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Radiographic evaluation of complete and incomplete discoid lateral meniscus

Jae Gwang Song [a], Jae Hwi Han [a], Jae Ho Kwon [b], Gautam M. Shetty [c], Leo Anthony M. Franco [d], Dae Young Kwon [e], Kyung Wook Nha [a,*]

[a] Department of Orthopaedic Surgery, Inje University, Ilsan Paik Hospital, Ilsan, Republic of Korea
[b] Department of Orthopaedic Surgery, Barunsesang Hospital, Bundang, Republic of Korea
[c] Asian Orthopaedic Institute, Asian Heart Institute and Research Centre, Mumbai, India
[d] Department of Surgery, Orthopaedic Section, Saint Louis University Hospital of the Sacred Heart, Baguio, Philippines
[e] Department of Radiology, Won-dang Radiology Hospital, Goyang, Republic of Korea

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ABSTRACT

Objectives: The aim of this retrospective study was (1) to evaluate the radiographic features to differentiate arthroscopically confirmed complete and incomplete discoid lateral meniscus (DLM) (2) to determine the cutoff values for any parameter that was found to differentiate complete from incomplete DLM.
Materials and Methods: We retrospectively analyzed plain knee radiographs of 130 arthroscopically proven DLM. Seventy-nine patients had complete DLM and 51 patients incomplete DLM. Knee radiographs from 52 patients with arthroscopically proven normal lateral meniscus acted as control group. Radiographic parameters measured included fibular height, lateral joint space, condylar cutoff sign, height of lateral tibial spine, obliquity of lateral tibial spine, squaring of the lateral femoral condyle, and cupping of the lateral tibial plateau.
Results: Among radiographic parameters, high fibular head, widening of the lateral joint space and femoral condylar cutoff sign showed statistically significant ($p < 0.0001$) differences between complete and incomplete DLM. At specific threshold points of fibular height < 11mm, lateral joint space > 6mm and condylar cutoff sign < 0.80, the diagnosis of complete DLM revealed 87.3% sensitivity, 81.6% specificity and 78.4% positive predictive value (PPV) for the fibular height, 81.0% sensitivity, 86.6% specificity and 83.1% PPV for the lateral joint space, and 86.1% sensitivity, 83.5% specificity and 80% PPV for the condylar cutoff sign.
Conclusions: Radiographic features of fibular height, lateral joint space and condylar cut off sign can be used for screening of a complete type of DLM. However, radiographs are not a reliable screening tool for an incomplete DLM.
Level of evidence: IV, Case Series

1. Introduction

Discoid lateral meniscus (DLM) in the knee is the most common type of anatomic variant of the meniscus leading to alteration in size, thickness and shape [1–3]. The prevalence of DLM may vary from 0.7% to 16.6% and it is reported to be more common in Asian population with 78% of the cases showing bilateral occurrence [1–3]. Symptomatic DLM may cause knee pain, locking, snapping and limited extension [1–3]. However, complete DLM may differ from the incomplete ones by being more prone to tears, being more frequently associated with underlying cartilage lesions and reportedly having poorer clinical outcomes [1,4–6].

Although various diagnostic modalities including plain radiographs, ultrasonography and magnetic resonance imaging (MRI) have been used to diagnose a discoid meniscus, a definitive method to differentiate between complete and incomplete DLM still remains elusive. Arthroscopic visualization and MRI, the two definitive methods of differentiating the complete from the incomplete DLM, involve increased cost, inconvenience and risk to the patient. Plain radiography of the knee joint, the initial imaging modality for diagnosing DLM, will show several features including lateral joint space widening, cupping of lateral tibial plateau, hypoplasia of lateral femoral condyle and tibial spine, high fibular head and condylar cut off sign [4,7–10]. However, to the best of our knowledge, the literature is lacking regarding differentiation of complete and incomplete DLM using plain radiographs. Furthermore, there are no studies which have tried this differentiation using plain radiographs in arthroscopically confirmed cases of complete and incomplete DLM.

* Corresponding author at: 2240, Daehwa-dong, Ilsan-Segu, Koyang-Si, Ilsan 411-706, Republic of Korea. Tel.: +82 31 910 7312; fax: +82 31 910 7319.
E-mail address: kwnhamj@hotmail.com (K.W. Nha).

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Table 1
The primary lesion observed during arthroscopic surgery in the DLM group.

Lesion	Complete DLM	Incomplete DLM
Lateral meniscal tear		
Radial tear	9 (11.5%)	15 (29.5%)
Horizontal tear	26 (33%)	5 (10%)
Longitudinal tear	3 (4%)	0 (0%)
Complex tear	25 (32%)	9 (18%)
Peripheral detachment	3 (4%)	5 (10%)
Incidental finding	13 (16.5%)	17 (33%)
Total	79	51

DLM—discoid lateral meniscus.

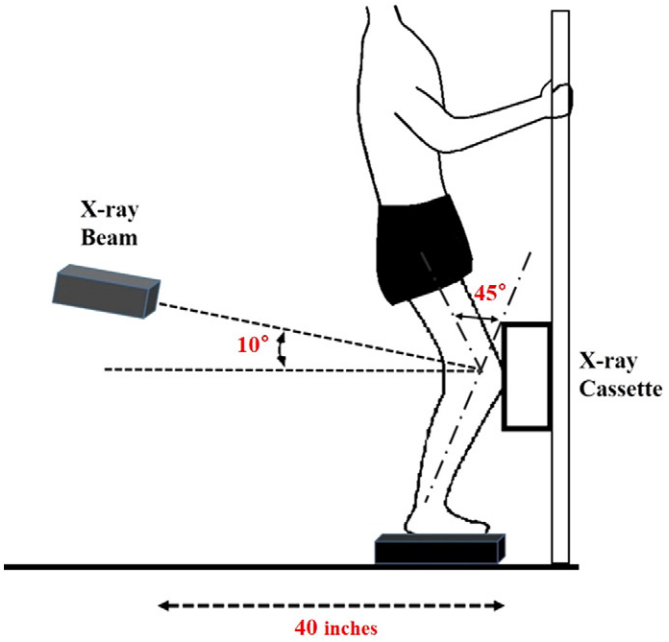

Fig. 1. The view of patient position in posteroanterior 45° flexion weight-bearing radiograph of the knee.

Hence, the purpose of this study was (1) to evaluate the radiographic features to differentiate arthroscopically confirmed complete and incomplete DLM, compared to a control group and (2) to determine the cutoff values for any parameter that was found to differentiate complete from incomplete DLM. We hypothesized that there would be distinct differences among the radiographic parameters for complete and incomplete type of DLM.

2. Patients and methods

We retrospectively reviewed the clinical and radiographic records of patients who underwent arthroscopic surgery at our institution between 2004 and 2012. We included all patients who had arthroscopically proven discoid lateral meniscus (both complete and incomplete types). We excluded patients who had significant trauma or osteoarthritis and who were under 18 years or over 55 years of age. This study was approved by the Institutional Review Board (IRB) of the hospital. A total of 130 cases of arthroscopically proven DLM were included in the study with 79 cases (61%) of complete type and 51 cases (39%) of incomplete type DLM. Out of the 79 complete DLM, 14 cases (18%) were a "thin" variant whereas the remaining 65 cases (82%) were a "thick" variant of complete DLM. The primary lesions observed during arthroscopic surgery in the DLM group are summarized in Table 1. For the control group, 52 cases with normal lateral meniscus found during arthroscopic surgeries performed for non-meniscal pathology during the same period were included. Hence, based on arthroscopic diagnosis, the study population was divided into three groups—complete DLM, incomplete DLM, and normal.

Clinical records were used to determine demographic parameters such as age, gender, height, weight, body mass index (BMI) and arthroscopic diagnosis. All patients had a set of standardized knee radiographs taken preoperatively after clinical assessment. These included a weight-bearing anteroposterior view with knee in full extension, weight-bearing posteroanterior (PA) view with knee in 45° flexion, lateral view, and tibial tunnel view with knee in approximately 40° flexion. All radiographs were taken at the study centre using standard radiographic protocols for each view and the position of the knee for views which involved placing the knee in flexion was confirmed using a standard goniometer to minimize errors. The weight-bearing PA view with knee in 45° flexion was obtained using the method described by Mason and Horne [8]. The patient stood, holding a wall mounted support bar and body weight distributed equally on each leg. Both knees were flexed to 45°, which was confirmed by the radiographer using a goniometer, with both patellae touching the film cassette. The radiograph beam was centered at the level of the inferior pole of the patellae and directed 10° caudad (Fig. 1). The tibial tunnel view was obtained using the method described by Ha et al. [9]. With the patient lying prone, both knees were flexed to 40°, which was confirmed by the radiographer using a goniometer. The radiograph beam was then

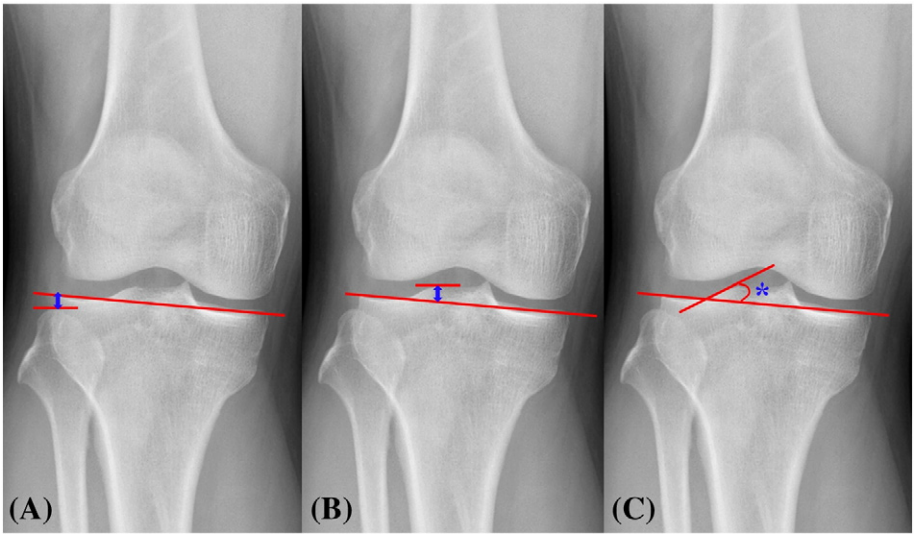

Fig. 2. The radiographic assessments on weight-bearing anteroposterior view. (A) Fibular height, (B) height of lateral tibial spine and (C) obliquity of lateral tibial spine.