

# Total knee arthroplasty in bony ankylosis in gross flexion

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**B**etween June 1993 and December 1994, we performed total knee arthroplasty (TKA) on 27 knees in 24 patients with spontaneous bony ankylosis in severe flexion. The mean age at operation was 43.5 years (30 to 60). No patient had preoperative pain. Three were unable to walk and 21 could manage less than five blocks. The mean duration of the ankylosis was 18.7 years (13 to 25) and its mean position was 105° flexion (75 to 135).

The preoperative Hospital for Special Surgery Knee Score of 60 points was improved to 87 at the final follow-up three to five years later. All knees were free from pain. The mean range of active flexion in 24 knees was 97° (78 to 115) and the mean arc of movement 91° (78 to 98). The mean fixed flexion deformity was 6° (0 to 25) and the extension lag 8° (0 to 25). Angular deformity was corrected to between 0° and 10° of valgus. Four patients were able to walk one block and 20 five to seven blocks. Thirteen knees (48%) showed some necrosis at the skin edge; one knee required arthrodesis and another resection arthroplasty. One had a recurrence of tuberculous infection requiring arthrodesis. One patient had a rupture of the quadriceps tendon. To date no prosthesis has required revision for loosening. Radiolucency of 1 mm or less about the tibial prosthesis was observed at follow-up in four of the 24 knees.

**Our results have shown that one-stage TKA and skeletal traction after operation can achieve correction of severe flexion deformity of the knee with marked improvement in the function and quality of life.**

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Growing experience with total knee arthroplasty (TKA) has allowed its application in a wide variety of unusual situations.

While there have been several reports of TKA in joints with ankylosis in extension,<sup>1-6</sup> we could find no account of the operation in bony ankylosis in severe flexion. We report our experience with TKA in this situation.

## Patients and Methods

Of the 405 primary TKAs carried out by the senior author (Y-HK) between June 1993 and December 1996, 27 knees (6.7%) had bony ankylosis in flexion of more than 75°. The 24 patients (19 men and 5 women), with a mean age of 43.5 years (30 to 60), were followed up for an average of 4.6 years (3.6 to 5). The contralateral knee in the 21 unilateral cases was normal. Three patients had a one-stage bilateral procedure. The diagnosis was rheumatoid arthritis in six knees, tuberculous arthritis from childhood in 19, and pyogenic arthritis from childhood in two. No patient had undergone previous surgery.

Routine follow-up examination took place at intervals of six weeks, three months, six months and one year after surgery and yearly thereafter. At these intervals, the patients were examined clinically and radiologically. Preoperative and postoperative data were recorded using The Hospital for Special Surgery Knee Score (HSSKS).<sup>7</sup>

The mean duration of ankylosis was 18.7 years (13 to 25). The mean position of the fixed flexion was 105° (75 to 135).

No patient had pain preoperatively. Their ability to walk is summarised in Table I. Before surgery, three had been confined to wheelchairs, one for 13 years and two for five years. The remaining 21 said that they were able to walk for only a limited distance, with a maximum of five blocks.

**Table I.** Walking ability of the 24 patients before and after surgery

	Number of patients	
	Preop	Postop
Non-walker	3	0
Less than five blocks	21	4
More than five blocks	0	20

All were able to negotiate stairs by some method.

**Operative technique.** The operations were carried out under tourniquet. Cephalosporin (6 g per day) was given intravenously immediately after the induction of anaesthesia and continued for 48 hours. A midline skin incision was used with a subvastus capsular approach and lateral dislocation of the patella. Although an attempt was made to reduce the lateral subluxation of the patella, a degree of this deformity remained in all knees since the flexion deformity was associated with a valgus and/or external rotation deformity. Lateral retinacular release was carried out in all knees from within the joint. Except for elevation of the quadriceps mechanism from the femur, no lengthening or shortening procedure was undertaken. The arthrodesis was taken down at the level of the original joint with preservation of bone stock and a carefully planned soft-tissue technique. Soft-tissue releases were carried out as necessary to correct angular and flexion deformity by sequential conservative section laterally or posteriorly. The aim was to correct the deformity while maintaining stability of the joint in both flexion and extension.

Valgus deformity with external rotation was corrected by releasing the iliotibial tract from its insertion to Gerdy's tubercle on the tibia. Extensive lateral release was not undertaken in order to avoid posterolateral instability in flexion which could lead to subluxation even when a posterior stabilised prosthesis is used.

Posterior soft-tissue release was undertaken after the bone cuts because, until they were made, posterior visualisation was poor and was impeded by the femoral condyles. The posterior capsule was divided transversely close to its femoral attachment. We found that it was best to begin medially and laterally where the popliteal fossa is protected by the heads of the gastrocnemius. The ability to see the muscle fibres gives a sense of the plane of dissection, which was then continued towards the midline. Any remnant of the posterior cruciate ligament was resected. Finally, the heads of gastrocnemius were detached from the femur with a long periosteal elevator.

Knees with varus/valgus or anteroposterior instability were managed by the use of a more constrained prosthesis, to compensate for capsular or ligamentous insufficiency. An Omnifit posterior stabilising prosthesis (Stryker, Allendale, New Jersey) was used. It is semiconstrained, allowing sacrifice of both cruciate ligaments which is essential in this type of severely deformed knee. The instruments developed for use with these implants were used for the soft-tissue release, bone cuts, and limb alignment.

There is a tendency for the knee to rest in more than 45° of flexion at the end of the operation. This was managed by the use of skeletal traction through a threaded Steinmann pin in the distal tibia rather than by further overzealous, soft-tissue release or bone resection. The minimum amount of bone was resected, in accordance with the particular requirements of the Omnifit implant. The surfaces of the cancellous bone were prepared by pulsatile lavage. Closed

suction drainage was used in all knees and maintained for 24 hours. All knees were hypoplastic due to the long duration of the disease from childhood or adolescence and required smaller components than normal (Table II). A patellar replacement was carried out. Epidural normotensive anaesthesia was used for all procedures. A light block was necessary for nerve function to be observed soon after operation. If muscle weakness or sensory disturbance was suspected, the knee was allowed to flex.

All wounds were dressed with absorbent dressings. On the day of operation traction of 2.27 kg was applied through the distal tibial pin and increased in a graduated fashion up to 9 kg. At the time of discharge from hospital, all patients wore a long-leg cast for 24 hours. This was then bivalved, lined and used as a resting night splint for three months.

## Results

The mean operating time was 115 minutes (90 to 164) and the mean estimated perioperative blood loss was 750 ml (250 to 1130).

Passive flexion of at least 110° was achieved after closure of the capsule in all knees but there was a residual flexion deformity which ranged from 45° to 80°. The mean duration of hospital stay was 21 days (14 to 52) and the mean duration of skeletal traction 17 days (10 to 42). We were concerned about possible distal tibial pin-track infection spreading to the knee, but none occurred.

At the time of discharge from the hospital, the flexion deformity was completely eliminated in 18 knees, there was a persistent deformity of 10° or less in seven and a residual deformity of 25° in two. All were able to walk with one or two sticks. The mean range of flexion was 101° (82 to 115). No knee required manipulation after operation.

The mean follow-up was for 4.6 years (3.6 to 5). Serial radiographs were available at the time of the clinical assessment in all patients. The mean preoperative HSSKS was 60 points; this increased to 87 points (73 to 96) at the final follow-up.

All knees were free from pain. Comparison of the preoperative and postoperative walking ability revealed striking functional improvement (Table I). All patients could now negotiate stairs. Of the three patients who had been unable to walk before operation, two could manage one block without the need for walking aids and one by using a

**Table II.** The size of the Omnifit posterior stabilised prosthesis used in the 24 patients

	Size of prosthesis		Polyethylene thickness (mm)	
	No. 3	No. 5	8	12
Component				
Femoral	9	18	-	-
Tibial	13	14	-	-
Patellar	9	18	-	-
Tibial polyethylene	-	-	18	9



Fig. 1a



Fig. 1b



Fig. 1c



Fig. 1d

Pre- and postoperative radiographs of the left knee of a 40-year-old woman with bony ankylosis in 75° flexion. Figure 1a – Preoperative lateral radiograph of the left knee showing solid bony ankylosis in 75° of flexion. Figure 1b – A lateral view taken in 90° of flexion 60 months after operation. Figure 1c – A lateral view taken in full extension 60 months after operation. Figure 1d – An anteroposterior view taken 60 months after operation showing an Omnifit posterior stabilised prosthesis in place in 0° valgus.

pair of platform crutches. Of the 21 patients who had only been able to walk less than five blocks, 20 were able to manage five to seven blocks. One patient who had had a resection arthroplasty was able to walk one block when wearing a brace. In the 24 knees (two with an arthrodesis and a resection arthroplasty respectively were excluded), the mean range of active flexion was 97° (78 to 115). The mean arc of movement for the 24 knees was 91° (78 to 98). The mean fixed flexion deformity was 6° (0 to 25) and the extension lag 8° (0 to 25). All patients with below-average results in terms of measurements, were pleased with their improvement. The angular deformities were corrected to between 3° and 10° of valgus in all knees.

Radiographs of 24 knees showed that 20 (83%) had no visible radiolucency at the cement-bone interface (Fig. 1). Four (17%) had a radiolucency of 1 mm or less and only beneath the tibial component. There was no evidence of demarcation of more than 1 mm, or of any change in the position of the components. Of the 24 patients, 23 were either employed outside the home or were full-time homemakers, but the remaining one was to some extent dependent on family.

All patients were very pleased with the results of the joint replacement and said that they would have the operation again. This included the two patients who subsequently had an arthrodesis in full extension, one for uncontrollable

recurrence of tuberculous infection and one because of skin necrosis.

**Complications.** Necrosis of the skin edge of the incision occurred in 13 knees (48%). All but three of these wounds healed spontaneously. In two knees the prosthesis was exposed. Arthrodesis in full extension was carried out on one knee using an Ilizarov external fixator after the removal of the prosthesis. The other knee had a debridement of the necrotic wound, removal of the prosthesis and a skin graft leaving the leg with an excision arthroplasty. One patient had a recurrence of tuberculous infection requiring removal of the prosthesis and arthrodesis in full extension using an Ilizarov external fixator. Another suffered a rupture of the quadriceps tendon one year after operation without serious disability. She refused to have a repair.

## Discussion

Progressive infection or arthritis of the knee may lead to spontaneous bony ankylosis in flexion which is not necessarily the result of neglect.<sup>8-10</sup> The deformity and functional deficit produced can have a disastrous effect on the patient's physical and emotional development. Options for treatment include osteotomy with judicious soft-tissue release, arthrodesis in an optimal position and arthroplasty. The last includes resection arthroplasty and joint replacement performed in one or two stages.

Osteotomy with judicious soft-tissue release often fails to correct severe flexion deformity. Resection arthroplasty used to be employed as either a primary or a salvage procedure, but although it produces a mobile joint, it does not provide satisfactory stability and will introduce an element of discomfort, if not pain, in a pain-free limb.

Arthrodesis in a good position is still considered the most satisfactory treatment for malpositioned ankylosis of the knee. It provides stability, but poor function.<sup>11</sup>

Joint replacement in any young patient remains controversial, raising questions of the duration of prosthetic fixation to bone, and the wear and fatigue properties of materials over a long period.<sup>12,13</sup> The young patients in our series were informed of the uncertain eventual outcome, but chose reconstructive joint surgery on account of their social and career needs.

In patients with a knee with bony ankylosis in severe flexion, one- or two-stage arthroplasty should be considered. Two-staged arthroplasty requires the fusion to be taken down with judicious soft-tissue release, and skeletal traction through a distal tibial pin to correct flexion deformity, after which TKA is performed. In our experience, one-stage arthroplasty and skeletal traction through a distal tibial pin achieved the correction of severe flexion deformity more quickly and completely.

In the three patients who had two-stage arthroplasty (not included in this series) skeletal traction before the arthroplasty failed to obtain full correction of the flexion deformity because of mechanical impingement between exposed

bone surfaces. In the one-stage arthroplasty, the prostheses provided a smooth gliding surface when skeletal traction was applied.

Careful preoperative planning is mandatory in these patients. All knees were hypoplastic from the long duration of childhood or adolescent disease and small components were required. High-quality preoperative radiographs and the use of templates helped to ensure that the correct size of prosthesis was available. We found that the supporting soft tissues of the knee, including the collateral ligaments, were intact, making the use of a semiconstrained prosthesis possible. The patellofemoral joint must be mobilised adequately to allow exposure of the articular surfaces of the tibia and femur. This involves osteotomy of the patellofemoral fusion with a saw or osteotome to mobilise the patella. Despite the bony ankylosis in flexion, the tibiofemoral joint line can usually be identified. Care and attention must be given to preservation of the collateral ligaments so that, with adequate resection of bone and soft-tissue release, including the gastrocnemius muscles, a resurfacing type of knee prosthesis can be used.

The three patients with bilateral procedures suffered from rheumatoid arthritis with many other arthritic joints, and had particular benefit.

Certain postoperative problems warrant discussion. The relatively high rate of necrosis of the skin edge (48%) means that special care must be taken in the handling of flaps. An ankylosed knee in severe flexion has already lost the anterior femoral condyles through infection or arthritis. When the knee is replaced, the anterior flange of the femoral component may force the patella forward from the bone, resulting in unacceptable tension of the soft tissues, predisposing to necrosis. To avoid this, preoperative skin distension may be beneficial. The patella, however, should not be resurfaced in a knee with flexion deformity of more than 90°. There was a tendency towards recurrence of flexion deformity in five of our patients. A removable night splint should be worn for at least three months after the operation.

Most patients in our series preferred the mobile knee. The numbers are too small for any firm recommendation, but TKA would seem to be contraindicated only in the presence of active pyogenic or tuberculous infection, since restoration of movement in the knee has important psychological and functional effects.

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