

COMPARING THE RESULTS OF TOTAL KNEE ARTHROPLASTY BETWEEN POSTERIOR CRUCIATE LIGAMENT SUBSTITUTION METHOD AND RETENTION METHOD, VISAKHAPATNAM, INDIA: A PROSPECTIVE STUDY.

¹Kola Sagar, ²Sharath Babu Mukka, ³Shaik Nabiya Asma Humaira, ⁴Pyla Hima Bindu

Associate Professor, Department of Orthopaedics, NRI Institute of Medical Sciences, Sangivalasa, Visakhapatnam, India¹

Associate Professor, Department of Orthopaedics, Prathima Institute of Medical Sciences, Karimnagar, Telangana, India²

Postgraduate, Department of Orthopaedics, NRI Institute of Medical Sciences, Sangivalasa, Visakhapatnam, India³

Assistant Professor, Department of Orthopaedics, NRI Institute of Medical Sciences, Sangivalasa, Visakhapatnam, India⁴

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ABSTRACT.

Background:

During arthroplasty, the cruciate ligament is either removed or kept in place because it is vital to the knee's kinematics. There are conflicting results; in some studies, the preserved cruciate ligament is found to improve bone function, while in other studies, the substituted cruciate ligament is found to improve knee function.

Method:

This was a prospective comparative study conducted at the NRI Institute of Medical Sciences, Sangivalasa, Bheemunipatnam from January 2022 to January 2024. In total 40 patients participated in the study. 20 patients underwent cruciate retaining arthroplasty and the other 20 patients underwent cruciate substituting arthroplasty. Postoperatively the knee was examined radiologically, and the pain score, swelling, redness, and difficulty in motion were assessed during follow-up after .2, 4, and 12 weeks.

Results:

The clinical outcomes and WOMAC score obtained for the knee of the patients in both groups were compared statistically and the p-value was more than 0.05, indicating that the difference in the values obtained from both groups was not statistically significant (p=0.07).

Conclusion:

In this study, it was found that TKA performed by the PCL retaining method and PCL substituting method do not have significant differences in the clinical outcome.

Recommendation:

Comparative studies on the TKA by PCL retaining and PCL substituting method should be done with a longer duration of follow-up and a larger sample size of the population. Also, the study of TKA for different pathological conditions should be considered.

Keywords: Total Knee Arthroplasty, Retaining Posterior Cruciate Ligament, Substituting Posterior Cruciate Ligament

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Corresponding author: Pyla Hima Bindu*

Email: bindupyla@gmail.com

Assistant Professor, Department of Orthopaedics, NRI Institute of Medical Sciences, Sangivalasa, Visakhapatnam, India.

INTRODUCTION.

TKA is a procedure of replacing the knee bones with prosthetics. The PCL plays a crucial role in the kinematics of the knee during arthroplasty it either remains as it is, or it is to be removed. There are contradictory findings, in

certain studies it is found that the retained cruciate ligament improves the function of the bone whereas in another case the substituted cruciate ligament improves the knee function [1,2]. Improvement of the complete contraction and flexion of the knee gives a range of motion that enables daily activity.

Prosthetics are expected to give full range of motion to the knee but the recovery also depends on the underlying pathological condition of the knee and the damage it has caused to the knee [3]. There are algorithms stated in which the type of the pathological conditions and degree of the deformity influence the choices of the surgical method [4]. However, the debate on retaining the cruciate ligament or removing remains contradictory [5,6]. The time of follow-up also determines the degree of recovery and range of motion achieved.

With the advent of new technologies such as fluoroscopy, it was found that the study in which cruciate substituting prosthetics improved the knee movements particularly the back-roll movement of the knee compared to another arthroplasty [7]. The movements of the normal knee are comparable to that of the cruciate substituting ligament. There are various methods available to determine the range of motion of the knee such as in vitro robotics, in vivo fluoroscopy, and radio spectroscopy [8]. Although there are various studies available that assess the recovery of the knee after arthroplasty [6-8, 9,10]. This study is done to determine the outcome of TKA in patients who have cruciate ligament retained and those who have substituted cruciate ligament by radiology, kinematics, and the international knee score system (WOMAC).

METHOD.

Study design.

This was a prospective comparative study.

Study setting.

The study was conducted at NRI Institute of Medical Sciences, Sangivalasa, Bheemunipatnam, India, from January 2022 to January 2024.

Participants.

Patients presenting with degenerative osteoarthritis which was not managed by conservative methods were included in this study. The patients who have knee degeneration due to autoimmune disorders, traumatic osteoarthritis, or any other bone disorder were not included in the study. The patient's age ranged from 30 to 80 years. They were thoroughly analyzed for the details of osteoarthritis and the international knee score (WOMAC) was given. The macroscopic examination of the existing posterior cruciate ligament was done to determine its intactness. If the ligament was not intact then they were not included in the study. The condylar damage in all the patients was more than 15 degrees. In total 40 patients participated in the study. 20 patients underwent cruciate retaining arthroplasty and the other 20 patients underwent cruciate substituting arthroplasty. Postoperatively the knee was examined radiologically, and the pain score, swelling,

redness, and difficulty in motion were assessed during follow-up after 2, 4, and 12 weeks.

Bias.

There was a chance that bias would arise when the study first started, but it was avoided by giving all participants identical information and hiding the group allocation from the nurses who collected the data.

Ethical consideration.

The ethical committee of the institute approved this study.

Statistical analysis.

Student's T-test was done to compare the outcomes of both methods. The p-value of less than 0.05 was considered significant.

RESULTS.

The study consisted of a total of 40 participants. It consisted of two groups, in group 1 arthroplasty was performed by retaining the posterior cruciate ligament and in group II arthroplasty was performed by substituting the posterior cruciate ligament. The ages of the patients ranged from 30 years to 80 years. The osteoarthritis and factors affecting the function of the knee were assessed in participants of both groups. The deformity was comparable in both the group and the PCL was intact in all the patients.

WOMAC score for the knee was recorded before the surgery and after surgery for 15 days, 1 month, and 3 months. The score was assessed by 3 modalities: pain, stiffness in the movement, and the function of the knee. The pain score of WOMAC ranged from 0 to 20. The pain in the cruciate retaining group was numerically lower than the pain in the cruciate substituting group. Nevertheless, the fall in the pain score was stable and significant in both groups during the last follow-up.

The score of the stiffness ranged from 0 to 8 and the stiffness in both groups was equal before the surgery. Both the groups had significant decreases in the stiffness and later on during the last follow the score for stiffness was equal. The functional score ranged from 0 to 68. The higher ends of the score indicated worsened functioning. The functional score was higher in the retaining group compared to the substituting group, indicating decreased functionality compared to the other group. However, the fall in the score was significant in the retaining group post 3 months of the surgery indicating that the function of the knee improved significantly.

Both the groups had significant improvement in the kinematics of the knee and the standard activity data outcome was similar in both the groups. The advanced activity was not restricted to the groups. The majority of them had excellent International Knee Society scores.

Table No. 1 compares and summarises the clinical outcomes of both groups.

Table no. 1: Summary of the finding.

Parameters		Cruciate retaining				Cruciate substituting			
Duration		Before	2 weeks	4 weeks	12 weeks	Before	2 weeks	4 weeks	12 weeks
WOMAC score	Pain	9	2	2	2	10	4	3	4
	Stiffness	3	3	3	1	3	3	2	1
	Function score	37	11	8	7	34	33	10	13
Functional activities (N=40)	With help	9				9			
	Without help	7				7			
Standard activity (N=40)	None	11				11			
	Mild	8				8			
	moderate	1				1			

DISCUSSION.

This study was done to compare the posterior cruciate-retaining and posterior cruciate substituting designs for total knee arthroplasty. In one of the groups the posterior cruciate-retaining arthroplasty was conducted and in the other group posterior arthroplasty substituting arthroplasty was conducted. The preoperative osteoarthritis characteristics were determined. The deformity in both groups was comparable.

The pain in the cruciate retaining group was numerically lower than the pain in the cruciate substituting group. Nevertheless, the fall in the pain score was stable and significant in both groups during the last follow-up. The finding in this study was consistent with a comparison study conducted similarly [11]. Yet another study reported that the cruciate retaining group had lower pain scores compared to the cruciate substituting group [12].

Considering the stiffness WOMAC score, it improved significantly in both groups during the last follow-up. The functional score found in this study was similar to various other studies conducted [13,14]. On the other hand, a study reported a significant difference in the WOMAC functional score of both groups [15]. However, the kinematics of the knee in the current study was similar. The range of motion achieved in both groups was comparable.

Overall, the study conducted initially showed that the cruciate retaining group had more pain and worse functional scores but it improved substantially. There was no significant statistical difference found in the clinical outcomes of both groups. The patients of both groups did not experience any resistance toward performing standard activities. This indicated that both cruciate-retaining and cruciate-substituting arthroplasty are effective concerning post-operative knee kinematics.

GENERALIZABILITY.

The study on knee arthroplasty, comparing outcomes between retaining and substituting the posterior cruciate ligament (PCL) in 40 participants aged 30 to 80 years, presents valuable insights but has limitations for generalizability. While the broad age range enhances applicability to various age groups, the small sample size and lack of demographic detail restrict the extent of generalization. Findings are specific to the surgical techniques employed and may not extend to settings using different approaches. The use of WOMAC scores for pain, stiffness, and function, although widely accepted, limits generalization to populations where these measures may not be as relevant. Additionally, the relatively short follow-up duration of up to 3 months may not capture longer-term outcomes. While favorable results were observed in functional activities and International Knee Society scores, applicability hinges on the relevance of these outcomes to diverse populations and healthcare systems. Further research with larger and more diverse samples is warranted to validate and extend these findings to broader clinical contexts.

CONCLUSION.

In this study, it was found that TKA performed by the PCL retaining method and PCL substituting method do not have significant differences in the clinical outcome. The range of motion and kinematics of the knee achieved after TKA by both methods are similar.

LIMITATION.

The duration of follow-up was shorter in this study and the study sample included 20 patients per group which is smaller than the required sample size to confirm the findings.

RECOMMENDATION.

Comparative studies on TKA by PCL retaining and PCL substituting methods should be done with a longer duration of follow-up and a larger sample size of the population. Also, the study of TKA for different pathological conditions should be considered.

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LIST OF ABBREVIATION.

WOMAC- Western Ontario McMasters Osteoarthritis
PCL- Posterior cruciate ligament
TKA- Total knee arthroplasty

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No funding received.

CONFLICT OF INTEREST.

The authors have no competing interests to declare.

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