Long-term results of total knee arthroplasty for valgus knees: soft-tissue release technique and implant selection

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ABSTRACT

Purpose. To report long-term results of total knee arthroplasty (TKA) for valgus knees.

Methods. 34 women and 19 men aged 39 to 84 (mean, 74) years with valgus knees underwent primary TKA by a senior surgeon. Of the 78 knees, 43, 29, and 6 had type-I, type-II, and type-III valgus deformities, respectively. A preliminary lateral soft-tissue release was performed, and the tibia and femur were prepared. The tight lateral structures were released using the pie-crusting technique. In 92% of the knees, cruciate-retaining implants were used. In knees with severe deformity and medial collateral ligament insufficiency, the posterior cruciate ligament was sacrificed and constrained implants were used. The Hospital for Special Surgery (HSS) knee score was assessed, as were tibiofemoral alignment, range of motion, stability, and evidence of loosening or osteolysis.

Results. Patients were followed up for 8 to 14 (mean, 10) years. All knees had a good patellar position and were clinically stable in both mediolateral and anteroposterior planes. No radiolucency was noted. The mean HSS knee score improved from 48 to 91 (p<0.001). The mean tibiofemoral alignment improved from valgus 20° to 5° (p<0.001). The mean range of motion improved from 65° to 110° (p<0.001). One patient developed a deep infection at year 4, and 2 had periprosthetic fractures at years 6 and 8.

Conclusion. Adequate lateral soft-tissue release is the key to successful TKAs in valgus knees. The choice of implant depends on the severity of the valgus deformity and the extent of soft-tissue release needed to obtain a stable, balanced flexion and extension gap, in order to achieve minimal constraint with maximum stability.

Key words: arthroplasty, replacement, knee; genu valgum; joint deformities, acquired; knee joint

INTRODUCTION

Valgus knees are defined as those with a valgus alignment of >10° on standing anteroposterior
radiographs. They are classified into 3 types (Fig.). In type I the medial soft-tissue stabilisers are intact. In type II the stabilisers are lax and the deformities are not passively correctible. Both types have lateral bony deficiency and soft-tissue contractures. Type III is the result of an overcorrected proximal tibial valgus osteotomy.

Soft-tissue balance is difficult to achieve in valgus knees. Total knee arthroplasty (TKA) can correct bony deformities (such as hypoplastic lateral condyle, tibial bone loss, and malaligned malpositioned patella) and rotational alignment of the limbs. There are various soft-tissue balancing techniques and implant options (including cruciate-retaining, -sacrificing, -substituting, or -constrained implants). We report long-term results of TKA for valgus knees. The choice of implant depends on the severity of the valgus deformity and the extent of soft-tissue release needed to obtain a stable, balanced flexion and extension gap, in order to obtain minimal constraint with maximum stability.

MATERIALS AND METHODS

Between January 1996 and December 2002, 34 women and 19 men aged 39 to 84 (mean, 74) years with valgus knees underwent primary total knee arthroplasty (TKA) by a senior surgeon for rheumatoid arthritis (n=37) or primary osteoarthritis (n=16). 25 patients had simultaneous bilateral TKAs and 28 had unilateral TKAs. With regard to these 78 knees, 43, 29, and 6 had type-I, type-II, and type-III valgus deformities, respectively.

After a pre-anaesthetic check-up, each patient was subjected to combined spinal epidural anaesthesia. The knee was exposed in flexion using a midline longitudinal skin incision and a medial parapatellar arthrotomy. A tourniquet was used. Osteophytes on the femur were removed. Soft tissues of the lateral compartment (the lateral retinaculum and the iliotibial band) from the proximal tibia were then released. The adequacy of release was assessed by internally rotating the tibial tuberosity beyond the midline in both flexion and extension. The tibia was then prepared using an extramedullary jig. The femur was prepared using intramedullary instruments. The distal femur was resected in 3º of valgus. The rotational alignment of the femur was referenced to the Whiteside line, transepicondylar axis, and the cut surface of the tibia. A spacer block was then used to check the flexion and extension gaps. In case the gaps were not rectangular, more lateral soft-tissue release was performed. Pie crust ing of the iliotibial band...
was resorted to when the extension space was not balanced.

The popliteus was retained in all except 2 knees in which the valgus deformity was severe (type III) and high tibial osteotomy had been performed. Popliteus release was mandatory in these 2 knees to obtain symmetrical flexion and extension gaps. For sagittal plane stability, the adequacy of the posterior cruciate ligament (PCL) was assessed by the pullout-liftoff test. In 3 knees, the PCL was recessed because of a tight PCL that tended to lift the tibial component anteriorly. In cases of laxity in the sagittal plane not correctable by a thicker insert, a cruciate-substituting implant was used.

In all 43 knees with a type-I deformity, a cruciate-retaining implant was used (Fig. a). Of the 29 knees with a type-II deformity, 25 used a cruciate-retaining implant and 4 used a cruciate-substituting implant (Fig. b). In all 6 knees with a type-III deformity, the PCL was sacrificed. Four of them entailed a cruciate-substituting implant and the remaining 2 entailed a constrained implant (Fig. c), based on the competency of the medial collateral ligament. Advancement of the ligament was not needed in any of the knees. The lateral retinaculum was released in 5 knees owing to patellar maltracking. All implants were cemented and the patella was not resurfaced.

Postoperatively the knees were placed in 10º of flexion for 2 days to prevent stretching of the peroneal nerve. Active and passive range-of-motion exercises (within a range of 10º to 85º) were allowed. The mean duration of hospital stay was 8 (range, 5–9) days. Patients were followed up by the same surgeon at 3, 6, and 12 months, and then yearly. The Hospital for Special Surgery (HSS) knee score was assessed. Limb alignment, patellar position, and evidence of loosening or osteolysis were assessed using standing anteroposterior, lateral, and skyline radiographs. Mediolateral stability was assessed by a varus-valgus stress in full extension. Anteroposterior stability was assessed by an anteroposterior stress test in 30º and 90º of flexion.

RESULTS

Patients were followed up for 8 to 14 (mean, 10) years. All knees had good patellar position and were clinically stable in both mediolateral and anteroposterior planes. No radiolucency was noted. The mean HSS knee score improved from 48 (range, 32–68) to 91 (range, 78–95) [p<0.001]. The mean range of motion improved from 65º (range, 45º–125º) to 110º (range, 80º–135º) [p<0.001].

One patient underwent a 2-stage revision at year 4 for a deep infection and has been infection-free for 5 years. Two patients underwent open reduction and internal fixation using femoral condylar plates for periprosthetic displaced supracondylar femoral fractures secondary to a fall at years 6 and 8.

Two patients developed transient peroneal nerve palsies, which resolved within 6 months. Three patients developed symptomatic deep vein thrombosis that was managed with low molecular weight heparin, warfarin, and thrombo-embolic deterrent stockings. There was no incidence of pulmonary embolism.

DISCUSSION

Achieving adequate soft-tissue balance in valgus knees during TKA is challenging. A sequential soft-tissue release of the iliotibial band, popliteus, lateral collateral ligament, and the lateral head of the gastrocnemius has been recommended, but such release may not be adequate because of late-onset instability. A tibial tubercle osteotomy is suggested in cases that the Q angle was >20º, but it has inherent risks of non-union and subsequent extensor mechanism problems.

Adequate lateral soft-tissue release has been emphasised to prevent residual valgus deformity and patellofemoral alignment problems. Medial advancement and lateral release of soft tissues can achieve well-balanced flexion and extension gaps, but has drawbacks such as non-union at the medial collateral ligament advancement site, increased surgery time, and delayed mobilisation. This technique would produce good results for young patients with type-II valgus knees (in whom the use of a constrained implant was not desirable), but in elderly patients, a constrained implant would perform equally well.

An unacceptably high rate of late-onset instability ensues when the iliotibial band is divided transversely above the joint line, and the lateral collateral ligament and the popliteus are detached from the lateral femoral condyle. A large lateral soft-tissue release may lead to peroneal nerve palsy and/or late-onset instability. These problems can be avoided without compromising the results when constrained implants were used. In a study with a mean follow-up of 7.8 years, the mean HSS knee score improved from 52 to 90, and there was no incidence of peroneal nerve palsy.
peri-prosthetic fracture, or flexion instability. Present-day TKA promotes the use of minimally constrained implants and adequate soft-tissue release to achieve knee stability. The tight structures around the posterolateral knee are released in extension and then in flexion after preparing the tibia and the distal femur. This resulted in 6% of the knees having a mild degree of mediolateral instability, and there was no peroneal nerve palsy or patellar dislocation after a mean follow-up of 7 years.7

Good stability and deformity correction were reported in 35 knees with >15º valgus deformity after 2 years of follow-up.8 In that series, a cruciform lateral retinacular release was used and the PCL of all the knees was preserved. In a study using a cruciate-retaining implant, no significant difference was reported in terms of knee score, alignment, or rate of revision surgery in patients with severe (≥20º) varus or valgus deformity and matched controls.9

Lateral collateral ligament and popliteus release from the femur increase the risk of revision.8,10 Cruciate-retaining implants can be successfully used in valgus knees and implant survival can be improved if at least one of the lateral-stabilising structures is preserved.10,11 96% of valgus knees yield good results after pie crusting for the lateral retinaculum and the iliotibial band, as this enables gradual stretching of lateral soft tissues.12

In our study, soft tissues in valgus knees were released sequentially. The posterolateral structures were first released in flexion. Internal rotation of the tibial tuberosity beyond the midline in flexion and extension was then assessed. Bone cuts were then taken and a trial reduction was performed. Any tight lateral structures were released at this time by means of pie crusting. Minimal constraint aided by adequate sequential soft-tissue balance achieved good results in these valgus knees. Our technique of soft-tissue release enabled full correction of the deformity and avoided late-onset instability. The decision to preserve or sacrifice the PCL was made intra-operatively, and in 92% of the knees, the PCL was preserved. Sacrifice of the PCL and use of constrained implants was needed if there was severe deformity or medial collateral ligament insufficiency, in which extensive posterolateral soft-tissue release was necessary to achieve full correction. Not using a constrained implant in these knees would have led to late-onset instability. The improvement in HSS knee score was consistent during the follow-up period. Cruciate-retaining implants can be used in most valgus knees (provided the soft tissues were adequately balanced), except for those with severe type-III deformity or medial collateral ligament insufficiency. All valgus knees are not amenable to good correction using cruciate-retaining implants. Hence, proper implant selection is important for a successful TKA for valgus knees, as is adequate lateral soft-tissue release leading to a well-balanced knee.

REFERENCES