Novel Technique for Removal of a Broken Intracortical Screw During THA

Matthew J. Dietz, MD; Samantha Chase, MD; Dennis W. Burke, MD; Young-Min Kwon, MD, PhD

Abstract: Most reports regarding hardware removal involve the violation of the cortex to allow a specialized tool to extract a retained fragment. This leaves large, unfilled screw holes that act as stress risers for months postoperatively. This article describes a novel technique to remove a retained intracortical screw fragment during total hip arthroplasty. Conversion of an intertrochanteric osteotomy to a total hip arthroplasty can be made more difficult by anatomical changes to the femur and retained hardware. Direct access to the intramedullary canal during total hip arthroplasty allowed for the safe removal of a retained intracortical screw using this technique.

Little evidence exists to suggest that retained hardware is harmful if left in situ. However, broken or retained hardware can prove to be problematic when undertaking future surgeries. Addressing these hurdles intraoperatively can require multiple incisions and additional steps or tools prior to continuing with the planned procedure. The removal of broken screws is a common scenario that often leads to the use of trephines, specialized extractors, or carbide drill bits. Most reports regarding hardware removal involve the violation of the cortex to allow either another instrument to assist in screw removal or a specialized tool to extract a retained fragment. This often leaves large, unfilled screw holes that can act as stress risers for as long as 4 months postoperatively.

Retained hardware can be present at the time of total hip arthroplasty (THA) as a result of an earlier intertrochanteric osteotomy. The goal of performing an intertrochanteric osteotomy for the treatment of osteoarthritis is to realign the hip and improve the joint congruency and mechanics of the hip in hopes of delaying the need for THA. Zweifel et al. reported a delay of 10 years or more in 40% of patients with osteoarthritis changes secondary to dysplasia who had undergone an intertrochanteric osteotomy. Another series reported survival rates greater than 80% at 10 years. In both studies, those patients having undergone an osteotomy with the longest survival were found to have low grades (Tonnis grade 0 or 1) of arthritic deformity. As pain and radiographic changes progress, many of these patients will eventually require THA.
This article describes the use of a device for the removal of an intracortical retained screw fragment during THA.

**CASE REPORT**

A 47-year-old man presented with bilateral hip osteoarthritis. He elected to undergo staged bilateral intertrochanteric osteotomies. His first osteotomy (left) had provided him such great relief that he elected to have an osteotomy performed on his contralateral (right) side also (Figure 1). He underwent hardware removal from his right hip successfully 27 months after his osteotomy, followed by THA 5 years after his initial procedure. His left hip initially did well after the osteotomy, but he began to have hardware-related pain 7 years later, requiring its removal. During this procedure, the most distal screw in the plate broke during removal. This left approximately 90% of the screw intracortical (Figure 2). It was decided at that time to leave the screw because it was felt that to use a trephine to remove the screw would have left a large defect in the cortex. This screw fragment did not become a concern until 58 months later, when the patient’s pain and arthritis had progressed to the point that he elected to undergo THA.

Surgery was performed via the posterolateral approach. The acetabulum was first prepared in a standard fashion. A prophylactic cerclage wire was passed above the lesser trochanter. To aid in screw removal, a custom-made stainless steel device was used. The shaft of the instrument was undersized according to the intramedullary diameter of the patient’s femur. The proximal end was fitted with a T-handle to allow the surgeon to apply adequate torque. At the distal end, a recessed cavity was created in accordance with the screw diameter, which allowed for a firm capture of the screw body and greater contact surface area (Figures 3, 4). The device was inserted into the femoral canal, and fluoroscopy confirmed that the screw was captured in the distal end of the device. A rotational force was then applied in an alternating clockwise and counterclockwise direction to apply torque to the screw and eventual fatigue of the screw. Once the screw broke and became dislodged from the femoral cortex, the screw fragments were retrieved from the canal (Video). Fluoroscopic images confirmed complete removal of the screw fragments, as well as an intact femoral cortex without evidence of fracture. The femoral preparation then continued in a standard fashion, and surgery was completed without complications (Figure 5).
patient was discharged home on postoperative day 1. The patient provided informed consent for this article to be published.

**DISCUSSION**

The authors present an original technique to remove retained intracortical screws at the time of THA. The removal of the screw through standard means (eg, trophines, overreaming, and carbide bits) would leave a large cortical defect that would act as a stress riser near the end of the femoral prosthesis.6,8,10,11 The femoral neck osteotomy provides the surgeon with access to the intramedullary cavity that is not possible in most other circumstances. With this access, the authors were able to disrupt the broken screw using this instrument and remove it piecemeal without violating the cortex. This stainless steel tool had a fish-mouthed distal end that was tapered and allowed a tight fit with the broken screw’s diameter. Without this device, the authors would have been forced to remove the screw through a more standard approach. This would have left a defect in the femoral cortex, which would have been located at the distal extent of the primary femoral stem. This purposeful perforation of the femoral cortex would have required that a longer stem or revision prosthesis be used.

Conversion of an intertrochanteric osteotomy to a THA can be made more difficult by displacement of the femoral shaft, sclerotic subtrochanteric bone, risk of perforation of the femoral cortex, and retained hardware.15 These difficulties can lead to longer operative times and more intraoperative blood loss.16 Despite these added complications, patients who undergo THA after an intertrochanteric osteotomy do well. Havercamp et al15 reviewed a series of 121 consecutive THAs after osteotomy and found no difference in survival rates when compared with native hips. They reported survival rates of 90% at 10 years and 83% at 15 years. Suzuki et al16 reported 100% survival of femoral components in 27 patients at 7 years. Breusch et al17 found uncemented femoral components did well, with 94% survival at 10 years. This is in contrast to the findings of Iwase et al,18 who found that cemented hips tended to have a much higher survival rate than uncemented hips (100% vs 77% at 5 years) in patients undergoing THA after osteotomy. Cementing of a femoral prosthesis in the setting of prior surgery can be difficult due to cement extravasation and irregular cement mantles due to altered femoral anatomy. New cementless stem designs have allowed for a stable prosthesis that is forgiving but achieves good fixation.

The technique described herein allowed the patient to undergo primary THA with little extra effort required for removal of his hardware. The authors recognize that some risks exist to using the device, as there are with any procedure. If a screw were to be too large in diameter and require a large torque prior to failure, it may lead to fracture of the femoral cortex prior to breakage of the screw. Concern also exists for retained screw fragments if they fall distal in the canal and are not able to be retrieved. Also, this is a technique that is only useful when the surgeon has access to the medullary canal, as in the setting of a THA. Despite these theoretical risks, the authors believe that their tool allowed easy removal of the patient’s hardware without having to extend his surgical procedure, change the femoral prosthesis selection, or alter the patient’s postoperative recovery in any fashion. This will remain a useful tool in their armamentarium for intracortical hardware removal.

**REFERENCES**


