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## Management of Medial Compartment Tibiofemoral Osteoarthritis of Knee Joint- a comprehensive review

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### Abstract

Osteoarthritis is a chronic, progressive degenerative joint disease which affects the articular cartilage, synovium, subchondral bone, ligaments, capsule etc. OA is the most prevalent form of arthritis, with an associated risk of mobility disability. This is one of the common type of degenerative joint disease affecting weight bearing joints of the body such as knee, hip, hand, spine etc. In this review, we focus on the recent advances in the treatment of OA and summarize the most common methods of treatment.

**Keywords:** Osteoarthritis, tibiofemoral, degenerative disease, knee joint

### Introduction

Knee osteoarthritis (OA), also known as degenerative joint disease, is typically the result of wear and tear and progressive loss of articular cartilage. It is most common in elderly people. WHO estimates that 10% of world population over the age 60 years suffers from OA and 80% of people with OA have limitations of movement and 25% cannot perform the major daily activities<sup>[1]</sup>.

It is divided into two types *i.e.*, primary and secondary:

1. **Primary osteoarthritis:** It is the articular degeneration without any apparent underlying cause.
2. **Secondary osteoarthritis:** It is the consequence of either an abnormal concentration of force across the joint as with post-traumatic causes or abnormal articular cartilage, such as rheumatoid arthritis (RA).

### Epidemiology

Osteoarthritis (OA) is the most common disease of the joints worldwide, with the knee being the most commonly affected joint in the body. It mainly affects people over the age of 45. OA can lead to pain and loss of function, but not everyone with radiographic findings of knee OA will be symptomatic. In one study, only 15% of patients with radiographic findings of knee OA were symptomatic.

- Osteoarthritis affects nearly 6% of all adults.
- Women are more commonly affected than men.
- Roughly 13% of women and 10% of men 60 years and older have symptomatic knee osteoarthritis<sup>[2]</sup>.
- Among those older than 70 years of age, the prevalence rises to as high as 40%.
- Prevalence will continue to increase as life expectancy and obesity rises.

### Aetiology

Knee OA is classified as either primary or secondary, depending on its cause.

- **Primary knee osteoarthritis:** It is the result of articular cartilage degeneration without any osteoarthritis. This is typically thought of as degeneration due to age as well as wear and tear.
- **Secondary knee osteoarthritis:** It is the result of articular cartilage degeneration due to a known reason.

### Possible Causes of Secondary Knee OA

- Joint hypermobility or instability
- Mal-positioning of the joint e.g. valgus/varus posture
- Previous injury to the joint e.g. fracture along articular surface (Tibial plateau fracture)
- Congenital defects
- Immobilisation and loss of mobility
- Family history
- Metabolic causes e.g. rickets
- Obesity <sup>[3]</sup>

### Pathophysiology

While osteoarthritis is a degenerative joint disease that may cause gross cartilage loss and morphological damage to other joint tissues, more subtle biochemical changes occur in the earliest stages of osteoarthritis progression.

The water content of healthy cartilage is finely balanced by compressive force driving water out and hydrostatic and osmotic pressure drawing water in.

However, during onset of osteoarthritis, the collagen matrix becomes more disorganized and there is a decrease in proteoglycan content within cartilage <sup>[4]</sup>.

The breakdown of collagen fibres results in a net increase in water content. This increase occurs because whilst there is an overall loss of proteoglycans (and thus a decreased osmotic pull), it is outweighed by a loss of collagen.

Other structures within the joint can also be affected. The ligaments within the joint become thickened and fibrotic, and the menisci can become damaged and wear away.

Menisci can be completely absent by the time a person undergoes a joint replacement. New bone outgrowths, called "spurs" or osteophytes, can form on the margins of the joints, possibly in an attempt to improve the congruence of the articular cartilage surfaces in the absence of the menisci.

The subchondral bone volume increases and becomes less mineralized (Hypo-mineralization). All these changes can cause problems functioning. The pain in an osteoarthritic joint has been related to thickened synovium and subchondral bone lesions <sup>[5]</sup>.

### Symptoms of knee osteoarthritis

Symptoms of knee OA develop slowly and worsen over time.

**Pain:** Movement causes pain.

Sometimes your knee will ache while sitting still.

Your knees may be stiff first thing in the morning or after sitting for a long time.

- **Loss of motion:** Over time, you may lose the ability to bend and straighten your knee all the way.
- **Creaking and grating (Crepitus):** You may hear crackling noises or feel a grating sensation.
- **Instability:** Your knee may "give out" or buckle, or feel like it could.
- **Locking:** The knee may lock or stick.
- **Swelling:** Your knee may get puffy all around or on one side.

Knee OA can be sub-divided into 5 grades

- **Grade 0:** This is the "normal" knee health
- **Grade 1:** Minor bone spur growth and is not experiencing any pain or discomfort.
- **Grade 2:** This is the stage where people will experience symptoms for the first time. They will have pain after a

long day of walking and will sense a greater stiffness in the joint. It is a mild stage of the condition, but X-rays will already reveal greater bone spur growth. The cartilage will likely remain at a healthy size.

- **Grade 3:** Moderate OA. Frequent pain during movement, joint stiffness will also be more present, especially after sitting for long periods and in the morning. The cartilage between the bones shows obvious damage, and the space between the bones is getting smaller.
- **Grade 4:** This is the most severe stage of OA. The joint space between the bones will be dramatically reduced, the cartilage will almost be completely gone and the synovial fluid will be decreased. This stage is normally associated with high levels pain and discomfort during walking or moving the joint <sup>[6]</sup>.

### Medial compartmental tibiofemoral osteoarthritis

The tibiofemoral joint is where the femur meets the tibia.

It includes intra articular structures such as menisci, anterior cruciate ligament and posterior cruciate ligament and extra capsular structures such as medial collateral ligament and lateral collateral ligament <sup>[7]</sup>.

Medial compartmental OA is a type of OA that affects only one part of the knee, the medial compartment (i.e. near the middle of the knee, on the inner side).

OA can affect one or more of these compartments. In a study of data for 250 knees with of fewer than 15% involves only one compartment.

Tibiofemoral knee OA is more commonly seen in the medial than lateral compartment, because of heavier weight loading. Joint space narrowing is an important component specific manifestation of knee OA <sup>[8]</sup>.

Knee malalignment is strongly associated with increased risk of OA progression. Biomechanical evidence demonstrates that varus malalignment increases force through the medial compartment.

During walking, the ground reaction force passes medial to the knee on the frontal plane, creating a moment that adducts the tibia relative to the femur.

The mechanics of gait in particular knee adduction moment contributing progression of medial compartment knee osteoarthritis <sup>[9]</sup>.

### Goals of medial compartmental tibiofemoral osteoarthritis

The main focus in osteoarthritis management is;

- Promoting self-management
- Reducing pain
- Optimize function
- Modifying the disease process and its effects

### Management

Treatment for knee OA can be done by;

- Conservative management
- Surgical management

Initial treatment always begins with conservative modalities and moves to surgical treatment once conservative management has been exhausted.

There is a wide range of conservative modalities available for the treatment of knee osteoarthritis.

**Conservative Management**

The primary treatment for OA knee conservatively is exercise therapy within physiotherapy.

Physiotherapy normally involves;

- Patient education
- Exercise therapy
- Activity modification
- Advice on weight loss
- Knee bracing
- The first-line treatment for all patients with symptomatic knee osteoarthritis includes patient education and physiotherapy.
- A combination of supervised exercises and a home exercise program have been shown the best results. These benefits are lost after 6 months if the exercises are stopped.
- Weight loss is valuable in all stages of knee OA. It is indicated in patients with symptomatic osteoarthritis with a body mass index greater than 25.
- The best recommendation to achieve weight loss is with diet control and low-impact aerobic exercise.
- Knee bracing in osteoarthritis can be used. Offloading-type braces which shift the load away from the involved knee compartment. This can be effective when there is a valgus or varus deformity <sup>[10]</sup>.

**IFT for pain relief**

- (Crossfire method of electrode placement)
- Patient position - long sitting or in supine position
- Method - 4 electrodes are placed according to the localisation of pain
- Intensity - according to the tolerance of the patient

**Exercises for knee osteoarthritis****Strengthening of hip flexors**

- Patient position - High sitting with arm folded at chest
- Therapist position - side of patient on which strengthening exercise should perform
- Therapist should place one hand on the back of the patient to prevent backward leaning of the patient to avoid any trick movement
- Method - place a weight cuff on around ankle joint to add resistance to the movement i.e. hip flexion rather than the action of gravity
- Ask the patient to raise her knees to the chest actively <sup>[11]</sup>

**Isometric quadriceps exercise**

- Patient position - Sit in high sitting position.
- Method - A rolled up towel was put beneath the knee. They were instructed to maximally activate their thigh muscles in order to straighten their knee and hold the contraction for 10 seconds and repeat the same process up to 10-15 times.

**Hamstring isometric exercise**

- Patient position - sit in high sitting position.
- Method - Place a rolled up towel beneath the ankle. They were instructed to press the towel downward by applying the pressure from the ankle. Hold the contraction for 10 seconds and repeat the same process up to 10-15 times <sup>[12]</sup>.

**Adductor isometric exercise**

Patient position - Patient lay flat on the back.

Method - Place a ball or pillow between the knees. Instruct the patient to contract the adductor muscle and squeeze the ball or pillow in between both the knees. Hold the contraction for 10 seconds and repeat the same process up to 10-15 times.

**Quadriceps strengthening exercise**

- Patient position - patient should be in high sitting for strengthening of knee extensors.
- Therapist position - side of patient on which strengthening exercise should perform.
- Therapist should place one hand on just above the knee joint or distal thigh other hand on the back of the ankle to avoid any trick movement like pendular motion or jerking.
- Method - place a weight cuff on around ankle joint to add resistance to the movement i.e. knee extension rather than the action of gravity.
- Ask the patient to raise her foot towards the ceiling actively <sup>[11]</sup>.

**Footwear Modifications**

- Use of full-length lateral-wedge insoles inserted into shock-absorbing walking shoes will decrease pain, stiffness, and functional impairment in patients with symptomatic medial compartment knee osteoarthritis of varying radiographic severity <sup>[3]</sup>.
- Reduction in pain mainly occurred when subjects walked up and down stairs, which suggests biomechanical analyses are needed to determine thresholds of joint reaction forces and moments for restricting the progression of degenerative articular cartilage lesions of knee osteoarthritis.
- Wedge insoles inserted into shock-absorbing walking shoes are an inexpensive, well-tolerated treatment for symptomatic medial compartment knee OA <sup>[8]</sup>.

**Pharmacological Treatment**

Other non-physiotherapy based interventions include pharmacological management

- Acetaminophen
  - Nonsteroidal anti-inflammatory drugs (NSAIDs)
  - COX-2 inhibitor
  - Glucosamine and chondroitin sulfate
  - Corticosteroid injections
  - Hyaluronic acid (HA)
- Drug therapy alongside physiotherapy should be the first-line treatment for patients with symptomatic knee osteoarthritis. There are a wide variety of NSAIDs available; however, caution should be used when prescribing NSAIDs due to their side effects <sup>[9]</sup>.
- Glucosamine and chondroitin sulfate are available as dietary supplements. They are structural components of articular cartilage, and the thought is that a supplement will aid in the health of articular cartilage. No strong evidence exists that these supplements are beneficial in knee osteoarthritis <sup>[3]</sup>.
  - Intra-articular corticosteroid injections may be useful for symptomatic knee osteoarthritis.
  - Intra-articular hyaluronic acid injections (HA) injections are another inject-able option. Local delivery

of HA into the joint acts as a lubricant and may help increase the natural production of HA in the joint.<sup>[11]</sup>

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