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## CLINICAL, FUNCTIONAL AND RADIOLOGICAL ASSESSMENT OF RESULTS OF TOTAL KNEE REPLACEMENT: A MID-TERM FOLLOW-UP

DR. ANIL KUMAR. S. V<sup>1</sup>, DR. VINEETHA VITTAL<sup>2</sup>, DR. SAMARTH ARYA\*<sup>3</sup>  
AND DR. A. DEVADOSS<sup>4</sup>

<sup>1</sup> Lecturer, Department of Orthopaedics, R.L.Jalappa Hospital and Research Centre, Tamaka, Kolar

<sup>2</sup> Lecturer, Department of Physiology, R.L.Jalappa Hospital and Research Centre, Tamaka, Kolar

<sup>3</sup> Jr. Resident, Department of Orthopaedics, R.L.Jalappa Hospital and Research Centre, Tamaka, Kolar

<sup>4</sup> Professor & Director, Institute of Orthopaedic Research and Accident Surgery, Madurai, Tamil Nadu

### ABSTRACT

A retrospective study was conducted to evaluate the results of 59 knee replacements done in 38 patients. Thirty patients replaced with 48 knees were available for the follow-up. The average period of the follow up was 4.5 years. There were 12 males and 18 females with average age of 56.83 years. The diagnosis was osteoarthritis in 21 patients, and rheumatoid arthritis in 9 patients. Eighteen patients underwent bilateral knee replacements (3 RA and 15 OA patients) and 12 patients had unilateral replacement (6 RA, 6 OA). Three types of prostheses were used: Total condylar prosthesis (25 knees), Post and cam type (9 knees), Ultra-congruent deep dish type (14 knees). Type of prosthesis were selected randomly and according to financial status of the patient. Clinical and Functional assessment was done by the knee Society Score (KSS) and Radiological assessment was by Knee Society Total Knee Arthroplasty Roentgenographic Evaluation and Scoring System. We concluded that most of our patients were replaced with Total Condylar Prosthesis knees and some of them had anterior knee pain. This was main reason for low KSS score with Total Condylar Prosthesis knees compared to Ultra-congruent polyethylene and Post and Cam. Even though knees replaced with Ultra-congruent polyethylene and Post and Cam had better KSS clinical and functional scores compared to Total Condylar Prosthesis, it was not statistically significant. Our 87.5% good to excellent results are on par with the other global studies.

**KEYWORDS:** knee replacement, Total condylar prosthesis, Post and cam type, Ultra-congruent deep dish type, Knee Society Score.



**DR. SAMARTH ARYA**

Jr. Resident, Department of Orthopaedics, R.L.Jalappa Hospital and  
Research Centre, Tamaka, Kolar

\*Corresponding author

## INTRODUCTION

In today's scenario of increasingly aged population and increasing problems of degenerated knees, management is less ambiguous with the availability of wide range of prosthesis. Since the introduction of total knee arthroplasty, many types of prosthesis have come to market, mainly to improve the biomechanics of the knee, to increase the survival of the prosthesis, to decrease the cost of the implant and others. We used a variety of prostheses to study the outcome of each using KSS score. Advances in the field of joint replacement surgery are being made at rocket pace to the sky high, and similarly the expenditure for the surgery also. A significant number of patients of our country cannot afford the expensive prosthesis of latest design available in the market. But the pain and deformity of their degenerated knees, which are not responding to conservative measures forces the patient as well as surgeons to opt for joint replacement. The surgeon's dilemma is which implant to offer for such patients that should meet their demands of pain relief, correction of deformity, to provide with reasonable ROM that is compatible with activities of daily living and also including the longevity of the implant, all within the reach of their pocket. The aim of this retrospective study is to present a data from the IORAS, Madurai, Tamilnadu on the mid-term (from December 2001 to April 2005) outcome of the TKR procedure with regards to the clinical, functional and radiological aspects of all the types of prostheses used here.

## MATERIALS AND METHODS

In the Institute of Orthopaedic Research and Accident Surgery, Madurai, Tamilnadu, 59 knee replacements were done in 38 patients between December 2001 and April 2005. A retrospective study was conducted to evaluate the results. At the time of recent follow-up in April 2008, 30 patients replaced with 48 knees were available for the follow-up. The minimum period of the follow up was 3 years and the maximum period was 6 ½ years, with an average of 4 ½ years. 30 patients with 48 knees replaced were available for the follow-up with their previous operative records, annual X-ray films and follow-up papers. Pre-

op deformities and its values were recorded for the study from the hospital case sheets and discharge summaries. There were 12 males and 18 females with ages ranging from 25 to 72 years, an average of 56.83 years at the time of surgery. The diagnosis was osteoarthritis in 21 patients, and rheumatoid arthritis in 9 patients. 44 knees had varus deformity ranging from 5 - 40°, with an average of 8.77°. 4 knees had valgus deformities ranging from 5 - 25°; with an average of 13.5°. 1 knee had an excessive valgus deformity of 25° and was associated with gross instability. 15 knees with various deformities had flexion contractures ranging from 5 - 20° with an average of 10.66°. 3 valgus knees had flexion contracture of 5 - 15° averaging 10°. Pre-op ROM ranged between 50° - 110° with an average of 80.73°.

## RESULTS

### CLINICAL RESULTS

Of the 48 knees (30 patients) available with an average follow-up of 4½ years, 35 knees (72.92%) were completely pain free, 5 knees (10%) had mild or occasional vague pain, 7 knees (15%) (3knees OA and 4 knees RA) had significant pain of varying magnitude 4 knees had pain for climbing stairs only and rest of the 5 knees to both walking and stairs, and 1 knee got infected. 33.33% of RA knees had anterior knee pain against 8.33% in OA knees. The average pre-op ROM was 80.73° (50° - 110°) which improved to 95.81° excluding the result of 1 knee in which, the patient was advised prosthesis removal and knee arthrodesis because of infection. The best recorded ROM was 120° and the minimum was 65°, however in 14 knees the ROM was less than 90°. There was a fixed flexion contracture in 18 knees pre-op which was corrected in 12 knees with the residual flexion contracture in 6 knees ranging from 5 - 10°. 5 knees had extension lag of 5 - 10°. We correlated the influence of pre-op ROM on post-op ROM, we found in 32 knees with the pre-op ROM of less than 90° (average 71.72°) there was an average improvement of flexion arc to 79.91°. In patients with pre-op ROM of over 90° (average 98.75°) the average post-



op flexion arc improved to 102.56°. Patients who had their knees replaced with Total Condylar Prosthesis and who had pre-op ROM < 90° (average 71.72°) had their post-op ROM improved to an average of 75.56° and who had their pre-op ROM > 90° (average 98.75°) had their post-op ROM reduced to an average of 94.68°. Patients who had their knees replaced with Ultra-congruent polyethylene and who had pre-op ROM < 90° (average 71.72°) had their post-op ROM improved to an average of 81.66° and who had their pre-op ROM > 90° (average 98.75°) had their post-op ROM improved to an average of 103°. Patients who had their knees replaced with Post and Cam and who had pre-op ROM < 90° (average 71.72°) had their post-op ROM improved to an average of 82.5° and who had their pre-op ROM > 90° (average 98.75°) had their post-op ROM improved to an average of 110°. According to knee society clinical scoring system, the average score for all the 48 knees was 78.16 points which is considered as a good result. 13 knees (27.08%) were excellent, 29 knees (60.42%) were good, 4 knees (8.33%) fair and 2 knees (4.17%) were poor results. Overall 87.5% had good to excellent results; the causes for poor clinical results were infection which required tibial base plate exchange on request by the patient and gross valgus instability. Among 42 knees, 21 out of 25 Total Condylar Prosthesis knees (84%), 13 out of 14 Ultra-congruent polyethylene knees (92.86%) and 8 out of 9 Post and Cam knees (88.88%) had excellent to good KSS clinical scores. The average KSS clinical scores for Total Condylar Prosthesis knee was 75.2 points, Ultra-congruent polyethylene was 78.86 points, and for Post and Cam was 85.33 points. But all knees on an average had excellent to good clinical scores. The knees that were replaced with Ultra-congruent polyethylene and Post and Cam had better clinical results compared to Total Condylar Prosthesis knees and clinical scores of Post and Cam knees were comparatively better than that of Ultra-congruent polyethylene. But when compared statistically, the KSS clinical scores between knees replaced with Total Condylar Prosthesis, Ultra-congruent polyethylene and Post and Cam were not significant. According to Stern S, Insall J, Scuderi G, knee arthroplasty with cement accompanied by

sacrifice of both cruciate ligaments, yields long term results that are as good as or better than those provided by other implants.

### FUNCTIONAL RESULTS

7 patients with knees having good clinical results had difficulty in walking for unlimited distance because of the multiple joint involvement in RA patients and also in 1 patient the opposite knee was unstable because of which patient had pain in the operated knee. Some patients had to use walking aids. The influence of the diagnosis was significant for the poor functional results, no patients with OA in our series had poor results in contrast to RA, and similarly patients with patient classification 'C' had constituted 66% of poor results. Considering the age as a factor, 33.33% of poor results were with age less than 60 years when compared to 66.66% of poor results with age over 60 years. Also patients with other complications also had poor results. The cause for the poor functional results in our study was multifactorial. Overall the functional results were excellent in 8 (26.6%), good in 15 (50%), fair in 4 (13.3%) and poor in 3 (10%) of patients. Average functional scores for patients replaced with Total Condylar Prosthesis knees was 70.73 points, 75.67 points for Ultra-congruent polyethylene (81.38 points excluding 1 infected case) and 83 points for Post and Cam. The low functional scores in patients replaced with Total Condylar Prosthesis knees was due to anterior knee pain who had some difficulty in walking for long distances and in climbing up and down the stairs. But the average KSS functional score for patients replaced with Total Condylar Prosthesis was still good. There was no significant difference between the KSS functional scores of Ultra-congruent polyethylene (excluding infected prosthesis) and Post and Cam (81.38 points for Ultra-congruent polyethylene and 83 points for Post and Cam) (Graphs 7 & 9). Even though the KSS functional scores of patients, whose knees were replaced with Ultra-congruent polyethylene and Post and Cam were better when compared to that of Total Condylar Prosthesis, it was not statistically significant. According to Stern S, Insall J, Scuderi G (JBJS 1992 74A), knee arthroplasty with cement accompanied by sacrifice of both cruciate ligaments, yields long term results



that are as good as or better than those provided by other implants.

### RADIOLOGICAL RESULTS

The ideal placement of the tibial component was defined as  $90 \pm 5^\circ$  deg to the long axis of the tibial shaft on both the antero-posterior and lateral X-rays. The desired placement of the femoral component was  $5 \pm 5^\circ$  of valgus on the antero-posterior X-rays and  $90 \pm 5^\circ$  on lateral X-rays (*Insall JN et al 1979*). Considering the given range of placement of components, the deviation most commonly seen in our study was excessive valgus of the femoral component and varus of the tibial component. In AP- view, 8 knees mostly in zone 1 & 2 of the tibial components showed insignificant radiolucent lines which were of non-progressive nature when compared with their previous annual X-ray films. In lateral view, 5 knees showed insignificant radiolucent lines less than 1mm in zones 1 & 2 of the tibial components. 1 femur in zone 1 and another in zone 4 showed a radiolucent line of 1mm. Apart from these changes there was no evidence other of loosening in the femoral and tibial components. Skyline views of the patella were taken in patients with anterior knee pain to see for the patellar tilt or displacement as per the parameters of *Grelsamer et al 1993*<sup>28</sup> ( $< 5^\circ$  tilt of the patella is considered normal). 3 knees out of 7 knees had displacement and tilt. There was no significant radiolucent lines confined to a particular type of prosthesis and there were posterior subluxation of tibia seen in 4 Total Condylar Prosthesis knees but the patients were asymptomatic. According to *Lewis JL, Askew MJ, Jaycox DP*<sup>29</sup>, radiographic analysis of radiolucencies indicated no difference in pattern or frequency of occurrence in the two groups (Total Condylar and Posterior stabilized knees).

### COMPLICATIONS

1 knee (Ultra-congruent polyethylene) had deep infection. The patient was a known case of diabetes mellitus and rheumatoid arthritis and the culture growth was staphylococcus aureus. The patient was advised prosthesis removal and knee arthrodesis. As patient refused for it, which we did a revision of tibial base plate. But the patient lost to follow-up 1 knee in a young rheumatoid arthritis patient

had superficial skin necrosis which needed a split-skin grafting later healed uneventfully. 7 knees (2 Post and Cam, 1 Ultra-congruent polyethylene and 4 Total Condylar Prosthesis) including knees with instabilities had some anterior knee pain though none of them were disabling. 1 patient had Extensor hallucis longus weakness post-operatively for about 6 months which improved with physiotherapy 1 patient (Total Condylar Prosthesis) had valgus instability at a recent follow up of 5 years. She also had a pre-op valgus instability of  $25^\circ$ . When we analysed retrospectively she was found to be a candidate for replacement with more constrained prosthesis.

### DISCUSSION

Soft tissue balancing for correction of fixed valgus or varus deformities is an essential first step of any total knee replacement. Correction of the varus and valgus alignment should not be performed by angling the plane of resection of tibial plateau as this will only tilt the tibial component away from the weight bearing axis of the limb and impose shearing stress on the implant with the probable increase in the incidence of wear and loosening. Resection of collateral ligaments performed during the course of any non-fully constrained total knee replacement might be expected to lead to a disastrously high incidence of failure, unlike sacrificing the cruciates. Our clinical results at an average follow up of  $4\frac{1}{2}$  years with about 87.5% of good to excellent results is certainly encouraging and on par with other studies. 7 knees (14.6%) in our series had *anterior knee pain* though none of them were disabling. We hypothesised the causes after studying the knee X-rays including the skyline views as patellar malalignment in 3 knees and degenerative changes in the patella, valgus instability in 1 RA knee, and oversized femoral component in others. In our series we have not done patella resurfacing and incidence of anterior knee pain is relatively less than other series without patellar resurfacing. i.e., 29% (*Picetti et al 1990*) and 40 – 50% (*Ranawat CS 1986*). The average ROM improved from  $80.73^\circ$  pre-op to  $95.81^\circ$  post-op (on an average  $87.79^\circ$  for Total Condylar Prosthesis,  $98.08^\circ$  for Ultra-congruent polyethylene and  $103.88^\circ$  for Post and Cam). When correlated for the influence of pre-op ROM on post-op



ROM, we found those patients whose pre-op ROM was less than 90° (average 71.72°) had an improvement to 79.91° (75.56° for Total Condylar Prosthesis, 81.66° for Ultra-congruent polyethylene and 82.5° for Post and Cam), but the patients with pre-op ROM more than 90° (average 98.75°), had a drop in flexion arc to 94.68° with Total Condylar Prosthesis knees but improved to 103° with Ultra-congruent polyethylene and 110° with Post and Cam. *Maloney WJ et al 1990*, in the meta-analysis of different studies found that independent of the design, post-operative improvement in the ROM is least when pre-operative ROM is greatest. Paradoxically, those patients with better pre-operative ROM have a better final motion. He also mentioned the more limited the pre-op ROM, the greater the quadriceps stiffness is likely to be, which is an important determinant of post-op flexion. The post-op range of flexion was more in knees replaced with Post and Cam followed by Ultra-congruent polyethylene and least was in knees replaced with Total Condylar Prosthesis knees. The average flexion with Total Condylar Prosthesis knees was 87.79°, that of Ultra-congruent polyethylene was 98.08° and Post and Cam was 103.88°. *Maloney WJ et al 1990*, in his paper also has also stated that the post-operative knee motion may depend on many factors, including the prosthetic design, disease, pre-op ROM, post-op regimen, patient compliance and motivation and surgical skill. 4 knees in our series had *posterior subluxation of tibia* with knee in 90° flexion and all of them were asymptomatic. This was the common finding seen with total condylar prosthesis (Total Condylar Prosthesis). The drop- back of tibia is because the tibial inter-condylar eminence does not abut the femoral component (*Scott et al 1988*). Instability in the AP plane generally results in posterior translation of tibia in flexion and usually is associated with a mismatch of flexion and extension spaces. Instability can be caused by over resection of posterior femoral condyles, undersizing of the femoral component, and excessive tibial slope (*Gonzalez MH et al 2004*). 1 knee in a patient with rheumatoid arthritis had *valgus instability* of 25° which they had even in pre-op evaluation (25°). We retrospectively analysed that this was an ideal case for a more constrained implant. Some knees showed

*insignificant radiolucent lines* more in the zones 1 and 2 of the tibial component and 1 knee showed another insignificant radiolucent line between the anterior femur and the anterior supra-condylar flange of the prosthesis. *Ecker ML et al 1987* has shown in his studies that the thin radiolucent lines do not seem to predispose to poor results as do thick globally occurring lines. *Schneider et al 1982* has concluded that a stable radiolucent line about the tibial component less than 2mm is of no clinical significance. There was no significant difference in the confinement of radiolucent lines to a particular type of prosthesis 1 knee (Ultra-congruent polyethylene) in our series had *deep infection*, and the patient was a known case of RA and diabetes mellitus and the patient was prone for infection because of his immuno-compromised status. On an average infection rate in arthroplasty set up is upto 2% (*Gonzalez MH et al 2004*). 1 patient with RA who underwent knee (Total Condylar Prosthesis) replacement had *superficial skin necrosis* which healed uneventfully with an SSG cover. *Laskin et al 1981* had 3 cases of superficial skin necrosis in 117 knee replacements in patients of rheumatoid arthritis. The clinical results of our series are satisfactory with 87.5% of good to excellent results, and the increased prevalence of poor results among most of our patients is multifactorial but most of these patients were happy to have a painless mobile knee.

## CONCLUSION

Our 87.5% good to excellent results are on par with the other global studies. Correction of deformities in majority of our patients to the physiological range of valgus and reproducibility of the technique is excellent. 14.6% incidence of anterior knee pain in our studies is less when compared with the others studies without patella resurfacing, and did not have any major influence on the overall results in our patients. The reason for poor functional scoring was multifactorial, of which RA being the significant cause, the majority of the knees were painless and mobile. Lower complication rate and no evidence of implant loosening in our medium term study are certainly encouraging. KSS scoring system is found to be relevant, simple but more exacting and



more objective. Increasing age and poor medical condition will not affect the clinical score of the knee. Most of our patients were replaced with Total Condylar Prosthesis knees and some of them had anterior knee pain. This was the main reason for low KSS score with Total Condylar Prosthesis knees compared to Ultra-congruent polyethylene and Post and Cam. Even though knees replaced with Ultra-congruent polyethylene and Post

and Cam had better KSS clinical and functional scores compared to Total Condylar Prosthesis, it was not statistically significant. Being less expensive, indigenously made Total Condylar Prosthesis provide a good option for the arthroplasty in less affordable patients when indicated. None of these three designs were able to completely satisfy our Indian patients regarding squatting.

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