Open Access

Original Article

Effects of Posterior Femoral Condylar Osteophytes Removal on Range of Motion in Primary Total Knee Arthroplasty

Muhammad Arsalan Azmat Swati, Muhammad Suhail Amin, Zeeshan Aslam, Zainullah Kakkar, Javaid Iqbal Niazi, Adeel Habib

Department of Orthopedic Surgery, Combined Military Hospital/National University of Medical Sciences (NUMS) Rawalpindi Pakistan

ABSTRACT

Objective: To see the effects of posterior femoral condylar osteophytes removal on range of motion in primary total knee arthroplasty.

Study Design: Quasi-experimental study.

Place and Duration of Study: Department of Orthopedics, Combined Military Hospital, Rawalpindi Pakistan, from Dec 2020 to Sep 2021.

Methodology: We studied 78 patients [18 males (23.0%) and 60 females (76.9%)]. All of these patients were followed for three months. The primary outcome was knee range of motion at 03 months following treatment. Following total knee arthroplasty, the knee range of motion was measured using a goniometer.

Results: The mean age of the patient was 63.05±4.98 years. The knee range of motion showed that the effect of posterior osteophyte removal significantly improved at one-month, 2-months, and 3-months of follow-up. At the one-month follow-up, the average knee range of motion was 10.29±3.06 degrees to 95.69±2.87 degrees. At the three-months follow-up, the knee range of motion was 0 degrees to 110.47±3.12 degrees.

Conclusion: Total knee arthroplasty aims to improve quality of life by reducing knee pain and improving function. Range of motion is an important part of knee function. This study showed that measurements improved at each follow-up. Removing osteophytes in primary knee arthroplasty positively influenced the range of motion.

Keywords: Osteoarthritis, Osteophytes, Primary Cemented Total Knee Arthroplasty, Range of Motion.

How to Cite This Article: *Swati MAA, Amin MS, Aslam Z, Kakkar Z, Niazi JI, Habib A. Effects of Posterior Femoral Condylar Osteophytes Removal on Range of Motion in Primary Total Knee Arthroplasty. Pak Armed Forces Med J 2024; 74(2): 380-384. DOI: https://doi.org/10.51253/pafmj.v74i2.8019*

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (https://creativecommons.org/licenses/by-nc/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

Total Knee Arthroplasty (TKA) is a well-established surgical procedure for severe knee osteoarthritis that has a high percentage of success and patient satisfaction.[1] Range of motion is crucial when it comes to total knee replacement. Most daily actions necessitate proper knee flexion (for example, walking necessitates 67, going upstairs necessitates 83, walking downstairs necessitates 90 and rising from a chair without assistance necessitates 93).[2,3] Pre-operative knee joint flexion is the most important factor in anticipating the pre-operative range of motion. Despite being considered a surgery with good clinical outcomes, some patient-based functional scores are low because of a restricted range of motion (ROM) and its associated impacts postoperatively.[4] The fundamental goal of TKA is to restore the normal mechanical axis by aligning the femoral and tibial components perpendicular to the mechanical axis of the femur and tibia, respectively. Restoration of the neutral coronal and sagittal alignment of the limb is critical.[5] Correcting the extension and flexion gaps intraoperatively is essential to total knee arthroplasty. The soft tissue envelope of the knee joint is then balanced to provide for optimum range of motion, knee stability, and patellar tracking. Proximal tibial resection, femoral component sizing and removal of the posterior osteophytes all affect gaps.[6] Usually, posterior femoral condylar osteophytes are removed during flexion gap preparation. Prior to the gap-balancing step of total knee arthroplasty, posterior condylar osteophytes are routinely removed. Because soft tissue can be fairly tight in some circumstances, removing posterior osteophytes prior to gap measure-ment can be challenging.[7,8] The excision of posterior femur condylar osteophytes reduces tenting effects on the joint capsule, resulting in a larger intraoperative extension gap and better extension at the time of operation. Because the rear portion of the Polyethene insert is anticipated to push on the osteophyte when flexion approaches 90 degrees, it is reasonable to assume that residual osteophyte on the femoral condyle will limit flexion following knee arthroplasty. The study aims to see effects of femoral osteophytes removal on knee range of motion.

Correspondence: Dr Muhammad Arsalan Azmat Swati, Department of Orthopedic Surgery, Combined Military Hospital, Rawalpindi Pakistan

Received: 13 Jan 2022, revision received: 18 Apr 2022; accepted: 19 Apr 2022

METHODOLOGY

The quasi-experimental study was carried out Department of Orthopaedics, Combined Military Hospital, Rawalpindi Pakistan, from December 2020 to September 2021, after approval from the Hospital Ethical Committee (No.216/11/21). The sample size was estimated using the WHO sample size calculator using a prevalence of 63.2%.[9] The sample was gathered using a non-probability consecutive sampling technique.

Inclusion Criteria: Patients of either gender, who underwent cemented posterior stabilised total knee arthroplasty during study duration for osteoarthritis, varus deformity, flexion contracture of up to 15 degrees, and adequate ppre-operativeknee flexion (equal to or more than 90 degrees) for osteoarthritis, were included.

Exclusion Criteria: Patients with pre-operative knee instability, post-traumatic or inflammatory osteoarthritis, a varus deformity of more than 20 degrees, a valgus knee deformity, a bone defect of more than 5mm at the tibia or femur and revision total knee arthroplasty were excluded.

For this study, all eligible patients were given verbal and written information. Participants were given an informed consent form in their native language if they accepted to participate in the study. After completing the papers, patients were enrolled in the study.

The patient who fulfilled the inclusion criteria underwent total knee arthroplasty for osteoarthritis using the posterior-stabilized design (Vanguard PS, Biomet). The same surgical team performed all surgeries using a standardised approach and a posterior-stabilized prosthesis.

Through midline incision, exposure was achieved by the medial parapatellar approach. The deep medial collateral ligament was released sequentially, considering the pre-operative varus deformity of the knee joint. A distal femur valgus cut angle of 6 degrees was made by an intramedullary alignment guide. An extramedullary alignment guide was utilized for proximal tibia resection. A 3 posterior slope was maintained in the sagittal plane to improve post-operative flexion of the knee joint. After which, the patella was prepared by cutting 8 mm of the articular bone surface. Using 4 in 1 cutting block, anterior, posterior, anterior chamfer and posterior chamfer cuts were made. Box cuts were made in the intercondylar region for the post and cam mechanism. Following that, the posterior femoral osteophytes were removed by osteophyte chisel. The tibial base plate trial and femoral trial component were implanted. Gap balancing in flexion and extension were evaluated and optimized. The implant sizes were confirmed. After using pulse lavage for washout, bone cement was used to secure the tibial, femoral, and patellar components. In the end, a Polyethene liner was inserted after trial. Final flexion/extension and varus/valgus stability were confirmed. After deflating the tourniquet, hemostasis was secured by cauterization. Vicryl 1 interrupted mattress suture was used to close the quadriceps and joint capsule. Vicryl 2/0 was used to stitch the subcutaneous tissue together, and the skin was closed with subcuticular sutures of prolene.

During the surgery, the sizes of the femoral, tibial, and patellar components and the polyethene insert sizes were documented in a standard form. Every patient was mobilized on the first post-op day, and range-of-motion exercises were started. A physiotherapist kept patients on a rehab protocol for at least one month. A continuous passive motion machine was not employed postoperatively in all the patients.

All patients were followed up one month, two months, and three months after the index procedure. At each follow-up, plain radiographs of the operative knee were taken (anterior-posterior and lateral views). Suppose post-operative osteophytes are seen in any plain radiograph; a CT scan was advised to measure the size of the osteophyte. The Knee Society Score were measured at each follow-up. The range of motion was measured with a goniometer. The range of motion assessed the study's outcome at the knee joint after the third month.

Statistical Package for Social Sciences (SPSS) version 25.0 was used for the data analysis. Quantitative variables were expressed as Mean±SD and qualitative variables were expressed as frequency and percentages. Independent sample t-test was applied to explore the inferential statistics. The *p*-value of 0.05 or less was taken as significant.

RESULTS

Seventy-eight total knee arthroplasties were performed in this trial. All of the patients had a cemented posterior stabilised total knee arthroplasty. On each follow-up, radiographs were taken for all patients, and no patient was lost. Eighteen males (23.0%) and 60 females (76.9%) were recruited in this

study. The average age of the participants in the study was 63.05±4.98 years.

At four-week follow-up, the average range of motion was 10.29±3.06 degrees to 95.69±2.87 degrees. At a two-month follow-up, the average knee motion was 0±1.07 degrees to 100.21±3.34 degrees. At the three-month follow-up, the knee ROM was 0±0.54 degrees to 110.47±3.12 degrees on the goniometer (Figure). The average pre-operative knee flexion was 104.65±3.21 degrees, while the average knee flexion 03 months after surgery was 110.47±3.12 degrees. Mean pre-operative fixed flexion deformity was 10.13±3.06 degrees (Table). An Independent Sample t-test was applied, which revealed a significantly better range of motion in the knee (p<0.01) at each follow-up, indicating a better outcome after the total knee arthroplasty with posterior osteophytes removal

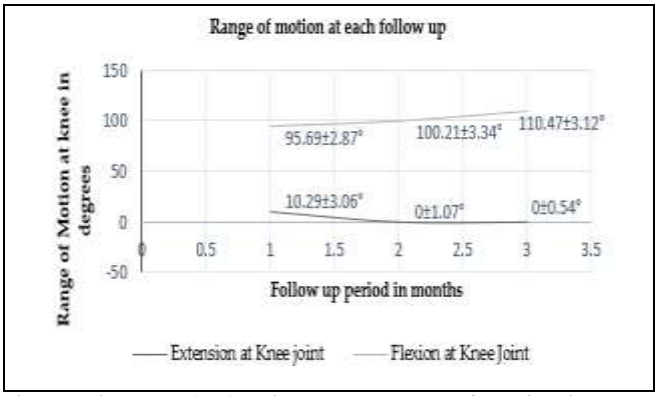


Figure: Line Graph Showing Mean Range of Motion in Knee Joint at Each Follow up.

Table: Mean Range of motion in Knee Joint at One Month, Two Months and Three Months (n=78)

Follow up	Range of Motion in Knee Joint
01 month	10.29±3.06° to 95.69±2.87°
02 months	0±1.07° to 100.21±3.34°
03 months	0±0.54° to 110.47±3.12°

DISCUSSION

The results of our study emphasize the positive effect of posterior femoral osteophyte removal on a range of motion in total knee arthroplasties and advocate the routine removal of these osteophytes to get better surgical outcomes. The expectation from total knee arthroplasty in patients of our community is increasing significantly with time, due to which surgery is no longer reserved for the elderly and crippled. Many total knee arthroplasty patients are in their thirties or forties and anticipate a normal life after surgery. In order to enjoy life after total knee arthroplasty, patients want improved knee flexion. The presence of residual osteophytes on the posterior femoral condyle and knee flexion 12 months after total knee arthroplasty was investigated by Yau *et al*.[8] The presence of residual posterior femoral condyle osteophytes was found to be the single most important surgical factor in predicting post-operative flexion of the knee joint. In total knee arthroplasty, Minoda *et al*.[9] discovered that the extension gap increased intraoperatively by 0.4 mm after posterior condylar resection and 0.6 mm following posterior condylar osteophyte removal. Removing the posterior osteophyte also improves flexibility by reducing polyethene insert impingement during full flexion of the replaced knee. Our research discovered that removing posterior osteophytes during total knee arthroplasty is easier following a 4-in-1 femoral cut during the flexion gap preparation step. Excessive manipulation can result in bleeding from posterior geniculate arteries. Although a very rare complication, vascular problems in total knee arthroplasties can result in a 7% death rate, a 42% chance of amputation, higher hospital costs and a longer hospital stay.[10,11] We have not come across such an issue in our study. The osteophyte is removed with a broad osteophyte chisel. If the chisel is placed too deeply, it might cause a supracondylar fracture of the femur. Removing posterior condylar osteophytes leads the posterior capsule to extend, increasing both the extension and flexion gaps, according to Sriphirom *et al*.[12] They concluded that the extension gap widened by 0.64 mm and the flexion gaps by 0.85 mm after removing the posterior femoral condylar osteophytes. The flexion gap widened more than the extension gap, with the highest variation in the lateral flexion gap (1 mm). Baldini *et al*. examined the flexion and extension gaps in 50 primary knee arthroplasties to examine if removing the condylar osteophytes increased the gap. Their study concluded that after posterior femoral condylar osteophytes were removed, the gaps in extension widened on average 1.8 mm medially and 1.8 mm laterally. Flexion increased on average by 2 mm medially and 2.2 mm laterally.[13]

According to new clinical trials, smaller osteophytes have a less evident effect than bigger osteophytes, especially in lower degrees of flexion.[14] According to the findings of a study, there was no noticeable difference in the magnitude of the influence of 10-mm and 15-mm osteophytes on balance.[15]

In our study, the range of motion at one month was 10.29±3.06 degrees to 95.69±2.87 degrees; at 02 months, it was 0±1.07 degrees to 100.21±3.34 degrees

and 0±0.54 degrees to 110.47±3.12 degrees at 03 months follow up. These results were similar to results reported by previous studies.[16]

Many studies show that osteophyte excision can accomplish limb alignment and gap balance without ligament release. Surgeons should not regularly remove capsuloligamentous structures as part of an exposure procedure, which should be done with caution to preserve the soft tissue envelope of the knee. Osteophytes should be recorded for their presence, position, and size before being carefully removed subperiosteally. Alignment and balance should be checked when the osteotomies are completed. In general, no more releases are necessary.[17,18]

This study, like many others, has some advantages and disadvantages. Our study's most significant strength is its 100 per cent follow-up rate. Independent assessors evaluated all of these participants at follow-up. Furthermore, the baseline demographic characteristics of our respondents were almost similar, decreasing the risk of bias in our study. A single surgeon conducted surgery to lessen the impact of variation in the surgical skill. For all patients, the rehabilitation protocol was standardized.

LIMITATION OF STUDY

The limitation of study was the short three-month follow-up time and the absence of valgus knees in our inclusion criteria, as a result, the our conclusion might not apply to valgus knees.

CONCLUSION

Besides other factors, removing posterior condylar osteophytes affects a range of motion in primary cemented total knee arthroplasties. Posterior condylar osteophyte removal improves the range of motion, but this should be achieved cautiously to avoid complications during surgery. Pre-operative imaging is an important modality to assess the presence of posterior osteophytes, as visualizing the posterior osteophyte is sometimes cumbersome. Following a good rehabilitation protocol is essential in achieving the range of motion after total knee arthroplasties.

Conflict of Interest: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

MAAS & MSA: Conception, study design, drafting the manuscript, approval of the final version to be published.

ZA & ZK: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

JIN & AH: Data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

REFERENCES

1. Canovas F, Dagneaux L. Quality of life after total knee arthroplasty. Orthop Traumatol Surg Res 2018; 104(1S): S41-S46. https://doi.org/10.1016/j.otsr.2017.04.017
2. Kettelkamp DB, Johnson RJ, Smidt GL, Chao EY, Walker M. An electrogoniometric study of knee motion in normal gait. J Bone Joint Surg Am 1970; 52(4): 775-790.
3. Siddiqi A, Smith T, McPhilemy JJ, Ranawat AS, Sculco PK, Chen AF. et al. Soft-Tissue Balancing Technology for Total Knee Arthroplasty. JBJS Rev 2020; 8(1): e0050. https://doi.org/10.2106/jbjs.rvw.19.00050
4. Athwal KK, Daou HE, Kittl C, Davies AJ, Deehan DJ, Amis AA. et al. The superficial medial collateral ligament is the primary medial restraint to knee laxity after cruciate-retaining or posterior-stabilised total knee arthroplasty: effects of implant type and partial release. Knee Surg Sports Traumatol Arthrosc 2016; 24(8): 2646-2655. https://doi.org/10.1007/s00167-015-3796-0
5. Leie MA, Klasan A, Oshima T, Putnis SE, Yeo WW, Luk L, et al. Large osteophyte removal from the posterior femoral condyle significantly improves extension at the time of surgery in a total knee arthroplasty. J Orthop 2019; 19: 76-83. https://doi.org/10.1016/j.jor.2019.10.021
6. Mizoguchi Y, Tanaka S, Matsumoto Y, Urakawa T, Kurabayashi H, Akasaka K, et al. Quality of life and life-space mobility after total knee arthroplasty in patients with rheumatoid arthritis: a pilot case-controlled study. J Phys Ther Sci 2021; 33(9): 660-667. https://doi.org/10.1589%2Fjpts.33.660
7. Holst DC, Dennis DA. Pearls: Early Removal of Posterior Osteophytes in TKA. Clin Orthop Relat Res 2018; 476(4): 684-686. https://doi.org/10.1007%2Fs11999.0000000000000015
8. Yau WP, Chiu KY, Tang WM, Ng TP. Residual posterior femoral condyle osteophyte affects the flexion range after total knee replacement. Int Orthop 2005; 29(6): 375-379. https://doi.org/10.1007/s00264-005-0010-x
9. Minoda Y, Sakawa A, Aihara M, Tada K, Kadoya Y, Kobayashi A. et al. Flexion gap preparation opens the extension gap in posterior cruciate ligament-retaining TKA. Knee Surg Sports Traumatol Arthrosc 2007; 15(11): 1321-1325. https://doi.org/10.1007/s00167-007-0394-9
10. Stewart AH, Baird RN. The prevention and early recognition of arterial complications in total knee replacement: a vascular surgical perspective. Knee. 2001; 8(4): 265-267. https://doi.org/10.1016/s0968-0160(01)00123-5
11. Ko LJ, DeHart ML, Yoo JU, Huff TW. Popliteal artery injury associated with total knee arthroplasty: trends, costs and risk factors. J Arthroplasty 2014; 29(6): 1181-1184. https://doi.org/10.1016/j.arth.2014.01.007
12. Sriphirom P, Siramanakul C, Chanopas B, Boonruksa S. Effects of posterior condylar osteophytes on gap balancing in computer-assisted total knee arthroplasty with posterior cruciate ligament sacrifice. Eur J Orthop Surg Traumatol 2018; 28(4): 677-681. https://doi.org/10.1007/s00590-017-2118-2
13. Baldini A, Scuderi GR, Aglietti P, Chalnick D, Insall JN. Flexion-extension gap changes during total knee arthroplasty: effect of posterior cruciate ligament and posterior osteophytes removal. J Knee Surg 2004; 17(2): 69-72. https://doi.org/10.1055/s-0030-1248201

14. Holst DC, Doan GW, Angerame MR, Roche MW, Clary CW, Dennis DA. et al. What is the Effect of Posterior Osteophytes on Flexion and Extension Gaps in Total Knee Arthroplasty? A Cadaveric Study. Arthroplast Today 2021; 11: 127-133. https://doi.org/10.1016/j.artd.2021.08.007
15. Mullaji A. Can isolated removal of osteophytes achieve correction of varus deformity and gap-balance in computer-assisted total knee arthroplasty? Bone Joint J 2020; 102-B(6_Supple_A): 49-58. https://doi.org/10.1302/0301-620X.102B6.BJJ-2019-1597.R1.
16. Agarwala S, Bajwa S, Vijayvargiya M. Intra- operative fractures in primary Total Knee Arthroplasty. J Clin Orthop Trauma 2019; 10(3): 571-575. https://doi.org/10.1016/j.jcot.2018.10.009
17. Vaienti E, Scita G, Ceccarelli F, Pogliacomi F. Understanding the human knee and its relationship to total knee replacement. Acta Biomed 2017; 88(2S): 6-16. https://doi.org/10.23750/abm.v88i2-S.6507
18. Uvehammer J. Knee joint kinematics, fixation and function related to joint area design in total knee arthroplasty. Acta Orthop Scand 2001; 72(299): 1-52. Erratum in: Acta Orthop Scand 2001; 72(2): 213.

.....