VOLUME 73 | ISSUE 1 | JANUARY - MARCH 2022

ORIGINAL

# Extended Trochanteric Osteotomy and its Role in Revision Total Hip Arthroplasty

Theofilos Karachalios, George A. Komnos, Antonios Koutalos, Socrates Varitimidis, Konstantinos N. Malizos

*Department of Orthopaedic Surgery and Musculoskeletal Trauma, General University Hospital of Larisa, Faculty of Medicine, School of Health Sciences, University of Thessaly*

## ABSTRACT

Extended trochanteric osteotomy represents a reliable surgical technique for component extraction of the femur and the management of bone defects, with low failure rates and satisfactory functional outcomes. It is a highly effective procedure that was initially established for the management of large bone defects of the femur (Paprosky III-A and III-B) and for long stem removal. Nowadays, utilization of this technique is closely related to the implantation of long stems.Nevertheless, research studies with longer follow up are required to establish its effectiveness.

**KEYWORDS: Extended trochanteric osteotomy, Total hip arthroplasty, Revision hip arthroplasty**

**Introduction**

Total hip arthroplasty (THA) is considered one of the most successful orthopaedic procedures. Nevertheless, some patients will eventually undergo a revision procedure in the short- or long-term. Several factors relevant to the patient, the surgeon and/or the implant may play a significant role in total hip arthroplasty failure.

The revision of a THA is an extremely demanding procedure that requires experience and meticulous pre-operative planning (1). The final clinical outcome depends upon many different factors. For example, patient's age and his/her ability to mobilize post-operatively and follow rehabilitation requirements all affect functional outcome. Moreover, patient demands and expectations should be realistic and a thorough and honest discussion between the surgeon and the patient is crucial in the attempt to achieve the best post-operative outcome and patient satisfaction.

Furthermore, the quality of the existing bone stock of the failed arthroplasty is extremely important (2,3). Acetabular and femoral bone biology and quality should be taken into consideration by the surgeon pre-operatively. The anatomy and geometry of the acetabulum and femur, the bone defects, the diameter and geometry of the canal, the canal configuration, and the thickness of the cortex can all

CORRESPONDING AUTHOR, GUARANTOR

Theofilos Karachalios, Professor of Orthopaedics
Department of Orthopaedic Surgery and Musculoskeletal Trauma, General University Hospital of Larisa, Faculty of Medicine, School of Health Sciences, University of Thessaly
Tel. 0030-2413-502720
Email: kar@med.uth.gr

***Figure 1a.*** *Integrity and continuity of the muscles (vastus lateralis and medius gluteus) is essential.*

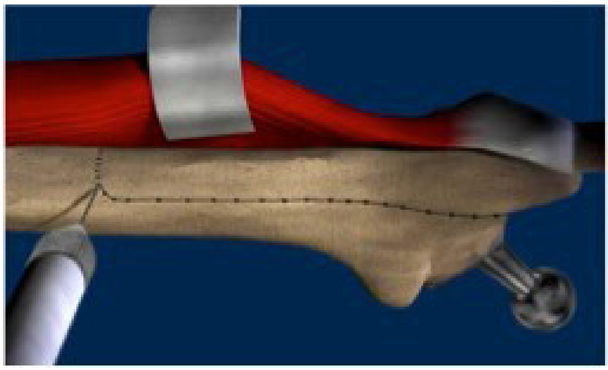


***Figure 1b.*** *Osteotomy is performed with a fine electric saw*

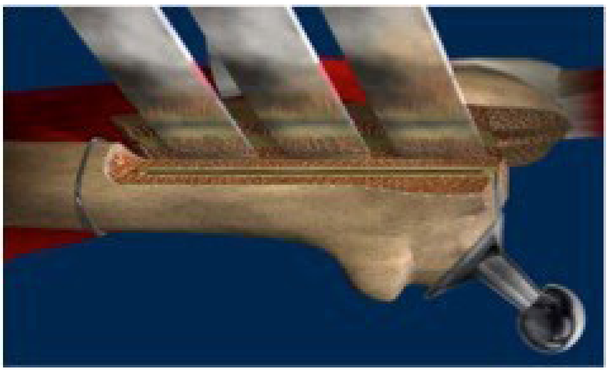


***Figure 1c.*** *Osteotomy is completed with widened osteotomes*

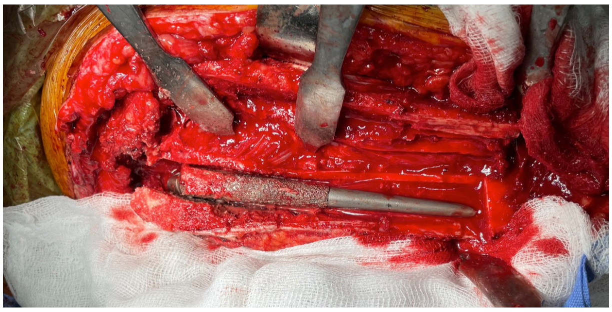


***Figure 1d.*** *Meticulous interface separation is of major importance*

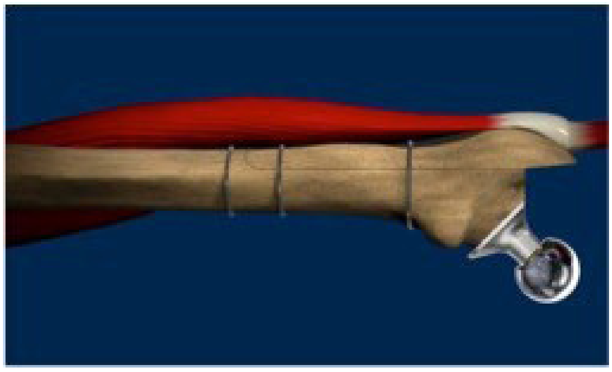


***Figure 1e.*** *Following reduction, the osteotomy is stabilized with wires or cables*

affect the type of the procedure chosen as well as the outcome (2,3).

Another important issue is the removal of the femoral stem. It can be extremely challenging and it should be performed in a way which ensures that bone loss is kept to a minimum. The aavailability and cost of the revision implants, along with the surgeon's experience, have an important influence on the success of the operation.

A successful surgical procedure presupposes detailed, accurate pre-operative planning. Intra-operatively, exposure should be adequate and bone preservation should be one of the first priorities (4,5). Notably, restoration of the axial and rotational stability of the femur and management of existing bone defects are of paramount importance for performing a successful operation.

One of the techniques that commonly accompanies a revision procedure after THA is the extended trochanteric osteotomy (ETO) (4). It is a highly effective procedure that was initially established for the management of large bone defects of the femur (Paprosky III-A and III-B) and for long stem removal. Nowadays, utilization of this technique is closely related to the implantation of long stems.

**Surgical Technique**

A technically satisfactory osteotomy requires main-

VOLUME 73 | ISSUE 1 | JANUARY - MARCH 2022

*Figure 2. Bone remodeling in the proximal part of the femur with union of the osteotomy (16 years follow-up)*

tenance of the continuity of soft tissue (gluteus medius and vastus lateralis) (**Figure 1a**), separation of the cortex utilizing a fine electric saw (**Figure 1b**) and utilization of large-wide osteotomes to achieve an appropriate bone window (**Figure 1c**). Widening of the osteotomy should be performed progressively in small, safe steps. A rigorous detachment of the femoral stem and the separation of the bone-implant interface is of major importance, especially in cementless prostheses (**Figure 1d**). Enlargement of the canal is performed to prepare it for reaming. Eventually, the osteotomy is stabilized with wires and cables (**Figure 1e**) (6).

The main advantages of ETO are better exposure and visualization of the femur and soft tissue preservation. It also promotes faster and safer removal of the femoral stem, either cemented or cementless. In case of implant breakage, finding and removal of the fragments is much easier through the osteotomy site. It should be noted that, when the implant has a porous surface, removal without osteotomy is remarkably strenuous and can result in severe bone defects. Subsequently, the use of the osteotomy contributes to the preservation of the bone stock and to smoother component extraction. Over and above this, correction of torsional and other deformities of the femur can also be achieved.

**Our Department's Experience**

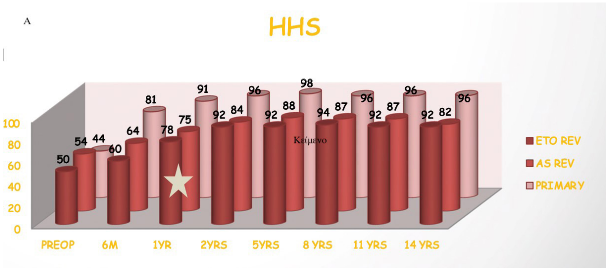
Extended trochanteric osteotomy is widely used in our department in total hip arthroplasty revisions. Between 2000 and 2008, 124 revisions for failure of total hip arthroplasties were performed. There were severe bone defects (Paprosky type IIIA and type IIIB) in 84 of them, while in almost half of the total procedures (61, 49,2%) a trochanteric osteotomy was performed. In all revisions cementless femoral tapered stems with flutes were implanted.

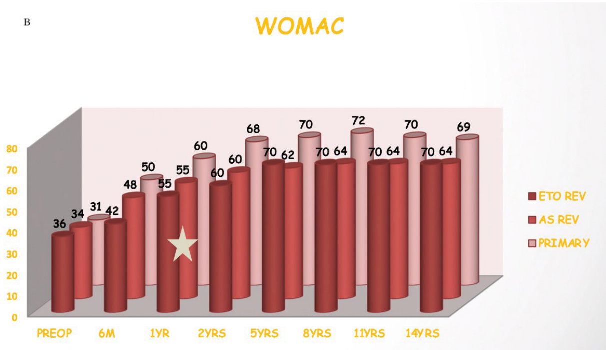
In a follow-up period of 12-20 years (16 years) only 7 cases resulted in a further revision (7/124, 5,6%). Two more suffered from a greater trochanter fracture and subsequent osteotomy failure. All remaining osteotomies, besides these two, united with apparent proximal bone remodeling (**Figure 2**). All patients were prospectively monitored at regular follow ups and satisfactory functional outcomes were observed.

The group of patients with ETO was characterized as group A. Two more groups (groups B and C) were reviewed in comparison with group A. Each of these two groups consisted of 60 patients. All cases were matched for age, gender and side within and across groups. Group B included patients who underwent primary total hip arthroplasty and group C patients who underwent total hip revision due to aseptic loosening. All patients were prospectively monitored and evaluated with HHS (Harris Hip Score), WOMAC (Western Ontario and McMaster Universities Arthritis Index), OHS (Oxford Hip Score) and HOOS (Hip Disability and Osteoarthritis Outcome Score) scales.

Mean values of HHS, WOMAC, OHS and HOOS scales in groups A and C, that included revision cases, were statistically significantly lower than those of Group B who were the primary arthroplasty cases (t-test, p=0.4). In a pairwise comparison between

VOLUME 73 | ISSUE 1 | JANUARY - MARCH 2022



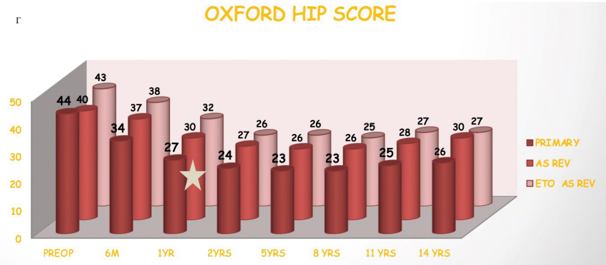




***Figure 3.*** *Outcome presentation using different scales of subjective and objective evaluation*
*a. HHS, b. WOMAC, c. OHS*

groups A and C, there was a trend for better outcomes in HHS, WOMAC, and OHS scales in the group with ETO, but without achieving significant statistical difference (t-test, p=0.6) (**Figure 3**). However, in parameters of daily activities and quality of life HOOS scale, these were statistically higher in the group that underwent ETO in comparison with the aseptic loosening revision, without ETO, group (t-test, p=0.6) (**Figure 4**).

## Discussion

Extended trochanteric osteotomy is commonly performed in cases of femoral stem revision in total hip arthroplasty. Its main indication and benefit is that it facilitates the removal of the femoral stem, either cemented or cementless, and the preservation of bone stock. In general, it has been correlated with the management of large bone defects (mainly Paprosky types IIIa and IIIb) and implantation of long cementless revision stems with distal fixation.

Long-term observation of our series has shown that ETO is a safe and reproducible procedure for component extraction and femur reconstruction in hip revision cases. Failure rate of osteotomies was found to be extremely low and in the majority of cases, bone remodeling was achieved in the proximal part. On top of this, patients who underwent revision with ETO were found to experience better functional outcomes than those who underwent revision without ETO.

Surgical technique is remarkably challenging and demanding. One of the most important factors is the length and extension of the osteotomy. In particular, how long should the distal extension be, and how gradual each step should be, in the attempt to eliminate bone loss (7). The length of the osteotomy is what essentially defines the size and length of the femoral stem that will be implanted. Notably, widening of the osteotomy is a continuing matter of debate.

The indications for ETO are wide and not limited in revision due to aseptic loosening. It can be also used in periprosthetic joint infections (PJIs), especially in cases where removal of the stem cannot be achieved by any other means. Under these circumstances, with periprosthetic infections, ETO is used as a part of the two-stage procedure. The main issue is whether it is safe, since more implants are used, adding an additional burden to infection eradication(8). Nevertheless, published data demonstrate satisfactory infection eradication rates, equivalent to those studies which do not utilize ETO (9).

Another application of the ETO technique is in periprosthetic fractures of the femur following THA. In these cases, a fracture induced osteotomy is usually performed, following the fracture lines. This approach allows access to the implant, with

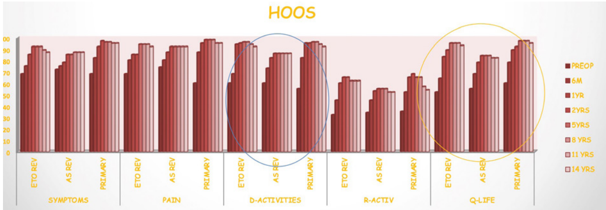



***Figure 4.*** *Results presentation based on HOOS scale*

preservation of the attached soft tissues (5). Application of this method has shown good results, but with short-term follow up, up to 2 years (10).

Utilization of ETO has also been advocated in complex primary hip arthroplasties, such as in cases of existing hardware, significant femur deformations, and congenital hip disease, with promising results (11).

**Conclusion**

Extended trochanteric osteotomy represents a reliable surgical technique for component extraction of the femur and the management of bone defects, with low failure rates and satisfactory functional outcomes. Nevertheless, research studies with longer follow up are required to establish its effectiveness.

# REFERENCES

1. Della Valle CJ, Paprosky WG. The femur in revision total hip arthroplasty evaluation and classification. Clin Orthop 2004; 420:55-62.
2. Paprosky WG, Sporer SM. Controlled femoral fracture: easy in. J Arthroplasty 2003; 18(3 S1):91-93.
3. Paprosky WG, Weeden SH, Bowling JW. Component removal in revision total hip arthroplasty. Clin Orthop 2001; 393:181-193.
4. Chen WM, McAuley JP, Engh J, Hopper J, Engh CA. Extended slide trochanteric osteotomy for revision total hip arthroplasty. J Bone Joint Surg Am 2000; 82(9):1215-1219.
5. Levine BR, della Valle CJ, Lewis P, Berger RA, Sporer SM, Paprosky W. Extended trochanteric osteotomy for the treatment of vancouver B2/B3 periprosthetic fractures of the femur. J Arthroplasty 2008; 23(4):527-533.
6. Miner TM, Momberger NG, Chong D, Paprosky WL. The extended trochanteric osteotomy in revision hip arthroplasty: A critical review of 166 cases at mean 3-year, 9-month follow-up. J Arthroplasty 2001;1 6(8 S1):188-194.
7. Petrie MJ, Harrison TP, Buckley SC, Gordon A, Kerry RM, Hamer AJ. Stay Short or Go Long? Can a Standard Cemented Femoral Prosthesis Be Used at Second-Stage Total Hip Arthroplasty Revision for Infection Following an Extended Trochanteric Osteotomy? J Arthroplasty 2017;3 2(7):2226-2230.
8. Morshed S, Huffman GR, Ries MD. Extended trochanteric osteotomy for 2-stage revision of infected total hip arthroplasty. J Arthroplasty 2005; 20(3):294-301.
9. Levine BR, della Valle CJ, Hamming M, Sporer SM, Berger RA, Paprosky WG. Use of the extended trochanteric osteotomy in treating prosthetic hip infection. J Arthroplasty 2009; 24(1):49-55.
10. Berry DJ. Treatment of Vancouver B3 periprosthetic femur fractures with a fluted tapered stem. Clin Orthop 2003; 417:224-231.
11. Della Valle CJ, Berger RA, Rosenberg AG, Jacobs JJ, Sheinkop MB, Paprosky WG. Extended trochanteric osteotomy in complex primary total hip arthroplasty. A brief note. J Bone Joint Surg Am 2003; 85(12):2385-2390.

READY - MADE CITATION

Karachalios T, Komnos GA, Koutalos A, Varitimidis S, Malizos KN. Extended Trochanteric Osteotomy and its Role in Revision Total Hip Arthroplasty. *Acta Orthop Trauma Hell* 2022; 73(1): 69-73.