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Effectiveness of weight bearing x-ray of both knees in classification of osteoarthritis

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Abstract

This article is about the comparison of non-weight bearing single leg x rays with weight bearing x-rays of both knees. A study was done in 2023 from April to October where x-rays of 30 patients having non-weight bearing single knee x-rays were compared with weight bearing both knee x-rays. X rays were classified as per clinical staging and Kellgren and Lawrence grading system of knee osteoarthritis. Out of 30 patient 3 patients with minimal joint space narrowing earlier, diagnosed as mild osteoarthritis. 12 patients with mild osteoarthritis earlier, diagnosed with moderate osteoarthritis and 15 patients with moderate osteoarthritis earlier, diagnosed with severe osteoarthritis. It was found that weight bearing X-ray is better diagnostic tool than non-weight bearing as intra articular gap especially on medially side is much lesser in weight bearing X-ray.

Keywords: Non-weight bearing x-rays, weight bearing x-rays, osteoarthritis grading

Introduction

Osteoarthritis of knee is straight forward clinical diagnosis; x-ray is done to grade the osteoarthritis. The way x ray is taken can influence the radiological diagnosis.

The knee has simplistic disposition of three bones but a complex design to maintain simplicity in movements and ability to withstand immense forces. There are two main articulations that make up the joint - Tibiofemoral joint (a modified hinge joint) and Patellofemoral joint (saddle joint).

Osteoarthritis is typical productive and progressive arthropathy with heterogeneous clinical presentation ^[1]. It is commonly an age related disorder or it could be end result of other arthritis or secondary to trauma. Primarily cartilage of joint and subchondral bone are main sites of tissue injuries. Decreased joint space, osteophytes formation due to new bone proliferation because of micro fractures in subchondral area and subchondral sclerosis because of increase in density of bone during healing process are typical three findings in case of knee osteoarthritis ^[2].

There are various causative factors for osteoarthritis like it could be Primary (Idiopathic) Secondary type including trauma, metabolic or endocrine causes, inflammatory disorders, neuropathic disorders, crystal deposition disease or some anatomical abnormalities.

There are various diagnostic modalities like radiography, magnetic resonance imaging, optical coherence tomography (OCT), and ultrasound (US) that helps in visualization of various structures. Radiography is primarily useful for the assessment of bony structures, while OCT is used for assessment of articular cartilage and US for the synovium. MRI permits visualization of ligaments and all intra-articular structures and pathologies ^[3].

There are various classification system for grading of osteoarthritis some of them are given below.

1. Clinical staging of knee osteoarthritis

Mild osteoarthritis	Pain and stiffness are intermittent, Pain after prolonged activities and stiffness after prolonged sitting.
Moderate osteoarthritis	Pain progress with passage of day, but usually relieves with medications.
Severe osteoarthritis	Pain persistent, alteration in structure of joint, fixed deformities and gait pattern changes.

2. American college of rheumatology radiological and clinical criteria for knee osteoarthritis

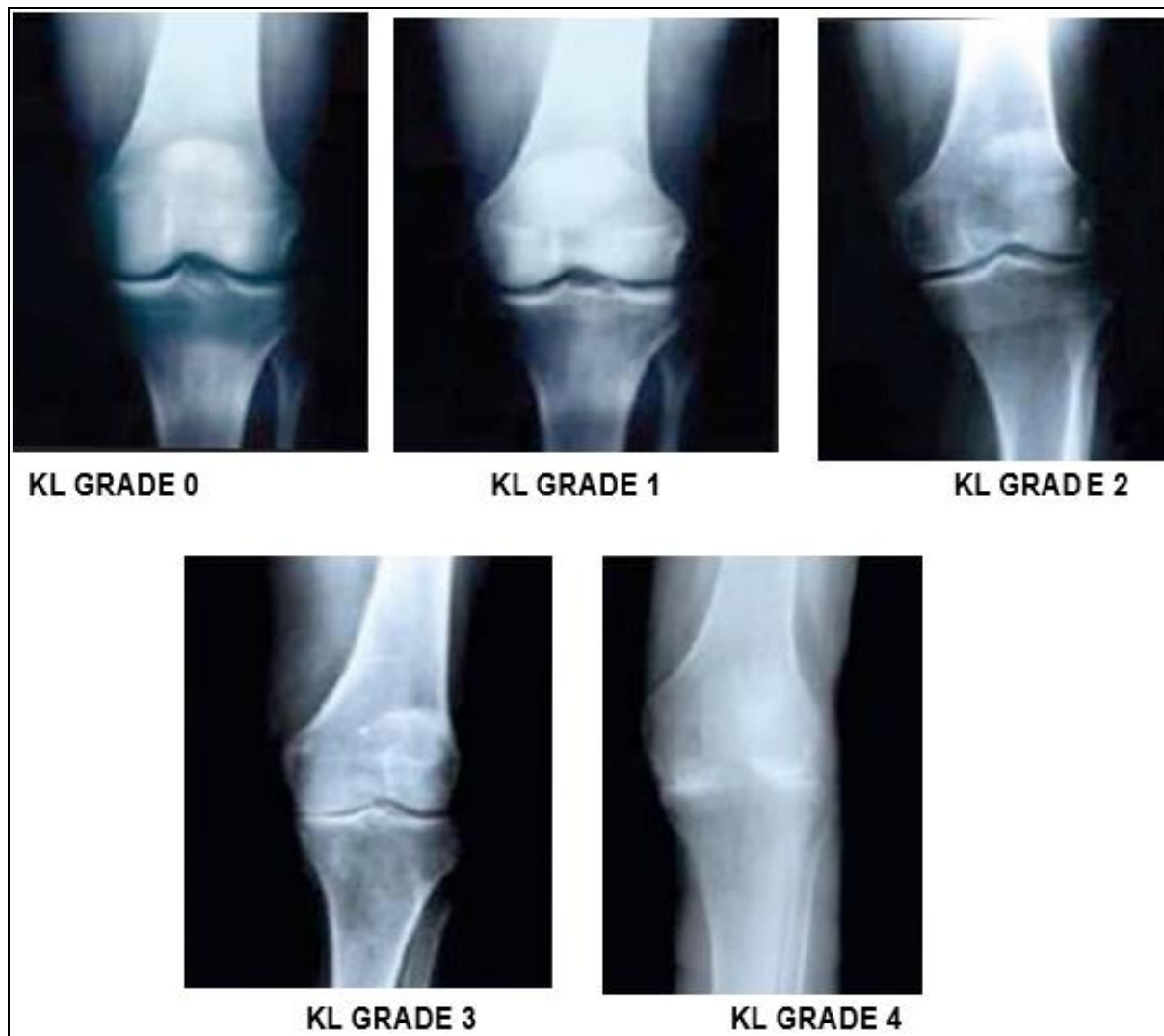
Knee pain ‘AND’ at least one of the following features:

- a) Age > 50 years.
- b) Morning stiffness < 30 minutes.

- c) Crepitus.
- d) ‘AND’ radiological osteophytes.

3. Kellgren and Lawrence (KL) system [4]

Grade 0	No radiographic features of osteoarthritis present.
Grade 1	Doubtful joint space narrowing and possible osteophytic lipping.
Grade 2	Definite osteophytes and possible joints space narrowing on AP weight bearing radiograph.
Grade 3	Multiple osteophytes, definite joints space narrowing, sclerosis and minimal Bony deformity
Grade 4	Large osteophytes, mark joints space narrowing square sclerosis and definite Bony deformity disturbing the joint alignment.



4. Ahlback classification system [5]

Grade 1	Joints space narrowing < 3 mm (Equivalent to grade 3 KL system)
Grade 2	Joints space obliteration (Equivalent to grade 4 KL system)
Grade 3	Minor bone attrition (0-5 mm)
Grade 4	Moderate bone attrition (5-10 mm)
Grade 5	Severe bone attrition (>10 mm)

In our study we use the method of clinical staging and Kellgren and Lawrence grading system of knee osteoarthritis to compare the single knee non weight bearing x-rays with both knee weight bearing x-rays after clinical examination of

patients.

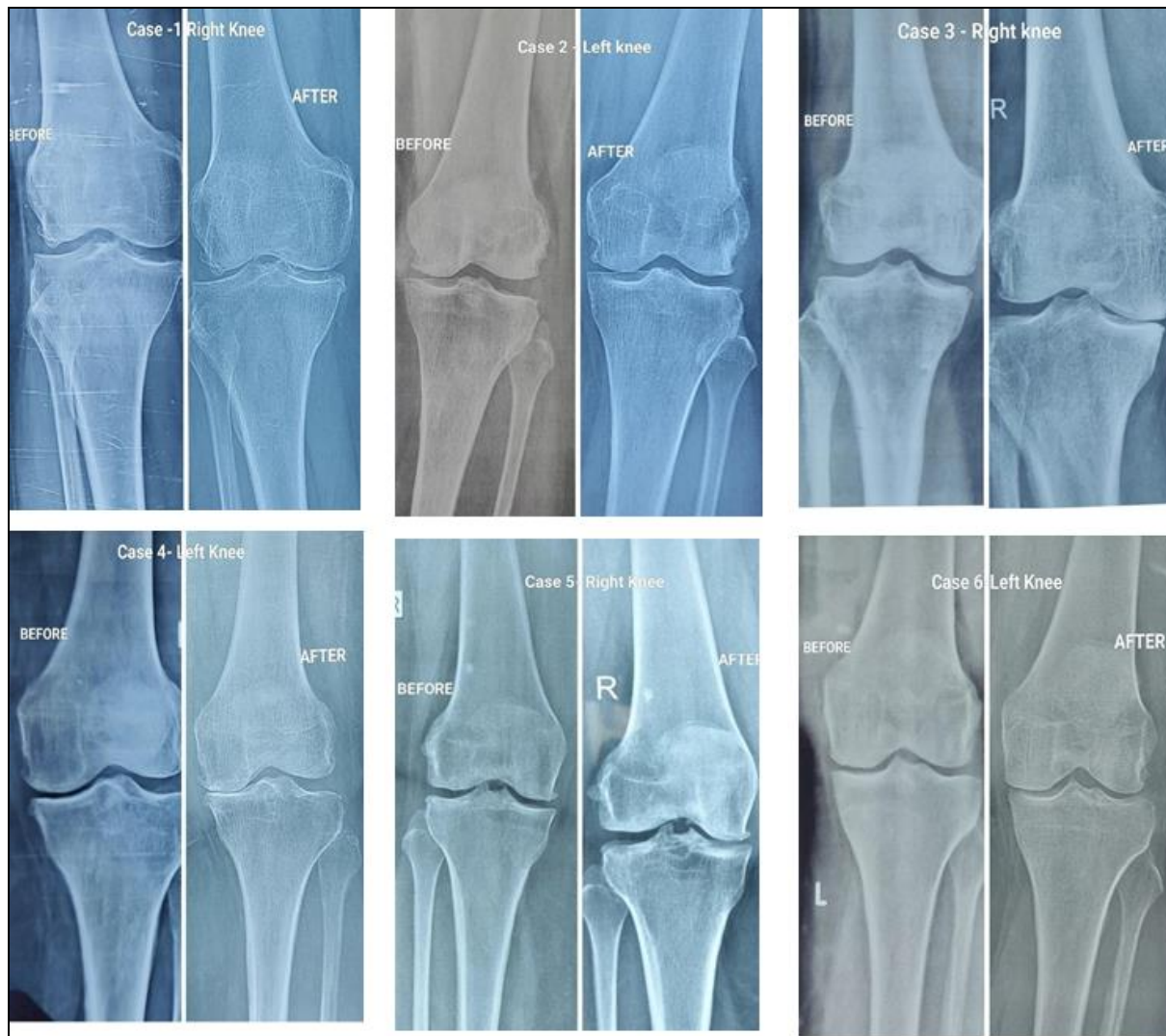
Case series study

This was a six months OPD based study done from April 2023 to October 2023 where the non weight bearing, single knee x-rays of patients with knee osteoarthritis compared with their both knees weight bearing x-rays and effectiveness of x rays measured in terms of increase in grading of osteoarthritis with decreased joint space especially medially was present in later x-rays.

Data was assessed after completion of data collection (First cycle of data collection), then corrective action were taken and it was followed by recollection of data after implementation of corrective action to improve the results

(second cycle of data collection). Following are some of the example of knee X-rays before and after taken of corrective

actions to improve the results and better diagnosis.



Data collection was done as follows

Patient EMR Number
Patient OPD Number
Age (Should be > 40 years) / sex
Complain (Pain one or both knees)

S. No.	Criterion	Classification of osteoarthritis
1.	Classification of osteoarthritis based on single knee non weight bearing x-rays	Mild Moderate Severe
2.	Classification of osteoarthritis based on both knees weight bearing x-rays	Mild Moderate Severe

Was there a change in classification?

Yes and No

It was found that there was changed in grading of osteoarthritis either from mild to moderate or from moderate to severe osteoarthritis after taken up corrective actions to improve the results.

Single leg non weight bearing x-rays (which were done in some outside centres) of 30 patients were compared with

weight bearing x-rays. Out of 30 patients, 12 were in mild osteoarthritis stage earlier, diagnosed as moderate osteoarthritis after taking of corrective measures, 15 patient were in stage of moderate osteoarthritis earlier, diagnosed to severe osteoarthritis and in 6 patient there was almost normal joint space earlier observed with joint space narrowing with mild osteoarthritis after taking corrective measures with both knee weight bearing x-rays.

S. No.	Earlier stage	Stage after corrective measures	Number of patients
1.	No joint space narrowing (KL Grade 1)	Mild osteoarthritis (KL Grade 2)	3
2.	Mild osteoarthritis (KL Grade 2)	Moderate osteoarthritis (KL Grade 3)	12
3.	Moderate osteoarthritis (KL Grade 3)	Severe osteoarthritis (KL Grade 4)	15

Discussion

Incidence and prevalence of knee osteoarthritis is continuously increasing now a days, It is important to diagnose it as early as possible. Correct way of diagnosis of knee osteoarthritis give us more clear picture of deformity and other problems related to knee osteoarthritis. For the diagnosis of knee osteoarthritis clinically criteria and then it's correlation with radiological features. The potential of a progressive disease can be prevented by earlier recognition and correction of associated factors [6].

Conservative management of osteoarthritis of knee is the main straight of treatment in majority of the patients. The treatment modalities depends upon the grade of osteoarthritis. As non weight bearing x-rays does not represent the true nature is osteoarthritis, wrong radiological grade may lead to ineffective treatment, so accurate diagnosis is radiological the cornerstone of management. Patients with osteoarthritis of grade 2 and 3 usually are pain free if they are not bearing weight. As pain is prevalent only during weight bearing in early cases, it can be assumed that x-ray in weight bearing position is most appropriate x-ray, also osteoarthritis is usually a bilateral disease specially if it is degenerative osteoarthritis, so a single leg x-ray fails to give a comprehensive picture of disease burden. Hence it is postulated that x-ray for diagnosis of knee osteoarthritis have to be

1. Weight bearing x-rays.
2. X-rays of both knees even if the other knee have minimal or no pain.

This need to be standard protocol for x-rays of knee for the diagnosis of knee osteoarthritis

Many a times even in appropriately taken x-rays the pain is disproportionately more to the radiological grading of osteoarthritis, in those cases we recommend Rosenberg's view to accurately diagnose posterior condyle osteoarthritis.

Regarding management of knee osteoarthritis there are various non surgical modalities and later on surgical with knee replacement. Patients education about self management, strength training and weight management is must. Apart from these NSAIDS, opioids, acetaminophen, physiotherapy with quadriceps strengthening exercises, acupuncture, chondroitin, glucosamine, intraarticular steroids, intraarticular hyaluronic acid are the various treatment modalities based on individual patient needs and preferences [7]. Physiotherapy plays a major role by encouraging patient for self management, increasing strength of muscles, increasing range of motion of joints, reducing pain and there by all over improvement in function of limb [8]. Intraarticular injections with steroids, hyaluronic acid and platelet rich plasma help in reducing pain and improving joint functioning to some extent in initial stages of disease [9].

Surgical management with knee replacement is gold standard management for patient with knee osteoarthritis. It is only management for improving osteoarthritic changes in knee joint and there by overall functional outcome of joint movements with cost effectiveness and better long term outcome [10].

In in our study we found that what was the great one became great to in three patients out of 30 what was great to became

grade 3 in 12 patients out of 30 and what was great 3 became grade 4 in 15 out of 30 patients. The conversion of moderate to severe osteoarthritis by our method is 50% or more in severe osteoarthritis the surgery is offered only when there is almost complete attrition of cartilage so we maybe denying surgical treatment in half the population of severe osteoarthritic patients.

As this is a very small sample size, a study on a bigger sample may strengthen our postulates better.

Conclusion

As incidence and prevalence of knee osteoarthritis is increasing in arithmetic progression now a days, it is important to diagnose the patient's radiological grade as early as possible so that to start the adequate care as per need of patient and stage of disease. Weight bearing and both knees x-rays is postulated as a better diagnostic tool than non weight bearing or single leg x-ray as intra articular gap especially on medially side is much lesser in weight bearing X-ray.

Quadriceps and hamstring muscle strengthening exercises are very important in early stages of osteoarthritic disorders. Failure to accurately diagnose this may compromise the effectiveness of long term conservative management of osteoarthritis of knees.

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