

## ORIGINAL ARTICLE

# POSTERIOR CRUCIATE-RETAINING VERSUS POSTERIOR STABILIZED TOTAL KNEE ARTHROPLASTY

Paras Motwani, Umang Shihora

Associate Professor, Department of orthopedics, Gujarat adani institute of medical science, bhuj, Gujarat

### ABSTRACT:

**Introduction:** Cruciate-retaining implants with cement less fixation were developed in the 1990s and refined to enable bone integration, some using hydroxyapatite coating. Mobile-bearing prostheses were created to maximize articular conformity throughout flexion. A perceived advantage was the potential for rotational self-alignment of femoral and tibial components, and reduced wear. Today, the selection of a TKR is from a variety of modular surface arthroplasties. **Material & Methods:** Sixty-four consecutive patients underwent total knee arthroplasty utilizing a posterior-stabilized prosthesis, and another group of sixty consecutive patients received a cruciate-retaining implant. All patients who had osteoarthritis, osteonecrosis, or rheumatoid arthritis and who were indicated for a total knee arthroplasty were invited to take part in a prospective study to follow their outcomes. **Results & Conclusions:** At a mean follow-up time of 60 months, the clinical scores of the two groups were similar, but the cruciate-retaining group had a higher mean range of motion. The mean Knee Society knee scores of the cruciate-retaining and posterior-stabilized groups were 85 points and 80 points, respectively ( $p=0.920$ ). The implants used in the current study more closely represent the current philosophy of orthopaedic surgeons, who have a preference of one implant design over the other. Aside from retaining or substituting for the PCL, all knees were implanted with the identical surgical technique.

**Keywords:** Posterior Cruciate, Retaining Stabilized, Total Knee Arthroplasty

Corresponding author: Dr. Paras Motwani, Associate Professor, Department of anesthesia, Gujarat Adani Institute of Medical Science, Bhuj, Gujarat

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**INTRODUCTION:**  
There is presently a spectacular rise in demand for total knee replacement (TKR). More knee than hip replacements are now implanted annually and the trend is likely to continue. Early designs from the 1950s were hinged prostheses with intramedullary stems. While capable of accommodating ligament insufficiency, torsion-induced loosening was common.<sup>1</sup> Today, rotating-hinge knee replacements are available but their use is limited to cases of unstable primary TKR and revision TKR. Designs of TKR from the 1960s were surface arthroplasties combining a small metallic femoral and polyethylene tibial component. However, as the patellofemoral region was not resurfaced, patellar pain was common.<sup>2</sup>

Total condylar resurfacing emerged in 1973 and has progressed to include a more anatomical trochlear and patellar resurfacing. Subsequently, a dichotomous evolution of prostheses arose with some surgeons retaining, and some sacrificing, the posterior cruciate ligament (PCL).<sup>3</sup> Dysfunction or absence of the PCL was associated with posterior tibial subluxation in flexion. Such instability was countered by constructs containing a tibial post against which a rolling femoral cam could abut, thereby limiting subluxation.<sup>3</sup>

Cruciate-retaining implants with cementless fixation were developed in the 1990s and refined to enable bone integration, some using hydroxyapatite coating. Mobile-bearing prostheses were created to maximise articular conformity throughout flexion.<sup>4</sup> A perceived advantage was the potential for

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rotational self-alignment of femoral and tibial components, and reduced wear. Today, the selection of a TKR is from a variety of modular surface arthroplasties. A plethora of both major and minor design choices exist, even from the same manufacturer, creating a selection dilemma.<sup>5</sup>

The short term results of cruciate retaining (CR) and cruciate stabilized (CS) total knee replacements (TKRs) have shown their ability to relieve pain and improve function. Nevertheless, the controversy continues regarding the superiority of one design type over the other. Proponents of CR TKR believe that maintaining the posterior cruciate ligament (PCL) provides increased stability and promotes femoral rollback, enhancing stairclimbing ability.<sup>6</sup> The maintained PCL can absorb shear forces that otherwise would be transmitted to the boneimplant interface and could result in premature loosening. Proponents of CS TKR argue that resection of the PCL facilitates correction of deformity and allows for the use of more congruent articular surfaces, minimizing polyethylene wear.<sup>6</sup> Although some studies found no difference between CR and CS TKR, others showed improved range of motion with PCL resection. These studies failed to take into account that differences between CR and CS TKRs may be related to implant design or surgical technique or both.<sup>7</sup> The purpose of the study was to analyze the clinical and functional results using knee society scoring system in patients undergoing CR and CS TKR. Hence the aim of the study is to compare the clinical and functional outcome between cruciate stabilizing and cruciate retaining prosthesis following total knee replacement.

#### **MATERIAL & METHOD:**

Sixty-four consecutive patients underwent total knee arthroplasty utilizing a posterior-stabilized prosthesis, and another group of sixty consecutive patients received a cruciate-retaining implant. All patients who had osteoarthritis, osteonecrosis, or rheumatoid arthritis and who were indicated for a total knee arthroplasty were invited to take part in a prospective study to follow their outcomes. In the cruciate-retaining cohort, 10 patients address were changes prior to the five-year follow-up visit, so their results were not included in the study. At the latest follow-up visit, the patients who were lost to follow-up had mean Knee Society knee and function scores of 75 points (range, 50 to 100 points) and 80 points (range, 50 to 100 points), respectively. In the posterior-stabilized group, 10 patients could not be

reached at the five-year follow-up visit, so they were also excluded. At their last follow-up (mean follow-up time 29 months; range, 7 to 49 months), the mean Knee Society knee and function scores of the patients who were lost to follow-up were 80 points (range, 34 to 100 points) and 85 points (range, 45 to 100 points), respectively. No other patients were excluded. The patients were evaluated in the office one month after the procedure and annually thereafter. The ranges of motion, Knee Society scores, radiographic outcomes, and complications were assessed at each follow-up visit, and these were compared at the five year follow-up. This study received full institutional review board approval. The patients who received cruciate-retaining arthroplasties consisted of 20 men and 44 women who had a mean age of 60 year, a mean preoperative Knee Society knee score of 42 points (range, 20 to 73 points), and a mean preoperative Knee Society functional score of 36 points (range, 10 to 60 points). The patients who received posterior-stabilized arthroplasties consisted of 30 men and 30 women who had a mean age of 66 years, a mean preoperative Knee Society knee score of 38 points and a mean preoperative Knee Society functional score of 32 points. All surgeries utilized the Scorpio CR cruciate-retaining system or the Scorpio PS posterior-stabilized system (Stryker, Mahwah, New Jersey). Each author performed approximately half of the CR procedures and half of the PS procedures. The patients were evaluated in the office one month, one year, and annually after the surgery. Knee Society scores, ranges of motion, and radiographs (weightbearinganteroposterior and lateral views) were assessed at each follow-up visit. Radiolucencies were evaluated using the system of zonal analysis developed by the Knee Society. The Knee Society scores and ranges of motion of the two groups were compared with Student t-tests. All statistical analyses were performed using SigmaStat version 3.0 (SPSS, Chicago, Illinois).

#### **RESULTS:**

At a mean follow-up time of 60 months, the clinical scores of the two groups were similar, but the cruciate-retaining group had a higher mean range of motion. The mean Knee Society knee scores of the cruciate-retaining and posterior-stabilized groups were 85 points and 80 points, respectively ( $p=0.920$ ). The mean Knee Society functional scores were 65 points for the cruciate-retaining group and 75 points for the posterior stabilized group

( $p=0.565$ ). The mean ranges of motion were  $130^\circ$  for the cruciate-retaining group and  $120^\circ$  for the posterior stabilized group. There were two incidents of postoperative knee pain in the cruciate-retaining group, but no revisions or reoperations in either group. Two 65 year old men who received cruciate-retaining prostheses began having persistent pain in the operative knees, at one year and five years after the surgery, respectively, with no radiologic or physical abnormalities, and they have both received adequate pain relief with analgesic medications. The Knee Society knee scores of the three patients were 55 and 68 points, and the Knee Society functional scores were 80, and 65 points at follow-up times of 59 and 60 months, respectively. Assessment of radiographs revealed no radiolucencies that were longer than one millimeter, and no progression of radiolucencies. There was one incidence of lateral patellar tilt in a 71 year old man who received a cruciate retaining prosthesis, but he was doing well clinically, with Knee Society knee and functional scores of 100 and 80 points, respectively, and he did not desire any treatment. No other radiographic abnormalities were seen.

## DISCUSSION

There were some limitations to this study. The patients were not randomized, although they were followed prospectively. Also, several patients in each cohort were deceased or could not be contacted for the five-year follow-up visit, although almost all of them were doing well one to four years after the procedure. Despite these limitations, this report demonstrates that both designs had excellent clinical outcomes at a follow-up time of five years, with few differences between the two types of prostheses.

Patients who underwent bilateral TKR received a posterior cruciate-sacrificed TKR (Total Condylar) in 1 knee and 1 of 3 different CR implants in the contra lateral knee. Five patients were eliminated from the study because they developed other joint symptoms. At 2 years postoperatively, gait laboratory data analysis on the remaining 11 patients revealed that the posterior cruciate-sacrificed TKR was less efficient, had greater medial loading, and higher joint reaction forces. The authors concluded these gait abnormalities may affect the durability of posterior cruciate-sacrificed TKRs. The 5-year Hospital for Special Surgery knee scores, patient satisfaction, and radiographic examination were the same for both implants. In another bilateral TKR study, Becker, Insall and Faris reported on the 2-to

5-years follow up of 30 patients who underwent bilateral TKR.<sup>8</sup> One knee received an Insall-Burstein (Zimmer, Warsaw, IN) CS prosthesis, whereas the contra lateral knee received 1 of 3 different CR prostheses.<sup>6</sup> In general, the more deformed knee received the CS implant. Laskin showed a poorer outcome in patients undergoing TKR with a CR design if they have significant preoperative flexion and varusdeformities. Becker, Insall, and Faris found no difference between the 2 groups with respect to Hospital for Special Surgery knee score, range of motion, stair-climbing ability, or patient satisfaction.<sup>6</sup> The authors concluded that there is no clinical advantage of one type of TKR over the other. Udomkiat and Meng et al conducted a matched-pair analysis to compare CR and CS TKRs. Of 150 consecutive TKRs, 38 matched pairs were included for this study. Patients received either a CR or CS Apollo TKR. With the exception of a traditional posterior stabilizer housing and 2 fixation pegs, the Apollo CS femoral component was identical to the CR component. At 2-year follow-up, the authors found no difference in the Knee Society patient functional scores or range of motion between the 2 implant designs.

The authors concluded that surgeons who prefer to resect the PCL should expect a clinical result as good as surgeons who retain the PCL. These Fluoroscopic analyses of TKRs showed that although CS knees showed posterior femoral rollback, dictated by the interaction of the femoral cam and tibial post mechanism, there was a large variability in contact pathways between varying CS implants. The implants used in the current study more closely represent the current philosophy of orthopaedic surgeons, who have a preference of one implant design over the other. Aside from retaining or substituting for the PCL, all knees were implanted with the identical surgical technique.

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