Original Research Article

Comparison of Cruciate-Sacrificing vs Posterior-Stabilized Total Knee Replacement- A Retrospective study

Abstract

Introduction

Total knee replacement (TKR) is a common surgical procedure in modern orthopaedics. There are two most commonly used implants in TKR: posterior cruciate ligament (PCL)-retaining or the Cruciate Retaining (CR) knees and posterior stabilized (PS) knees in which the Posterior Cruciate Ligament is not retained, and a mechanism in the implant stabilizes the knee.

In this study we try and compare the clinical outcomes of CR and PS knees by following up patients who have undergone TKR

Materials and Methods

In this study we have retrospectively reviewed patients who have undergone CR or PS TKR at a single tertiary care center in southern India. Patients were called at one year post surgery for the assessment, and were assessed primarily using the Knee Society Score (KSS).

Results

A total of 200 patients were included in the study. There were 100 patients in the CR group and 100 patients in the PS group. The mean KSS at 2 years was 90 in the CR group and 85 in the PS group. There was no significant difference in pain, range of motion, or patient satisfaction between the two groups.

Conclusion

This study found that there was no significant difference in clinical outcomes between CR and PS knees at 2 years of follow-up. These findings suggest that either type of knee replacement can be a safe and effective option for patients who are considering TKR.

Limitations

This study was limited by its retrospective design. Additionally, the study was conducted at a single academic medical center, and the results may not be generalizable to all patients who undergo TKR.

Key words: CR knee, PS knee, retrospective study, KSS score

Introduction:

The ongoing discussion pertains to the comparative excellence of cruciate-retaining (CR) total knee arthroplasty (TKA) versus posterior-stabilized (PS) TKA in achieving knee joint stability with functional enhancement. Most previous studies have failed to reveal any noteworthy disparity in functional outcomes, range of motion, kinematics, and survival rates between CR and PS TKAs. Instead, strict adherence to surgical indications and a comprehensive comprehension of variances in surgical principles may hold greater significance than the specific selection of either a CR or PS prosthesis (1).

Total knee arthroplasty (TKA) is widely recognized as the predominant treatment for end-stage knee osteoarthritis (OA) and remains a viable option for addressing other underlying conditions, including inflammatory arthritis, fracture-related complications (post-traumatic OA and/or deformity), dysplasia, and malignancy (2).

Advocates of preserving the posterior cruciate ligament (PCL) contend that it is one of the most robust ligaments around the knee and confers inherent stability to the TKA. Conversely, proponents of PCL sacrifice argue that the degenerative process compromises the PCL's efficacy. When dealing with patients without significant varus or valgus malalignment and lacking significant flexion contracture, retaining the PCL may be appropriate, whereas in cases with these deformities, PCL removal may be necessary (3).

Patients presenting severe steep posterior slope and a small femoral component exhibit a notably high conversion rate from CR to PS-type prostheses, necessitating meticulous consideration for the appropriate selection of the prosthetic type (4).

It has been reported that the clinical disparities between TKAs utilizing CR and PS- type prostheses may not solely arise from the treatment of the PCL but rather involve a multitude of complex variables, including the surgeon's skill and various patient-related factors. Consequently, there is a need to investigate the influencing factors regarding the conversion to a PS-type prosthesis in cases where preoperative plans initially involved the use of a CR-type prosthesis (5).

To shed light on this debate, a retrospective study was conducted on a cohort of patients who underwent TKR using either the cruciate-sacrificing or posterior-stabilized design. The study aimed to compare various clinical and functional parameters using the Knee Society Score.

Materials and Methods:

This retrospective study aimed to compare the clinical outcomes of CR and PS knees in patients who underwent TKR. The study was conducted at a single academic medical center and included patients who underwent TKR between January 2018 and January 2020. The inclusion criteria comprised patients who had a diagnosis of severe osteoarthritis of the knee and received either a CR or PS knee implant. Patients with a minimum follow-up duration of 2 years were included in the study.

Data collection included demographic information, preoperative characteristics, surgical details, and postoperative outcomes. The primary outcome measure was the Knee Society Score (KSS), a widely used and validated measure of knee function. Secondary outcome measures included pain levels, range of motion, and patient satisfaction. Statistical analyses were performed to compare the outcomes between the CR and PS groups.

Results:

A total of 200 patients were included in the study, with 100 patients in the CR group and 100 patients in the PS group. The mean age was 65 years in both groups, and the majority of patients were female (62% in the CR group, 58% in the PS group). There were no significant differences in preoperative characteristics between the two groups.

At the 1-year follow-up, the mean KSS score was 90 in the CR group and 85 in the PS group. The difference, however was not statistically significant ($p > 0.05$). (Table no 1)

Table 1. The significant difference between two groups at $p > 0.05$.

Sl No	Patient no	CR/PS group	KSS Score	P value
1	100	CR	90	>0.05
2	100	PS	85	

Discussion:

Two most commonly used prosthesis are the CR and PS type, both the prosthesis has a different mechanism through which the femoral roll back occurs to facilitate knee flexion. In a CR knee the femoral roll back occurs by preserving the posterior cruciate ligament and the knee range of motion is better and gait tends to be more of a normal gait post TKA. In contrast to the PS prosthesis where in the femoral rollback occurs through a femoral cam mechanism. When the knee flexion is occurring in a PS knee the femoral cam will come in contact with the tibial post at around 70 degrees of flexion and in turn moves the contact point between the tibia and femur backwards consequently completing the femoral roll back movement. (6)

A 10 year follow up study by Kanna et al (7) demonstrated that CR knee had a better survivorship compared to the PS knee, so CR was the favored knee in younger patients. In terms of complications and clinical parameters like range of motion no statistical difference was noted between both the knees. When a satisfactory ligament balance is achieved its better for surgeons to stick to CR knee.

A long-term study by kim et al (8) which followed up 253 knees (159 CR and 94 PS) for a duration of 10 years concluded that there was no difference between the knees with respect to functional outcomes, range of motion and complications if any. The implant survival rate showed no difference between both the knees at 10 years.

Cruciate substituting knee replacement is a surgical procedure that involves replacing the posterior cruciate ligament (PCL) with a tibial polyethylene post. This post interacts

with a cam located between the femoral condyles. The purpose of this cam/post articulation during deep flexion is to inhibit anterior femoral translation and mimic the natural femoral rollback. Research on the knee's kinematics has shown that this mechanical rollback leads to a smoother flexion movement and significantly improves the range of motion, particularly during deep flexion. (9).

A study conducted by Seon et al (10) followed 48 CR and 47 PS knees for a duration of 27 months and assessed weight bearing and non-weight bearing maximal flexions and functional scores were also assessed and compared between the two knees. The study concluded that high flexion PS knee showed better weight bearing flexion and femoral roll back then compared with the CR knee, although no clinical outcome difference was noted between the two designs.

A study by Kim et al (11) followed up 44 patients for a duration of 3 years, patients were operated with high flexion PS knee on one knee and standard CR knee in the other. At the end of 3 years patients were assessed clinically and radiographically. Study concluded that there was no significant difference between the two groups in relation to knee range of motion or the clinical or radiographic parameters.

A study by Catani et al (12) showed that PS knee did not show a statistically significant migration of tibial component with respect to CR implants. Current results show that replacement of posterior cruciate ligament with cam and post mechanism of the PS knee won't affect the stability of the tibial component.

In a study conducted by Mayne et al. (13), they found that after a 10-year follow-up, there was no significant difference between the Cruciate Retaining (CR) and Posterior-Stabilized (PS) knee replacements in terms of functional assessment, range of motion, or patient satisfaction. Initially, the PS knees showed better knee flexion in the early post-operative period compared to CR knees, but this difference became less noticeable over time. However, when taking into account the preoperative range of motion and calculating the improvement score, the PS knees showed a significantly better range of motion improvement compared to the CR knees. Despite this slight advantage in knee flexion improvement, it did not seem to have a significant impact on patient-related outcome measures.

It is important to note that the decision to choose between CR and PS knees should be based on a comprehensive evaluation of the patient's individual characteristics, including knee anatomy, ligamentous integrity, functional demands, and surgeon expertise. A multidisciplinary approach involving orthopedic surgeons, physical therapists, and patients is crucial in making an informed decision.

Conclusion:

This study compared the clinical outcomes of CR and PS knees in patients undergoing TKR and found no significant differences in terms of knee function, pain levels, range of motion, or patient satisfaction at the 2-year follow-up. These findings are consistent with previous research, suggesting that both CR and PS knees can provide satisfactory outcomes for patients with severe osteoarthritis of the knee. However, it is important to consider patient-specific factors, surgeon expertise, and implant design when making the decision between CR and PS knees. Further prospective studies with larger sample sizes

and longer follow-up durations are needed to confirm these findings and evaluate the long-term outcomes of CR and PS knees.

In summary, while the choice between CR and PS knees in TKR remains a topic of debate, both types of knees can provide satisfactory clinical outcomes for patients with severe osteoarthritis of the knee. The decision should be based on individual patient characteristics, surgeon expertise, and implant design, considering factors such as preoperative deformity, ligament laxity, and functional demands.

Limitations:

This study has several limitations. First, the retrospective design introduces potential biases and limitations in data collection. Second, the study was conducted at a single academic medical center, which may limit the generalizability of the findings. Third, the follow-up duration of 1 year may not capture long-term outcomes and implant survival rates. Future research should address these limitations by conducting prospective studies with larger and more diverse patient populations and longer follow-up durations.

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