

# Outcome of isolated polyethylene tibial insert exchange after primary cemented total knee arthroplasty

Christian Konrads · Stefanie Brieske · Michael Holder ·  
Matthias Walcher · Maximilian Rudert · Maik Hoberg

Received: 9 October 2014 / Accepted: 3 November 2014 / Published online: 23 November 2014  
© SICOT aisbl 2014

## Abstract

**Purpose** Total knee arthroplasty using a modular design gives the possibility for an isolated exchange of the tibial polyethylene insert in patients with failed total knee arthroplasty. The success of this kind of surgery is still controversial. We analysed the clinical outcome after isolated tibial polyethylene insert exchange.

**Methods** In this retrospective study we included 62 consecutive patients with an isolated tibial polyethylene insert exchange at our institution. The average follow-up was 35 months. For clinical evaluation we used the Oxford Knee score, the Knee Society score, the Turba score, and the Kujala score. The health-related quality of life was determined with the SF-36 score and the visual analogue pain scale.

**Results** The operations were performed 73 months after primary total knee arthroplasty on average. The main reasons for isolated tibial polyethylene insert exchange were instability and wear. In the clinical outcome patients achieved 31.5 points in the Oxford Knee score, 120.5 points in the Knee Society score, 9.3 points in the Turba score, and 49.0 points in the Kujala score. Mean level of persisting pain was 2.2. In the SF-36 score patients achieved 36.3 points physical and 51.7 points mental. The overall survival for isolated tibial insert exchange revealed 72.2 % survival at 6.25 years follow-up with a repeat revision rate of 11 %.

**Conclusions** Isolated tibial polyethylene insert exchange revealed a good clinical outcome. There is a tendency for better results in comparison with the information given in literature for most of the parameters including a lower rate in repeat revision.

**Keywords** Tibial insert exchange · Total knee arthroplasty · Knee revision surgery

## Introduction

Modular design of total knee prosthesis was developed in the 1980s and offers the opportunity to exchange the polyethylene insert without revising the tibial component. This preserves bone stock in contrast to exchanging the other prosthesis components. Recent studies show an easier recovery, a more simple operation and relatively little morbidity for patients who underwent this kind of surgery [1–3]. In very selected cases we offer patients the isolated tibial polyethylene insert exchange (ITIE). It is indicated in patients with well fixed and well aligned implants but instability in extension or flexion, stiffness, pain, polyethylene wear, and effusion. However, the clinical outcome of patients receiving an ITIE is still controversial. Some studies reported bad results in most cases in regards to the clinical outcome and repeat revision rate. Babis et al. reported a high rate of failures in the early outcome but Jensen et al. showed a revision rate of 15 % after 40 months follow-up [4–6]. The aim of the present study was to determine the clinical outcome and overall survival rate after ITIE of cemented total knee arthroplasty (TKA) in our patients.

## Patients and methods

From our own database we identified 62 patients who underwent an ITIE in our institution during the years 2005 until 2011. Patients were only included in the study if they had no revision before ITIE. Pre-operative requirements for ITIE were well fixed and well aligned implants in well-balanced knees or balance could be achieved in the revision surgery in absence of infection. Component fixation was examined prior

C. Konrads · S. Brieske · M. Holder · M. Walcher · M. Rudert ·  
M. Hoberg (✉)  
Orthopaedic Clinic Koenig-Ludwig-Haus, Center for  
Musculoskeletal Research, Julius-Maximilians-University  
Wuerzburg, Brettreichstr. 11, 97074 Wuerzburg, Germany  
e-mail: m-hoberg.klh@uni-wuerzburg.de

to ITIE by standard X-ray radiographs and confirmed by intra-operative meticulous assessment [7] (Figs. 1 and 2). During surgery we checked the rotation of all components and were able to establish a good balance of soft tissues.

This study includes 62 patients, of which six were lost to follow-up. From the 56 patients analysed 38 were females and 18 males with a mean age of 69 years (min. 50, max. 83). The diagnosis leading to index TKA was primary osteoarthritis in 48 cases, posttraumatic osteoarthritis in six cases and rheumatoid arthritis in two cases. Forty-four TKAs were posterior cruciate retaining and 12 were posterior stabilized designs, all fixed bearings. ITIE was performed on average 73 (min. 1, max. 258) months after primary TKA. Where necessary, soft-tissue rebalancing or synovectomy was performed additionally. In all cases we used a medial parapatellar approach with a median skin incision in the old scar without osteotomy of the tibial tubercle or revision of the extensor apparatus. Mean follow-up time was 35 months (min. 25, max. 75).

Clinical assessments included determination of Oxford Knee score, the Knee Society score, the Turba score, and the Kujala score [8, 9]. The health-related quality of life was determined with the SF-36 score and the visual analogue pain scale [10]. Pre-operative and postoperative standard radiographs were available for all patients. We defined ITIEs as failures when patients underwent rerevision surgery for any reason.

#### Statistical analysis

The main end point in this study was the overall survival after ITIE, and univariate analysis was performed using the Kaplan-Meier test and the log-rank test, respectively.

We compared the range of motion preoperative to postoperative using t-test for paired data. A  $p$ -value of  $<0.05$  was considered to be statistically significant. For statistical analysis the SPSS 15.0 program (SPSS Inc., USA) was used.

#### Results

Most TKAs were cemented type PFC Sigma® by DePuy, USA (70 %), NexGen® by Zimmer, USA (15 %), and Columbus® by Aesculap, Germany (7 %). The type of implant revealed no significant difference in all parameters investigated. The main reasons for isolated tibial polyethylene insert exchange were instability and wear.

In revision the new polyethylene liner was mostly increased by 2 mm in thickness compared to the liner that was used in index total knee arthroplasty (Fig. 3). The range of motion was significantly increased in the postoperative knee flexion but no change in the extension deficit was found in comparison to the pre-operative findings (Fig. 4).



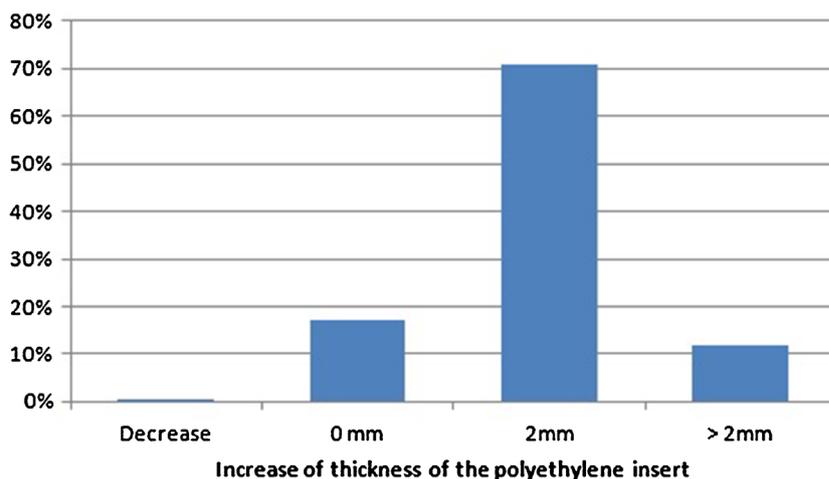
**Fig. 1** Medial polyethylene wear of a primary knee arthroplasty 101 months after implantation

In the score based clinical outcome patients achieved 31.5 (min. 12, max. 49) points in the Oxford Knee score, 120.5 (min. 7, max. 199) points in the Knee Society score, 9.3 (min.



**Fig. 2** Intra-operative picture of a polyethylene insert 148 months after implantation with medial and lateral delamination

**Fig. 3** Increase of the thickness of the polyethylene liner used in isolated tibial polyethylene insert exchange (ITIE) compared to the index procedure

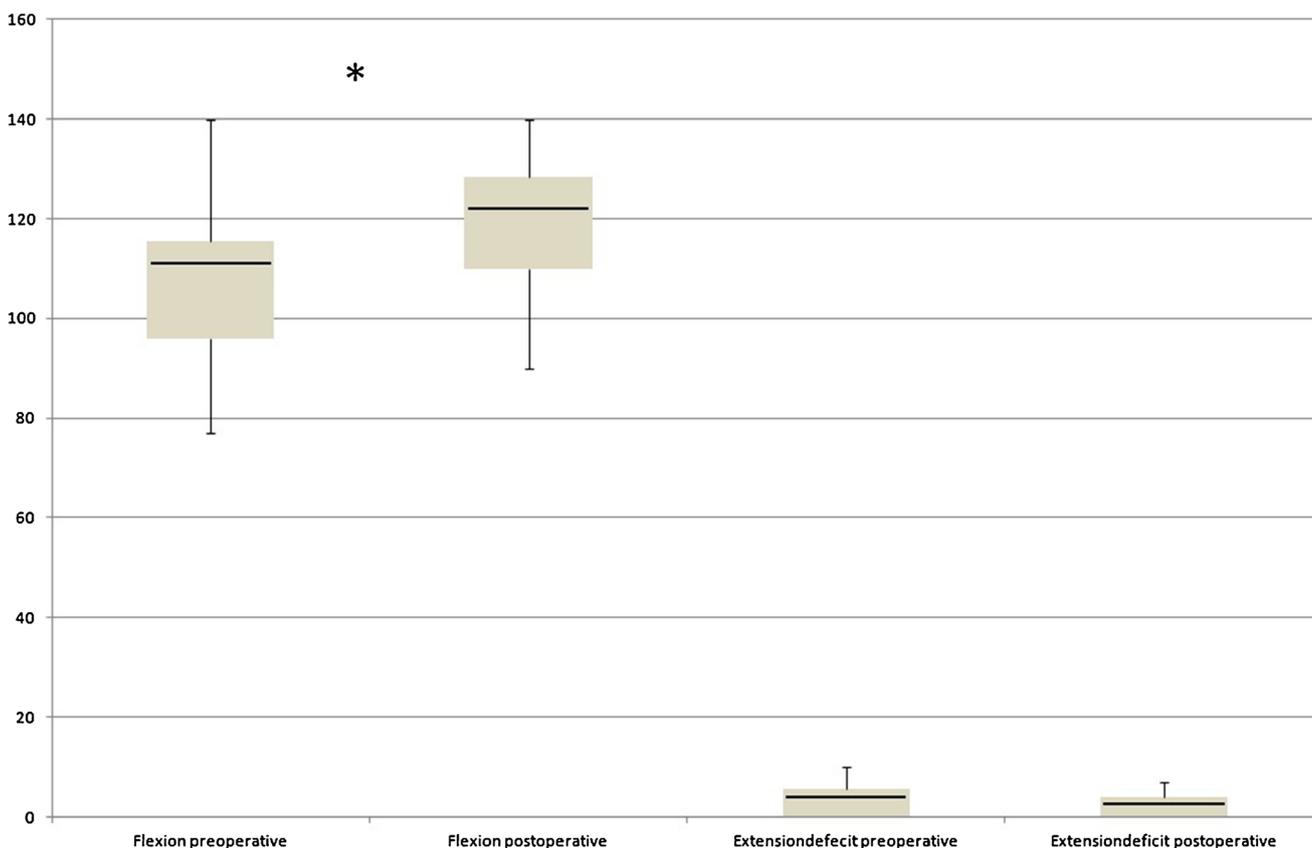


0, max. 17) points in the Turba score, and 49 (min. 20, max. 80) points in the Kujala score on average. Mean level of persisting pain was 2.2. In the SF-36 score patients achieved 36.3 (min. 16, max. 66) physical points and 51.7 mental points (min. 15, max. 71).

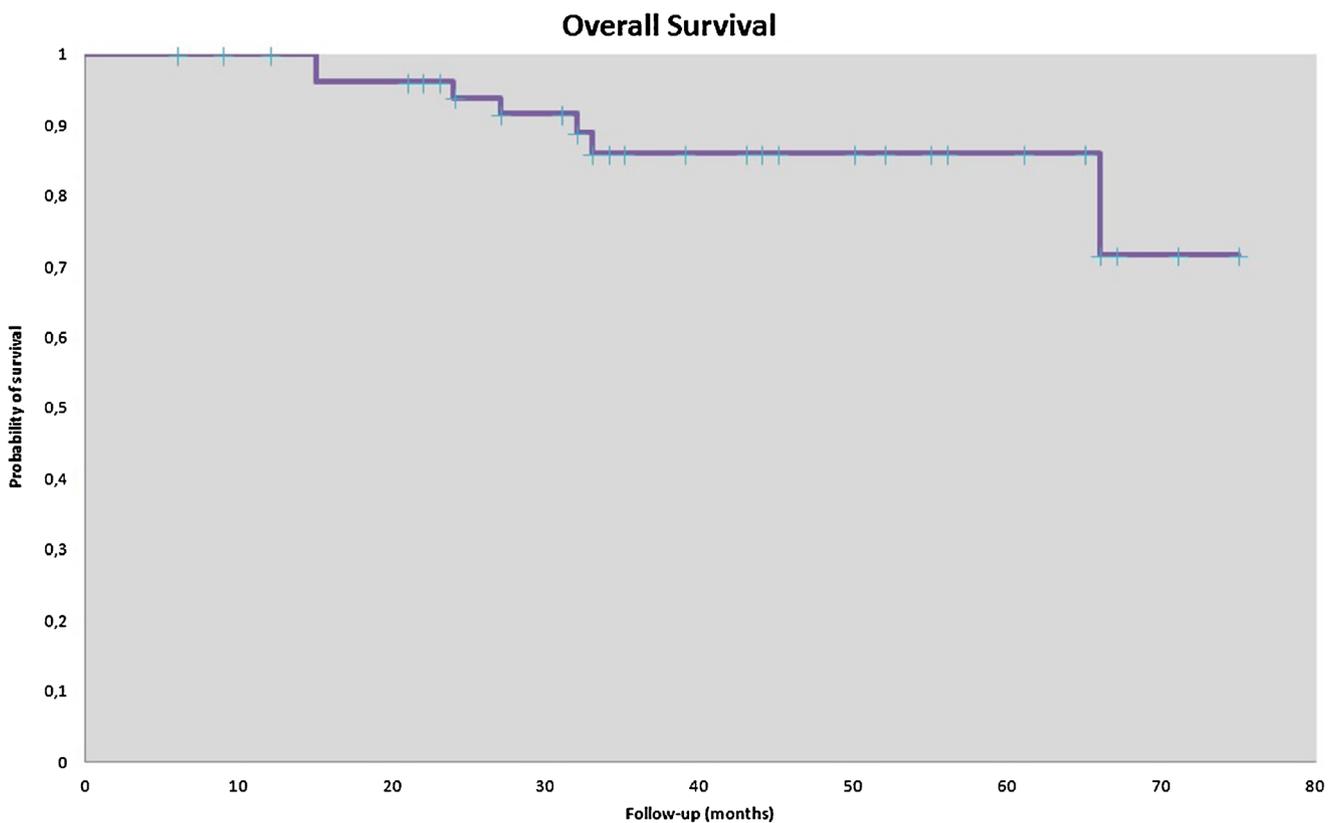
We distinguished between posterior cruciate retaining (CR-group,  $n=44$ ) and posterior stabilized (PS-group,  $n=12$ ) prosthesis designs. Between these two groups we did not find a significant difference.

The CR-group on average achieved 31.1 (min. 12, max. 48) points in the Oxford Knee score, 121.1 (min. 7, max. 197) points in the Knee Society score, 9.1 (min. 0, max. 16) points in the Turba score and 49.1 (min. 21, max. 80) points in the Kujala score. Mean level of persisting pain was 2.2. In the SF-36 score patients achieved 36.3 (min. 17, max. 65) physical points and 51.4 (min. 15, max. 70) mental.

The PS-group on average achieved 33.9 (min. 13, max. 49) points in the Oxford Knee score, 119.2 (min. 7, max. 199)



**Fig. 4** Pre- and postoperative range of motion after isolated polyethylene tibial insert exchange (\*  $p<0.05$ )



**Fig. 5** Survivorship during follow-up after isolated tibial polyethylene insert exchange (ITIE) with revision for any reason as end point

points in the Knee Society score, 9.5 (min. 3, max. 17) points in the Turba score and 48.2 (min. 20, max. 79) points in the Kujala score. Mean level of persisting pain was 2.0. In the SF-36 score patients achieved 36.3 (min. 16, max. 66) physical points and 52.3 (min. 16, max. 71) mental.

During the revision surgery 37 % of the patients also received a patellar resurfacing but no difference was found in the clinical outcome compared to the group without additional patellar surgery.

The calculated overall survival for isolated tibial insert exchange revealed 72.2 % survival at 6.25 years follow-up (Fig. 5). Six out of 56 (11 %) patients were considered failures of ITIE due to rerevision. Reasons for secondary revision were persisting severe pain (4), instability (1), and infection (1).

## Discussion

Isolated tibial polyethylene insert exchange is a rarely performed revision procedure after total knee arthroplasty. Additional exchange of these prosthesis components are often required due to intra-operative findings in revision TKA like macroscopic damage to femoral or tibial metal components or malalignment of the prosthesis [11–14]. The clinical outcome of our patient cohort revealed very promising results. But past

studies have shown rather bad outcomes for this type of surgery in the indications of stiffness, instability, early wear, and pain with failure rates up to 44 % in the subgroup of instability as indication for ITIE [4–6, 15]. Few recent studies revealed slightly better but inconsistent results for the clinical outcome after ITIE. Jensen et al. reported very promising results with isolated tibial insert exchange in 27 patients but 22 of them also received a patella button [1–3]. We have shown that the combination of resurfacing of the patella with ITIE has no negative influence on the clinical outcome. To us patient selection seems to be very important although Baker et al. couldn't find a significant difference between subgroups with different indications for this type of procedure. In comparison with the available information given in literature we found more promising mid-term results regarding clinical outcome and overall survival after ITIE. Most of our patients also had a soft tissue balancing and a concomitant synovectomy as a part of the isolated polyethylene insert exchange procedure. Because routine soft tissue surgery and balancing is a standard part in every revision surgery performed in our institution we do believe that these parts of the procedure are not confounding factors in our series, according to the study of Baker et al. [1]. In our experience stability in full extension and flexion along with meticulous soft tissue balancing is of utmost importance. In cases where these requirements for success can't be established by insert

exchange and soft tissue surgery, revision of one or more components is needed.

## Conclusion

Although until now there does not exist a study with a larger sample size in literature. Patient selection and careful intraoperative implant evaluation seem to be foremost important for a significant improved clinical outcome and patient satisfaction. Isolated tibial polyethylene insert exchange may be a probable revision procedure for patients with failed TKA if implants are well fixed and well aligned.

**Conflict of interest** The authors declare that they have no conflict of interest.

## References

- Baker RP, Masri BA, Greidanus NV, Garbuz DS (2013) Outcome after isolated polyethylene tibial insert exchange in revision total knee arthroplasty. *J Arthroplast* 28:1–6. doi:10.1016/j.arth.2012.05.030
- Griffin WL, Scott RD, Dalury DF, Mahoney OM, Chiavetta JB, Odum SM (2007) Modular insert exchange in knee arthroplasty for treatment of wear and osteolysis. *Clin Orthop Relat Res* 464:132–137
- Jensen CL, Petersen MM, Jensen KE, Therbo M, Schroder HM (2006) Outcome of isolated tibial polyethylene insert exchange after uncemented total knee arthroplasty: 27 patients followed for 8–71 months. *Acta Orthop* 77:917–920. doi:10.1080/17453670610013222
- Babis GC, Trousdale RT, Pagnano MW, Morrey BF (2001) Poor outcomes of isolated tibial insert exchange and arthrolysis for the management of stiffness following total knee arthroplasty. *J Bone Joint Surg Am* 83-A:1534–1536
- Babis GC, Trousdale RT, Morrey BF (2002) The effectiveness of isolated tibial insert exchange in revision total knee arthroplasty. *J Bone Joint Surg Am* 84-A:64–68
- Willson SE, Munro ML, Sandwell JC, Ezzet KA, Colwell CW Jr (2010) Isolated tibial polyethylene insert exchange outcomes after total knee arthroplasty. *Clin Orthop Relat Res* 468:96–101. doi:10.1007/s11999-009-1023-3
- Ewald FC (1989) The Knee Society total knee arthroplasty roentgenographic evaluation and scoring system. *Clin Orthop Relat Res* 248:9–12
- Insaall JN, Dorr LD, Scott RD, Scott WN (1989) Rationale of the Knee Society clinical rating system. *Clin Orthop Relat Res* 248:13–14
- Murray DW, Fitzpatrick R, Rogers K, Pandit H, Beard DJ, Carr AJ, Dawson J (2007) The use of the Oxford hip and knee scores. *J Bone Joint Surg Am* 89:1010–1014. doi:10.1302/0301-620X.89B8.19424
- Ware JE Jr, Sherbourne CD (1992) The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. *Med Care* 30:473–483
- Bert JM, Reuben J, Kelly F, Gross M, Elting J (1998) The incidence of modular tibial polyethylene insert exchange in total knee arthroplasty when polyethylene failure occurs. *J Arthroplast* 13:609–614
- Bozic KJ, Kurtz SM, Lau E, Ong K, Chiu V, Vail TP, Rubash HE, Berry DJ (2010) The epidemiology of revision total knee arthroplasty in the United States. *Clin Orthop Relat Res* 468:45–51. doi:10.1007/s11999-009-0945-0
- Falez F (2014) Knee arthroplasty today. *Int Orthop* 38:221–225. doi:10.1007/s00264-013-2274-x
- Victor J, Ghijselings S, Tajdar F, Van Damme G, Deprez P, Amout N, Van Der Straeten C (2014) Total knee arthroplasty at 15–17 years: does implant design affect outcome? *Int Orthop* 38:235–241. doi:10.1007/s00264-013-2231-8
- Engh GA, Koralewicz LM, Pereles TR (2000) Clinical results of modular polyethylene insert exchange with retention of total knee arthroplasty components. *J Bone Joint Surg Am* 82:516–523