The Journal of Arthroplasty 29 (2014) 210–213

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Utility of Trephine Reamers in Revision Hip Arthroplasty

Vamsi K. Kancherla, MD [b,*], Daniel J. Del Gaizo, MD [c], Wayne G. Paprosky, MD [a], Scott M. Sporer, MD [a]

[a] Department of Orthopaedic Surgery, Rush University Medical Center, Chicago, Illinois
[b] Department of Orthopaedic Surgery, St. Luke's University Health Network, Bethlehem, Pennsylvania
[c] Department of Orthopedic Surgery, University of North Carolina, Chapel Hill, North Carolina

ARTICLE INFO

Article history:
Received 22 January 2013
Accepted 8 April 2013

Keywords:
trephine
reamers
revision hip arthroplasty
necrosis
thermal

ABSTRACT

Powered trephines used over a femoral component to disrupt the bone component interface can yield acceptable clinical and radiographic outcomes while minimizing direct mechanical injury and indirect thermal necrosis. Thirty-six patients required trephining for fractured stems (16), infection (8), malposition (7), modular junction failure (4), and acetabular exposure (1). Harris Hip Scores (HHS), radiographic healing, and complications were assessed at a follow-up of 50.01 mo. Mean HHS increased from 46.61 preoperatively to 87.78 postoperatively ($p < .0001$). Two patients suffered spontaneous postoperative periprosthetic fractures in the region of the trephined bone at 3 mo and 4 mo postoperatively. Despite undergoing ORIF with locked plates, they both re-fractured with necrotic bone observed at the time of revision. There is a 5.6% incidence of femoral shaft fractures near the region of trephined bone within 1 year of surgery. Given the location of these fractures, thermal necrosis may have occurred and consideration should be given to distally bypassing the region of the femur that has been trephined.

Bone preservation is of utmost importance in revision hip arthroplasty as it can significantly influence clinical and radiographic outcomes. Revision of well-fixed components presents the challenge of maintaining bone stock and preventing iatrogenic injury. In these circumstances, special instrumentation is often required, including broad osteotomes; flexible osteotomes; Gigli saws; high-speed, metal-cutting burrs; and multiple trephines with diameters .5 mm larger than the stem to be removed [1–3].

There is a paucity of literature evaluating the outcomes of revision total hip arthroplasty (THA) where powered trephine reamers were utilized. No study to date has documented the outcomes and complications of this surgical technique. Trephine reamers have been shown to aid in the extraction of well-fixed femoral components by safely disrupting the implant-bone interface.

We hypothesize that the use of powered trephine reamers in revision THA can yield favorable clinical and radiographic outcomes in patients requiring the revision of a well fixed femoral component.

Materials and Methods

After IRB approval, a retrospective review of consecutive femoral component revisions performed by 2 surgeons between 01/2004 and 01/2010 yielded 43 patients that required trephining to remove a well fixed femoral component. Seven patients were lost to follow up, leaving 36 patients for analysis with a mean clinical and radiographic follow up of 50.01 months (range 12.4–94.6).

Background data included demographics (age, sex), operative site, indications for revision surgery, and osteotomy performed. For clinical comparison, pre-operative and most recent follow up (MRFU) Harris Hip Scores (HHS) were collected. Radiographic analysis consisted of femoral bone loss as classified by Paprosky et al. [4], leg length discrepancy, osteotomy healing, component loosening, and femoral osseo-integration as described by Engh et al. [5]. Subsidence was judged by evaluating the relationship between the tip of the greater trochanter to the head neck junction over serial radiographs.

The statistical significance between pre-operative and most recent follow-up (MRFU) HHS was determined by using a two-tailed Student's *t* test calculated with SPSS version 16.0 (SPSS Inc, Chicago, IL).

Source of Funding

No funding was procured for this study.

Surgical Technique

All surgical procedures were performed utilizing a posterior approach with the patient in the lateral decubitus position. An extended trochanteric osteotomy (ETO) was performed in the majority of patients at a minimum of 12 centimeters from the tip

The Conflict of Interest statement associated with this article can be found at http://dx.doi.org/10.1016/j.arth.2013.04.009.

Reprint requests: Vamsi K. Kancherla, MD, St. Luke's University Health Network, Department of Orthopaedic Surgery, 801 Ostrum St, PPHP2, Bethlehem, PA 18015.

0883-5403/2901-0042$36.00/0 – see front matter © 2014 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.arth.2013.04.009

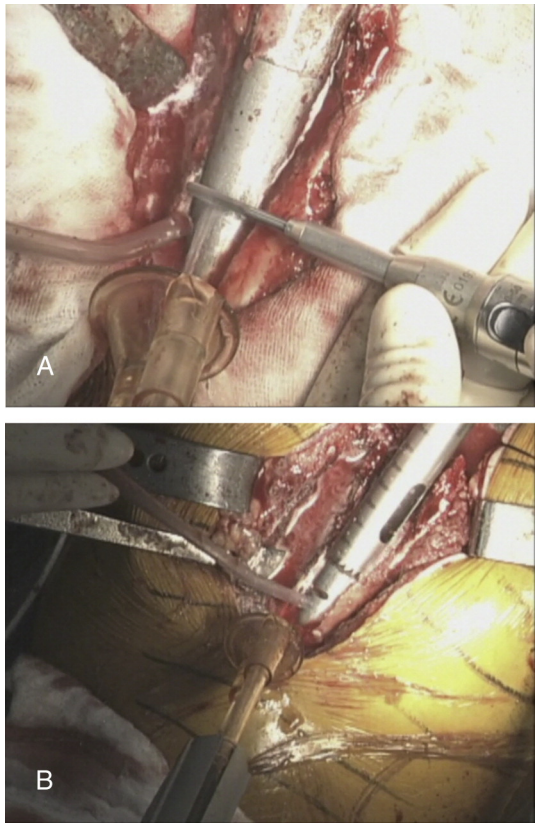

Fig. 1. (A and B) Placement of trephine reamer.

of the greater trochanter. An extended trochanteric osteotomy was not used in patients that had a broken femoral component which allowed removal of the broken proximal segment. Among the patients that had an ETO with an intact implant, the well-fixed stem was sectioned between the tapered and cylindrical portion using a metal cutting burr. The proximal segment was removed using a Gigli saw allowing exposure of the retained distal segment. A trephine 0.5 mm larger than the diameter of the well-fixed distal implant was advanced distally on a power reamer until the interface between the host bone and implant was disrupted (Fig. 1A and B). Continuous saline irrigation was used throughout the component removal.

A cerclage cable was placed distal to the osteotomy site prior to femoral preparation. An extensively coated monoblock stem or a modular tapered stem was used for the femoral reconstruction depending upon the remaining host bone with the goal of achieving at least 4 cm of scratch fit between the stem and diaphysis. Once distal fixation was achieved, the osteotomy was reattached using a minimum of two cerclage cables. Patients' weight bearing was restricted for a minimum of 6 weeks prior to allowing weight bear as tolerated.

Table 1
Patient Characteristics.

N	36
Age (y)	65.4
Sex	20 M, 16 F
R/L hip	19R, 17 L
Indication for revision	Fractured stem (16), infection (8), malposition (7), modular junction failure (4), acetabular exposure (1)
Bone loss	2 (21/36), 3A (12/36), 3B (2/36), 4 (1/36)
Osteotomy performed	29 ETO, 7 none

ETO = Extended trochanteric osteotomy.

Table 2
Clinical Outcomes.

Outcomes	
Follow-up (mo)	50.01 (12.4-94.6)
Leg length discrepancy	0/36
Pre-op HHS	46.61
Post-op HHS	87.78
Pre vs. post HHS p-value	<.0001

Results

There were 36 patients (20 males, 16 females) with an average age of 65 (range 40–86). The majority of patients in this study requiring trephine use were due to a broken femoral stem (16/36), infection (8/36), and component malposition (7/36) (Table 1). Femoral bone loss was classified as 21 (58%) Paprosky II, 14 (39%) Paprosky III, and 1 (3%) Paprosky 4. 32 were cylindrical extensively coated stems and 4 were tapered stems which had distal fixation. Of the patients, 29 (80.6%) had an extended trochanteric osteotomy during the surgery. Mean HHS improved ($p < .0001$) from 46.6 (range 25–79) to 87.8 (range 19–99) at a mean follow up of 43 months (range 12–75) (Table 2). Current radiographs demonstrated stable fixation in 34 (94%) patients. Bone ingrowth was noted in 31 (86%) patients, fibrous ingrowth in 3 (8%), and no ingrowth in 2 (6%). Subsidence occurred in 2 tapered stems and 6 cylindrical stems (Table 3). At latest follow up, there were23 cylindrical stems and 13 tapered stems in place.

There were 2 (5.6%) patients with marked sclerosis without remodeling near the area of previous trephine use (Table 4). Despite achieving at least 4 cm of scratch fit between the stem and diaphysis, the revision stems were placed 6 mm and 100 mm short of the distal extent of trephining. Other complications included 1 periprosthetic fracture at 53 months (motorcycle crash), 1 intraoperative femoral shaft fracture (extruded trephine), and 2 septic hips (post-operative infection). All 3 post-operative periprosthetic fractures were treated with open reduction internal fixation (ORIF) with a locked plate construct. 2/3 (66%) locked plate fixations failed, ultimately requiring revision hip arthroplasty with a modular tapered stem (Table 4, Figs. 2 through 6). The one intraoperative femoral shaft fracture was treated intraoperatively with a long tapered revision stem without any further complication at most recent follow-up.

Conclusion

Over the last few decades, several techniques have evolved for the removal of a well ingrown cementless femoral stem. When simple extraction devices fail, the preferred techniques have relied on disrupting the bone-implant interface by using some combination of osteotomes, high-speed burrs, and trephine reamers [2]. In our study, we demonstrate that a majority of patients who underwent revision THA requiring powered trephines for removal of well-fixed components had acceptable results. However, there were 6 complications (16.7%) noted in our study group (Table 4). These included 3

Table 3
Radiographic Outcomes.

Thermal necrosis	2/36
Osteotomy healed	29/29
Ingrowth	31 Bone, 3 Fibrous, 2 None
Stability	34 Stable, 2 Unstable
Subsidence	28 with 0 mm, 4 with 1 mm, and 4 with greater than 1 mm (2 mm, 3 mm, 4 mm, 7 mm)