Factors determing range of motion post operatively in total knee arthroplasty

Hitesh Shukla[1], Arvind Goregaonkar[2], Jitesh Manghwani[3,*], Rajesh S[4], Rajib Naskar[5]

[1]Senior Resident, Dept. of Orthopaedics, Baba Sahib Ambedkar Hospital, Mumbai, Maharashtra, [2]Professor and HOD, [5]Senior Resident, Dept. of Orthopaedics, Lokmanya Tilak Municipal Medical College and General Hospital, Mumbai, Maharashtra, [3]Senior Registrar, Dept. of Orthopaedics, Seth GS Medical College & Kem Hospital, Mumbai, Maharashtra, [4]Lecturer, Dept. of Orthopaedics, Government Medical College, Nagpur, Maharashtra, India

Corresponding Author: Jitesh Manghwani
Email: dr.jiteshm@gmail.com

Abstract

Objective: Patient satisfaction after total knee arthroplasty is dependent on post operative range of motion and pain. This study is an attempt to determine the influence of factors like age, sex, BMI, pre op flexion, Tibiofemoral angle on post operative range of motion.

Materials and Methods: The sample size was 94, of which 4 patients were lost in follow up. The patients included were ones with similar type of implant, primary cases, similar technique and surgeon. Demographics, pre op range of motion using goniometer and tibiofemoral angle on radiographs was determined. The cases were followed up regularly for 1 year and the range was noted.

Results: Factors like age, BMI, pre operative flexion, Tibiofemoral angle determine the amount of flexion post operatively. However factor like sex is not statistically significant. The p value for pre operative flexion and tibiofemoral angle is <0.001 with correlation co efficient of 0.86 and -0.58 respectively.

Conclusion: Proper patient counseling about the range of motion achievable post operatively balancing the factors affecting it is important for patient satisfaction.

Total knee arthroplasty, range of motion, pre op flexion, tibiofemoral angle.

Keywords: Total knee arthroplasty, Range of motion, Pre op flexion, Tibiofemoral angle.

Introduction

Over the period of time the level of education and the wish of staying physically independent has lead to an increase in the number of joint replacements and also in patients opting the same who are younger than 60 years.[1] The successful outcomes are primarily measured on a scale of pain relief and range of motion.[2-6] It is confirmed by multiple studies that amount of flexion needed for various activities is different and not the same. It is approximately 67 degrees is needed for the swing phase, 83 degrees for climbing stairs, 90 degrees for descending stairs, and 93 degrees for rising from a chair.[7-9] The amount of postoperative flexion is not the same in all the cases. There have been studies confirming the increased range of motion post operatively, in knees with restricted range of motion preoperatively. However there have been studies showing that the range remains the same or even may worsen after the replacement. Different studies have tried to find the significance of different parameters affecting the post operative range of motion. These includes patient demographic factors like age, sex, BMI, pain, comorbidities, tibiofemoral angle, etiology of arthritis and some surgeon factors like choice of implant, physiotherapy protocols.[2-7,10-12] Our study aims to find such factors which contribute to the amount of flexion patient has post operatively and determining the common linking factors between the population having restricted flexion post operatively.

Materials and Methods

This study was prospective and retrospective. The study was done on a sample size of 94. We lost 4 patients in follow up. Of the total 31 were males and 59 were females. The cases were analysed at the end of one year. Regular follow up was scheduled. The cases included in the study were primary cases undergoing fixed bearing, cruciate substituting type of design. The ones with etiology being osteoarthritis or rheumatoid arthritis only were included. The cases excluded were ones undergoing revisions, ones having complications postoperatively like infection, previously operated knee, different type of implant like high flexed, hinged. The cases included were ones who gave written informed consent.

Preoperatively the age, sex, BMI, comorbidities, range of motion, tibiofemoral angle were taken into account. All the cases were operated by the same surgeon after written informed consent. The cases were performed under local or general anesthesia using pneumatic tourniquet. The surgical technique in all the cases was similar, cemented implants, same type of implant (The implant company is not mentioned because the author avoids being a source of any form of publicity). All the cases had post operatively negative suction drain inserted for approximately 48 hours. The patients were under the cover of antibiotic prophylaxis. Postoperatively the patients underwent similar physiotherapy regimens. The patients were followed up for 1 year regularly to record the range of motion achieved. The flexion and extension was measured

using a goniometer. Tibiofemoral angle was measured on x rays.

The data collected was analysed by STRATA software using pearson coefficient (normally distributed data) and spearmans coefficient (data not normally distributed).

Results

Age: The average flexion postoperatively of patients less than 60 years was 111.6 degrees and of those more than 60 years of age was 96.7 degrees. These results are statistically significant with a p value of <0.001. (unpaired 't' test)

Table 1: Relation between age and flexion postoperatively

S. No.	Age	Flexion range post operatively	Mean flexion
1	Less than 60	101.5-116.3	111.6
2	More than 60	90.8-104.6	96.7

P value <0.001* by using unpaired 't' test * Significant

Sex: The average flexion in males postoperatively was 107.1 degrees and that in females was 101.4 degrees. However this flexion is not statistically significant. (unpaired 't' test)

Table 2: Relation between sex and flexion postoperatively

S. No.	Sex	Flexion range post operatively	Mean flexion
1	Males	98.5-112.5	107.1
2	Females	90.8-111.6	101.4

BMI: The average amount of flexion for patients with BMI less than 30 was 114.7 degrees while for patients with BMI more than 30 was 97.5 degrees. These values are statistically significant. (unpaired 't' test)

Table 3: Relation between BMI and flexion postoperatively

S. No.	BMI	Flexion range post operatively	Mean flexion
1	Less than 30	101.5-120.3	114.7
2	More than 30	90.8-112.5	97.5

P value <0.001* by using unpaired 't' test * Significant

Preop Flexion Range: The average amount of flexion for patients with flexion range less than 90 degrees was 74.2 degrees preoperatively. This increased to average 101.4 degrees. The average flexion increased from an average value of 99.4 degrees to 114.1 degrees post operatively. These values are statistically significant with R= 0.86 (Spearman Correlation as data is NOT normally distributed) and P value <0.001 by using Spearman correlation test.

Table 4: Relation between preoperative flexion and flexion postoperatively

S. No.	Preop Flexion	Mean preop flexion	Flexion range post operatively	Mean flexion
1	Less than 90	74.2	90.8-108.2	101.4
2	More than 90	99.4	98.4-120.3	114.1

P value <0.001* by using Spearman correlation test * Significant

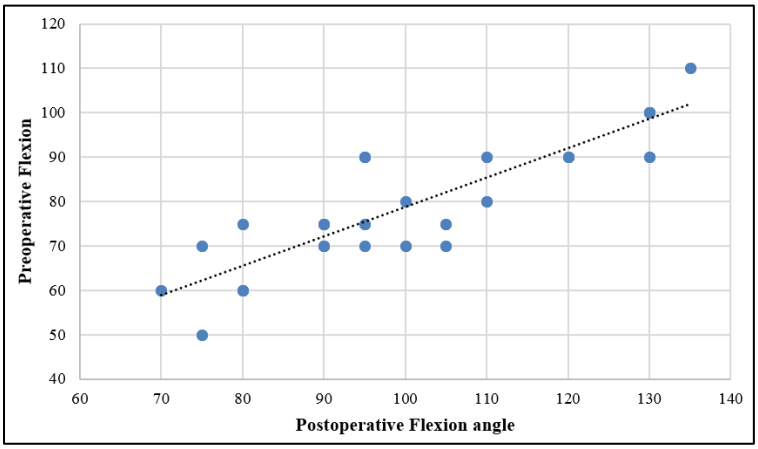

Fig. 1: Correlation between preoperative flexion and postoperative flexion angle

Tibiofemoral Angle: The average pre operative tibiofemoral was 181.6±11.4 and postoperatively 176.6±3.3. The amount of flexion is statistically significant with a P value of <0.001. The pearson correlation (as data is normally distributed) is R=-0.58 by using pearson correlation test.

Table 5: Relation between tibiofemoral angle and flexion postoperatively

S. No.	Tibiofemoral angle	Flexion range	Mean flexion
1	181.6±11.4(pre op)	68.2-104.3	86.6
2	176.6±3.3(post op)	90.4-116.6	106.7

P value <0.001* by using Pearson correlation test * Significant

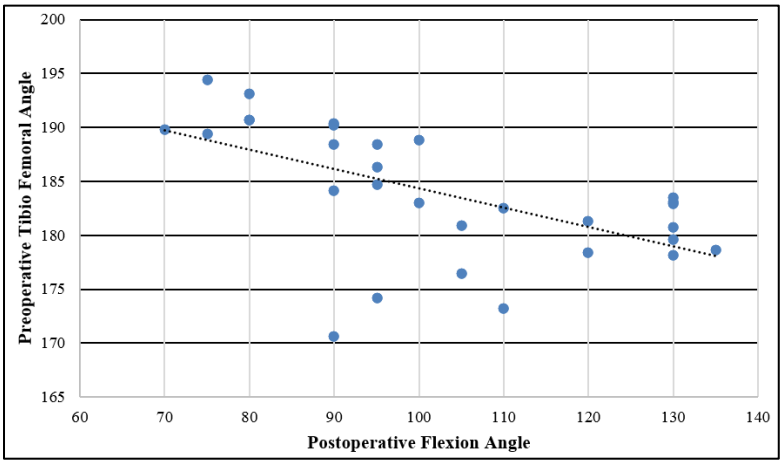

Fig. 2: Correlation between preoperative tibio femoral angle and postoperative flexion angle

Discussion

Total knee arthroplasty is a standard successful modality of treatment for various knee pathologies. The primary aim is making the patients pain free with a good range of motion. These are the parameters on which relies the patient satisfaction. This study aims at finding out factors affecting the range of motion which thus can help in predicting the flexion post operatively.

Range of Motion and Age: Patients were divided in two groups of less than and more than 60 years of age. It was found that average flexion attained in age group of more than 60 years was statistically lower than that in the less than 60 years age group. Horikawa et al,[13] Harvey et al,[14] and Anouchi et al,[15] found no such correlation of range of motion with age. Study by Alejandero Lizaur et al[16] concluded significant relation of age and range of motion.

Range of Motion and Sex: No significant correlation between range of motion post operatively and the sex of the patient is found in our study. This result co relates well with results of studies by B.S.K Reddi et al,[17] Schurman et al,[7] who concluded no significant association of flexion with sex.

Range of Motion and Body Mass Index (BMI): Range of motion and Body mass index (BMI): We found patients with lower BMI (less than 30) had significantly higher flexion attained against ones of higher BMI (higher than 30). Studies by Shoji et al,[18] Lizaur et al,[16] Naomi et al,[19] concluded significant association as well. This is important as far as counseling is concerned. Patients with higher BMI shouldn't be considered a contraindication to total knee replacement, but should be counseled about the expected range of motion postoperatively.

Range of Motion and Preop Flexion Range: Most of the studies have proved that cases with higher preoperative flexion have better range of motion post operatively. This is in agreement with results by Kurosaka et al[20] who reported that preoperative range of motion of the knee joint was the most important factor governing the post operative range. However the amount of flexion increased postoperatively in cases with lower flexion pre operatively was higher than the cases with higher flexion range postoperatively. The amount of flexion increased for the group with flexion range less than 90 degrees was on an average 26.82%. The flexion increased by 12.88% on an average in the group with pre operative flexion more than 90 degrees. This increased to average 101.4 degrees. But at the end the group with higher flexion pre operatively had higher range of motion postoperatively.

Range of Motion and Tibiofemoral Angle: The average pre operative tibiofemoral was 181.6±11.4 and postoperatively 176.6±3.3. The amount of flexion is statistically significant with a P value of <0.001. The pearson correlation (as data is normally distributed) is R=-0.58. This negative coefficient indicates patients with higher tibiofemoral angles (varus knees) had lower post operative range of motion. However our results are contrary to the results by B.S.K Reddi et al[17] who

reported no such association. With our results its clear patients with lesser deformity have better post operative range of motion than ones who opt for surgery later, when the deformity has progressed.

There has been a discrepancy with the results of studies with some showing positive correlation with preoperative tibiofemoral varus/valgus angle on the results of postoperative flexion;[10,12,21] and some concluding no such correlation.[22,23]

Conclusion

The primary outcome of a good total knee depends of technique, maintaining axis, balancing of soft tissues. However the patients, primarily are satisfied with good range of motion postoperatively and no pain. This study is an attempt to find factors affecting the range of motion post operatively.

1. Age (< 60 years) is a factor affecting range of motion postoperatively.
2. The post operative range is independent of sex of the patient.
3. BMI >30 (obesity) is a cause affecting the flexion postoperatively.
4. Better range of flexion preoperatively is one of the major determinants of post operative range.
5. Tibiofemoral angle influences the range, with higher angles leading to negative impact on range of motion.

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