OBJECTIVE: To determine the outcome of total knee replacement using a posterior cruciate-substituting knee prosthesis in patients who have undergone previous patellectomy.

DESIGN: A cohort study, with a follow-up ranging from 2 to 9 years.

SETTING: A university-affiliated institution specializing in elective orthopedic surgery.

PARTICIPANTS: Sixteen patients with arthritis of the knee who had had patellectomy. All agreed preoperatively to a prolonged postoperative follow-up.

INTERVENTION: A cemented posterior cruciate-substituting knee replacement.

MAIN OUTCOME MEASURES: Stair climbing ability, the Hospital for Special Surgery knee rating system for clinical results and a radiologic rating using a zonal system.

RESULTS: Clinical rating was 69% good or excellent. Eighty-one percent of patients could use the replaced knee as the lead leg on stair climbing. Minor radioluency, mostly single zone only, was found. Two patients required revision because of pain, but no obvious reasons for this pain were found at operation.

CONCLUSION: In the absence of a patella, a posterior cruciate-substituting prosthesis gives reasonable results.

OBJECTIF : Déterminer le résultat du remplacement total du genou par une prothèse de substitution du croisé postérieur chez les patients qui ont subi auparavant une patellectomie.

CONCEPTION : Étude de cohorte et suivi variant de 2 à 9 ans.

CONTEXTE : Établissement affilié à une université spécialisé en chirurgie orthopédique élective.

PARTICIPANTS : Seize patients souffrant d’arthrite du genou qui avaient subi une patellectomie. Tous ont consenti avant l’intervention à participer à un suivi postopératoire de longue durée.

INTERVENTION : Remplacement du genou par substitution cimentée du croisé postérieur.

PRINCIPALES MESURES DES RÉSULTATS : Capacité de monter des marches, système d’évaluation du genou de l’Hospital for Special Surgery à l’égard des résultats cliniques, et évaluation radiologique fondée sur un système de zone.

RÉSULTATS : L’évaluation clinique a varié de bonne à excellente dans 69 % des cas. Quatre-vingt-un pour cent des patients ont pu utiliser le genou remplacé comme première jambe pour monter des marches. On a constaté une perméabilité mineure aux rayons X, surtout dans une seule zone seulement. Deux patients ont eu besoin d’une révision à cause de la douleur, mais on n’a trouvé aucune raison évidente de cette douleur au moment de l’intervention.

CONCLUSION : En l’absence de rotule, une prothèse de substitution du croisé postérieur donne des résultats raisonnables.

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After total knee replacement, the patella functions as an anterior stabilizer of the knee. Results of total knee replacement in patients who have previously undergone patellectomy have been inferior to those in patients with a patella. In a small series, bicompartamental unicompartmental knee prostheses were compared with posterior stabilized knee prostheses for total knee replacement in patients who had previously undergone patellectomy. The posterior stabilized knee was found to give superior results.

With the passage of time, enough cases have been added to justify a re-examination of the results that can be achieved with a posterior stabilized knee in these circumstances.

**Patients**

Sixteen patients (8 men, 8 women) who had a prior patellectomy and were treated by the senior author (H.U.C.) with a posterior cruciate-substituting knee prosthesis were included in the study. Those who had knee-fusion takedowns were excluded because they formed a separate subgroup.

The patients ranged in age from 46 to 77 years (mean 65.5 years) at the time of knee replacement. One patient had rheumatoid arthritis, 1 had psoriatic arthropathy, 1 had previous sepsis, and 13 had osteoarthritis. In addition to patellectomy, two had undergone tibial osteotomy, two had received bicompartamental unicompartmental knee prostheses, one had received a medial unicompartmental knee prosthesis and one had received a semiconstrained condylar type knee prosthesis. One patient had had a supracondylar fracture.

There was one intraoperative complication, a crack of the tibia when the stem punch was being inserted. This was closed with compression screws and healed without complication. One patient had a patellar tendon subluxation preoperatively, so the operation was done through a lateral parapatellar approach. The standard medial parapatellar approach was used in all other cases. All prostheses were cemented.

Follow-up ranged from 2 to 9 years. During that time all patients were seen at yearly intervals. The Hospital for Special Surgery (HSS) clinical rating and the Knee Society radiologic rating systems were used to evaluate the results. Patients were also questioned about their ability to climb stairs and the site of any knee pain. Knee flexion and extension torques were not measured. Because the patients’ perception of their abilities is important, we asked the question, “Do you use the replaced knee as the lead leg on stairs?”

**Results**

Overall HSS results at the close of the study were 11 (69%) good or excellent and 5 (31%) fair or poor. The clinical scores did not change with the passage of time. Results at 2, 4 and 6 years were evaluated (Table I).

All patients had full extension and flexion. There was no quadriceps lag in the group. In two patients flexion was limited to less than 75°; flexion in the remainder was over 100°. Thirteen (81%) of the 16 patients could use the replaced knee as the lead leg on stairs, 7 (44%) continued to have pain — end-of-stem pain in 2 patients, diffuse knee pain in 3 patients and some aching from the patellar tendon on stair climbing in 2 patients.

Two patients required revision, one at 5 years for end-of-stem pain or at least pain in the tibia at the end of the stem. At the time of revision surgery, no obvious cause could be found for the tibial pain in one of them, and revision to a long stem failed to relieve the symptoms. Since only the tibial component was changed and the knee itself remained pain free and functional, the patient was kept in the study. A second patient was pain free for several years and then experienced sudden, unexplained pain in the knee. At the time of revision surgery, no real abnormalities were found. There was no loosening and minimal wear. A synovectomy was done and a thicker tibial component inserted. At follow-up, the patient was functioning well and the pain appeared to have been relieved.

The five fair or poor results included the patient with end-of-stem pain, one patient whose range of motion was only 0° to 60°, one patient

**Table I**

Follow-up Assessment by the Hospital for Special Surgery (HSS) Rating System in 16 Patients Who Underwent Total Knee Arthroplasty With a Posterior Cruciate-Substituting Knee Prosthesis

<table>
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<tr>
<th>Follow-up, yr</th>
<th>HSS rating</th>
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<tbody>
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<tr>
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<td>2</td>
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<table>
<thead>
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<th>Follow-up, yr</th>
<th>Excellent</th>
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<td>5</td>
<td>1</td>
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with significant other comorbidities, one Workers’ Compensation Board case and one patient who had severe pain following knee replacement. Exploration 3 months after total knee replacement revealed some brownish tissue in the patellar tendon. Excision of the tissue decreased the pain to some extent.

Radiologically, one femoral component showed lucency in one zone. Eight tibial components showed lucency on anteroposterior view, four being in one zone and four in two zones (Fig. 1). Seven tibias also showed lucency on the lateral view, four being in one zone and three in two zones.

**DISCUSSION**

The senior author had previously reported very poor results with the use of a semiconstrained knee prosthesis after a patellectomy. A review of the literature tends to confirm this. Lennox, Hungerford and Krackow had a 46% acceptable result using a semiconstrained knee; two patients required fusion for intractable pain. Most patients were noted to have an intact posterior cruciate ligament. Joshi and associates reported 19 cases in which a semiconstrained knee prosthesis was used. They gave no overall results, but they reported pain relief in 79% of their cases. They reported knee instability in 16% of cases. Larson and associates reported on 14 primary total knee arthroplasties and 12 revision knee arthroplasties, with a whole series of different knee prostheses, some very obsolete. They had 50% acceptable results. Martin, Haas and Insall reported nine cases in which the original total condylar prosthesis was used. Acceptable results were obtained in four cases. Of 12 posterior cruciate-substituting knee prostheses used, there was an acceptable result in 9.

The reason that the patellar-deficient knee does badly is not clear. In previous publications, the senior author felt that the absent patella resulted in a deficient anteroposterior

**FIG. 1.** Anteroposterior and lateral views show lucent line (arrowhead) under medial tibial plateau (anteroposterior view) and under anterior femoral flange (open arrow) (lateral view), which had not changed for several years. Sliver of bone (black arrow) can be seen in patellar tendon on lateral view. This represents myositis ossificans which formed in patellar tendon after patellectomy.
stabilizing mechanism, producing painful anteroposterior instability. Lennox, Hungerford and Krackow3 pointed out that the strength of the quadriceps and hamstring muscles was quite diminished in such cases relative to a control group. They also pointed out that unsatisfactory results correlated well with a number of previous operations and wondered if some of these patients had reflex sympathetic dystrophy of the knee. One of their patients continued to have severe pain after a successful knee fusion. In two of the cases in this current series, reflex sympathetic dystrophy was certainly considered but was not proven. Martin, Haas and Insall4 indicated that the longer the interval between patellectomy and total knee replacement the better the result.

It is theoretically possible to retain an isometric posterior cruciate ligament at the time of total knee replacement and therefore use a semiconstrained knee. This, however, is technically difficult, and the patellar-deficient knee is dependent on an isometric posterior cruciate ligament. In this series 67% of patients had an acceptable result with a posterior cruciate-substituting knee. Although not exceptional, these results are reasonable

FIG. 2. Anteroposterior and lateral views of revision of this patient’s tibial component. Revision simply moved site of tibial pain 5 cm distally. Subsequent strut grafts and sympathetic blocks failed to relieve symptoms, whose origins were never clear. IB = Insall–Burstein. Arrow shows site of end-of-stem pain.
in the light of previous experience. Therefore, we continue to believe that a posterior cruciate-substituting knee is a reasonable implant choice for total knee arthroplasty in the absence of a patella.

Although end-of-stem pain can occur with a noncemented stem, the finding of end-of-stem pain in two cases in the series was quite unexpected because both patients had short, cemented titanium stems. Neither stem was loose and in neither case did the stem make endosteal wall contact without an intervening layer of cement. The end-of-stem pain in one case was insignificant, but in the second case (Fig. 2) the pain was intractable, and multiple consultations with experts in the field failed to offer any solution. The incidence of radiolucent lines was relatively low and did not increase with time. It would therefore appear that the absence of a patella is not associated with loosening.

References