

Posteriorly Stabilised Total Condylar Knee Replacement

Syed Ghazanfar Ali Shah, Pervaiz Iqbal

Department of Orthopaedics, Sheikh Zayed Hospital Lahore.

SUMMARY

We have reviewed 10 knees in 8 patients after total condylar posteriorly stabilised (Insall Burstein) knee replacement with average follow-up of 18 months. Excellent or good results were obtained in 80 percent with average maximum flexion of 95 degrees. Two fair results included one with mild subluxation of the knee and other with lateral subluxation of patella. No knee showed signs of probable tibial loosening. The patellar impingement symptoms were present in one patient (10%). The virtue of prosthesis lies in its versatility for use in severely deformed joint.

The modern era of total knee arthroplasty began with the Gunston report in 1971 of his experience with minimally constrained total knee arthroplasty and the reported results have improved consistently with time[1,2,3]. Early designs were associated with many problems, which frequently led to early failure[4,5]. In 1974, the total condylar knee prosthesis was introduced and it is one of the first designs to be associated with good early results[6] and long term result better than average total hip arthroplasty[7]. As described by Insall et al[6], the basic surgical technique for inserting the prosthesis has always included excision of cruciate ligaments, balancing of collateral ligaments and creating equal space for flexion and extension.

The posterior stabilised condylar knee is a development of the total condylar design by providing more active and concrete posterior cruciate substitution[8]. This function was assumed by a central spine in tibial component, which articulates against a transverse cam on the femoral component thus increasing the range of movement and providing stability in flexed position.

This study is a preliminary report of experience at Sheikh Zayed Hospital regarding the use of posteriorly stabilised total condylar knee prosthesis. The aim of this study included evaluating the results of this prosthesis in group of patients from our social, cultural and economic setup and determining its limitations in our customs where the majority of population has to perform its social duties while sitting or squatting on the floor.

MATERIALS AND METHODS

From September 1986 to August 1989, a total of 10 knees in 8 patients were replaced at Department of Orthopaedics Sheikh Zayed Postgraduate Medical Institute Lahore. There were 6 females (75%) and 2

males (25%). The average age was 54.1 years (range 45-65). Out of eight, five patients had associated illness like diabetes, hypertension, and ischemic heart disease. Four were taking steroids for the last 3-9 years. The average hospital stay was 16 days. No patient died during this period and all were regularly followed up.

Table 1: Preoperative clinical and radiographic detail of 10 knee replacement in 8 patients.

	Number	Percent
Diagnosis		
Osteoarthritis	03	30
Rheum. arthritis	07	70
Category		
Unilateral disease	02	20
Bilateral disease	08	80
Unilateral operation	08	80
Bilateral operation	02	20
Simultaneous Surgery		
Ipsilateral hip and knee replacement	01	10
Previous surgery		
Tibial osteotomy	00	00
Synovectomy	00	00
Other	00	00
Deformity (degrees)		
Varus	06	60
mean	13	
range	5-20	
Valgus	03	30
mean	15	
range	10-20	
Flexion contracture	09	90
mean	24	
range	5-40	
No deformity	01	10
Maximum flexion		
mean	65	
range	10-100	
Stiff knee (ROM < 50°)	01	10
Ankylosed Knee	00	00
ROM, range of movement		

Technique of operation

All patients were operated by single surgeon (GA Shah) in conventional operation theatre with ultra violet lamp facilities but no laminar flow system of sterilisation. The standard surgical technique was employed⁹. Anterior mid line incision was applied in all patients. We used original instrumentation with tensor device and mechanism for securing bony fixation. We aimed at valgus alignment of 6-10 degrees. Metal backed tibial components were not used due to non-availability in this country. The routine ligament release was used to correct angulation. This facilitates the insertion of prosthesis without excessive bone resection. The minimal tibial resection at 90 degrees to the axis of the tibia is very important. We agree with Dorr¹⁰ that in varus knee, not more than 5 mm of bone on the medial and 10 mm on the lateral side should be removed as to preserve the stonger subchondral bone¹¹. Flexion contractures of 20-25 degrees were automatically corrected by a slightly more generous distal femoral resection and more severe contracture required a posterior capsulotomy. In all patients patella was resurfaced. All patients received one gram of Inj. Kefzol/Vclosef before application of pneumatic tourniquet while two ampules of Inj. Zinacef 750 mg. were mixed in bone cement.

Postoperative care

Postoperatively, knee was placed in bulky soft dressing. Intravenous antibiotics were administered for 48 hours and were stopped after removal of suction drain. The bulky dressing was removed on third postoperative day and a less bulky dressing applied. The patients were then allowed to walk using crutches in department of physiotherapy and active flexion exercises were delayed for one to two week. Manipulation under anaesthesia was not performed in any patient. All patient were put on Tab. Disprin 300 mg once a day to give prophylaxis against deep venous thrombosis. Continuous passive motion exercises (CMP) were not used in any patient.

Clinical evaluation

Preoperatively and postoperatively, all patients were evaluated, using the rating scale of Hospital for Special Surgery¹². Of the 100 points for a normal knee, 30 points are for lack of pain,, 22 for function, 18 for range of movements and 10 each are for muscle strength, absence of flexion deformity and stability.

Radiological evaluation

Standard anteroposterior radiographs taken on a

30 cm by 40 cm x-ray film were obtained. With a standard lateral view and a sky-line view at 45 degrees¹³. The x-ray beam was aligned parallel to the prosthesis-bone interfaces by the use of an image intensifier and these interfaces at all three components were studied by a zone method⁸. The ideal position for the tibial component was considered to be at 90 degrees plus minus 2 degrees to the long axis of tibia in frontal plane. In sagittal plane, we accepted up to 5 degrees of posterior tilt but no anterior tilt. The ideal position for the femoral component was considered to be 6-10 degrees of valgus, with anterior flange of the femoral component flush with the anterior cortex.

RESULTS

(Table 2 to 6). The mean follow-up was 18 months (range 2 to 36 months). The average knee score increased from 45 to 85. Four knees had excellent result while four knees had good result. Of the two fair results, one had subluxation of the knee one month after surgery and second had multiple joint involvement due to rheumatoid arthritis.

The walking distance was over 500 meter in both patients with osteoarthritis and two patients with rheumatoid arthritis. Five patients could ascend stairs with or without use of a hand rail.

Table-2: Comparative results of posteriorly stabilised total condylar knee replacement given as numbers and percentages.

	Knees replaced	Knees evaluated	% O.A.	Follow-up years
Insall et al. 1982 ⁸	133	118	92	2-4
Scott and Robinstein 1986 ¹⁹	62	56	86	3-6
Aglicetti and Buzzi 1988 ¹⁴	95	85	72	3-8
Shah and Iqbal 1989	10	10	20	2/12-3

The maximum postoperative flexion was 125 degrees while four knees had more than 100 degrees. A residual flexion contracture of 10 degrees was found in two knees. The symptoms of patellar impingment were found in one patient.

Total Condylar Knee Replacement

Table-3: Comparative results of posteriorly stabilised total condylar knee replacement given as numbers and percentages.

	Score Pre/postop.	Excellent results	Good results
Insall et al. 1982 ²⁸	50/90	88	9
Scott and Robinstein 1986 ¹⁹	47/90	87	7
Aglietti and Buzzi 1988 ¹⁴	40/80	38	50
Shah and Iqbal 1989	45/85	40	40

Table-4: Comparative results of posteriorly stabilised total condylar knee replacement given as numbers and percentages.

	Max. Flex. pre/postop.	Unlimited walking	Stairs normally
Insall et al. 1982 ²⁸	95°/115°	76%	76%
Scott and Robinstein 1986 ¹⁹	88°		
Aglietti and Buzzi 1988 ¹⁴	90°/98°	12%	17%
Shah and Iqbal 1989	90°/125°	20%	30%

Table-5: Comparative results of posteriorly stabilised total condylar knee replacement given as numbers and percentages.

	Impingment symptoms	Patellar stress Fx.
Insall et al. 1982 ²⁸	2.5%	11%
Scott and Robinstein 1986 ¹⁹		5%
Aglietti and Buzzi 1988 ¹⁴	20%	0
Shah and Iqbal 1989	10%	0

Radiographic results

The ideal position for the tibial component was obtained in 9 knees. There was no correlation between tilt from 2 degrees anteriorly to 8 degrees posteriorly and any subsequent radiolucency.

The ideal position for the femoral component with 6-10 degrees of valgus was achieved in 7 knees (70%). There was 0-5 degrees of valgus in 2 knees (20%) and 11-15 degrees in one knee (10%). The anterior flange of femoral component was not flush with the distal femoral cortex in one knee (10%); the femoral component had been cemented in slightly flexed position.

Table VI: Comparative results of posteriorly stabilised total condylar knee replacement given as numbers and percentages.

	Insignificant tibial lucent lines	Probable loosening	Reoperation
Insall et al. 1982 ²⁸	31%	0	1%
Scott and Robinstein 1986 ¹⁹	41%	9%	0
Aglietti and Buzzi 1988 ¹⁴	55%	5%	2%
Shah and Iqbal 1989	20%	0	0

There were insignificant radiolucent lines (less than two mm and non progressive) in two patients (20%) but there was no loosening.

Complications

One patient presented with mild subluxation of the knee, one month after surgery. It was managed by plaster cylinder in extension for 3 weeks. The recovery was smooth and uneventful later on.

The wound healing was delayed in two patients. Both had rheumatoid arthritis and were taking steroid for the last 3-9 years. Active flexion was delayed for 3 weeks but weight bearing was allowed. Wounds healed without subsequent problems.

One patient had difficulty in mobilisation because of surgery of right wrist along with left total knee replacement. She was patient of rheumatoid arthritis with multiple joint involvement. Her right knee had already been replaced. She was depressed and had less than desired motivation to get up from bed. However, with intensive efforts of department of physiotherapy, she was able to walk with help of a walker 25 days after surgery.

One patient presented with mild lateral subluxation of patella 6 weeks after surgery. The most likely cause was inadequate lateral release at time of surgery.

DISCUSSION

Although no controlled study has been performed, but most of senior orthopaedic surgeons of the country agree that osteoarthritis of the knee is more common as compared to osteoarthritis of the hip, and it presents at an early age group, in this part of the world. This is most likely due to our sitting, praying, eating and working habits, which need squatting. The use of indian

outdoor toilets also put excessive stress and strain on knees due to extreme flexion. Primary osteoarthritis cripples a significant segment of our productive population in their early fifties. This assumption is supported by our clinical experience and this study in which the average age of patients at the time of orthoplasty was 54.1 years, about a decade less than average age in western studies[2,7,14].

The knee is frequently involved in patients with long standing rheumatoid arthritis. Although involved at the onset of disease in only 8 percent of patients[15] early in course of disease process, one or both knees will be involved in nearly 90 percent of patients. Involvement is unilateral in 30-35 percent. By comparison, the hip is involved early in the course of the disease in fewer than 10 percent,, and fewer than 40 percent of patients with long-standing RA have hip involvement[16]. Frequent involvement of both upper extremities make the mobilisation both difficult and painful. For this reason, it is highly desirable to achieve at least 105 degrees of flexion in patients undergoing knee arthroplasty for rheumatoid arthritis[17]. Skeletal immaturity may not be a contraindication to surgical treatment if the patient is bedridden with progressive deformity[18].

In our series, 7 knees (70%) had rheumatoid arthritis while 3 knees (30%) had osteoarthritis. The percentage of osteoarthritis in total knees replaced varies from 72-92 in various studies[8,14,19]. It is the most important factor in lower postoperative average knee score in our patients.

Posterior subluxation of tibia occurred in one of our patients postoperatively because tight fit in flexion was not achieved at operation. She was obese lady with flexion contracture of 40 degrees at right knee which needed extensive soft tissue release. Although retension of posterior cruciate ligament can prevent posterior subluxation, but presence of this ligament makes collateral ligament balance more difficult. Preservation of posterior cruciate ligament in severely deformed knees is rarely practicable [2].

It is a small series and follow up is very short. We cannot compare our results with that reported by the designer of the prosthesis[8]. But we support his contention that replacement of function of posterior cruciate ligament does not adversely affect the results at eight years. The prosthesis can be used for wide range of deformities, while cruciate sparing prosthesis are more difficult to insert.

The posterior stability mechanism had been said to increase tangential shear stresses on the tibial

component[20] and it has been suggested that it is better to preserve the posterior cruciate ligament, which will transfer stress directly to bone[17]. Although this ligament is present in most joints for replacement and can be preserved in the less deformed ones, it is difficult to achieve the correct tension. Technical difficulties are compounded by the consequent need to maintain the joint line at its original level[21] and to advance the collateral ligament on the convex side in cases of severe deformity.

Patellofemoral problems provide the most frequent complication; incidence as high as 20 percent has been reported[14]. In our series it was 10 percent. The impingement symptoms are due to the patella and the proximal soft tissue rubbing against the anterior edge of the femoral component. Impingement has decreased in frequency and in severity after the introduction of a modified femoral component; it was more common when the patella was lower than usual. The patella is low because the tibial component is thicker than the amount of bone resected[22]. We should not try to lower the patella more than 10 mm, but consider patella "baja" a small price to pay for stable knee with good tibial fixation. The imposed posterior roll-back do not cause patellar problems; this actually improves the moment arm[23].

Ninty degrees of flexion has been generally considered as the minimum amount necessary for the daily life in western societies. In our society patient demand greater flexion postoperatively due to cultural needs. Shoji, Yoshing and Komagamine[24] have reported Y/S total knee arthroplasty system with improved range of motion. In their series 39 out of fifty patients were able to squat fully with a minimum follow-up period of 1.5 years. Because the contact area of the joint shifts far posteriorly in deep flexion, the articular surface of the tibial component was flattened to the posterior end to allow a sliding and rolling motion of the femoral condyle to the posterior region. While the articular surface was elevated anteriorly to provide an intrinsic stability within the prosthesis for extension and less flexion range, together with intercondylar eminence of the tibial component, the posterior edge of the center was cut out to so that it could be used to retain the posterior cruciate ligament. We think this prosthesis will suit best to social requirements of our country. We hope to start using this prosthesis in the near future.

One of our patients had rheumatoid arthritis involving both hips and knees. He was on steroids for the last 5 years. His left hip and knee were replaced in the same operation 15 months after his right knee

Total Condylar Knee Replacement

arthroplasty. The main indication for multiple joint replacement in this patient was severe restriction of activity due to pain and deformity resulting from joint destruction. The patient had smooth postoperative course and follow-up after one year revealed excellent result of both knees and left hip.

Ipsilateral and bilateral hip and knee replacement have been reported in literature. Johnson[25] reported 11 patients who had bilateral hip and knee arthroplasties and suggested that hips should be replaced before the knees. This advice has been well supported by other workers[26,27]. The replacement of two joints under single anaesthesia has advantages such as reducing the hospital stay and therefore cost to the patient. We agree with Head and Paradies[28] that shorter rehabilitation is of significant value in increasing the motivation of the patient towards good function. However, we keep in mind the increased incidence of pulmonary embolism[29], wound problems[30], and ectopic bone formation[31] associated with double replacement.

Total condylar knee arthroplasty is a safe, durable and predictable procedure and has a longer survivorship than hip arthroplasty. With proper surgical technique, it is possible to restore the mechanical axis of the knee with stability and 90 degree or more painfree range of motion. The arthroplasty fails at times due to early or late infection, mechanical loosening, instability, and fractured patella.

REFERENCES

1. Freeman MAR, Samuelson KM, Levack B, de Alencar PG. Knee arthroplasty at the London Hospital: 1975-84. *Clin Orthop* 1986; 205:12-20.
2. Insall JN, Hood RW, Flawn LB, Sullivan DJ. Total condylar knee prosthesis in gonarthrosis: a five to nine year follow-up of first one hundred consecutive replacements. *J Bone Joint Surg* 1983; 65-A: 619-28.
3. Ranawat CS, Rose HA. Clinical and radiographic results of total condylar knee arthroplasty: a 3-8 years follow-up. In: Ranawat CS, ed. *Total condylar knee arthroplasty: technique, results and complications*. New York: Spring-Verlag, 1985; 140-8.
4. Hamilton LR. UCI total knee replacement: a follow-up study. *J Bone Joint Surg* 1982; 64-A:740-4.
5. Lewallen DC, Bryan RS, Peterson LF. Polycentric total knee arthroplasty: a ten year follow-up study. *J Bone Joint Surg* 1984; 66-A:1211-8.
6. Insall JN, Scott WN, Ranawat CS. The total condylar knee prosthesis: a report of two hundred and twenty cases. *J Bone Joint Surg* 1979; 61-A:173-80.
7. Ranawat CS, Boachie-Adjei O. Survivorship analysis and results of total condylar knee arthroplasty: Eight to eleven years follow-up period. *Clin Orthop* 1988; 226: 6-13.
8. Insall JN, Lachiewicz PF, Burstein AH. The posterior stabilised knee prosthesis, a modification of the total condylar design: two to four year clinical experience. *J Bone Joint Surg* 1982; 64-A: 1317-23.
9. Insall JN. Total knee replacement. In: Insall JN ed. *Surgery of the Knee*. New York: Churchill Livingstone, 1984; 587-695.
10. Dorr LD. Complications: loosening of the cement-bone interface after total knee arthroplasty: technique, results and complications. New York: Spring-Verlag, 1985: 173-85.
11. Sneppen O, Christensen P, Larsen H, Vang PS. Mechanical testing of trabecular bone in knee replacement: development of an osteopenetrometer. *Int Orthop* 1981; 5: 251-6.
12. Insall JN, Ranawat CS, Algietti P, Shine J. A comparison of four models of total knee replacement prosthesis. *J Bone Joint Surg* 1976; 58-A: 754-65.
13. Merchant AC, Mercer RL, Jacobsen RH, Cool CR. Roentgenographic analysis of patellofemoral congruence. *J Bone Joint Surg* 1974; 56-A: 1391-6.
14. Algietti P, Buzzi R. Posteriorly stabilised total-condylar knee replacement. three to eight years follow-up of 85 knees. *J Bone Joint Surg* 1988; 70-B:211-6.
15. Fleming A, Benn RT, Corbett M, et al. Early rheumatoid disease: II patterns of joint involvement. *Ann Rheum Dis.* 1976; 35: 361.
16. Jacoby RK, Jayson MIB, Cosh JA. Onset early stages and prognosis of rheumatoid arthritis: a clinical study of 100 patients with 11 years follow-up. *Br Med J* 1973; 2: 96.
17. Sledge CB, Walker PS. Total condylar knee arthroplasty in rheumatoid arthritis. *Clin Orthop* 1984; 182: 127-36.
18. Sarokhan TAJ, Scott RD, Thomas WII, et al. Total knee arthroplasty in juvenile rheumatoid arthritis. *J Bone Joint Surg* 1983; 64-A: 1071-80.
19. Scott WN, Robinstein M. Posterior stabilized knee arthroplasty: six years experience. *Clin Orthop* 1986; 205: 138-145.
20. Ranawat CS. Future trends in arthroplasty. In: Ranawat CS. ed. *Total condylar knee arthroplasty: technique, results and complication*. New York: Spring-Verlag 1985:168-71.
21. Dorr LD, Boiardo RA. Technical considerations in total knee arthroplasty. *Clin Orthop* 1986; 205: 5-11.
22. Figgie E III, Goldberg VM, Heiple KG, Moller IIS III, Gorden NII. The influence of tibial-patellofemoral location on function of the knee in patients with the posterior stabilized condylar knee prosthesis. *J Bone Joint Surg* 1986; 68-A: 1035-40.
23. McLain RF, Bargar WF. The effect of total knee design on patellar strain. *J Arthr* 1986; 1: 91-8.
24. Shoji H, Yoshino S, Komagamine M. Improved range of motion with the Y/S total knee arthroplasty system. *Clin Orthop* 1987; 218: 150-63.
25. Johnson KA. Arthroplasty of both hips and both knees in rheumatoid arthritis. *J Bone Joint Surg* 1975; 57-A: 901-4.
26. Arafles RP, Gustilo RB. Joint replacement in non ambulatory patients. *J Bone Joint Surg* 1979; 61-A: 892-7.
27. McElwain JP, Sheehan JM. Bilateral hip and knee replacement for rheumatoid arthritis. *J Bone Joint Surg* 1985; 67-B: 261-5.
28. Head WC, Paradies LH. Ipsilateral hip and knee replacements as a single procedure. *J Bone Joint Surg* 1977; 59-A: 352-4.
29. Gradillas EL, Volz RG. Bilateral total knee replacement under one anaesthesia. *Clin Orthop* 1979; 140: 153-8.
30. Ritter MA, Stringer EA. Bilateral total hip arthroplasty: a single procedure. *Clin Orthop* 1980; 149: 185-90.
31. Barcy D, Wroblewski BM. Bilateral charnley arthroplasty as a single procedure: a report on 400 patients. *J Bone Joint Surg* 1981; 63-B: 354-6.

The Authors

Prof. Syed Ghazanfar Ali Shah.
F.R.C.S.
Diplomate American Board in Orthopaedic Surgery.
Professor and Head,
Department of Orthopaedics,
Shaikh Zayed Hospital
Lahore.

Dr. Pervaiz Iqbal.
M.B.B.S.,
Registrar,
Department of Orthopaedics,
Shaikh Zayed Hospital
Lahore.

Address for Correspondence

Prof. Syed Ghazanfar Ali Shah.
F.R.C.S.
Diplomate American Board in Orthopaedic Surgery.
Professor and Head,
Department of Orthopaedics,
Shaikh Zayed Hospital
Lahore.