

## FUNCTIONAL OUTCOME OF CRUCIATE SUBSTITUTED TOTAL KNEE ARTHROPLASTY USING ULTRA CONGRUENT DEEP DISHED POLYETHYLENE INSERT -A MID TERM ANALYSIS

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### Abstract

**Background:** Posterior Cruciate Ligament is an important static stabilizer in normal knee and helps in femoral roll back. Resecting the PCL and substituting with post-cam requires box cut and thus a greater resection of bone mass from femur. Ultra congruent deep dish with PCL resection allows implantation with lesser bone resection. **Materials and Methods:** A prospective study -20 patients with grade iv OA Knee were operated upon in our institute using ultracongruent deep dish insert. Patients were assessed using knee society score and functional score preop and post op. **Result:** The Patients were followed up for a period of 3 years. The knee society score increased from 40 to 88 and functional score increased from 35 to 80. The flexion of knee increased from 80 to 105 degrees. **Conclusion:** We conclude that there is no anteroposterior instability and ultra congruent deep dish polyethylene insert eliminates the need for increased bone resection. However obese patients and those with fixed flexion deformities might require posterior stabilized implants.

## INTRODUCTION

The Posterior Cruciate Ligament is an important primary stabilizer of knee and helps in physiologic femoral roll back. Resecting the posterior cruciate ligament and substituting with Post-Cam mechanism prevents posterior subluxation of Tibia and helps in better stair climbing ability and range of motion. Accommodation of Post-Cam mechanism requires box-cut in the inter-condylar notch and thus decreases the bone mass in supra-condylar femur.<sup>[1-8]</sup> Total knee arthroplasty with a more conforming ultra congruent insert along with resection of the posterior cruciate ligament obviates the need for cam mechanism, avoiding the risk of cam impingement, wear and tear. In our study, the aim is to assess the functional outcome of this design.<sup>[9-15]</sup>

## MATERIALS AND METHODS

This is a prospective study of patients who underwent primary Total Knee Arthroplasty between October 2017 to October 2019 in our hospital using a highly conforming ultra congruent deep dish polyethylene insert

### Inclusion Criteria

- Grade IV primary osteoarthritis and rheumatoid arthritis knee
- Age > 50 years

- Both male and female

### Exclusion Criteria

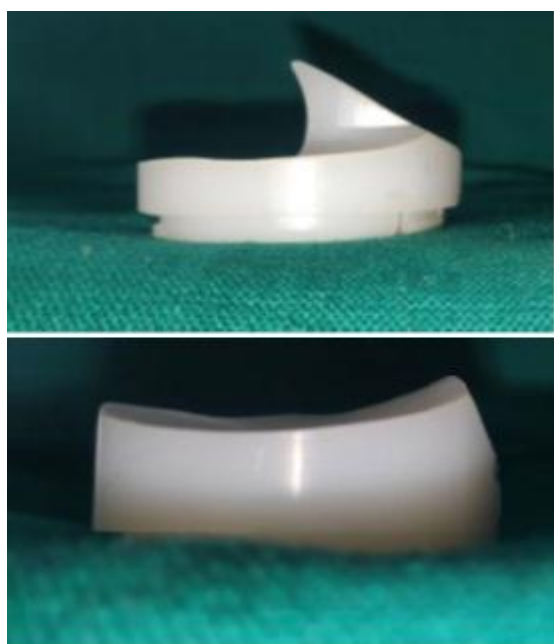
- Young patient < 50 years
- Prior tibial or femoral osteotomies
- Revision total knee arthroplasty

The preferred surgical approach is medial parapatellar approach. varus valgus deformities were corrected using appropriate soft tissue releases. After sizing the antero-posterior dimensions of the distal femur and the Tibia, flexion and extension gaps were measured using spacer blocks. Tibial component is fixed first and femoral component is then cemented. The deep dish ultra-congruent polyethylene insert is fixed by sliding mechanism in tibial tray. Wound closed in layers with negative suction drain. Postoperative rehabilitation protocol for all patients included immediate weight bearing as tolerated on post-operative day 1. Low-molecular-weight heparin for DVT Prophylaxis employed.

### Follow up

All patients were followed up regularly. Pre-operative and post-operative Knee Society Score (KSS) and Functional score (FS) were compared. Statistical analysis was performed using paired Student t tests (with significance set at p<0.05). Survivorship was determined using Kaplan-Meier survivorship curves, with clinical or radiographic failure (defined as a revision of the tibial, femoral components or any subsequent procedure that altered

knee components) taken as the end point. SPSS software was used for statistical analysis.



## RESULTS

In our study, Out of 20 patients, 12, operated were in the age between 50-60 years and 8 patients were between 60-70 years .12 cases were females and 8 were males.

The mean pre-operative range of motion is 83.25. Out of these, 6 knees had <75 degrees, 12 knees had 76-90 degrees and 2 knees had >90 degrees of motion.

### Post-Operative Range of Motion vs Age

Average range of motion in patients in age group of 50-60 years was 108.75 degrees and in 60-70 years was 107.5 degrees.

The 't' test was not statistically significant hence there is no correlation between range of motion and age.

### Knee Society Score vs Age

Post-Operative knee society score of patients in age group 50-60 years was 89.16 and in age group 60-70 years was 87.37. The 't' test was not statistically

significant that there is no correlation between knee society score and age.

### Functional Score vs Age

Post-operative Functional score of age group 50-60 years was 78.75 and age group 60-70 years was 83.75. The 't' test was statistically significant that there is correlation between functional score and age.

### Range of Motion vs Sex

Post-operative mean range of motion was 108.25 degrees. Mean range of motion in males was 106.25 degrees and in females was 109.58 degrees. The 't' test was not statistically significant that there is no correlation between range of motion and age.

### Knee Society Score vs Sex

The mean Post-Operative knee society score was 88.45. The average knee society score in males was 89 and in females were 88.08. The 't' test was not statistically significant that there is no correlation between post-operative knee society score and sex.

### Functional Score vs Sex

The post-operative mean functional score was 80.75. The average functional score in males was 83.75 and in females was 78.75. The 't' test was statistically significant that there is correlation between functional score and sex.

### Range of Motion vs Disease

The mean post-operative range of motion in osteoarthritis and rheumatoid arthritis was 106.25 and 116.25 respectively. The 't' test was statistically significant that there is correlation between range of motion and disease.

Postoperative range of motion is good in rheumatoid arthritis patients compared to osteoarthritis patients

### Knee society Score vs Disease

The mean knee society score in Osteoarthritis and Rheumatoid arthritis was 88.87 and 86.75 respectively. The 't' test was not statistically significant

that there is no correlation between knee society score and disease.

### Functional Score vs Disease

The post-operative functional score in osteoarthritis and rheumatoid arthritis was 79.06 and 87.5 respectively. The 't' test was statistically significant that there is correlation between functional score and disease.

**Table 1: KNEE Society Score (KSS) and Functional Score (FS).**

	Pre-Op	Post op
Knee Society Score	40.80	88.45
Functional score	35.50	80.75

## DISCUSSION

Total knee arthroplasty is done for the patients suffering from osteoarthritis knee. The management of the posterior cruciate ligament with respect to total knee arthroplasty design is a subject of controversy. Among the reasons cited for using a cruciate-preserving total knee arthroplasty system are femoral rollback, superior knee kinematics and improved stair-climbing ability.<sup>[16-20]</sup>

Posterior cruciate ligament-preserving designs use minimally conforming components, and such flat on flat configurations have been shown to result in an abnormal screw home motion, higher peak contact forces, eccentric loading, and premature wear.<sup>[21-23]</sup>

Total Knee Arthroplasty systems with cruciate-substituting components, are reported to result in increased range of motion. furthermore, their conforming articular surfaces minimize premature wear of the polyethylene component and avoid

compromised knee kinematics. Among the disadvantage of cruciate-substituting systems are the need for additional resection of femoral bone from the intercondylar notch, potential wear at the femoral cam polyethylene post interface, and abnormal gait patterns. Hence the use of a highly conforming deep dished polyethylene insert and after resecting the posterior cruciate ligament came in to use.<sup>[24-30]</sup>

The case for using deep dished tibial polyethylene inserts is supported by the results of studies using normal cadaveric knees. During axial loading, dishing of the menisci, especially at the medial and lateral edges, results in a wedging effect that produces increased stability between the femoral and tibial surfaces.<sup>[31-35]</sup>

It has been postulated earlier that proprioception is better with the cruciate retaining implants. In arthritic knees, age related changes in the proprioception also occur in posterior cruciate ligament. Some studies have shown that cruciate retaining implants showed better proprioception than the posterior stabilized total knee arthroplasty. When the degree of preoperative arthritis is severe, posterior stabilized knees performed better than cruciate retaining knees.<sup>[36-38]</sup>

Initial studies regarding the gait analysis, revealed that stair climbing is better with cruciate retaining designs. A forward bending posture when climbing stairs was noted in patients who underwent cruciate sacrificing or substituting TKA and it was suggested that this happens because of the lack of femoral rollback. But recent studies showed there is no difference in the range of motion or isokinetic muscle strength between the cruciate retaining and posterior stabilized knees.<sup>[39-42]</sup>

Our study evaluated the results of functional outcome of patients who underwent total knee posterior cruciate ligament resection and substituting with deep dished polyethylene insert. We evaluated knee performance by using Knee Society Scoring and functional scoring in both pre operatively and post operatively. All our patients were operated with similar technique and approach.<sup>[43-45]</sup>

Aaron A Hoffman et al. concluded that there is increased antero posterior stability and also the need of bony resection in the intercondylar notch is eliminated in the deep dish design.<sup>[46]</sup>

Massin et al. in 2012 conducted an Intraoperative kinematic study of 10 UC knees. UC dish decreases AP translation and femorotibial rotation. No differences in ROM. Some kind of posterior impingement in absence of rollback in UC Laskin et al.<sup>40</sup> compared a posterior stabilized tibial polyethylene insert with a dished polyethylene insert and reported no statistically significant differences in range of motion, ability to ascend and descend stairs or knee scores.<sup>[47]</sup>

Font-Rodriguez et al. analyzing the long-term results of 215 total condylar prostheses with an all-polyethylene dished tibia, reported an average annual failure rate of 0.46% and a 21-year success rate of 90.77%.<sup>[48]</sup>

Roh et al. in 2013 studied Evaluation of kinematic and functional outcomes in UC CR vs. UC PS .Preservation of PCL is not helpful in improve kinematics and clinical outcomes. No difference in ROM, functional scores and radiological results. CR has more varus rotation over 90° of flexion and more anterior translation. No difference in internal/external rotation Kim et al. in 2015 studied Intraoperative kinematics and clinical outcomes comparison of UC vs. PS in 90 patients and inferred that UC decrease axial rotation. PS reduce AP translation and more physiological femoral rollback. No differences in clinical outcomes.<sup>[49,50]</sup>

Neither UC or PS reproduce perfectly the normal knee kinematic Bartelet al concluded that during stress and strain analysis on several knee designs, there is reduction in interface stress and polyethylene wear in systems with conforming articulating surfaces and they were superior to other articulations they studied.<sup>[51]</sup>

Sathappan et al concluded in his study that better functional outcome can be achieved with dished polyethylene designs, which is sufficient for anteroposterior knee stability when proper balancing of flexion and extension gap is done and mechanics of the knee restored.<sup>[52]</sup>

In our study, we found that posterior cruciate ligament resection helps in proper soft tissue balancing and correction of varus and fixed flexion deformities. In our study there is no evidence of radiolucency or thinning while in midterm results by they showed non progressive radiolucency in zone 1 and 4 of tibial component bone interface.<sup>[53]</sup>

In our study, also due to posterior cruciate ligament resection, we achieved good varus correction and no fixed flexion deformity postoperatively.

## CONCLUSION

In our study of 20 cases of posterior substituting total knee replacement using ultra-congruent deep dished polyethylene insert, we conclude that

1. It provides good pain relief and improves functional ability.
2. There is no anteroposterior instability seen.
3. It eliminate the need of bone resection in the intercondylar notch of femur thus reduces the risk of supracondylar femur fracture.
4. The rate of wear and tear is less in deep dished polyethylene insert.
5. Since it eliminates the need of bone resection, it can be used in small knees also.
6. However, it cannot be used for morbidly obese and with gross fixed flexion and varus deformity, who may require posterior stabilized implants.

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