Arthroscopic Treatment of Medial Femoral Condylar Coronal Fractures and Nonunions

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Abstract: Nonunion of medial femoral condylar coronal fractures are uncommon. In neglected Hoffa fractures despite nonunion, there is a risk of missing accompanying ligamentous and intra-articular injuries. Neither preoperative clinical examination nor magnetic resonance imaging showed these injuries before arthroscopy. Arthroscopy before internal fixation gives additional information and changes the surgical protocol for these fractures and nonunions.

Hoffa fractures are intra-articular fractures in which the distal fragment behaves like a large loose fragment in the joint. Only a few reports have reported on Hoffa nonunions, and none of them mentioned the diagnostic difficulties with these injuries.1,2 When present, they usually indicate a high-energy trauma.1 Weight bearing and knee movements lead to nonunion of the fracture. In neglected Hoffa fractures despite nonunion, there is a risk of overlooking accompanying ligamentous and intra-articular injuries. We describe a new technique for the treatment of medial Hoffa fractures and nonunions. This technique presents the opportunity to treat additional intra-articular injuries.

Technique

Video 1 presents a clear demonstration of our technique. The procedure is performed with the patient under general anesthesia. The patient is positioned supine on the operating table with a pneumatic tourniquet and a side support about the proximal aspect of the thigh. After the induction of anesthesia, the patient is examined to evaluate the stability and range of motion of the joint. It is difficult to accurately diagnose ligamentous injuries before fixation of the fracture because of movement of the fragment. Valgus stress and anterior or posterior drawer tests may yield false-positive findings before fixation of the fracture. Therefore this examination has to be repeated after internal fixation of the fracture. A routine assessment of the joint is made through standard anterolateral and anteromedial portals with a 30°, 4.0-mm arthroscope. Additional injuries such as meniscal, chondral, or anterior cruciate ligament injuries can be diagnosed and treated as usual. The fracture or nonunion side can be visualized directly by arthroscopy. Hematoma and bone debris at the fracture site should be identified and debrided with an arthroscopic shaver and curette.

During arthroscopy, after additional intra-articular injuries are treated, the fracture site should be examined. In a nonunion case, after visualization of the fracture site and the size of the fracture gap, the decision can be made to use additional bone graft at this point. The surgeon may choose to perform an operation by open reduction and autografting. For fracture reduction, a far medial portal should be used with direct visualization with the arthroscope, which should be directed toward the distal-medial portion of the medial Hoffa fracture. A reduction forceps uses 1 arm from the anteromedial portal and the other arm from the far medial portal (Fig 1). Careful positioning of the forceps is needed to avoid damaging the meniscus or chondral surface. After placement of the forceps, reduction can be achieved by manipulation to the distal fragment. During fixation, the surgeon must hold the forceps and maintain reduction.

After full reduction is observed by direct arthroscopic visualization, 2 parallel guidewires should be placed from the suprapatellar region (Fig 2). C-arm fluoroscopy
with anteroposterior and lateral view control is needed at this point. The screw holes are drilled with a cannulated drill bit, and the screw length is determined with a measuring device. Partially threaded 6.5-mm screws are placed over the guidewires, which are then removed. Any impingement of the screw head is checked in flexion and extension by direct visualization with the arthroscope. The reduction quality is confirmed by direct arthroscopic visualization after irrigation. The knee is taken through its range of motion, and stability tests should be performed. Finally, a suction drain is inserted and a compressive dressing applied.

**Discussion**

Coronal shear fractures of the distal femoral condyle (Hoffa fractures) are rare injuries. This intra-articular fracture affects the lateral condyle more commonly than the medial condyle. In contrast to nonoperative treatment, open reduction—internal fixation of these fractures yields good long-term results. When overlooked, such fractures are prone to nonunion because of the pulling strength of the gastrocnemius, leading to high shear forces down to the fracture line.

Open reduction—internal fixation reduces the risk of malunion and nonunion. Three reports of arthroscopically assisted reduction and internal fixation of femoral condyle fractures have appeared in the literature. In addition, a series of 24 intra-articular knee

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**Table 1. Advantages, Indications, Contraindications, Tips and Pearls, Pitfalls and Risks, Key Points, and Limitations**

| Advantages | Allows articular reduction without arthrotomy |
|------------|---------------------------------------------|
|            | Avoids long incision and soft-tissue disruption |
|            | Allows diagnosis and treatment of additional intra-articular injuries |
|            | Decreased blood loss |
|            | Excellent intra-articular visualization |

| Indications | For acute fractures: non-comminuted, large fragments |
|------------|-----------------------------------------------------|
|            | For nonunions: non-comminuted, large fragments; good bone quality |

| Contraindications | Additional neurovascular injuries |
|-------------------|----------------------------------|
|                   | Nonunions that require autografting |
|                   | Irreducible fragment |

| Tips and pearls | Use supine position and radiolucent table |
|-----------------|--------------------------------------------|
|                 | Debride the fracture site with arthroscopic shaver and curette |
|                 | Clean all debris in nonunion site to establish healthy vascularity at fracture site |
|                 | Manipulate fragment into reduced position by use of reduction forceps |
|                 | Use cannulated, partially threaded 6.5-mm screws |
|                 | Check any impingement of screw head in flexion and extension, by direct visualization with arthroscope |
|                 | Confirm anatomic articular reduction with direct arthroscopic visualization |

| Key points | Adequate exposure of fracture or nonunion site is needed |
|------------|---------------------------------------------------------|
|            | Parallel confirmation of guidewires |
|            | Maintain reduction by use of reduction forceps during guidewire insertion |
|            | Check reduction by direct visualization with arthroscope |
|            | Repeat stability tests after fixation |

| Limitations | Careful patient selection is needed |
|-------------|------------------------------------|
|             | Good arthroscopy skills are needed |

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**Fig 1.** Photograph of patient’s knee showing reduction forceps position.

**Fig 2.** Direct arthroscopic visualization of 2 parallel guidewires inserted from suprapatellar region.
fractures that were treated with arthroscopically assisted reduction and internal fixation, which included 2 Hoffa fractures, has been reported. These articles addressed lateral femoral condyle fractures; in addition, the authors did not specifically describe their technique. Only a few reports have reported on Hoffa nonunions, and none of them mentioned the diagnostic difficulties with these injuries. In neglected Hoffa fractures despite nonunion, there is a risk of overlooking accompanying ligamentous and intra-articular injuries. These nonunions are complex injuries; movement of the fragment makes it difficult to distinguish meniscal and ligamentous injuries with physical examination. The valgus stress test may yield false-positive findings because of fragment movement or a real medial collateral ligament injury. Joint line tenderness may be positive because of the nonunion or an accompanying meniscal or chondral injury. Moreover, false-positive anterior and posterior drawer tests are expected because of the movement of the nonunion fragment. Clinical examination alone does not adequately show the accompanying intra-articular and ligamentous injury. Plain radiographs may show the nonunion, whereas computed tomography may give more information about the nonunion. With a nonunion fragment and effusion in the knee, magnetic resonance imaging evaluation is not sufficient to adequately diagnose this injury.

Advantages, indications, contraindications, tips and pearls, pitfalls and risks, key points, and limitations of the procedure are further described in Table 1.

The described distal femoral fractures and nonunions are intra-articular complex injuries. Arthroscopy before open reduction—internal fixation gives additional information and changes the surgical protocol for these fractures and nonunions.

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