The Arthroscopic-Assisted Removal of a Distal Femoral Condylar Locking Plate
A Case Report

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Abstract
We describe a minimally invasive procedure for removal of a distal femur locking plate using arthroscopic assistance. Using lateral accessory portals, we performed arthroscopically-assisted removal of distal locking screws. Under fluoroscopic image, proximal screws were removed from the diaphysis. The accessory lateral portal sites used to remove the distal screws were connected. Through this arthrotomy, the plate was elevated from the distal femur and removed without difficulty. With this method we were able to concomitantly visualize the intra-articular regions while accomplishing the hardware removal.

Patients commonly present to the office complaining of pain and irritation near implanted orthopaedic hardware. Rates of hardware removal have been estimated at 5% of elective orthopaedic cases. Hardware removal is usually a low morbidity procedure, with a recent report citing improvements in pain of up to 77% in the lower extremity at 1 year postoperatively. In a recent survey to an international community of orthopaedic surgeons, as many as 37% felt that all hardware should be removed in all patients under 40 years of age to prevent subsequent morbidity. When plate and screw constructs are used in the periarticular region, such as the distal femur and the proximal humerus, it becomes possible to visualize the implant arthroscopically. Periarticular plate removal often requires an open approach, which may require extensive dissection and soft tissue stripping to obtain adequate exposure. An arthroscopic approach to periarticular hardware removal can help localize the position of the implanted screws and minimize the amount of dissection necessary, potentially limiting the morbidity associated with the procedure. Methods for arthroscopically assisted hardware removal have been described for implants used about the proximal humerus, proximal tibia, and the distal femur. We present a case where a distal femoral locking plate was successfully removed under arthroscopic guidance through small incisions with minimal soft tissue dissection.

Case Presentation
The patient in this case is an otherwise healthy 53-year-old woman who presented to the office with activity related left knee pain 18 months following open reduction and fixation of a supracondylar femur fracture. She reported discomfort about the lateral aspect of her knee with ambulation, ascending and descending the stairs, and when rising from a chair. Physical examination demonstrated a well healed, lateral-sided incision, which was approximately 6 inches in length along with four stab incisions proximally which had been used for percutaneous diaphyseal screw insertion. She had full knee extension and was capable of flexion to 130°.

Reproduction of her laterally based symptoms occurred at the mid-range of knee flexion, which appeared to be related to contact between her iliotibial band and the implanted hardware. Additionally, she had evidence of decreased patellar mobility along with mild patellofemoral crepitation throughout her range of motion. Radiographic evaluation demonstrated a well healed distal femur fracture. An anatomic alignment with a laterally based 9 hole Synthes 4.5 mm locking condylar plate that had no evidence of screw migration or breakage along with two separate cortical screws, which had been implanted in a lateral to medial direction (Fig. 1). Her joint spaces were well maintained in the medial, lateral, and...
Figure 1 Preoperative anteroposterior, lateral, and merchant views demonstrating a well healed supracondylar femur fracture with implanted hardware in place.

Figure 2 Arthroscopic view showing the distal aspect of the distal femoral condylar locking plate.

Figure 3 Removal of scar tissue attached to the distal femoral condylar locking plate using electrocautery device.

Figure 4 Screw removal through small arthrotomy under direct arthroscopic visualization.

Figure 5 Percutaneous removal of diaphyseal locking screws under fluoroscopic guidance.
patellofemoral compartments. Based on her history, physical examination, and imaging, she was indicated for a left knee arthroscopy for scar tissue debridement and removal of her symptomatic hardware.

**Surgical Technique**

With the patient in the supine position after suitable general anesthesia, standard arthroscopic portals were created. Diagnostic arthroscopy identified the presence of scar tissue in the suprapatellar pouch in addition to the intercondylar notch. Grade 3 chondromalacia was evident within the central region of her trochlea and the distal, lateral facet of her patella. In the lateral gutter, the distal aspect of the condylar locking plate was visible, (Fig. 2) with some soft tissue overgrowth present over the heads of the implanted locking screws. Using a large shaver, scar tissue was debrided from both the suprapatellar pouch and the intercondylar notch, resulting in significant improvement in the extent of her patellar mobility. Electrocautery was used to achieve hemostasis following the scar tissue debridement, and attention was turned to the implanted hardware.

An accessory superolateral portal was created under spinal needle localization. Soft tissue covering the hardware was removed using a shaver and electrocautery device inserted via the superolateral accessory portal, exposing the edges of the plate and the six distal locking screw heads (Fig. 3). Next, a spinal needle was used under arthroscopic guidance to localize the position of the central of the three more proximal distal locking screws. A small arthrotomy was made using a scalpel blade, just large enough to insert the star-shaped screw driver into the knee. Under direct visualization, the screw driver was inserted into the locking screw head, and the screw was removed uneventfully (Fig. 4). With flexion and extension of the knee, the position of the arthrotomy relative to the implant was altered allowing for sequential removal of the remaining two more proximal distal locking screws. The spinal needle was then used to localize the central of the three more distal locking screws. A second small arthrotomy was made allowing for insertion of the screw driver and removal of the remaining distal locking screws. Next, the four proximal, diaphyseal locking screws were localized using fluoroscopy and removed through small percutaneous incisions (Fig. 5). With all of the screws removed, an elevator was inserted into the distal arthrotomy and used to elevate the plate from the distal femur and distal femoral condylar locking plate from the femur using an elevator.

**Figure 6** Freeing the distal femoral condylar locking plate from the femur using an elevator.

**Figure 7** Hardware removal through small incision created by connecting two small arthrotomy sites.

**Figure 8** Postoperative anteroposterior and lateral views following arthroscopically assisted hardware removal.
femoral shaft (Fig. 6). Finally, the lateral arthrotomy sites were connected allowing for grasping of the plate with a heavy needle driver and easy removal from the knee (Fig. 7). Since the heads of the two additional cortical screws were not visible and were not symptomatic, they were left in-situ. The knee was then copiously irrigated and the wounds closed in layers. A sterile dressing was applied and the patient transferred to the recovery room in stable condition. She was allowed weightbearing as tolerated postoperatively.

**Discussion**

The presence of persistent pain near implanted orthopaedic hardware with no discernible cause for other sources of symptoms is an indication for hardware removal. When considering removing symptomatic hardware, it is important to counsel the patient that the success rate of pain relief with hardware removal is variable, and the procedure may not completely resolve their symptoms. The patient must also be made aware that the risks associated with the procedure include the potential for infection and post-removal fracture.8 Utilizing arthroscopy to aid in the removal of a periarticular locking plate may limit the risk of postoperative infection as smaller incisions and less soft tissue dissection is required. Additionally, the use of arthroscopy prior to implant removal enables the operating surgeon to rule out other potential causes of knee pain that may be mimicking as hardware-related symptoms. When planning for an arthroscopically assisted periarticular plate removal, care must be taken to properly identify the implant preoperatively to allow for appropriate instrumentation to be available in the operating suite. The reported case was done at an outpatient surgical center, and the patient had a quick recovery in her postoperative period. We feel that arthroscopic removal of a distal femoral locking plate is a feasible and safe option for patients who have persistent lateral sided knee pain following open reduction and internal fixation of the distal femur, allowing for a low morbidity procedure with a quick return of postoperative function.

**Disclosure Statement**

None of the authors have a financial or proprietary interest in the subject matter or materials discussed, including, but not limited to, employment, consultancies, stock ownership, honoraria, and paid expert testimony.

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