International Journal of Orthopaedics Sciences

ISSN: 2395-1958
IJOS 2019; 5(3): 58-64

www.orthopaper.com
Received: 07-05-2019
Accepted: 09-06-2019

Dr. HS Chandrashekar
Professor of Orthopedics, Director of Sanjay Gandhi Institute of Trauma and Orthopedics Department, Orthopedics Rajiv Gandhi University of Health Sciences, Karnataka India

Dr. M Shekar
Professor of Orthopedics, Director of Sanjay Gandhi Institute of Trauma and Orthopedics Department, Orthopedics Rajiv Gandhi University of Health Sciences, Karnataka India

Dr. M Devendra
Senior resident, Sanjay Gandhi Institute of Trauma and Orthopedics, Department Orthopedics, Rajiv Gandhi University of Health sciences, Sanjay Gandhi Institute of Trauma and Orthopedics, Karnataka Indi

Correspondence
Dr. M Shekar
Professor of Orthopedics, Director of Sanjay Gandhi Institute of Trauma and Orthopedics Department, Orthopedics Rajiv Gandhi University of Health Sciences, Karnataka India

Cruciate retaining versus posterior-stabilized total knee arthroplasty: A short-term comparative study

Dr. HS Chandrashekar, Dr. M Shekar and Dr. M Devendra

DOI: https://doi.org/10.22271/ortho.2019.v5.i3b.1508

Abstract
Background: Total knee arthroplasty is a well-established procedure in the management of terminal stage arthritis. Among the techniques (posterior-stabilized vs posterior cruciate retaining total knee arthroplasty) it is unclear whether one design has superior outcome over another. The purpose of the present study was to directly compare clinical and radiological outcomes of these two designs.
Methods: A prospective study involving 29 patients who received a cruciate-retaining implant were compared to 30 patients who received posterior-stabilized prosthesis. The patients were followed up at 3 monthly intervals in the first year and 6 monthly thereafter. At 2years follow-up time clinical and radiological evaluation done and results were analyzed.
Results: At 2 years follow-up time mean knee society scores improved from 47.19/34.2 (clinical/functional score) points to 91.9/89.25 points in the cruciate-retaining group and from 46.2/37.5 (clinical/functional score) points to 93.4/92.2 points in the posterior-stabilized group. The ranges of motion were 120.2° (range, 90° to 130°) and 125.3° (range, 100° to 140°) in the cruciate-retaining and posterior-stabilized group respectively, at 2-year follow-up. One had superficial infection (treated with dressing) and one patient with superficial infection required debridement.
Conclusions: This study did not conclusively demonstrate the superiority of one knee design over the other, but clinical and functional score and range of motion were marginally better in patients with posterior stabilized implants which were not statistically significant.

Keywords: Posterior-stabilized, arthroplasty

Introduction
Total knee arthroplasty is terminal and effective available surgical treatment for arthritis of knee joint. Survivorship of cemented TKA rages from 91%-99% over 10 years and 91%-96% over 15 years. Many authors have now reported long-term survivorships of well over 75% at 15- to 20-year follow-up. Numerous implant designs have been developed to improve the durability and function of these procedures. However, there has been controversy regarding techniques. The debate regarding the superiority of cruciate retaining or posterior stabilized design stated right since the very inception of the two designs.
Cruciate retaining techniques preserves posterior cruciate ligament. This design has advantages of bone preservation, increased proprioception, reduced shear stress at fixation interface, near normal knee kinematics and greater stabilization of the prosthesis and more effective femoral roll back (PCL preventing anterior translation of the femur on the tibia). Posterior-stabilized implants have got a polyethylene post and femoral cam to replace the role of the PCL. During extension post and cam interact to prevent anterior translation of the femur on the tibia, while allowing femoral rollback during flexion. Potential advantages of these designs include a less technically demanding procedure, a more stable component interface, predicted femoral rollback and increased range of motion [7, 9, 11].
Recent studies have shown high short- and midterm success rates of both designs, but there is no consensus about superiority of one design over another [12-16]. The purpose of the present study was to directly compare clinical and radiological outcomes, and complications of two groups of patients who received cruciate-retaining or posterior-stabilized implant and provide guidance to surgeon on selecting implant for particular patient.

Methods

The prospective study carried out on 59 patients, who had been operated for primary total knee arthroplasty at Sanjay Gandhi institute of trauma and orthopedics. Patients were included in our study selected on basis on inclusion and exclusion criteria. The study lasted from June 2016 to June 2018.Patients with osteoarthritis, rheumatoid arthritis and post traumatic arthritis of knee who required total knee arthroplasty, were included in study. Patients who underwent revision knee arthroplasty and who lost follow-up were excluded from study. Informed written consent was taken from all patients. Cases were divided in two groups depending upon type of implantation they received. The patients were matched for the age, sex and degree of preoperative deformity. The criteria for cruciate ligament retention were

1. Structurally intact PCL.
2. Fixed flexion deformity of <20°
3. Varus deformity of <20°
4. Valgus deformity of <20º.

Pre-operatively, patients clinically and radiologically evaluated. Clinical evaluation involved history, thorough examination, BMI (Body mass index) calculation and knee society score.[17] Radiological evaluation done on standing weight bearing antero-posterior x-ray and lateral x-ray (knee 90 flexed).

Patients were operated in standard arthroplasty operative setup. All Surgeries done using midline anterior skin incision followed by medial parapatellar arthrotomy [19, 20]. Femoral and tibial cuts taken with help of intra-medullary and extra-medullary jig respectively. Negative suction drain was kept for 24 hours in all patients. Physiotherapy was started from 1st postoperative day. Full weight bearing walking with support started from 2nd post- op day and stair climbing was allowed from 7th post-op day. All patients were discharged on 5th or 6th post op day. Physiotherapy was advised for 2-3 weeks. Stitches were removed on 14th post-op day. After that support gradually weaned off over period of 2 weeks. All patients re-evaluated clinically, radio logically (as it was done pre-operatively) and for complications after 3 months, 6months 1year and at 6 monthly intervals thereafter. Data was recorded and was analyzed.

Results

There were 59 cases included in study with mean age of 62.5±7 years (45–80 years) (Table 1). Male to female ratio was 1: 2.1 (21/45) (Table 2). Mean BMI (Body mass index) of patients was 28±4 kg/m^2. In 27 cases, left knee was operated, in 32 cases right knee was operated. (Table 3).51 patients had primary osteoarthritis, 4 patients had associated rheumatoid arthritis, 2 patients had pseudo out, 2 patients' post-traumatic osteoarthritis. 51 cases had varus alignment in which predominantly medical compartment was involved. 4 cases had valgus alignment in which predominantly lateral compartment was involved and 4 cases had neutral coronal alignment in which both compartments were equally involved.

Table 1: Age distribution

Age (in years)	Number of cases
<40	0
40-50	4
51-60	19
61-70	23
71-80	12
>80	0

Table 2: Sex distribution.

Sex	No. of patients
Female	21
Male	38

Table 3: Operated side.

Side	Number of patients
Left	27
Right	32

About 40 patients had medical history of hypertension, 18 patients had history of diabetes mellitus, 4 patients had thyroid disorders.

In CR group, pre-op mean clinical and functional knee society score was 47.1 and 34.2 respectively. Average ROM observed was 92.4. In PS group, pre-op mean knee society score was 46.2 and 37.5 (clinical/functional) respectively. Observed mean ROM was 95.1°

Average surgical time was 62±8 min and average hospital stay was 5.3 days. Pre-operatively and post-operatively in all cases patella position was normal.

Post-op 12 weeks follow-up, mean ROM in CR and PS joint was 117.2° and 120.3° respectively. The knee range of motion improved to 120.2 and 125.5 at final follow up at the end of 2 years and clinical/functional knee society score corrected to 91.9/89.25 and 93.4/92.2 in CR and PS group respectively (Table 5). No statistically significant differences were found between Posterior stabilized and PCL-retaining groups when Knee society clinical scores, function scores, and flexion arc were evaluated.

Total 3 patients developed complications; one patient presented at 7th post op with superficial infection which was managed with removal of infected suture material followed by regular dressing along with oral antibiotic. Another patient presented on 6th postop day with superficial infection required superficial debridement and antibiotic treatment for a month; and one patient presented at 10th day with periprosthetic un-displaced supra-condylar femur fracture which was treated with above knee plaster.

Table 4: Clinical results.

Arthroplasty system		ROM		Knee society score (Mean)		
				Clinical score	Functional score	
		Pre-op 2 years postop		Pre-op 2year post-op		Pre-op 2year post-op
CR knees	92.4°	120.2°	47.1	91.9	34.2	89.25
PS knees	95.1°	125.3°	46.2	93.4	37.5	92.2

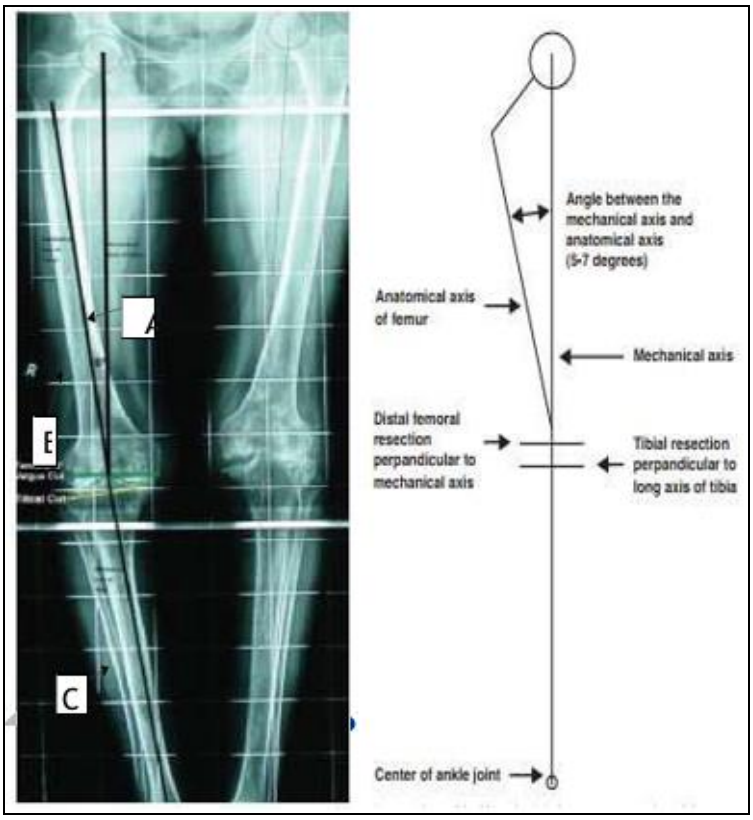

Fig 1: Pre-op radiological evaluation.

Case illustration-1

Preoperative x ray of the knee with grade 4 osteoarthritis with varus deformity operated on the left knee first

Postoperative AP and lateral x ray of left knee.

Patient was operated on the right knee 1 month later

At 6 months follow up

Case illustration-2

Pre-operative radiograph of both knees

Preoperative scanogram of both knees

Post-operative x-ray of left knee joint Post-operative scan gram with left knee joint operated

Post-operative x-ray of right knee

Post-operative knee scanogram

At 6 Months Follow Up

Discussion

Our study was conducted on 59 patients. Number of male patients was almost twice that of female patients. Major indication of the surgery was osteoarthritis of knee joint (51 patients) followed by rheumatoid arthritis (4 patients) and post traumatic arthritis (2 patients), pseudo out (2 patients). Majority of patient had medial compartmental arthritis with varus deformity (51 knees) while only 4 patients had lateral compartmental arthritis with valgus deformity (4 knees) in few patients with rheumatoid arthritis both compartments were more or less equally involved (4 knees). On radiological evaluation 96.9% of total cases had complete loss the joint space.

We have used medial para patellar approach in all cases. Patella resurfacing was not done. Because of better surgical technique, post-operative pain management and post-op rehabilitation training we could able to shorten hospital stay to less than 6 days. Complications were reported in 3 patients; one patient presented at 1 week with superficial infection which was treated with removal of infected Vicryl stitch and regular dressing along with oral antibiotic. Another patient with superficial infection required superficial debridement and antibiotic treatment for a month; so both cases required some local procedures with antibiotics to treat infection [21, 22].

Evaluating post-operative radiographs, femoral component and tibial component were almost perpendicular to mechanical axis of limb. Patella position was not altered.

The mean postoperative alignment of the knee postoperatively was 4.9^0 valgus in cruciate retaining and 5.0^0 valgus in posterior stabilized group. Several other studies have directly compared the two prosthetic designs, with mixed results. Maruyama *et al* did prospective, randomized comparison of posterior cruciate-retaining (PCR) and posterior stabilized (PS) total knee arthroplasties (TKAs) conducted in 20 patients who underwent bilateral TKAs for osteoarthritis (One knee was implanted with a PCR TKA, and a contralateral knee with a PS TKA). Patients had a clinical and radiographic evaluation at a mean of 31.7 months for PCR TKAs and 30.6 months for PS TKAs postoperatively and there were no significant differences between the PCR and PS TKAs in postoperative knee scores. However, postoperative improvement in range of motion was significantly superior in the PS group (131° versus 122°, $p<0.05$) [23]. Yoshiya *et al* performed *in vivo* kinematic analysis of 20 patients who underwent bilateral total knee arthroplasties with a posterior-stabilized implant in one knee and a cruciate-retaining implant in the other. In the PCR TKA, an anterior femoral translation from 30 degrees to 60 degrees of flexion was observed in the

weight-bearing condition indicating that the PCL might not be functioning while flexion kinematics for the PS TKA was more stable characterized by the maintenance of a constant contact position under weight-bearing conditions and posterior femoral rollback in passive flexion. They also found a greater range of motion of the knees that had posterior-stabilized implants (131°±12° versus 121°±16°) [24]. Bolanos *et al* examined fourteen patients with a posterior- stabilized prosthesis in one knee and a posterior cruciate- retaining prosthesis in the contralateral knee at mean 98 months follow-up time Hospital for Special Surgery (HSS) knee scale were evaluated by isokinetic muscle testing and comprehensive gait analysis. At mean 98 months' time no significant differences were found between the cruciate-retaining and the posterior-stabilized knees with regard to gait parameters, knee range of motion, and electromyography waveforms during level walking and stair climbing. Both knee prosthesis performed equally well [24]. Tanzer *et al* examined two groups of 20 patients who were randomized to receive cruciate-retaining or posterior-stabilized implants, they found no differences in Knee Society or radiographic scores at the two-year follow-up [26].

In our study mean knee society score (clinical/ functional) at 2-year follow-up was 93.4/ 92.2 for PS joint and 91.9/89.25 for CR joint. So there was no significant difference functional outcome as far as CR or PS knees concerned (p value 0.62 and 0.49 respectively) In 3 CR joint KSS was below 80 at 2 year follow-up, among them all the 3 had extremely low pre-op KSS. In two PS knee KSS was below 80. One had low pre-op score and one had developed post-op infection. All patients had good functional ROM at follow-up (125.3° in PS knee and 120.2° in CR knees) comparing both system PS joints had significant improvement in early ROM (18.3°) compare to CR joints (9.8°) (p=0.01).

Conclusion

The results of this study would suggest that, CR design offer normal knee kinematics and increased proprioception, preserves bone and greater stabilization of the prosthesis, with the PCL preventing anterior translation of the femur on the tibia. PS design does appear to support improved postoperative range of motion when compared with the CR design, while comparing in regards to clinical outcomes, there was no significant difference. Both designs give equal and good results. We preferred CR Knees in relatively young patients and patients with smaller knees as its bone conserving implant and PS knees in patients with Inflammatory arthritis, patient with severe varus or flexion deformity, when tibial cut is more than 10 mm and when intra-operatively findings suggestive of nonfunctional posterior cruciate ligament.

Funding: No funding sources Conflict of interest: None declared

Ethical approval: The study was approved by the institutional ethics committee

References

1. Attar FG, Khaw FM, Kirk LM, Gregg PJ. Survivorship analysis at 15 years of cemented press- fit condylar total knee arthroplasty. J Arthroplasty. 2008; 23:344-9.
2. Baker PN, Khaw FM, Kirk LM, Esler CN, Gregg PJ. A randomised controlled trial of cemented versus cementless press-fit condylar total knee replacement: 15-year survival analysis. J Bone Joint Surg Br. 2007; 89:1608-14.
3. Khaw FM, Kirk LM, Morris RW, Gregg PJ. A randomised, controlled trial of cemented versus cementless press-fit condylar total knee replacement. Ten-year survival analysis. J Bone Joint Surg Br. 2002; 84:658-66.
4. Langlais F, Belot N, Ropars M, Lambotte JC, Thomazeau H. The long-term ressults of press-fit cemented stems in total knee prostheses. J Bone Joint Surg Br. 2006; 88:1022-6.
5. Rodricks DJ, Patil S, Pulido P, Colwell CW. Jr. Press-fit condylar design total knee arthroplasty. Fourteen to seventeen-year follow-up. J Bone Joint Surg Am. 2007; 89:89-95.
6. Vessely MB, Whaley AL, Harmsen WS, Schleck CD, Berr y DJ. The chitranjan ranawat award: Long-term survivorship and failure modes of 1000 cemented condylar total knee arthroplasties. Clin Orthop Relat Res. 2006; 452:28-34.
7. Yoshiya S, Matsui N, Komistek RD, Dennis DA, Mahfouz M, Kurosaka M. *In vivo* kinematic comparison of posterior cruciate-retaining and posterior stabilized total knee arthroplasties under passive and weight-bearing conditions. J Arthroplasty. 2005; 20:777-83.
8. Fantozzi S, Catani F, Ensini A, Leardini A, Giannini S. Femoral rollback of cruciate-retaining and posterior-stabilized total knee replacements: *In vivo* fluoroscopic analysis during activities of daily living. J Orthop Res. 2006; 24:2222-9.
9. Nabeyama R, Matsuda S, Miura H, Kawano T, Nagamine R, Mawatari T, Tanaka K, Iwamoto Y. Changes in anteroposterior stability following total knee arthroplasty. J Orthop Sci. 2003; 8:526-31.
10. Maruyama S, Yoshiya S, Matsui N, Kuroda R, Kurosaka M. Functional comparison of posterior cruciate-retaining versus posterior stabilized total knee arthroplasty. J Arthroplasty. 2004; 19:349-53.
11. Arabori M, Matsui N, Kuroda R, Mizuno K, Doita M, Kurosaka M *et al*. Posterior condylar offset and flexion in posterior cruciate-retaining and posterior stabilized tka. J Orthop Sci. 2008; 13:46-50.
12. Scott WN, Insall JN. A third-generation, posterior stabilized knee prosthesis: Early results after follow up of 2 to 6 years. J Arthroplasty. 2006; 21:821-5.
13. Kolisek FR, Barnes CL. Scorpio posterior-stabilized knee system: 5-year clinical and functional results. J Arthroplasty. 2006; 21:1187-92.
14. Lachiewicz PF, Soileau ES. The rates of osteolysis and loosening associated with a modular posterior stabilized knee replacement. Results at five to fourteen years. J Bone Joint Surg Am. 2004; 86:525-30.
15. Dalury DF, Gonzales RA, Adams MJ, Gruen TA, Trier K. Midterm results with the pfc sigma total knee arthroplasty system. J Arthroplasty. 2008; 23:175-81.
16. Kubiak P, Archibeck MJ, White RE, Jr. Cruciate retaining total knee arthroplasty in patients with at least fifteen degrees of coronal plane deformity. J Arthroplasty. 2008; 23:366-70.
17. Insall JN, Dorr LD, Scott RD, Scott WN. Rationale of the knee society clinical rating system. Clin Orthop Relat Res, 1989, 13-4.
18. Ewald FC. The knee society total knee arthroplasty roentgenographic evaluation and scoring system. Clin Orthop Relat Res. 1989; 248:9-12.

19. Vail TP, Lang JE. Insall and Scott surgery of the knee. 4th ed. Philadelphia: Churchill Livingstone, Elsevier, 2006, 1455-1521.
20. Insall J, Ranawat CS, Scott WN, Walker P. Total condylar knee replacement. Preliminary report. Clin Orthop Relat Res. 1976; 120:149-54.
21. Vilchez F, Martinez-Pastor JC, Garcia-Ramiro S, Bori G, Tornero E, Garcia E *et al*. Efficacy of debridement in hematogenous and early post- surgical prosthetic joint infections. Int. J. Artif. Organs. 2011; 34:863–9.
22. Ehlinger M, Adam P, Abane L, Rahme M, Moor BK, Arlettaz Y *et al*. Treatment of periprosthetic femoral fractures of the knee. Knee Surg Sports Traumatol Arthrosc. 2011; 19:1473-1478.
23. Maruyama S, Yoshiya S, Matsui N, Kuroda R, Kurosaka M. Functional comparison of posterior cruciate-retaining versus posterior stabilized total knee arthroplasty. J Arthroplasty. 2004; 19:349-53.
24. Yoshiya S, Matsui N, Komistek RD, Dennis DA, Mahfouz M, Kurosaka M. *In vivo* kinematic comparison of posterior cruciate-retaining and posterior stabilized total knee arthroplasties under passive and weight-bearing conditions. J Arthroplasty. 2005; 20:777-83.
25. Bolanos AA, Colizza WA, McCann PD, Gotlin RS, Wootten ME, Kahn BA *et al*. A comparison of isokinetic strength testing and gait analysis in patients with posterior cruciate-retaining and substituting knee arthroplasties. J Arthroplasty. 1998; 13:906-15.
26. Tanzer M, Smith K, Burnett S. Posterior-stabilized versus cruciate-retaining total knee arthroplasty: Balancing the gap. J Arthroplasty. 2002; 17:813-9.