

Good survival of uncemented tapered stems for failed intertrochanteric osteotomy: a mean 16 year follow-up study in 45 patients

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Abstract

Introduction Inferior survival of cemented total hip arthroplasty has been reported after previous femoral osteotomy. We previously presented 5–15 years results of uncemented femoral stems for this subgroup of patients. The purpose of the present study was to re-evaluate that same patient group at 10–20 years follow-up.

Materials and methods Forty-eight hips in 45 patients had undergone conversion THA for a failed intertrochanteric osteotomy of the hip after a mean of 12 years (2–33 years). Mean time of follow-up was 16 years (10–20 years).

Results At the latest follow-up five patients had died (five hips), and one patient (one hip) remained lost to follow-up. Compared to the previous evaluation, one more patient required femoral revision for aseptic loosening giving a total of four patients (four hips) with femoral revision—one for infection and three for aseptic loosening of the stem. Survival of the stem was 91% at 15 and 20 years respectively; survival with femoral revision for aseptic loosening as an end point was 93%. The median Harris-Hip-Score at final follow-up was 76 points (previously 80 points). Radiolucent lines in Gruen zones 1 and 7 were present in 20 and 17% of hips, respectively. Radiolucencies in other zones were not detected. There was no radiographic evidence of femoral osteolysis, stress-shielding or loosening.

Conclusion The long-term results with this type of uncemented tapered titanium femoral component after proximal femoral osteotomy remain encouraging and compare favorably to those achieved in patients with regular femoral anatomy.

Keywords Osteotomy · THA · Primary · Uncemented · Titanium · Straight · Stem · Long-term follow-up

Introduction

Intertrochanteric femoral osteotomy remains an operative treatment option in selected patients with early symptomatic degenerative hip disease (DHD) or femoral head necrosis [7, 27]. With failure rates of 18 to 30% after 10 years and up to 60% after 15 years [11, 16, 18, 19], conversion to primary THA may eventually become necessary. The proximal femoral anatomy is then frequently distorted by malalignment, residual deformity or significant sclerosis in the metaphyseal region. As a consequence, preparation of the femoral canal can be challenging and higher intraoperative complication rates have to be anticipated [8, 12, 25]. Interestingly, there are only few reports on long-term results of cemented THA after proximal femoral osteotomy [5, 8, 11, 16, 22]. Data on uncemented THA after this condition is even more limited, which is particularly intriguing as cementless stem designs are favored by many surgeons and commonly offered to young patients. Iwase et al. [16] suggested cemented stems preferable to cementless stems after failed femoral valgus osteotomy.

We previously published the clinical and radiographic outcome of a consecutive series of 48 hips with THA using the uncemented CLS Spotorno stem (Zimmer, Winterthur) after proximal femoral osteotomy with a mean of 10.5 years follow-up (5–15 years) [6].

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The current study presents a concise follow-up of this series with a mean follow-up of 16 years (10–20 years).

Materials and methods

A consecutive series of 48 cementless THAs in 45 patients received a cementless Spotorno CLS stem (Zimmer, Winterthur) between 1985 and 1995. Previous proximal intertrochanteric osteotomy had been performed at a mean of 12 years (2–33 years) before conversion to THA. The follow-up rate was 98% for the entire group. The mean time of follow-up after arthroplasty was 16 years (10–20 years). During the follow-up period, seven patients (eight hips) had died, and one patient (one hip) was lost to follow-up (Fig. 1). In all patients who died, the prosthesis was in situ at the time of death. Clinical and radiographic follow-up data were obtained for 35 hips, of which 33 were collected directly at our institution. The remainder was seen by their local orthopedic surgeon: standard radiographs were taken and sent to our institution for evaluation. Diagnoses and patient demographics are listed in Table 1. In all patients a cementless CLS Spotorno stem was implanted using press-fit technique. In 94% of cases, smooth cementless threaded cups were used. A total of 83% ($n = 40$) received threaded spherical cementless Mecron cups (Mecron medizinische Produkte GmbH), and 11% ($n = 5$) received threaded conical cementless Weill rings (Sulzer Orthopedics). In 6% ($n = 3$) of cases, cemented cups (Aesculap) were implanted. In all cases 32 mm BioloX ceramic heads (Ceramentec) and conventional polyethylene liners were used.

The details regarding the surgical approach and the rehabilitation protocol have been published previously [6]. In

Table 1 Distribution of diagnoses and patient demographics

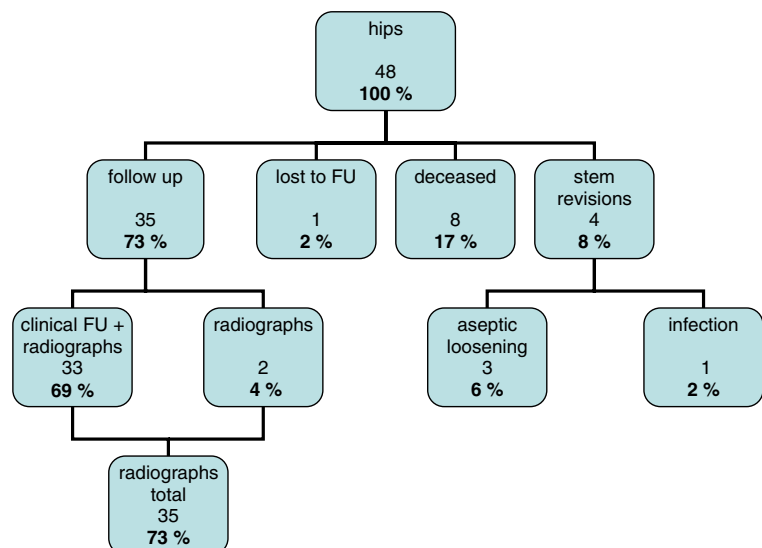
Diagnoses	<i>n</i> (%)
CDH	34 (69)
AVN	7 (15)
Idiopathic OA	5 (11)
Posttraumatic OA	2 (5)
Demographics	
Median age (years)	50 (26–67)
BMI	27 (24–30)
Female (<i>n</i>)	36 (75%)
Male (<i>n</i>)	12 (25%)
Left (<i>n</i>)	22 (46%)
Right (<i>n</i>)	26 (54%)

summary, an anterolateral or lateral approach was used. No attempt was made to achieve cortical fixation. Partial weight bearing was encouraged for 6 weeks.

At final follow-up, a standardized questionnaire including the items of the Harris Hip Score was administered for each patient. Clinical assessment included limp, range of motion and pain. Patients assessed their pain in the operated hip at the time of follow-up on a visual analogue scale (VAS: 0–10). In addition, the pain score according to Harris was used [15].

The most recent radiographs were examined by two independent experienced orthopaedic surgeons for stem alignment, subsidence, radiolucent lines, bone hypertrophy, osteolysis, stress shielding, pedestal formation at the stem tip, heterotopic ossifications and femoral and acetabular loosening (see below). Varus or valgus stem malalignment was defined as deviation from the longitudinal femoral axis of more than 2°. Radiolucent lines were allocated to Gruen

Fig. 1 Distribution of hips evaluated



regions 1–7 [14] and bone hypertrophy was defined as thickening of the distal periprosthetic diaphyseal bone. Osteolysis was defined as areas of localized bone resorption or endosteal erosion. Stress shielding was defined according to Engh [9]. Pedestal formation was defined as a shelf of endosteal new bone at the stem tip partially or completely bridging the intramedullary canal. A femoral stem was regarded loose if radiolucent lines >2 mm were present around the entire implant. Acetabular loosening was defined as continuous migration >5 mm or tilting of $>5^\circ$ compared with baseline AP radiographs.

Using revision of the stem for any cause and revision for aseptic loosening as endpoint, a Kaplan–Meier survival analysis was constructed and the 1–20 year survival rates were calculated.

Results

Revisions

Stem revisions

In 43 hips (90%), the femoral prosthesis had not been revised. In four patients (four hips), the stem had been revised. One hip was revised for deep infection, three stems for aseptic loosening.

Cup revisions

Twenty-three acetabular cups (48%), all of them Mecron components, had been revised prior to follow-up. From the remaining hips, four Mecrons had migrated and are awaiting revision.

Complications

In two cases femoral fissures occurred during stem preparation, and none of them required further treatment. One early dislocation occurred, which was successfully treated by closed reduction.

Clinical results

The median Harris Hip Score of the 35 hips at the time of follow-up evaluation was 80 (range, 38–100) points (out of 100). No pain was reported in 49% ($n = 17$) of the hips; in 20% (seven hips) slight pain; in 11% (four hips) mild pain; in 17% (six hips) moderate pain; and in 0.3% (one hip) severe pain was reported. In one hip a Harris pain score of 10 or less (of possible 44) points was reported; this patient had a loose acetabular component. No thigh pain was reported.

Radiographic evaluation

There was no evidence of radiographic loosening, osteolysis or subsidence. The position of the femoral prosthesis at the time of follow-up was in neutral in 31 hips (90%); two hips (5%) had a varus position, and two hips (5%) had a valgus position.

Radiolucent lines were limited to Gruen zones 1 and 7 in 17% (six hips) and 20% (seven hips), respectively. Other Gruen zones were not affected (Fig. 2). Mild rounding of the calcar was found in most patients (81%). Severe stress shielding (2° – 4°) or distal femoral hypertrophy was not observed. The radiographic analysis showed only mild stress shielding in all patients. Pedestal formation at the tip of the prosthesis was not observed (Fig. 3).

Survival analysis

Femoral stem

The Kaplan–Meier analysis (Figs. 4, 5) revealed a low annual failure rate. The overall survival rate of the femoral component was 91% at 15 and 20 years with 26 hips still at risk (revision for any reason). Survival with femoral revision for aseptic loosening as an end point was 93% at 15 and 20 years with 27 hips still at risk.

Discussion

Intertrochanteric osteotomy is a valuable alternative treatment option in younger patients, especially in dysplastic

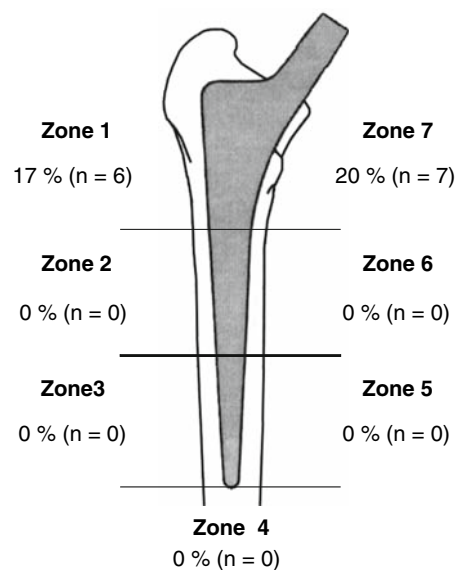


Fig. 2 Radiographic findings divided by Gruen-zones of 35 hips with radiographic follow-up

Fig. 3 Preoperative, postoperative and 19 year follow-up films of the left hip of a 45-year-old male patient, HHS: 93 points. Calcar rounding is present at 19 years, the osteotomy site is still visible

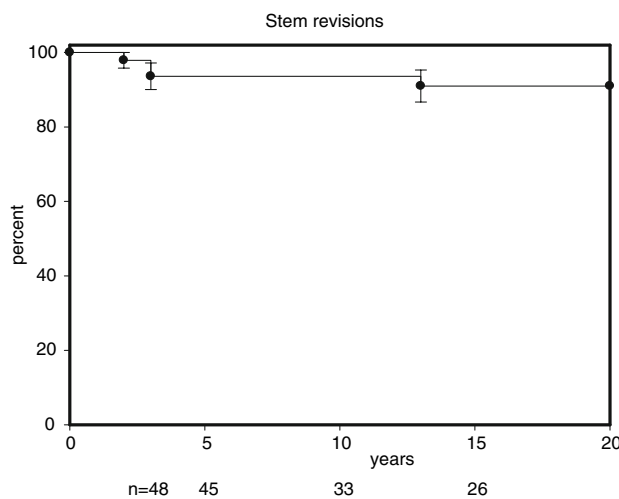


Fig. 4 Kaplan–Meier survival analysis for all stem revisions as endpoint. Survival at 15 years 91% with 26 hips still at risk

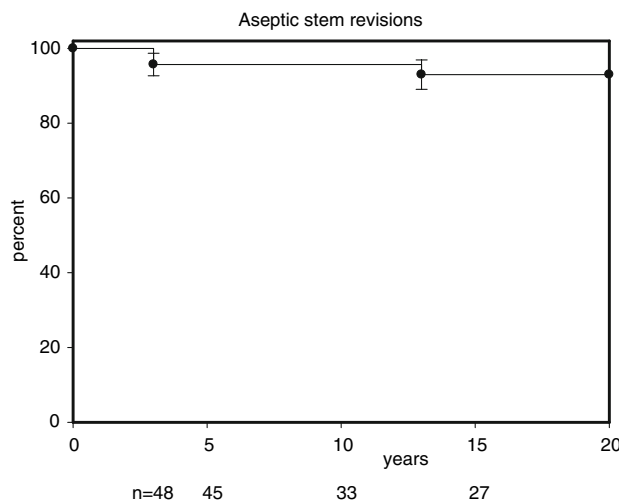


Fig. 5 Kaplan–Meier survival analysis for all stem revisions for aseptic loosening as endpoint. Survival at 15 years 93% with 27 hips still at risk

hips to improve joint congruency, relief pain, and restore function of the hip [7, 24, 27]. However, the results of osteotomies are oftentimes impaired by progression of disease necessitating conversion to total hip arthroplasty. Results of cemented THA with the use of first generation cementing techniques after failed proximal femoral osteotomy have shown to have inferior results in the long term than standard THA [5, 11, 16]. Femoral revision rates of 18% after 5 [11] and 10 years [5] have been reported. The use of second generation cementing technique significantly improved survivorship of stems after osteotomy and most failures were due to an insufficient cement mantle supposedly caused by irregular femoral anatomy [22]. However, residual cortical holes may compromise cement pressurization and thus penetration into cancellous bone, and may even predispose to earlier failure [11]. Cementless stems, in theory, do not pose this problem but have not performed equally well in this context, so far. Iwase et al. [16] found a high failure rate with 18 cementless stems (Ominiflex, Ominifit) after an average follow-up of 5 years and suggested that it is unreasonable to use standard cementless stems which are designed for normal femoral canals [20].

In contrast, the long-term results of the grit blasted tapered uncemented stem used in our study are comparable to those achieved in patients without previous femoral osteotomy managed with this specific stem (Fig. 3) [1, 4, 21, 23]: we previously reported a survival rate of 94% after 10 years [6]. In the present follow-up study of that same patient cohort with a mean of 16 years after THA, the survival rate of 91% at 15 and 20 years appears to be superior compared to the published results of cemented stem fixation for this specific indication.

Even though predominantly uncemented smooth surface threaded cups, which have been reported with a high rate of migration and failure, had been implanted in our study [3, 24] survival of the stem was not affected. Radiologically,

no case of severe stress shielding and no distal cortical hypertrophy were found in the patients investigated. This finding is in contrast to the results of other uncemented implants [10, 13, 17]. The tapered design in combination with a very slim diaphyseal part of the stem seems to provide proximal diaphyseal load transfer over 10–20 years [2] as suggested by the authors [26] even in the presence of disturbed proximal femoral anatomy with sclerotic host bone (Fig. 3). Non-progressive radiolucent lines limited to the proximal regions of the stem (Gruen zones 1 and 7) were seen in almost 20%. Surprisingly, even 5 years later, there was still no significant radiographic evidence of femoral osteolysis. Although we did not measure wear in this study, the ceramic femoral heads might have contributed to the absence of osteolysis after up to 20 years in the non-revised patient group. In the 23 hips that had undergone acetabular revision an exchange of the initial bearing surfaces might have had a beneficial effect on the production of wear particles and consecutive osteolysis.

At 10–20 years follow-up we confirm our previous results demonstrating a low revision rate due to aseptic loosening with the CLS stem after proximal intertrochanteric osteotomy. We continue to believe that the insertion of this tapered uncemented femoral stem is less demanding and the results are more predictable than in cemented THA, in particular under unusual anatomic conditions. The long-term results suggest that CLS Spotorno stems can be recommended in the management of patients after failed intertrochanteric osteotomy.

References

- Aldinger PR et al (2003) A ten- to 15-year follow-up of the cementless spotorno stem. *J Bone Joint Surg Br* 85(2):209–214
- Aldinger PR et al (2003) Pattern of periprosthetic bone remodeling around stable uncemented tapered hip stems: a prospective 84-month follow-up study and a median 156-month cross-sectional study with DXA. *Calcif Tissue Int* 73(2):115–121
- Aldinger PR et al (2004) Long-term fate of uncemented, threaded acetabular components with smooth surface treatment: minimum 10-year follow-up of two different designs. *Arch Orthop Trauma Surg* 124(7):469–475
- Aldinger PR et al (2003) Cementless Spotorno tapered titanium stems: excellent 10–15-year survival in 141 young patients. *Acta Orthop Scand* 74(3):253–258
- Boos N et al (1997) Total hip arthroplasty after previous proximal femoral osteotomy. *J Bone Joint Surg Br* 79(2):247–253
- Breusch SJ et al (2005) Ten-year results of uncemented hip stems for failed intertrochanteric osteotomy. *Arch Orthop Trauma Surg* 125(5):304–309
- D'Souza SR et al (1998) Proximal femoral osteotomy as the primary operation for young adults who have osteoarthritis of the hip. *J Bone Joint Surg Am* 80(10):1428–1438
- Delbarre JC et al (2002) [Total hip arthroplasty after proximal femoral osteotomy: 75 cases with 9-year follow-up]. *Rev Chir Orthop Reparatrice Appar Mot* 88(3):245–256
- Engl CA, Bobyn JD, Glassman AH (1987) Porous-coated hip replacement. The factors governing bone ingrowth, stress shielding, and clinical results. *J Bone Joint Surg Br* 69(1):45–55
- Engl CA Jr et al (2001) Long-term results using the anatomic medullary locking hip prosthesis. *Clin Orthop* 393:137–146
- Ferguson GM, Cabanela ME, Ilstrup DM (1994) Total hip arthroplasty after failed intertrochanteric osteotomy. *J Bone Joint Surg Br* 76(2):252–257
- Gerundini M, Avai A, Taglioretti J (1995) Total hip replacement after intertrochanteric osteotomy. *Int Orthop* 19(2):84–85
- Grubl A et al (2002) Cementless total hip arthroplasty with a tapered, rectangular titanium stem and a threaded cup: a minimum ten-year follow-up. *J Bone Joint Surg Am* 84-A(3):425–431
- Gruen TA, McNeice GM, Amstutz HC (1979) "Modes of failure" of cemented stem-type femoral components: a radiographic analysis of loosening. *Clin Orthop Relat Res* 141:17–27
- Harris WH (1969) Traumatic arthritis of the hip after dislocation and acetabular fractures: treatment by mold arthroplasty. An end-result study using a new method of result evaluation. *J Bone Joint Surg Am* 51(4):737–755
- Iwase T et al (1999) Total hip arthroplasty after failed intertrochanteric valgus osteotomy for advanced osteoarthritis. *Clin Orthop Relat Res* 364:175–181
- Kim YH, Kim JS, Cho SH (1999) Primary total hip arthroplasty with the AML total hip prosthesis. *Clin Orthop Relat Res* 360:147–158
- McGrory BJ, Estok DM 2nd, Harris WH (1998) Follow-up of intertrochanteric osteotomy of the hip during a 25-year period. *Orthopedics* 21(6):651–653
- Morita S et al (2000) Long-term results of valgus-extension femoral osteotomy for advanced osteoarthritis of the hip. *J Bone Joint Surg Br* 82(6):824–829
- Noble PC et al (1988) The anatomic basis of femoral component design. *Clin Orthop Relat Res* 235:148–165
- Schramm M et al (2000) Total hip arthroplasty using an uncemented femoral component with taper design: outcome at 10-year follow-up. *Arch Orthop Trauma Surg* 120(7–8):407–412
- Shinar AA, Harris WH (1998) Cemented total hip arthroplasty following previous femoral osteotomy: an average 16-year follow-up study. *J Arthroplasty* 13(3):243–253
- Siebold R et al (2001) Long-term results with the cement-free Spotorno CLS shaft. *Orthopade* 30(5):317–322
- Simank HG et al (2001) Comparison of results of core decompression and intertrochanteric osteotomy for nontraumatic osteonecrosis of the femoral head using Cox regression and survivorship analysis. *J Arthroplasty* 16(6):790–794
- Soballe K et al (1989) Total hip replacement after medial-displacement osteotomy of the proximal part of the femur. *J Bone Joint Surg Am* 71(5):692–697
- Spotorno L et al (1993) The CLS system. Theoretical concept and results. *Acta Orthop Belg* 59(1):144–148
- Tonniss D (1976) An evaluation of conservative and operative methods in the treatment of congenital hip dislocation. *Clin Orthop Relat Res* 119:76–88