee and other joints. These drugs inhibit both

cyclooxygenase 1 and 2, and have analgesic and anti-inflammatory properties, but they can be associated with gastrointestinal and other side effects. Specific cyclooxygenase-2 inhibitors have demonstrated clinical efficacy in the treatment of symptomatic arthritis of the knee, with decreased gastrointestinal and renal side effects. However, specific cyclooxygenase-2 inhibitors are more expensive, and risk-benefit and cost-benefit analyses must be completed to better define the role of these agents (18).

Opioid analgesics, with or without paracetamol, are useful alternatives in patients for whom NSAIDs, including COX-2 selective inhibitors are contraindicated, ineffective, and/or poorly tolerated (4).

#### **Adjunct Therapies**

Nutritional supplements (nutraceuticals), that appear to have medicinal properties, like glucosamine and chondroitin sulfate, have been tested in some double-blind, placebo-controlled randomized controlled trials. In a study by Reginster et al. (19), 212 patients with osteoarthritis of the knee were randomized to a glucosamine or a placebo treatment group. After three years of treatment, the glucosamine group had less joint-space narrowing and improved WOMAC (Western Ontario and McMaster University Osteoarthritis Index) scores when compared with the placebo group.

Studies on the structure of disease modifying drugs in the treatment of OA are becoming more popular. These drugs are intended to retard, prevent or reverse the progression of OA. Tetracyclines, diacerrhein, avocado and soya unsaponifiables are promising in this respect (18).

### **Operative Management of Knee Osteoarthritis**

#### **Arthroscopy**

Arthroscopy has a limited indication in the operative treatment of knee osteoarthritis. Diagnostic arthroscopy of an arthritic knee can be helpful in planning the definitive surgery by defining the extent of the degenerative process. (Fig. 4) Arthroscopic surgery for unicompartmental arthritis of the knee can be useful for patients with mechanical symptoms (catching, clicking, locking, instability, or giving

way) that are consistent with loose meniscal fragments, chondral flaps, loose bodies, and/or impinging intercondylar spurs. On the other hand, joint lavage and debridement can provide a symptomatic treatment in osteoarthritis. No controlled, prospective, long-term studies have clearly defined the role of lavage in treatment of the arthritic knee. Given the studies available, it is fair to say that the results of this treatment method are initially good but deteriorate with time. (20 – 23). Although a notable percentage of patients with arthritic knees who undergo arthroscopic débridement report significant relief of symptoms at follow-up, published rates of improvement at 1 year vary from 32% to 80%. (24,25)

In the early stages of the disease, chondral lesions can be treated arthroscopically in order to stop the progression of the degeneration. Arthroscopic drilling can be helpful by providing bleeding in subchondral tissue in order to stimulate new fibrocartilage formation. Cartilage transplantation is an other way of treatment in a selective group of patients in unicompartmental knee osteoarthritis.

#### **Osteotomy**

Limb malalignment can accentuate stress on damaged articular cartilage, leading to pain, progressive loss of articular cartilage, and increasing angular deformity of the knee. The goal of osteotomy in the treatment of unicompartmental arthritis of the knee is to realign the limb and shift weight-bearing force from the degenerated tibiofemoral compartment to the healthier compartment. (Fig. 5) A stable knee with arthritis of the medial compartment associated with a varus deformity, without subluxation or lateral thrust, and with an arc of motion of 90° in patients, younger than 60 years of age with a high-demand, active lifestyle whose life expectancy exceeds the expected survival of a knee prosthesis may be treated with a proximal tibial valgus osteotomy. (26 – 30)

The aim of osteotomy in the treatment of unicompartmental arthritis of the knee is to correct the malalignment of the limb and shift weight-bearing force from the affected compartment to the healthier compartment. Patient selection is the most important point for

the success of this operation, can stop the progression of the disease completely or delay the need for knee arthroplasty surgery.

### **Unicompartmental Knee Arthroplasty**

When restoration of the articular cartilage and osteotomy are not indicated, arthroplasty is accepted for treatment of painful unicompartmental arthritis. It is difficult to give exact criteria to choose between unicompartmental or total knee arthroplasty. It depends on the patient, knee and the surgeon. The ideal candidate for unicompartmental knee arthroplasty has low activity demands, a stable knee with <15° of flexion contracture, no varus or valgus malalignment or minimal malalignment that can be passively corrected on examination, and unicompartmental osteoarthritis with no or minimal degeneration of the articular cartilage of the contralateral compartment or patellofemoral joint. (31,32)

In general, unicompartmental osteoarthritis and osteonecrosis are possible indications for unicompartmental knee arthroplasty. In inflammatory arthritis, unicompartmental knee arthroplasty is contraindicated.

### **Total Knee Arthroplasty**

Total knee arthroplasty is an accepted surgical treatment for painful unicompartmental osteoarthritis of the knee in older patients, and the prevalence of total knee arthroplasty is increasing. (33-37) Total knee arthroplasty has also performed well in younger patients. (38 – 42) When patients of any age with unicompartmental osteoarthritis and with any diagnosis are poor candidates for other types of nonoperative and operative treatment, total knee arthroplasty is an option.

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