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Posterior cruciate-retaining versus posterior stabilized total knee arthroplasty

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Abstract

Background: Some surgeons decide to preserve or sacrifice PCL preoperatively based on their experience and training, while others decide intraoperatively after evaluating morphology of PCL, knee alignment, range of motion (ROM) and stability of knee. Several papers have been published comparing outcomes of PCL-retaining and PCL-stabilizing types of prostheses in neutrally aligned knees. Some potential advantages of cruciate-retaining prosthetic designs include preservation of bone, more normal knee kinematics, increased proprioception, femoral rollback on the tibia during flexion, and greater stabilization of the prosthesis, with the PCL preventing anterior translation of the femur on the tibia.

Aim of the study: To compare posterior cruciate-retaining versus posterior stabilized total knee arthroplasty.

Materials and methods: For the study, a total of 60 patients underwent total knee arthroplasty utilizing a posterior-stabilized prosthesis, and another group of 60 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. 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.

Results: We observed that the mean Knee Society knee scores of the Group 1 was 80 and for Group 2 was 75. The mean Knee Society functional scores were 67 points for Group 1 and 78 for Group 2. The mean ranges of motion were 132° for Group 1 and 125° for the for Group 2. The results on comparison were found to be statistically non-significant.

Conclusion: Within the limitations of the present study, it can be concluded that posterior cruciate-retaining versus posterior stabilized total knee arthroplasty offers significant benefits postoperatively; however, on comparing both the procedures provide similar results.

Keywords: Knee replacement, knee arthroplasty, range of motion, posterior cruciate ligament

Introduction

Patients with pain and restrictions to daily functions that impair quality of life, have deformity, or instability of arthritic knee joint can be successfully treated with total knee arthroplasty (TKA) [1, 2]. Performing TKA in severe varus knees is technically more challenging than routine primary TKA of neutrally aligned knees. It remains controversial, and the literature is also indecisive about fate of posterior cruciate ligament (PCL) in TKA with severe varus deformity of knee [3, 4]. Some surgeons decide to preserve or sacrifice PCL preoperatively based on their experience and training, while others decide intraoperatively after evaluating morphology of PCL, knee alignment, range of motion (ROM) and stability of knee. Several papers have been published comparing outcomes of PCL-retaining and PCL-stabilizing types of prostheses in neutrally aligned knees. Some potential advantages of cruciate-retaining prosthetic designs include preservation of bone, more normal knee kinematics, increased proprioception, femoral rollback on the tibia during flexion, and greater stabilization of the prosthesis, with the PCL preventing anterior translation of the femur on the tibia. Posterior-stabilized implants attempt to replace the role of the PCL with a polyethylene post and femoral cam that 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, and increased range of motion [5, 6]. Hence, the present study was conducted to compare posterior cruciate-retaining versus posterior stabilized total knee arthroplasty.

Materials and methods

The present study was conducted in the Department of Orthopedics of the medical institution. The ethical clearance for the study was approved from the ethical committee of the hospital. For the study, a total of 60 patients underwent total knee arthroplasty utilizing a posterior-stabilized prosthesis (Group 1), and another group of 60 patients received a cruciate-retaining implant (Group 2). 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. 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. All surgeries utilized the Scorpio CR cruciate-retaining system or the Scorpio PS posterior-stabilized system. Knee Society scores, ranges of motion, and radiographs were assessed at each follow-up visit. Radiolucencies were evaluated using the system of zonal analysis developed by the Knee Society.

The statistical analysis of the data was done using SPSS version 11.0 for windows. Chi-square and Student's t-test were used for checking the significance of the data. A p-value of 0.05 and lesser was defined to be statistically significant.

Results

Table 1 shows demographics of Group 1 and 2. The patients who received cruciate-retaining arthroplasties consisted of 25 men and 35 women who had a mean age of 58 year, a mean preoperative Knee Society knee score of 46 points (range, 20 to 73 points), and a mean preoperative Knee Society functional score of 39 points (range, 10 to 60 points). The patients who received posteriorstabilized arthroplasties consisted of 29 men and 31 women who had a mean age of 61 years, a mean preoperative Knee Society knee score of 40 points and a mean preoperative Knee Society functional score of 37 points. Table 2 shows post-operative knee scores and range of motion. We observed that the mean Knee Society knee scores of the Group 1 was 80 and for Group 2 was 75. The mean Knee Society functional scores were 67 points for Group 1 and 78 for Group 2. The mean ranges of motion were 132° for Group 1 and 125° for the for Group 2. The results on comparison were found to be statistically non-significant.

Discussion

In the present study a total of 120 patients were included. A total of 60 patients underwent total knee arthroplasty utilizing a posterior-stabilized prosthesis and another group of 60 patients received a cruciate-retaining implant. In the present study, we observed that the mean preoperative knee society knee score and mean preoperative knee society function score improved significantly post-operatively. The results on comparison were found to be statistically non-significant. The results were compared with previous studies from the literature. Jiang C *et al.* [7] compared the knee scores, post-operative knee range of motion (ROM), radiological outcomes about knee kinematic and complications between CR TKA and PS TKA. They searched literature published up

to August 2015 was searched in PubMed, Embase and Cochrane databases, and meta-analysis was performed using the software, Review Manager Version 5.3. Totally 14 random control trials (RCTs) on this topic were included for the analysis, which showed that PS and CR TKA had no significant difference in Knee Society knee Score (KSS), pain score (KSPS), Hospital for Special Surgery score (HSS), kinematic characteristics including postoperative component alignment, tibial posterior slope and joint line, and complication rate. However, PS TKA is superior to CR TKA regarding post-operative knee range of motion (ROM), improvement of ROM. They concluded that there are no clinically relevant differences between CR and PS TKA in terms of clinical, functional, radiological outcome, and complications, while PS TKA is superior to CR TKA in respects of ROM, while whether this superiority matters or not in clinical practice still needs further investigation and longer follow-up. Kolisek FR *et al.* [8] compared the outcomes of these two designs. Forty-five patients who received a posterior-stabilized prosthesis were compared to 46 consecutive patients who received a cruciate-retaining implant. At a mean follow-up time of 60 months (range, 49 to 69 months), the mean Knee Society knee scores improved from 42 points (range, 20 to 73 points) to 93 points (range, 39 to 100 points) for the cruciate-retaining group and from 38 points (range, 20 to 70 points) to 94 points (range, 60 to 100 points) for the posterior-stabilized group. The mean Knee Society functional scores improved from 36 points (range, 10 to 60 points) to 71 points (range, 15 to 100 points) for the cruciate-retaining group and from 32 points (range, 10 to 70 points) to 73 points (range, 32 to 100 points) for the posterior-stabilized group. The ranges of motion were 125° (range, 100 to 140°) and 118° (range, 87 to 135°) in the cruciate-retaining and posterior-stabilized groups, respectively, at final follow-up. Radiographic analysis revealed no radiolucencies that were progressive or were greater than 1 millimeter in length. There were no re-operations in either group. This study did not conclusively demonstrate the superiority of one knee design over the other, suggesting that the choice of implant should be based on surgeon preference and existing pathology of the posterior cruciate ligament.

Mayne A *et al.* [9] compared outcomes between cruciate-retaining and posterior-stabilised knees exist. A matched paired study comparing a cohort of 107 Zimmer Nexgen® Cruciate Retaining (CR) patients with a cohort of 107 Nexgen Posterior-Stabilised (PS) knees matched for age, sex, body mass index and preoperative American Knee Society score was undertaken. All patients underwent independent clinical assessment and knee society scoring preoperatively and at 1, 3, 5, 7 and 10 years postoperatively. Fifty-three patients (49.5%) in the CR group and 44 patients (41.1%) in the PS group were alive at 10-year follow-up. There were no significant differences between the CR and PS groups with regards to functional assessment ($P = 0.95$), overall range of movement or patient satisfaction at 10 years. However, there was a significantly better score improvement in range of movement in PS knees compared with CR knees. There were six revisions (5.6%) in the PS group and 1 (0.93%) in the CR group. Both CR and PS knees showed excellent survivorship with no significant difference at 10 years. They concluded that there were no significant differences in functional score, overall range of motion or patient satisfaction between the Nexgen cruciate retaining and posterior stabilised total knee arthroplasty at 10-year follow-up. However, PS knees had a greater score improvement in range of motion compared with

CR knees. Ettinger M *et al.* [10] evaluated the mid term outcome of CR versus PS TKA for the treatment of valgus OA in groups between 3°-6° of valgus, 7-10° of valgus and >10° of valgus. With the KOOS score as the primary endpoint, a sample size of 117 cases (78 CR and 39 PS) was needed in order to get a statistical power of 80%. Between 01-2011 and 03-2014 a total of 248 patients with a preoperative valgus >3° were treated with a CR TKA (167 cases) or a PS TKA (81 cases) of the same manufacturer (Stryker Triathlon, Stryker, Kalamazoo USA). CR patients were divided into the following groups: Preoperative valgus >3°-6°, 7°-10° and >10°. PS patients were divided into the following groups: Preoperative valgus >3°-6°, 7°-10° and >10°. The KOOS Score and the Oxford Knee score was collected at the time of follow up. For the CR and PS group failure rates and failure

etiologies were analyzed. Patients demographics and were collected as well. 141 patients were included into this study (97 CR and 44 PS cases). The CR group had a mean follow up of 57 & #61617; weeks, the PS group had a follow up of 52 & #61617; weeks. In the CR group, 11/97 (11%) patients were revised due to A.P. instability, whereas 2/44 (5%) patients were revised in the PS group due to infection or aseptic loosening. There was no difference regarding OKS and the KOOS score between the two groups. Further, there was no difference regarding patients demographics and no correlation between the BMI and the clinical outcome. They concluded that the CR group showed a significant higher early revision rate, whereas the clinical mid term follow up results are equal. The CR version of the used system showed significantly higher early failure due to A.P. instability.

Table 1: Demographics of Group 1 and 2

Variables	Group 1	Group 2
Total no of patients	60	60
Number of men	25	29
Number of women	35	31
Mean preoperative Knee Society knee score	46	40
Mean preoperative Knee Society functional score	39	37

Table 2: Post-operative knee scores and range of motion

	Group 1	Group 2	p-value
Mean Knee Society knee scores	80	75	0.75
Mean Knee Society functional scores	67	78	0.36
Mean range of motion	132°	125°	0.25

Conclusion

Within the limitations of the present study, it can be concluded that posterior cruciate-retaining versus posterior stabilized total knee arthroplasty offers significant benefits postoperatively; however, on comparing both the procedures provide similar results.

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