

Geometric total knee replacement in osteoarthritis

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The current methods of treating osteoarthritis of the knee are osteotomy, debridement, tibial plateau replacement arthroplasty, femoral mold arthroplasty, hinged metal on metal total knee replacement arthroplasty, and arthrodesis of the knee. Osteotomy of the proximal tibia has been performed frequently in cases of osteoarthritis of the knee. It is most useful in cases in which the osteoarthritic changes are only on the medial or lateral side of the knee joint with a genu valgum or varum deformity. Patients with flexion contractures of 20° or more, instability, or valgus deformity greater than 20° are not suitable for tibial osteotomy. Realignment of the weightbearing line by tibial osteotomy is not likely to relieve the symptoms when the disease is severe.^{1, 2}

Another operation available for treating the osteoarthritic knee is the debridement procedure described by Magnuson.³ This operation consists of removing osteophytes from the margins of the knee joint and ridges from the central portions of the joint; it may include patellectomy. Pain may be relieved in some instances, but patellectomy often further weakens an already atrophied quadriceps muscle. Consequently, patients may experience buckling of the knee, a feeling of unsteadiness, and weakness. Magnuson's procedure is of limited value and cannot be relied upon to correct the more severe forms of osteoarthritis of the knee joint.⁴

The metal on metal hinged type of total knee replacement devised by Walldius,⁵ Young,⁶ and Shiers⁷ can correct the severe deformities of osteoarthritis, but complications have been frequent. Loosening or fracture of the stems of the prosthesis, failure of the bolt, infection, nerve palsies, and skin necrosis have been reported after these operative procedures. Salvage of a Walldius, Young, or Shiers prosthesis by arthrodesis is not always successful, and amputation may be necessary to relieve the patient's pain.

Tibial plateau prostheses or the femoral mold prostheses correct only one half of the problem in the knee joint and have been advised only for the patient over 70 years of age. Lateral subluxation of the knee can-

not be corrected by tibial plateau prosthetic arthroplasty and is thought to be a contraindication.^{8, 9} Arthrodesis of the knee has been highly successful, but the stiff knee causes difficulty in sitting, getting out of a chair, and climbing stairs.¹⁰

A new form of arthroplasty of the knee has been clearly needed. The geometric total knee replacement has been devised to correct the articular damage to both the tibia and femur.¹¹ It has the advantage of being able to retain both the cruciate and collateral ligaments and provides flexion to at least 90° and a small degree of rotation. The geometric total knee prosthesis provides stability and allows adequate soft tissue coverage. The materials, vitallium for the femoral component,

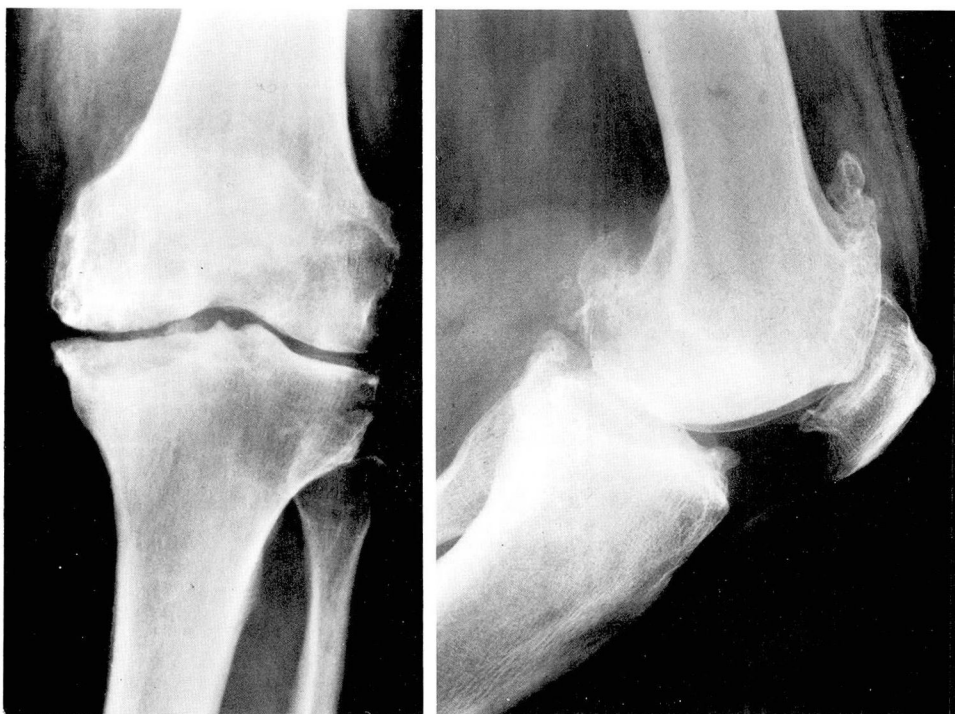


Fig. 1. Anteroposterior and true lateral roentgenograms of the left knee joint demonstrating osteoarthritic changes consisting of osteophytes at the margins of the femur, tibia, and patella. There is depression of the medial tibial plateau and sclerosis of bone beneath the joint surfaces.

high density polyethylene for the tibial portion of the prosthesis, and methyl methacrylate to cement both components to bone, have had a satisfactory trial in the Charnley and Charnley-Mueller total hip replacement.^{12, 13} Experience with a case of severe bilateral knee disease is herein reported.

Case report

A 63-year-old white man employed as a boiler fireman was first examined March 20, 1968, for pain in the right knee. The pain had begun in 1954 when he was struck in the right knee by a cement mixer. He heard a loud, snapping sound in the right knee joint and fell to the ground. He had severe pain, and with movement of the knee there was a loud, snapping sound again and much of the pain was relieved. The knee swelled and he was confined to

bed 1 week. Thereafter he had pain in his right knee joint with weightbearing. Twelve days before the examination on March 20, 1968, he had an acute, painful swelling of the right knee joint which had begun spontaneously when he was in bed. Examination revealed a tender swelling of the right knee and fluid in the suprapatellar pouch. Motion of the right knee was from 60° to 90° and a genu varum deformity was present. Aspiration of the knee joint and subsequent culture revealed β -hemolytic streptococcus; an incision and drainage of the knee joint was performed. The infection cleared after incision, drainage, and treatment with penicillin. He returned to work several months later.

Pain and stiffness in the left knee joint began in 1968 mainly on the medial side with weightbearing. There was no history of trauma to the left knee joint. He was examined again on November 30, 1971, for

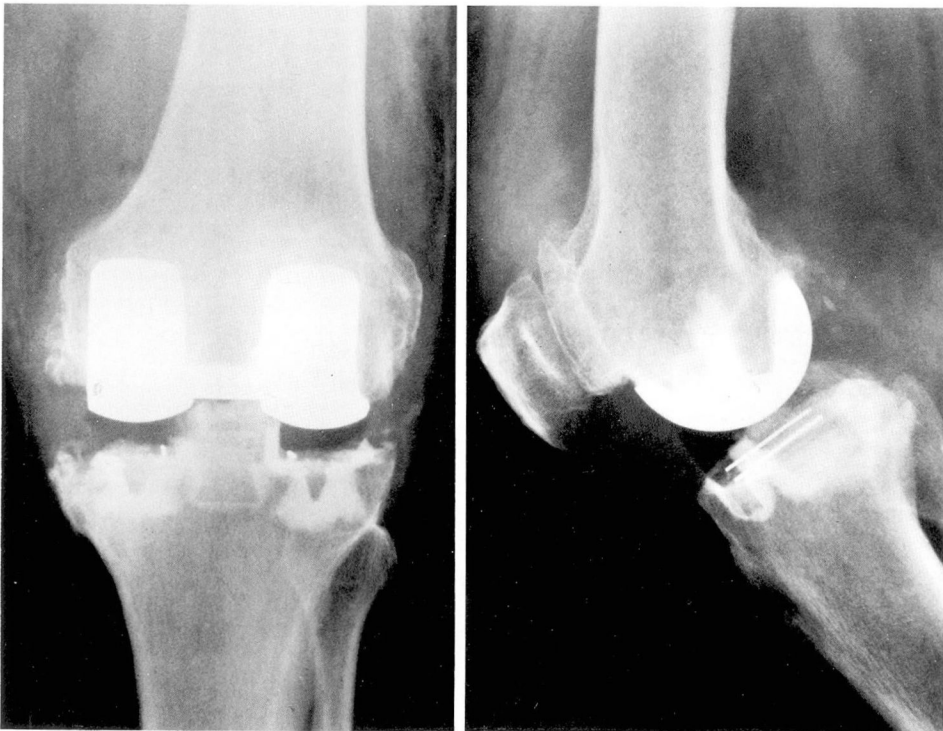


Fig. 2. Anteroposterior and true lateral roentgenograms after geometric total knee replacement. Many of the osteophytes have been removed, and the varus deformity has been largely corrected.

pain in both knee joints, more severe in the left than the right. Examination revealed bilateral genu varum. Motion was 25° to 90° flexion in the left knee and 30° to 60° in the right knee. There was gross crepitus with motion of both knees. The knee score on the left knee was 54 points out of a possible 100. Roentgenograms of both knee joints revealed severe degenerative arthritis. The degenerative changes in the right knee were caused by osteoarthritis and old infection. The changes in the left knee were caused by primary osteoarthritis (*Fig. 1*).

A geometric total knee replacement arthroplasty was performed on the left knee March 1, 1972. Full extension and good stability resulted. Postoperatively there were no complications and the patient was discharged on March 22, 1972. He walked with the aid of a cane. Postoperative roentgenograms revealed satisfactory placement of the prosthesis and correction of the genu varum deformity (*Fig. 2*). He returned to work as a boiler fireman. When last examined on September 11, 1972, the patient's only complaint referable to his left knee was some aching during inclement weather. He did not use a cane or other external aids. The motion in the left knee was from 10° to 90° flexion. There was a 5-degree varus with weightbearing. There was no instability and the knee score postoperatively was 90 points out of a possible 100. Pain in the right knee, the site of previous sepsis, has continued.

Summary

A new form of knee arthroplasty, the geometric total knee replacement, appears promising for the treatment of severe osteoarthritis. The geometric total knee replacement corrects articular damage on both femoral and tibial sides of the joint and can be applied in cases of severe osteoarthritis which are

not suitable for treatment by osteotomy or arthrodesis.

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