Revision total knee arthroplasty with the Total Condylar III system in inflammatory arthritis


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We report a consecutive series of 16 revision total knee arthroplasties using the Total Condylar III system in 14 patients with inflammatory arthritis which were performed between 1994 and 2000. There were 11 women and three men with a mean age of 59 years (36 to 78). The patients were followed up for 74 months (44 to 122).

The mean pre-operative Knee Society score of 37 points (0 to 77) improved to 88 (61 to 100) at follow-up (t-test, p < 0.001) indicating very good overall results. The mean range of flexion improved from 62° (0° to 120°) to 98° (0° to 145°) (t-test, p < 0.05) allowing the patients to stand from a sitting position. The mean Knee Society pain score improved from 22 (10 to 45) to 44 (20 to 50) (t-test, p < 0.05). No knee had definite loosening, although five showed asymptomatic radiolucent lines. Complications were seen in three cases, comprising patellar pain, patellar fracture and infection.

These results suggest that the Total Condylar III system can be used successfully in revision total knee arthroplasty in inflammatory arthritis.

The long-term results of total knee arthroplasty (TKA) in osteoarthritic and rheumatoid knees are generally satisfactory. However, to our knowledge there have been no reports of the results of revision TKA in patients with inflammatory arthritis.

Inflammatory joint diseases, such as rheumatoid arthritis and juvenile chronic arthritis, are a heterogeneous group which can destroy extracellular matrices in bone and articular cartilage. In chronic disease, the quality of the musculoskeletal tissues and the general condition of the patient are a challenge for the surgeon, especially in revision TKA which may have to address extensive bone loss as well as angular deformity and ligamentous laxity. Our aim therefore was to assess the results of revision TKA using the Total Condylar III system (Depuy, Johnson & Johnson, Leeds, UK) in patients with inflammatory arthritis.

Patients and Methods

Between 1994 and 2000, 16 revision TKAs using the TCIII system were performed on 14 patients with inflammatory arthritis at Tampere University Hospital by two experienced orthopaedic surgeons (JP, PH) who also undertook the pre-operative assessment. The patients were examined clinically and radiologically before revision, during hospitalisation and at follow-up at two months and at one, three, five and eight years. The clinical post-operative examination was undertaken independently by an experienced physiotherapist (AV) who was blinded to the pre-operative data.

There were 13 women and one man with a mean age at revision of 59 years (36 to 78) and a mean weight of 69 kg (47 to 96). The mean follow-up was 74 months (44 to 122). All had inflammatory arthritis, with a mean duration of disease of 27 years (12 to 48). Twelve had RA, one JCA in both knees, one psoriatic arthritis and one ankylosing spondylitis. Radiological degeneration of the knee according to the classification of Larsen, Dale and Eek before the initial operation was grade III in three knees, grade IV in five, grade V in six and was not assessed in two. The reasons for revision were aseptic loosening (four), instability (three), wear of polyethylene (three), patellar dislocation (two), infection (two), periprosthetic fracture (one) and osteolysis (one). Original prostheses included the Porous Coated Anatomic (PCA; Howmedica, Rutherford, New Jersey) (six), the Anatomic Graduated Component (AGC; Biomet, Warsaw, Indiana) (two), the Townley (Howmedica) or Townley Syna-
tomic (DePuy) (five), the Anametric (Howmedica) (one), the Miller-Galante (Zimmer, Warsaw, Indiana) (one) and the Press Fit Condylar (PFC; DePuy) (one). Cement fixation had been used in all and there were various combinations of stemmed and stemless prostheses. At revision, all the femoral components and tibial trays were fixed with cement. The method of fixation of the stems (both femoral and tibial) varied and both cementless press-fit and cemented stems were used. The patella was resurfaced in eight cases.

The Knee Society rating systems were used for clinical\textsuperscript{21} and radiological\textsuperscript{22} evaluations. The best possible clinical score (100) indicates a normal knee. Anteroposterior and lateral standing radiographs were taken in all cases.

**Statistical analysis.** All data were checked for normality using Wilks's $W$ test. Comparisons between the pre- and post-operative data used SPSS 12.0 Software (SPSS, Chicago, Illinois) with the paired $t$-test for normal distribution and Wilcoxon’s test for skewed data. A $p$ value of $< 0.05$ was considered to be significant.

**Results**

**Clinical evaluation.** The mean Knee Society score improved from 37 (0 to 77) pre-operatively to 88 (61 to 100) at the final follow-up ($t$-test; $p < 0.001$). The mean Knee Society score for pain improved from 22 (10 to 45) to 44 (20 to 50; Wilcoxon’s test, $p < 0.05$). Before surgery, 12 knees (75\%) had moderate or severe pain on weight-bearing, but at the final follow-up only two had moderate or severe pain and there was no pain in ten. The mean pre-operative range of motion was $62^\circ$ ($0^\circ$ to $120^\circ$) which improved significantly to $98^\circ$ ($0^\circ$ to $145^\circ$) (Wilcoxon test; $p < 0.05$). Severe anteroposterior instability ($> 10$ mm) was observed in one knee and mild or moderate ($5$ to $10$ mm) in four. Severe mediolateral instability ($> 15$) was seen in three knees and mild or moderate ($6$ to $14$) in nine. Three knees were stable in both directions. Marked angular deformity (varus or valgus $> 11^\circ$) was present in one knee and there was mild valgus ($0^\circ$ to $4^\circ$) in three. Post-operatively, stability and the tibiofemoral angle improved in all knees and there were only two cases of mild mediolateral instability.

The mean Knee Society function score did not improve significantly (26 (0 to 70) vs 34 (0 to 90); $t$-test; $p > 0.05$). The walking distance score improved from 18 (0 to 40) to 22 (10 to 40), but was not significant (Wilcoxon test, $p > 0.05$). The stair-climbing score was unchanged (17 (0 to 50) vs 21 (0 to 50); Wilcoxon test, $p > 0.05$).

**Post-operative complications.** These occurred in three knees. One patient developed severe patellar pain, which was successfully treated by resurfacing. Another presented with a patellar fracture at 3.75 years. Attempts at reconstruction failed and active extension remained impossible. In one patient the patellar component loosened and a fistula developed. The loose component was removed, the joint was debrided and the patient received antibiotics for a year. This treatment was unsuccessful. The infected Total Condylar III was removed 2.3 years post-operatively and a hinged S-ROM prosthesis (DePuy, Warsaw, Indiana) implanted three months later.

**Radiological evaluation.** The mean femorotibial, femoral and tibial angles changed slightly ($4^\circ$ to $6^\circ$, $96^\circ$ to $98^\circ$ and $88^\circ$ to $89^\circ$, respectively) between pre-operative assessment and final follow-up. The angle of the tibial tray improved from a mean of 1.8$^\circ$ of valgus ($5.9^\circ$ varus to 8.1$^\circ$ valgus) pre-operatively to 0.9$^\circ$ of varus ($2.8^\circ$ varus to 6.6$^\circ$ valgus) post-operatively and the posterior slope from a mean of 6.2$^\circ$ ($-7.6^\circ$ (anteriorly) to 29.0$^\circ$) to 0.6$^\circ$ ($-2.7^\circ$ (anteriorly) to 2.7$^\circ$; $t$-test, $p < 0.05$). In the lateral view the angle of the femoral component was changed from a mean of 6$^\circ$ of flexion ($10^\circ$ of extension to $30^\circ$ of flexion) pre-operatively to 2$^\circ$ of flexion ($3^\circ$ of extension to $5^\circ$ of flexion) post-operatively. The mean distance from the centre of the tibial component to the centre of the tibia improved from $1.7$ mm pre-operatively to $0.6$ mm post-operatively in the anteroposterior view and from 2 mm to 1.6 mm in the lateral view.

At the cement-bone interfaces, radiolucent lines were seen in five knees after a follow-up of more than seven years. Four knees had radiolucent lines associated with both the femoral and tibial components and one knee with the tibial component only. At the femoral cement-bone interface radiolucent lines were mainly seen in zone 1 (Knee Society score\textsuperscript{22}). On the tibial side, radiolucent lines were mainly seen in zone 1 and/or zone 4. All radiolucent lines were $< 1$ mm in width (grade I) (grade 0, no radiolucencies; grade 1, $< 1$ mm; grade II, between 1 and 2 mm; grade III, $> 2$ mm).

**Discussion**

In our study, the pain, range of movement and stability of the knee were improved after revision TKA, and there were anatomical improvements in the alignment of the joint and favourable changes in walking distance.

The range of flexion is important for patients with inflammatory arthritis in order to rise from a sitting position and normally requires approximately $100^\circ$ of knee flexion and/or support from the upper limbs. The latter is often compromised in inflammatory polyarthritides. Restoration of adequate flexion is thus an important goal. In our study the mean range of flexion was increased from an inadequate $68^\circ$ pre-operatively to $98^\circ$ at the end of follow-up, indicating that this goal had been attained. This functional improvement was accompanied by an improvement in stability and/or deformity.

Long-term results are affected by alignment of the TKA. In our series there were improvements in anteroposterior and lateral measurements of alignment, indicating good surgical technique. These improvements are important for normal biomechanical function and distribution of stress in and around the implant. Our results are almost ideal and suggest these excellent medium-term results will probably continue in the long term.

The literature suggests that radiolucent lines occur more often after revision than after primary TKA.\textsuperscript{23,24} In the early stages after revision TKA using the Total Condylar III...
implant, Rosenberg, Verner and Galante reported radiolucent lines in 60% of patients and Kim identified such lines in 71% around tibial components and 29% around femoral components. Recent reports suggest that radiolucent lines occur in 33% to 73% of patients after revision TKA using other prostheses. In our study all the radiolucent lines were seen at the tibial or femoral cement-bone interfaces in five knees during a follow-up period of more than seven years, in four around the femoral and tibial components and in one around the tibial component only. They occurred almost exclusively in zones 1 and/or zone 4 and all were < 1 mm thick. These promising results indicate that excellent results can be achieved with the Total Condylar III system.

Resurfacing of the patella may be challenging in inflammatory arthritis in which reduced bone stock is weakened by osteoporosis. Arguments for and against resurfacing and the high rate of patellar fracture in primary and revision TKA have been reported. In our study the patella had not been routinely resurfaced at the time of primary arthroplasty. At the revision operation the usual policy was to revise even a well-fixed patellar button because of the change in the type of component. To prevent patellar fracture, we prefer the use of cement in patients with inflammatory arthritis because the difference in stiffness between cement and weak cortical bone is much less than that with press-fit components. In our study half of the knees had a patellar resurfacing at the revision operation because of destruction and one case failed because of patellar fracture. Our rate of complication (three cases, 16%) is lower than reported in some series, but higher than in others. Patellar pain was successfully treated by resurfacing and deep prosthetic infection by re-revision with a hinged prosthesis, but reconstruction of the patellar fracture failed. It can be concluded that patients with Total Condylar III revision TKA need to be followed up and complications can usually be managed by minor operations or by re-revision. The number of patients in our study is relatively small as these patients are rare, even in specialised centres. However, the study material was uniform and no patient was lost to follow-up.

In summary, we have shown that revision of TKA using the Total Condylar III system in patients with inflammatory arthritis has an excellent clinical outcome in the medium term, with results equal to those in primary TKA. We are cautiously optimistic that the Total Condylar III system will continue to show good results in the longer term.

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References