

Fixed Flexion Deformity due to Displaced Hoffa Fracture: A Case Report

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Learning Point of the Article:

Fast and adequate radiologic intervention and correct evaluation of traumatic knee injuries, followed by correct and urgent orthopedic surgical intervention is essential to avoid complications and improve the recovery.

Abstract

Introduction: Hoffa fractures of the femoral condyles are rare, especially in the pediatric population. A Hoffa fracture causing an acute fixed flexion deformity has never been described in literature.

Case Report: A 14-year-old girl sustained a complex Hoffa Fracture of the lateral femoral condyle of her left knee, which caused acute locking of the patella distal to this fracture and subsequent a fixed hyperflexion deformity. After radiological imaging, this fracture was closely reduced in the operation room. Four days after trauma, the fracture was arthroscopically treated with 2 headless compression screws.

Conclusions: Urgent recognition of Hoffa fractures is of utmost importance. Quick and adequate evaluation and surgical treatment of these fractures improve the return to normal activity level and decrease the complications.

Keywords: Hoffa fracture, knee, open reduction internal fixation, arthroscopy.

Introduction

Hoffa fractures are coronal-plane shear fractures involving one or both condyles of the distal femur. They are rare, accounting for approximately 0.65% of all femoral fractures. These fractures are further subclassified into lateral condylar, medial condylar and bicondylar fractures. Among them, lateral unicondylar fractures are predominant, representing roughly 75–85% of all Hoffa fractures [1, 2, 3]. In the pediatric (skeletally immature) population, Hoffa fractures are extremely rare [4, 5].

The mechanism of injury leading to Hoffa fractures is most commonly associated with high-energy trauma, such as motor vehicle accidents or sports-related injuries; however, it remains incompletely understood. Biomechanically, Hoffa fractures are

believed to result from an axial load transmitted through the knee in deep flexion ($\geq 90^\circ$), often combined with valgus or varus stress and rotational forces [6, 7].

This case reports presents a 14-year-old girl who sustained a lateral Hoffa fracture during a minor trauma which resulted in a locked knee in fixed flexion. Only limited literature describes the occurrence of mechanical knee locking as a presenting symptom of Hoffa fractures. This clinical manifestation is very rare and has mainly been reported in isolated case reports or small case series, typically in association with displaced osteochondral fragments or interposition of the fractured condylar fragment within the knee joint. In the available literature, mechanical knee locking related to Hoffa fractures has most often been described in

Access this article online

Website:
www.jocr.co.in

DOI:
<https://doi.org/10.13107/jocr.2026.v16.i09.8046>

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Submitted: 24/06/2026; Review: 16/07/2026; Accepted: August 2026; Published: September 2026

DOI: <https://doi.org/10.13107/jocr.2026.v16.i09.8046>

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Figure 1: Clinical photograph; clinical photograph at presentation demonstrating a mechanically locked knee fixed in hyperflexion following injury, with inability to actively or passively extend the joint.

case report, the fracture was treated with closed reduction and followed by arthroscopic fixation.

Case Report

A 14-year-old girl presented to the emergency department with a mechanically locked left knee, fixed at approximately 130° of flexion (Fig. 1). She reported a seemingly trivial, low-energy injury mechanism consisting of a twisting motion while standing still, during which she heard an audible crack, followed by a fall. Following the injury, she experienced extreme pain and the inability to extend the knee. Physical examination revealed no neurovascular deficits in the affected limb. Conventional anteroposterior and lateral radiographs of the knee demonstrated a fracture of the lateral femoral condyle, accompanied by caudal displacement of the patella, locked distal to this fracture border (Fig. 2). Due to extreme pain and fixed flexion deformity, an urgent intervention under general anesthesia was performed. The patella was unlocked, and the Hoffa fracture could be reduced with manual posterolateral compression with fluoroscopic confirmation of reduction (Fig. 3). The patient was put in a long leg cast in full extension. An additional computed tomography (CT) scan confirmed the presence of the Hoffa Fracture, which was anatomically reduced (Fig. 4). Three days after trauma, the patient was surgically treated for this fracture. The patient was positioned supine on the operating table with the knee flexed to 90°. A tourniquet was applied. Standard anteromedial and anterolateral arthroscopic portals were established. Hemarthrosis was evacuated to improve visualization. Intra-articular inspection revealed Grade 1 chondral lesions in all three compartments, intact menisci, intact cruciate



Figure 2: Initial plain radiograph; Initial plain radiograph of the knee demonstrating a Hoffa fracture with the patella locked behind the fractured condylar fragment (circle).

ligaments, and the already reduced lateral Hoffa fracture. The fracture fragment was temporarily reduced and stabilized using a large bone clamp, followed by definitive fixation using 2 headless compression screws through 2 additional lateral portals with fluoroscopic confirmation of reduction (Fig. 5).

Postoperatively, a long leg cast in extension was applied for 2 weeks, followed by free mobilizations of the knee. The patient was not allowed to weight bear for 6 weeks.

Six weeks after trauma the patient had a full range of motion and was able to start partially weight bear. A rehabilitation program could be started, focusing on restoring mobility, flexibility, and quadriceps strength under the supervision of a physiotherapist. Radiographs at 0, 2, 6, and 16 weeks showed perfect position and

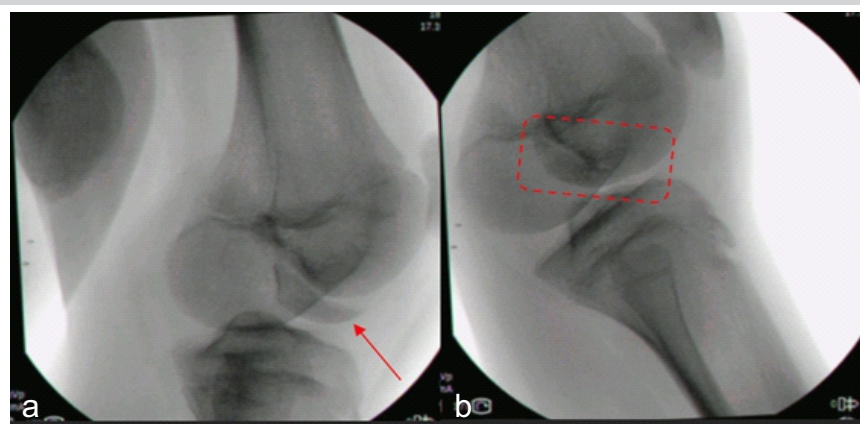


Figure 3: (a) Intraoperative fluoroscopic image; intraoperative fluoroscopic image obtained before closed reduction, demonstrating the Hoffa fragment (arrow). (b) Intraoperative fluoroscopic image; Intraoperative fluoroscopic image confirming maintained anatomical reduction of the fracture fragment (rectangle) and satisfactory patellofemoral alignment.

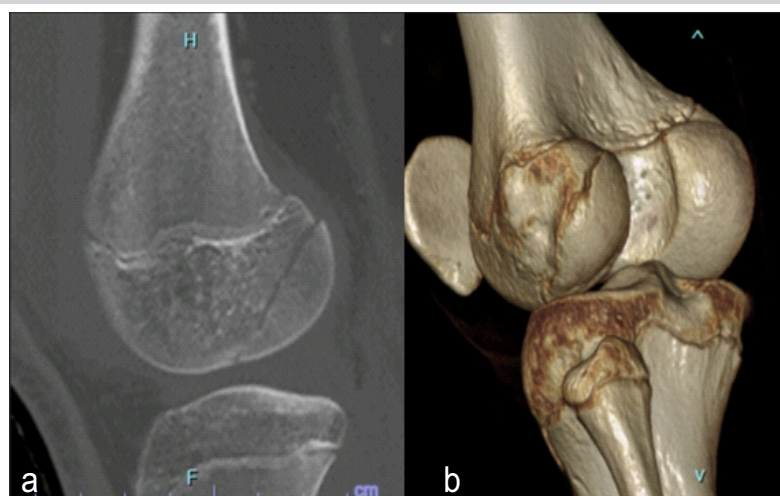


Figure 4: (a) Computed tomography (CT); CT scan obtained after closed reduction under general anesthesia demonstrating an anatomical reduction of the Hoffa fracture. (b) Three-dimensional CT; three-dimensional CT reconstruction following closed reduction under general anesthesia, illustrating the anatomical reduction of the fracture fragment.

healing of the Hoffa fracture (Fig. 6). Four months after trauma, there was a full range of motion, normal quadriceps muscle strength and waist, comparable to the contralateral right side. At

that time, she had a Knee Injury and Osteoarthritis Outcome Score of 93, a Tegner score of 7, and she was able to return to normal activity and sport level. Due to the excellent clinical and radiological examination, no additional control CT was performed to avoid additional irradiation in this young patient.

Discussion

Despite classically described after high-energy trauma in adults, in this case, a minor trauma caused the Hoffa fracture. Several other authors have reported this type of fracture occurring after low-energy trauma in skeletally immature patients [4, 9]. This susceptibility in children and adolescents has been attributed to incomplete bone mineralization, a higher cartilage-to-bone ratio, and the relative mechanical weakness of the immature distal femur, predisposing it to shear-type intra-articular fractures even after minor trauma [4, 10]. This case report, however, represents a single pediatric case, which limits the ability to generalize our findings to all Hoffa fractures in skeletally immature patients.

Conservative (non-operative) management of Hoffa fractures has consistently been associated with poor clinical outcomes, including malunion, nonunion, fragment displacement, premature post-traumatic osteoarthritis, and avascular necrosis of the femoral condyle. Consequently, open reduction and internal fixation has long been regarded as the gold-standard treatment to achieve anatomical reduction and stable fixation of this intra-articular fracture. In recent years, minimally invasive and fully arthroscopic reduction and fixation techniques have been described; however, their use remains limited to selected cases and is predominantly reported in small case series and case reports [7, 8, 10, 11, and 12].

Arthroscopic reduction and fixation of Hoffa fractures offer several potential advantages compared to open techniques, including preservation of soft tissues, reduced surgical exposure, and minimized disruption of periarticular structures. These benefits are associated with decreased intraoperative blood loss and shorter operative times, which may in turn reduce the risk of surgical site infection [8, 10]. Furthermore, arthroscopic management allows for early post-operative

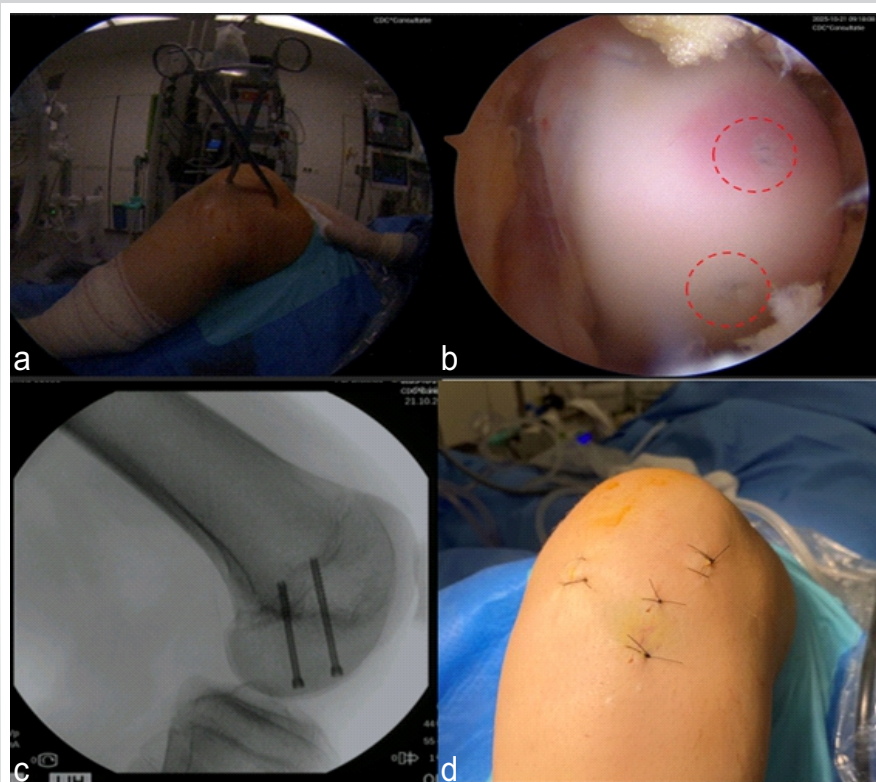


Figure 5: (a) Intraoperative photograph; intraoperative photograph during the second procedure showing a pointed reduction clamp temporarily stabilizing the Hoffa fragment. (b) Arthroscopic view; arthroscopic view of the femoral condyle after screw fixation, demonstrating an anatomically restored articular surface with minimally damaged cartilage (circles). (c) Intraoperative fluoroscopic image; intraoperative fluoroscopic image during definitive fixation demonstrating two screws securing the Hoffa fragment in anatomical position. (d) Post-operative photograph; post-operative photograph showing arthroscopic portal incisions and the entry points of the fixation screws after wound closure.

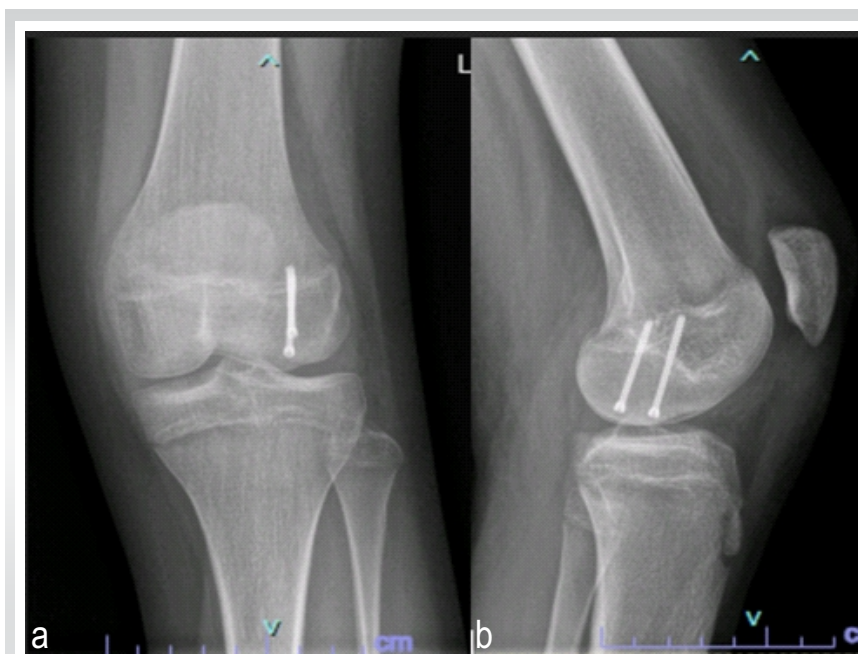


Figure 6: (a and b) Immediate post-operative radiograph; immediate post-operative anteroposterior (a) and lateral (b) radiograph confirming anatomical reduction and appropriate positioning of the fixation screws.

protocols, potentially facilitating faster recovery of knee range of motion and functional outcomes [10, 12]. An additional advantage of the arthroscopic approach is the ability to directly visualize the intra-articular surface and to diagnose and treat concomitant intra-articular lesions – such as chondral defects, meniscal tears, or ligamentous injuries – during the same surgical procedure [10, 11]. In this way, an additional magnetic resonance imaging scan could be avoided. In this case, penetration of the lateral femoral physis by the fixation screws could not be avoided. Given the patient's age and near skeletal maturity, the risk of clinically significant growth disturbance is considered low. However, to fully assess this possible complication, yearly clinical and radiological follow-up until skeletal maturity is advised.

This case report has some limitations. Due to the rarity of Hoffa fractures with acute fixed flexion deformity, comparison with larger studies and standardized treatment protocols is limited. The short follow-up of 4 months is insufficient to assess long-term complications such as cartilage injuries, post-traumatic osteoarthritis, avascular necrosis, physeal disturbance, or

implant-related issues.

In this case, the fracture was anatomically reduced before definitive fixation. It is difficult to determine whether similar outcomes would occur in irreducible or more comminuted Hoffa fractures. However, Souto et al. reported good clinical and radiological outcomes of a comminuted Hoffa fracture after arthroscopic reduction and fixation [12].

In the literature, so far, no complications were associated with arthroscopic fixation. Larger studies or case series are needed to determine possible complications such as infection, hardware irritation, or stiffness.

Being a case report from a single institution, the favorable outcome may reflect surgeon experience and careful patient selection, limiting broader applicability of the conclusions.

Conclusion

Closed reduction and arthroscopic anatomic fixation of certain Hoffa fractures lead to restoration of the anatomy and biomechanics and excellent clinical outcomes.

Clinical Message

Clinicians should consider the possibility of a Hoffa fracture in adolescents presenting with a locked knee after seemingly trivial trauma. Although rare in young patients, these fractures can be successfully managed with arthroscopic techniques. Nevertheless, urgent reduction may be required in selected cases to prevent complications and restore normal knee function.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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Conflict of Interest: Nil
Source of Support: Nil

Consent: The authors confirm that informed consent was obtained from the patient for publication of this article

How to Cite this Article

Van Steenberge A, van den Broek M. Fixed Flexion Deformity due to Displaced Hoffa Fracture: A Case Report. *Journal of Orthopaedic Case Reports* 2026 September;16(09): 233-237.

