

MRI Differentiation of Osteochondritis Dissecans and Subchondral Insufficiency Fracture of the Knee: A Two-Case Report Across Age Groups

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DOI: <https://doi.org/10.36347/sjmcr.2026.v14i05.073> | Received: 08.04.2026 | Accepted: 15.05.2026 | Published: 23.05.2026

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Abstract

Case Report

Differentiating Osteochondritis Dissecans (OCD) from Subchondral Insufficiency Fracture of the Knee is essential due to differences in pathophysiology, prognosis, and management [1–3]. We report two cases across different age groups highlighting the key role of MRI in this distinction. An 18-year-old patient presented with knee pain, instability, and mechanical symptoms. MRI revealed an osteochondral lesion of the medial femoral condyle with a T2 hyperintense fluid interface at the fragment–bone junction and subchondral bone marrow edema, consistent with unstable OCD (Hefti stage III). An elderly patient presented with acute-on-chronic knee pain without trauma. MRI demonstrated a linear hypointense subchondral fracture line with extensive bone marrow edema, without osteochondral fragment or fluid interface, consistent with SIFK. These cases emphasize that MRI enables reliable differentiation between OCD and SIFK based on fragment integrity, fluid interface, and fracture morphology, which is essential for appropriate management and prognosis.

Keywords: Osteochondritis Dissecans; Subchondral Insufficiency Fracture of the Knee; Knee MRI; Medial femoral condyle; Bone marrow edema; Osteochondral lesion; Subchondral fracture.

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INTRODUCTION

Osteochondritis Dissecans (OCD) is a focal disorder of subchondral bone that may lead to instability of the overlying cartilage and potential detachment of an osteochondral fragment [1,2]. The medial femoral condyle is most commonly affected. OCD primarily occurs in adolescents and young adults, although adult forms are increasingly recognized and are associated with poorer healing potential and increased risk of osteoarthritis [2].

In contrast, Subchondral Insufficiency Fracture of the Knee is a fragility-related condition occurring in elderly patients, resulting from mechanical overload on weakened subchondral bone [3,4]. It is frequently associated with osteoporosis, meniscal root tears, and varus malalignment [4,5].

MRI is essential for differentiating these entities by evaluating subchondral integrity, fracture patterns, and lesion stability [2–5].

Case 1:

An 18-year-old patient presented with knee pain associated with instability and mechanical cracking. Radiographs revealed an osteochondral defect of the medial femoral condyle.

MRI demonstrated a well-defined osteochondral lesion in the same location, showing low signal intensity on T1-weighted sequences and a hyperintense rim on T2-weighted images at the fragment–parent bone interface, consistent with interposed fluid. Associated subchondral bone marrow edema and focal cartilage irregularity were also present. These imaging features were consistent with unstable Osteochondritis Dissecans (Hefti stage III).



Figure1: Weight-bearing anteroposterior radiograph of the right knee demonstrates an osteochondral defect in the medial femoral condyle

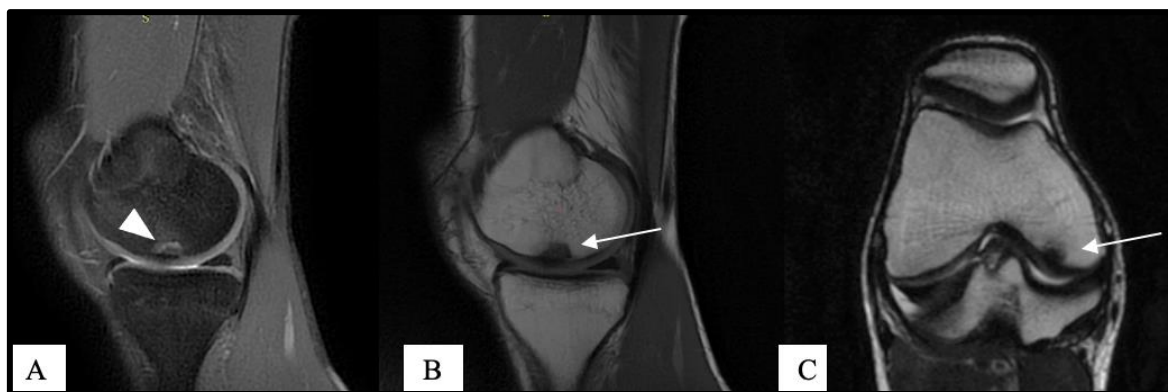


Figure 2: Sagittal DP(A), sagittal(B) and Axial(C) T2-weighted images of the right knee. The osteochondral lesion (solid arrow) demonstrates a distinct hyperintense rim at the interface between the fragment and the parent bone (white arrowhead), corresponding to a fluid interface sign, a major indicator of instability (Hefti grade III)

Case 2:

A 70-year-old woman with seropositive rheumatoid arthritis presented with a 6-week history of progressively worsening right knee pain and functional limitation, without any history of trauma or mechanical overload. Clinical examination showed moderate

effusion and focal tenderness over the medial femoral condyle, with painful but stable range of motion.

Weight-bearing radiographs demonstrated moderate degenerative changes with joint space narrowing and marginal osteophytes, without subchondral lesion, collapse, or osteochondral defect.

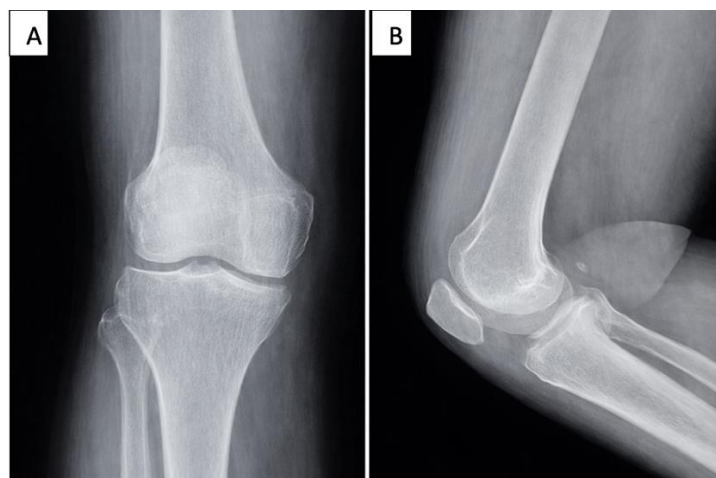


Figure 3: Weight-bearing anteroposterior (A) and lateral (B) radiographs of the right knee. Moderate joint space narrowing is observed in the medial and lateral femorotibial compartments, along with mild marginal osteophytosis. There is no evidence of focal subchondral lesion, geodes, subchondral collapse, or obvious osteochondral defect

MRI revealed a linear hypointense subchondral fracture line in the medial femoral condyle on T1-weighted images, surrounded by extensive bone marrow edema on fluid-sensitive sequences. Importantly, there

was no evidence of a discrete osteochondral fragment, no fluid-filled interface, and no signs of fragment instability.

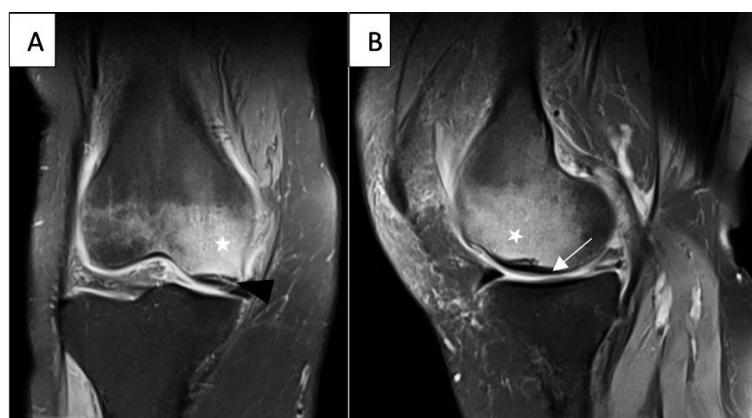


Figure 4: MRI of the right knee (coronal (A) and sagittal(B) PD sequences) demonstrating a subchondral insufficiency fracture, characterized by an irregular hypointense subchondral line parallel to the articular surface with extensive adjacent bone marrow edema. A fluid-filled hyperintense rim at the fragment–bone interface is also noted, suggesting lesion instability

These findings were consistent with subchondral insufficiency fracture (SIFK), a condition that may initially mimic OCD or osteoarthritis. SIFK is characterized by a spectrum of severity, ranging from isolated bone marrow edema to subchondral collapse and secondary osteoarthritis.

DISCUSSION

OCD and SIFK are two distinct entities that may present overlapping clinical presentations, but differ fundamentally in pathophysiology, imaging features, and prognosis.

OCD is a focal osteochondral disorder affecting predominantly young patients and is characterized by a potential for fragment instability. MRI is essential for diagnosis and staging, particularly through the identification of fluid signal at the fragment–bone interface, which defines instability according to the Hefti classification [2,3]. Additional MRI findings such as subchondral cysts, cartilage breach, and displaced fragments further support advanced disease [3].

In contrast, SIFK is a fragility-related insufficiency injury occurring in elderly patients due to mechanical overload on weakened bone [4]. The key imaging feature is a subchondral hypointense fracture line surrounded by diffuse bone marrow edema, without a detached fragment or true osteochondral instability. The bone marrow edema in SIFK tends to be more diffuse compared to the localized pattern seen in OCD [4,5].

Importantly, SIFK may progress to subchondral collapse and secondary osteoarthritis if not recognized early. Meniscal root tears and altered load distribution

play a major role in its pathogenesis, particularly in the medial compartment [5].

Therefore, accurate differentiation between OCD and SIFK is essential, as their management strategies differ significantly: OCD may require surgical fixation or drilling in unstable lesions, whereas SIFK is primarily managed conservatively in early stages, with unloading and treatment of underlying bone fragility [4,5].

CONCLUSION

Osteochondritis dissecans and subchondral insufficiency fracture of the knee represent two distinct pathological entities with overlapping symptoms presentations but fundamentally different mechanisms, imaging characteristics, and prognoses. MRI is the cornerstone of diagnosis, allowing precise differentiation through assessment of lesion stability in OCD and identification of fracture morphology in SIFK. Early and accurate recognition is essential to prevent progression to irreversible joint damage, particularly in elderly patients at risk of subchondral collapse.

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