Research Article

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Total knee arthroplasty and posterior tibial slope

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ABSTRACT

Background: Total knee arthroplasty has been considered as a standard procedure for intractable pain in the end-stage degenerative arthritis of the knee and maintaining range of motion (ROM) to facilitate the ability to perform daily living activities. A majority of studies have reported that the influence of PTS on the range of motion, however controversy exists.

Methods: Two hundred patients (400 knees) who underwent simultaneous or staged bilateral knee replacements and who met our inclusion criteria were included for this study. The pre-operative and post-operative knee ROM and PTS were recorded for each patient. Patients followed up at regular interval with minimum follow up of one year.

Results: 200 patients that is, 400 knees who underwent posteriorly stabilised TKA were considered. Respective mean ROM and PTS were 106^0 and 7.8^0 preoperatively and 128^0 and 5.7^0 postoperatively. We divided the patients in to group A (post-operative PTS $\leq 8^0$) 346 knees, and group B (postoperative PTS $> 8^0$) 54 knees and analysed the relation between PTS and ROM.

Conclusions: Change in PTS does not have influence on postoperative ROM in posteriorly stabilised TKA. Preoperative range of motion has got significant effect on post op range of motion following TKA.

Keywords: Range of motion, Posterior tibial slope, Total knee arthroplasty

INTRODUCTION

Total Knee Arthroplasty (TKA) has been considered as a standard procedure for intractable pain in the end-stage degenerative arthritis of the knee and maintaining range of motion (ROM) to facilitate the ability to perform daily living activities. Factors that have been associated with the change in ROM after TKA include preoperative ROM, implant design, patient characteristics, posterior femoral condylar offset, intraoperative soft tissue balancing, and Posterior Tibial Slope (PTS). Development of a new method for significant increase in the maximal angle of flexion would be beneficial for the improvement in pain and function following TKA.

The type of knee prosthesis (PCL-retaining or PCL-sacrificing) is an important factor that should be considered in evaluating the relationship between PTS and TKA outcomes. Studies have reported that the influence of PTS on the ROM was notable in PCL-retaining TKA, whereas insignificant in PCL-sacrificing TKA. Sansara and Markel showed that, there was no difference in the postoperative ROM between the knees with 0° and 5° of PTS after PCL-sacrificing TKA. Shi et al. reported that 1.8° flexion increment with every 1° increase in tibial slope in a cohort of 56 patients (65 knees) who had undergone posterior-stabilised TKA. The purpose of this study is to evaluate the influence of PTS on ROM after PCL-sacrificing TKA using PFC sigma prosthesis.

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METHODS

Two hundred patients (400 knees) who underwent simultaneous or staged bilateral knee replacements and who met our inclusion criteria were included for this study. Only Primary osteoarthritis patients were included in the study. Single type of PCL sacrificing implant, PFC sigma (Depuy) used in all the patients. The pre-operative, post-operative and follow up knee flexion and extension were recorded for each patient till one year, at the same time radiographs of all patients were reviewed. ROM was measured using a goniometer (Figure 1) preoperatively, postoperatively and subsequently. With the angle in full extension set as 0^0 , the increase in the angle was measured till maximum knee flexion.



Figure 1: Measurement of ROM.



Figure 2: Measurement of preoperative PTS.

Posterior tibial slope was measured on the lateral radiograph preoperatively and postoperatively at day 1, 3 months and one year. The PTS was measured as an angle created by a line perpendicular to the anterior tibial cortex and a line drawn to the tibial plateau (Figure 2) preoperatively, and the angle created by a line perpendicular to the anterior tibial cortex and a line drawn to the tibial component base plate (Figure 3) postoperatively. The postoperative PTS was measured from the radiograph taken immediately after surgery and on subsequent follow ups however there was no change in the reading.

The findings were analyzed with SPSS software. The ttest was used to compare findings among the groups. The test was considered statistically significant if p value < 0.05.



Figure 3: Measurement of postoperative PTS.

RESULTS

200 patients (400 knees) were under the consideration. Respective mean ROM and PTS were 106⁰ and 7.8⁰ preoperatively and 128° and 5.7° postoperatively.

We divided the patients in to group A (post-operative PTS $\leq 8^{\circ}$) 346 knees, and group B (postoperative PTS >80) 54 knees. Group A had preoperative PTS 6.7⁰ and post-operative 4.4° whereas group B had preoperative PTS of 10.8° and 9.8° postoperatively.

Preoperative flexion was 105° in group A and 110° in group B, who respectively achieved postoperative ROM of 127° and 131° at one year follow up.

The postoperative increase in ROM in comparison to preoperative ROM was significant in both the groups, however increased ROM achieved among both the groups was comparable (statistically insignificant).

DISCUSSION

As we know, postoperative ROM is an important indicator of the success of TKA. There are various factors that may influence the postoperative ROM, importantly posterior tibial slope has been considered positively correlated with the maximal angle of flexion. 11 Bauer et al reported that the correlation between PTS and maximal knee flexion that can be observed after PCL-retaining TKA was not noted after PCL-sacrificing TKA.5 Braun et al. reported posterior tibial slope would delay tibiofemoral impingement and recommended 6.5° of posterior tibial slope to maximize the maximal angle of flexion. ¹² Mean postoperative PTS in our study was 5.7°. In a study by Hoffman it was found that tibiae cut parallel to the surface exhibited 40% greater load carrying capacity and 70% greater stiffness than paired tibiae cut perpendicular to the long axis.¹³ Therefore, an increased tibial slope is not desirable although it improves the maximum flexion achieved. 14 The mean PTS in our study of arthritic patients was 7.8°. Yoga R¹⁵ reported the mean PTS of 8.8° in Indian cases (10.1 degrees in overall study population) which is comparable to our finding of 7.8° .

In study based on clinical data, Malviya et al. divided TKA patients into 3 groups according to the posterior tibial slope (≤ 50 , >50 to < 80, and ≥ 80), and found that the posterior tibial slope was correlated with maximal angle of flexion. ¹⁶ Our results correlated with Kansara and Markel where, the patients divided into two groups according to the use of either a 0^0 or 5^0 proximal tibial cutting block and reported no significant relationship between the posterior tibial slope and ROM in their PCLsacrificing TKA patients.6

We found that improved ROM in both the groups (group A and B) was comparable, and not statistically significant. However preoperative ROM. Preoperative ROM positively correlated with postoperative ROM. However in study by Jong-Heon Kim, a statistically significant positive correlation was found between PTS and maximal flexion angle after PCL-sacrificing TKA using a medial pivot implant. Author also states that, understanding the design characteristics of the PCLsacrificing medial pivot knee system that has a larger contact area in the medial compartment compared to the PCL-substituting knee implants could contribute to the correlation between PTS and flexion range.¹⁷

Limiting factor in our study is that we did not consider the confounding factors such as BMI, age, sex, comorbidities and other patient related characteristics.

CONCLUSION

There was improvement in postoperative ROM in all the patients. Postoperative ROM in both the groups was comparable. Preoperative range of motion has got significant effect on post op range of motion following TKA. Change in PTS does not have influence on postoperative ROM in posteriorly stabilised TKA.

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