



## Revision of the Gunston polycentric knee arthroplasty with total knee arthroplasty

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The Gunston polycentric knee arthroplasty, first designed and performed by Frank Gunston in 1971, is the first prosthesis considering the natural knee biomechanics. Although the polycentric knee arthroplasty showed encouraging results to relieve pain and to preserve the preoperative range of motion and joint instability, the improvements in prosthesis design and arthroplasty technology rapidly made the polycentric knee prosthesis obsolete. Herein, we report a 58-year-old male patient who had revision of the Gunston polycentric knee arthroplasty with total knee arthroplasty performed 32 years after the initial operation.

**Key words:** Arthroplasty; knee; polycentric knee; revision.

In 1971, a later version of Macintosh acrylic tibial plateau prosthesis combined with metal femoral component was recommended for patients with rheumatoid arthritis.<sup>[1]</sup> Polycentric total knee arthroplasty was the first non-constrained metal-polyethylene bearing surface replacement used in the knee joint. It was first performed by Frank Gunston who designed the polycentric components with Sir John Charnley.<sup>[1]</sup> It was first used in patients with severe arthrosis with no alternative procedures except arthrodesis. Only short tibial blocks and two sizes of femoral components were used with bone cement.<sup>[2]</sup>

Polycentric total knee arthroplasty was reported to provide significant relief of pain in 86% of 500 knees. The independence and activity levels of the patients increased dramatically.<sup>[2]</sup>

The advances in prosthesis implantation and design technology solved more problems than the polycentric total knee prosthesis in the last two decades. We present a case of Gunston polycentric knee arthroplasty revised with knee arthroplasty. To

our knowledge this is the last case worldwide that was revised with the revision knee arthroplasty.

### Case report

A 58-year-old man admitted to orthopedic clinic with right knee pain which worsened in the last six months. He underwent unilateral polycentric knee arthroplasty with diagnosis of rheumatoid polyarthrititis 32 years ago. He also had a hip arthroplasty operation 9 years ago for the same reason.

Knee motions were limited to 50° of flexion and full extension. Varus test was painful with grade I laxity. There was mild effusion and tenderness in the joint line. He was using one crutch on the opposite site for the last 3 years, and two crutches for the last 6 months.

Plain radiography revealed obliteration of the joint space with subsidence of the prosthetic components. Periprosthetic loosening and cystic degeneration was remarkable on the medial side (Fig. 1a and 1b).



**Fig. 1.** Preoperative (a) anteroposterior and (b) lateral radiographs of the knee with Gunston prosthesis.

Under combined epidural anaesthesia, the previous incision scar was used for a medial para-patellar approach. Due to the contracture of the extensor mechanism, patella was everted laterally after V-Y release of quadriceps tendon. The tibial and femoral components were loose in medial side, and easily removed (Fig. 2). Lateral components were stable and bony overgrowth covered the femoral side anteriorly. Lateral components were removed with osteotome, and cement remnants were cleared care-

fully. After debridement of the joint, a posterior stabilising knee prosthesis with both femoral and tibial stems was applied. Autograft bone was impacted to reconstitute the femoral and tibial defects. The prosthesis was then cemented in a standard fashion.

Postoperative rehabilitation involved splinting of the knee in extension for 3 days, and then a standard regimen of active range of motion exercises with partial weight bearing progressing to full weight bearing



**Fig. 2.** Intraoperative view of the knee joint with Gunston prosthesis



**Fig. 3.** Postoperative lateral radiograph of the revision of Gunston prosthesis.

over a 6 weeks period. Full extension and 60° of flexion were gained with good quadriceps power.

Follow-up radiographs have demonstrated good incorporation of the graft in one year following surgery. It is now almost six years after the revision surgery, and the patient is in the operating list for the other side with no problem with the revised one (Fig. 3).

## Discussion

Gunston and MacKenzie<sup>[1,3]</sup> used the basic concept of substituting metallic runners embedded in the femoral condyles and adding polyethylene extensions attached to the tibial plateau. The components were fixed rigidly to the bone by using acrylic cement, which makes the Gunston polycentric prosthesis one of the first cemented surface replacement of the knee. Polycentric knee arthroplasty was designed to simulate opposing joint surfaces by separate implants for each joint surface. Collateral and cruciate ligaments are both retained to maintain joint stability. The unconnected prosthetic articular surfaces are subjected to mainly compression loading.<sup>[3]</sup> The patella may be retained because no impingement of the patella on the prosthesis occurs, but the polycentric design does not offer a solution to the problem of patellofemoral arthritis. Another problem with this design is that the weak proximal metaphyseal surface of the tibia in rheumatoid bone could not show sufficient strength to resist subsidence of the tibial components and offer poor resistance to shear stress.<sup>[4,5]</sup>

Many modes of failure for the polycentric knee arthroplasty were reported. Revision due to the patellofemoral involvement was the first complication for the rheumatoid arthritis patients. Dislocation and subluxations were the main complications resulting from the ligamentous laxity in the presence of

unbalanced soft tissue forces or uncontrolled recurvatum. Loosening was another cause of failure invariably affecting the tibial components.<sup>[6,7]</sup>

As a conclusion, although the polycentric knee arthroplasty showed encouraging results to relieve pain, to preserve the preoperative range of motion and joint instability, the improvements in prosthesis design and arthroplasty technology rapidly made the polycentric knee prosthesis obsolete. The long survival of the prosthesis presented here may be misleading. Limited mobilization of this rheumatoid patient with additional support of crutches for a long time period may retard the need of revision. The presented case may be one of the last Gunston polycentric knee arthroplasty case revised with the revision knee arthroplasty.

## References

1. Gunston FH. Polycentric knee arthroplasty. Prosthetic simulation of normal knee movement. *J Bone Joint Surg Br* 1971;53:272-7.
2. Skollnick MD, Bryan RS, Peterson LF, Combs JJ Jr, Ilstrup DM. Polycentric total knee arthroplasty. A two-year follow-up study. *J Bone Joint Surg Am* 1976;58:743-8.
3. Gunston FH, MacKenzie RI. Complications of polycentric knee arthroplasty. *Clin Orthop Relat Res* 1976;(120):11-7.
4. Bryan RS, Peterson LF. Polycentric total knee arthroplasty: a prognostic assessment. *Clin Orthop Relat Res* 1979;(145):23-8.
5. Thomas BJ, Cracchiola A 3rd, Lee YF, Chow GH, Navarro R, Dorey F. Total knee arthroplasty in rheumatoid arthritis. A comparison of the polycentric and total condylar prostheses. *Clin Orthop Relat Res* 1991;(265):129-36.
6. Jones WT, Bryan RS, Peterson LF, Ilstrup DM. Unicompartamental knee arthroplasty using polycentric and geometric hemicomponents. *J Bone Joint Surg Am* 1981;63:946-54.
7. Lewallen DG, Bryan RS, Peterson LF. Polycentric total knee arthroplasty. A ten-year follow-up study. *J Bone Joint Surg Am* 1984;66:1211-8.