Hip Resurfacing with Retention of Existing Hardware
Case Report

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Abstract
Despite operative reduction and internal fixation (ORIF), many patients who sustain proximal femur fractures develop posttraumatic arthritis. Conventional total hip arthroplasty (THA) in the setting of altered femoral morphology and retained hardware can be quite challenging. Hip resurfacing can provide a favorable option. The present report describes three patients in whom the use of resurfacing precluded the need for hardware removal and provided excellent pain relief.

In Western countries, approximately 10% of the population over the age of 60 years is affected by osteoarthritis (OA).1 Posttraumatic OA constitutes a large proportion of this osteoarthritic population, an estimated 12% of hip, knee, or ankle OA in one report.2 Often individuals who develop posttraumatic hip OA have sustained acetabular or proximal femoral fractures that were treated by internal fixation. Although hardware removal is commonly performed, there is limited data to indicate whether this is necessary.

Treatment for patients who have failed nonoperative treatment and have end-stage symptomatic posttraumatic arthritic hips typically consists of hardware removal and total hip arthroplasty (THA).3 However, extra-articular deformities or retained implants can make standard THA difficult or unfeasible.4 In addition, refractures can result from hardware removal, especially if stress risers result from screw removals.5 Although the current literature regarding refracture rates does not support either retention or removal of hardware, there appears to be no increased risk of fracture when hardware is retained.6 It is also important to consider that any surgical procedure carries the risk for wound complications, nerve injury, blood loss, and infection. Given these concerns, it is reasonable to search for alternative treatment options that would require only one operation for patients with posttraumatic hip arthritis with retained hardware. Our objective was to present three patients who received total hip resurfacing for posttraumatic arthritis with retained hardware in order to raise awareness and share our experience with this treatment option.

Case 1
A 30-year-old male with a history of bilateral epiphyseal dysplasia of the hips was in a motor vehicle accident that resulted in a closed midshaft femoral fracture and open talar and calcaneal fractures. An intramedullary nail was initially used to fix the femoral fracture. Three months after the initial nailing, the patient underwent exchange nailing for a prominent nail with delayed union (Fig. 1A). Following recovery from his injuries, he developed severe OA of his right hip. His range of motion was limited, and he was unable to work or complete any house or yard work. Removal of the femoral nail and hip arthroplasty with resurfacing was considered as a treatment option.

However, it was believed that nail removal might weaken the femoral neck and predispose it to fracture. Surgical findings confirmed that the femoral nail was contained within the bone, with no protruding sections. A resurfacing was performed with retention of the existing hardware (Fig. 1B). At 36-month follow-up, the patient was extremely satisfied with his surgery and reported no pain.

Case 2
A 55-year-old male developed OA of the right hip without serious symptoms. His OA was noted when he experienced
an oblique subtrochanteric fracture after a minor fall (Fig. 2A). His plan was for a combination of standard THA-open reduction and internal fixation (ORIF), with a long stemmed hip component. However, due to the location of the fracture, it was decided that appropriate management would be a staged ORIF of the fracture, using a dynamic condylar screw. This initial procedure would be followed at a later date by resurfacing or long-stem hip arthroplasty if he experienced persistent hip pain. Fixation was achieved with a dynamic condylar screw-plate device (Fig. 2A). One year postoperatively, he continued to complain of hip pain with all activities of daily living. Hardware removal for hip arthroplasty would have required a long-stemmed component to bypass the screw holes and potential stress risers; therefore, the patient was offered a resurfacing with hardware retention.

The hip was exposed through a posterior approach, and a guide wire was placed through the femoral head. Guide wire position in relation to both the femoral neck axis as well as the dynamic condylar screw was confirmed by intraoperative fluoroscopy. The central drill hole was created, and the femoral head was prepared in a standard manner (Fig. 2B). Nine months after surgery, the patient reported no pain and expressed high satisfaction with this procedure. Although he had a mild limp with some abductor weakness on physical examination, the patient was able to return to work as a full-time factory laborer and resume his other normal activities. At 2.5 years postoperatively, the patient sustained a traumatic right supracondylar femoral fracture and underwent ORIF with an intramedullary (IM) nail (Figs. 2C and D).

Case 3

A 41-year-old male was scheduled for a right THA to relieve pain due to posttraumatic arthritis. His past history included a motor vehicle accident 6 years previously, in which he sustained an open right femoral fracture. The fracture was reduced and fixed with a retrograde nail. The patient failed nonoperative treatment for what was found to be an infected nonunion, and after several procedures, he eventually underwent exchange nailing.

The patient reported persistent, disabling hip pain a year-and-a-half after the exchange nailing and nearly 6 years after the initial motor vehicle accident. Plain radiographs demonstrated a well-healed femoral fracture with right hip OA. After failed nonoperative treatment, standard total arthroplasty was considered. Because of the possibility that hardware removal could activate latent inactive infection and cross-contaminate a hip arthroplasty, hip resurfacing was performed without exposure of the prior hardware site. A 50-mm femoral head component was placed following standard femoral preparation via a posterior hip approach. The acetabulum was disproportionally large compared to the femoral head; therefore, a 62-mm dysplasia cup with two 24-mm bolts was used on the acetabulum, with bone graft placed behind the cup. Seven months after surgery, the patient was ambulating well with only minor pain. Further follow-up is unobtainable, as he expired 1 month after his
last visit due to injuries sustained in another motor vehicle accident.

**Discussion**

These three cases demonstrate that resurfacing is a viable option for the relief of posttraumatic arthritic pain in patients with retained femoral hardware. Arguments supporting hardware removal contend that hardware retention might lead to implant-related pain, metal sensitivity, carcinogenesis, and peri-implant fracture. However, in many patients, implant removal can be difficult and can result in neurovascular injury, refracture, or recurrence of deformity. In addition, studies have shown that increased duration of hardware retention reduces refracture rates. Also, the direct and indirect economic costs of hardware removal for both the patient and the institution should be considered; 4.9% of orthopaedic operations in the US are implant removals, many of them elective.

Retention of hardware can be considered, especially in patients who have had hardware for several years without any negative symptoms. For many patients, the hardware used to fix the original fracture is not removed; one study

**Figure** 2 Case 2. (A) Ten months after open reduction internal fixation and 4 months prior to resurfacing (B) Ten months after resurfacing (C and D). At 33 months after resurfacing and 3 months after nailing for a supracondylar fracture.
has shown that only 20% of intramedullary nails are removed after the femoral shaft fracture has healed.\(^8\)

Another study reported that 42% of patients undergoing internal fixation for fractures or joint injuries later had the implant removed. Of those patients who underwent implant removal, 19% had major complications.\(^9\) Thus, it is feasible to retain hardware for many years, necessitating a new method for treating OA in patients in which new bone growth has made implant removal difficult.

The outcomes of resurfacing compare favorably with those of standard THA performed with proper patient selection.\(^10,11\) When deciding between THA and hip resurfacing, surgeons should consider several factors in addition to the risks and benefits of hardware removal stated above. A key criterion in patient selection for resurfacing with retained femoral hardware is complete union of the femoral fracture. In Case 3, for example, considerable effort was expended to ensure femoral union before resurfacing with intramedullary nail dynamization and ultimately exchange nailing. However, if nonunion persists, nail removal and THA is recommended.\(^12,15\)

Because posttraumatic OA patients are often younger than the typical THA population, other considerations in treatment selection are the patients’ youth and the nature of their traumatic injuries.\(^2,10\) These two factors put these patients at a higher risk for later revision; thus, it is important to conserve bone in the initial surgery if a revision is needed.\(^11\) If femoral hardware and resurfacing components are positioned to avoid contact, this treatment method provides an alternative to hip arthroplasty with femoral bone conservation.\(^4\)

Several technical considerations may aid in proper patient selection and achieving a successful outcome. If retained hardware forces the surgeon to insert the femoral component in anteversion, retroversion, varus, or extreme valgus, the patient may not be a good candidate for the procedure.\(^16\) One way to assure correct placement in insertion of the femoral component is to radiographically confirm guide-wire position with regard to the femoral neck axis and the retained hardware, using a C-arm in the operating room. The surgeon should be prepared to remove the hardware and perform a standard THA, and patients should be counseled for this possibility if the resurfacing procedure must be aborted based on intraoperative findings.

Stuchin\(^17\) proposed a classification system to separate risk factors in order to allow for better planning and prognostication for resurfacing for extra-articular deformities, dysplastic conditions, and in the setting of retained hardware. Intramedullary categories include expanded, constricted, and obstructed deformities. Constriction or obstruction may be caused by bone or an implant. Extramedullary deformities include a variety of femoral shaft problems, such as angular, rotational, translational, and longitudinal discrepancies. Complex deformities, such as developmental dysplasia of the hip, may consist of both intramedullary and extramedullary elements or may be combined. Despite the surgical challenge that these various anatomic conditions represent, resurfacing may be an appropriate option to alleviate the symptoms of posttraumatic arthritis of the hip. Furthermore, studies have shown that if a patient who has had resurfacing does require a revision to THA in the future, it can be converted to a standard THA without compromising outcome.\(^18\)

**Conclusion**

Femoral resurfacing in patients with retained hardware provides a reasonable and bone-conserving arthroplasty option to alleviate arthritic pain. If the surgeon is experienced in resurfacing technique, it is possible to position the stem of the femoral component without coming in contact with retained hardware in the femur. Resurfacing reduces the intra-operative trauma associated with removal of the original femoral hardware and placement of a larger prosthesis. In addition, it allows for future internal fracture fixations, such as IM nailing, as in case 2 (Figs. 2C and 2D). In conclusion, resurfacing should be considered as a straightforward procedure for patients who have retained hardware based on our experience as well as those of other studies.\(^17,19\)

**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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