



CRUCIATE RETAINING (CR) VERSUS POSTERIOR STABILIZED (PS) TOTAL KNEE ARTHROPLASTY: A SHORT-TERM COMPARATIVE STUDY

Orthopaedics

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ABSTRACT

Total knee arthroplasty is a very successful procedure with good clinical outcomes. Among the techniques (posterior-stabilized vs posterior cruciate retaining total knee arthroplasty) it is not clear whether one design is superior over another. The purpose of the present study was to directly compare clinical and radiological outcomes of these two designs.

KEYWORDS

Total knee arthroplasty, Cruciate retaining knees, Posterior-stabilized knees.

INTRODUCTION

Total knee arthroplasty is final and effective available surgical treatment for arthritis of knee joint. Multiple studies shows that it has got excellent result and survival rates greater than 90% at follow-up times of 10 to 20 years^{[1]-[6]} Numerous implant designs have been developed to improve the durability and function of these procedures. The debate over the relative merits of substituting or retaining the PCL in TKA is still ongoing.

Cruciate retaining techniques preserves posterior cruciate ligament. This design has advantages of bone preservation, increased proprioception, near normal knee kinematics and greater stabilization of the prosthesis. 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]-[11]}

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.

METHODOLOGY

The retrospective study carried out on 60 patients, who had been operated for primary total knee arthroplasty at our center from March 2018 to September 2019. 60 patients were included in our study selected on basis on inclusion and exclusion criteria.

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.

Pre-operatively, patients clinically and radiologically evaluated. Clinical evaluation involved history, thorough examination, BMI (Body mass index) calculation and knee society score.[12] Radiological evaluation done on standing weight bearing antero-posterior x-ray and lateral x-ray (knee 90 flexed). It includes alignment parameters like aL DFA (Anatomical Lateral Distal Femoral Angle), mMPTA (Mechanical Medial Proximal Tibial Angle), radiological Ahlback grading of arthritis (Figure 1) .[13]



Figure 1: Pre-op Radiological Evaluation.

All patients were operated in standard modular operation theatre. All Surgeries were done using midline anterior skin incision followed by medial parapatellar arthrotomy. In CR group, we tried to keep tibial slope as normal as possible while in PS group we tried to keep tibial slope $5^{\circ} \pm 1^{\circ}$ (3° cutting tibial cutting block was used). Negative suction drain was kept for 24 hours in all patients. Full weight bearing walking with support started from 1st post- op day. All patients were discharged on an average 3rd or 4th post-operative day. Physiotherapy was advised for 2-3 weeks. Stitches were removed on an average 18th post-op day. After that support gradually weaned off over period of 2 weeks. All patients re-evaluated clinically, radiologically (as it was done pre-operatively) and for complications over a period of 18 months.

RESULTS

There were 60 cases included in study (62 knees) with mean age of 63.81 years. Male to female ratio was 1: 2.1 (19/41). Mean BMI (Body mass index) of patients was $33 \pm 4 \text{ kg/m}^2$. 50 cases had varus alignment in which predominantly medial compartment was involved. 5 cases had valgus alignment in which predominantly lateral compartment was involved and 5 cases had neutral coronal alignment in which both compartments were equally involved.

In CR group, pre-op mean clinical score and function score was 51.5 and 48.26 respectively. Average ROM observed was $107.30^{\circ} \pm 1.69^{\circ}$. According to Ahlback grading (based on radiograph) 2 cases had grade 1 changes, 8 patients had grade 2 changes 12 had grade 3 changes and 4 had grade 4 changes. In PS group, pre-op mean clinical score was 48.72 and function score was 41.6. Observed mean ROM was $106.5^{\circ} \pm 1.73^{\circ}$. On radiograph, according to Ahlback grading 7 cases had grade 2 changes, 18 had grade 3 changes, 7 had grade 4 changes and 4 had severe grade 5 changes.

Average surgical time was 62 ± 8 min and average hospital stay was 3.3 days. Pre-operatively and post-operatively in all cases patella position was normal.

Post-op 18 month follow-up, mean ROM in CR and PS joint was $120.07^{\circ} \pm 1.47^{\circ}$ and $128.5^{\circ} \pm 1.73^{\circ}$ respectively.

In CR group mean clinical score and function score improved to 93.11 and 92.11 respectively.

In PS group mean clinical score and function score improved to 94.5 and 94.33 respectively.

DISCUSSION

Our study was conducted on 60 patients (62 knees). Number of female patients was more compared to male patients. Major indication of the surgery was osteoarthritis of knee joint (55 patients) followed by rheumatoid arthritis (5 patients). Majority of patients had medial compartmental arthritis with varus deformity (52 knees) while only 5 patients had lateral compartmental arthritis with valgus deformity (5 knees), in few patients both compartments were more or less equally involved (5 knees). On radiological evaluation 93.5% of total cases had complete loss the joint space and total 72.5% cases had bony involvement.

Evaluating post operative radiographs, femoral component and tibial component were almost perpendicular to mechanical axis of limb.

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. 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° , $p < 0.05$). [14]

Yoshiya et al performed in vivo kinematic analysis of a 20 patients. 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 ($131^{\circ} \pm 12^{\circ}$ versus $121^{\circ} \pm 16^{\circ}$). [15] 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 electromyographic waveforms during level walking and stair climbing. Both knee prosthesis performed equally well. [16] 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. [17]

In our study mean knee society score (clinical/functional) at 18 month follow-up was 94.5/94.33 for PS joint and 93.11/92.11 for CR joint. So there was no significant difference.

All patients had good functional ROM at follow-up ($128.5^{\circ} \pm 1.73^{\circ}$ in PS knee and $120.07^{\circ} \pm 1.47^{\circ}$ in CR knees) comparing both system PS

joints had significant improvement in ROM (22°) compare to CR joints (12.77°).

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. In Indian scenario where total knee replacement is done at a late stage of osteoarthritis, sacrificing the contracted PCL has better outcomes as compared to retaining it.

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