Clinical Results Associated with Changes of Posterior Tibial Slope in Total Knee Arthroplasty

Seung Suk Seo, MD, PhD1, Chang Wan Kim, MD, PhD2, Jung Han Kim, MD2, and Young Kyoung Min, MD2

1Department of Orthopaedic Surgery, Bumin Hospital, Busan; 2Department of Orthopedic Surgery, Inje University Busan Paik Hospital, Inje University College of Medicine, Busan, Korea

Purpose: The purpose of this retrospective study is to investigate the effect of posterior tibial slope (PTS) on clinical results in total knee replacement arthroplasty (TKA).

Materials and Methods: We analyzed 801 knees in 768 patients who underwent TKA using a cruciate-retaining prosthesis for osteoarthritis from July 2003 to July 2009. PTS was measured on simple X-ray films and patients were divided into 5 groups, according to the change in PTS that was calculated by subtracting the preoperative from the postoperative PTS: group 1, >3°; group 2, 3° to 1°; group 3, 1° to -1°; group 4, -1° to -3°; and group 5, <-3°. We analyzed the correlations between the change in PTS and clinical results, such as Knee Society knee score, Knee Society functional score, Feller patella score, Kujala score, visual analog scale score, range of motion, and complications.

Results: There was no statistically significant intergroup difference; however, Feller patella score and Kujala score were significantly different in groups 2 and 3. There were no complications, such as progressive loosening of implants, fractures of polyethylene inserts and wears.

Conclusions: Clinically meaningful improvement was observed in all patients after TKA. Groups 2 and 3 (3° to -1°) showed significant improvement compared to the other groups.

Keywords: Total knee replacement, Arthroplasty, Knee, Posterior tibial slope
studies.

The purpose of this study is to assess the influence of intraoperative changes in PTS on clinical results under the hypotheses that 1) compared to excessive postoperative PTS, insufficient PTS after PCL-retaining TKA relatively increases anterior dislocation of the femur, which results in a higher femorotibial contact pressure and development of patellofemoral pain, and 2) PTS is positively correlated with stress on the posterior compartment of the tibia in flexion, which results in component loosening. In the absence of established intraoperative measurement methods, PTS measured from the preoperative and postoperative radiographs were used to assess the relationship between PTS change and clinical outcome and ROM.

Materials and Methods

1. Patients

A total of 1,028 TKAs were performed at our institution between July 2003 and July 2009. Of those, 801 cases with a minimum follow-up of 12 months were enrolled in this retrospective study. The exclusion criteria were <90° preoperative ROM, rheumatoid arthritis, traumatic or infectious arthritis, patellar resurfacing, and ≥Outerbridge grade III lesion in more than 50% of the patellofemoral joint. The mean age of the enrollees was 68.4±8.1. The surgery was performed on the right knee in 436 cases and on the left knee in 465 cases. There were 134 males and 677 females. Surgery was performed using the E-motion (Aesculap, B-Braun, Tuttlingen, Germany) PCL-retaining prosthesis in all cases. The mean follow-up period was 51.2±20.2 months.

2. Operative Technique

All the operations were performed by the same surgeon using a medial parapatellar approach. Proximal tibial osteotomy was performed with care to maintain the original slope of the articular surface by taking 3° of posterior slope of the tibial implant into consideration. The tibial cut was followed by distal femoral osteotomy. Rotation of the femoral component was determined as 3°−5° of external rotation with respect to the posterior condylar axis based on the preoperative computed tomography (CT) scan. Taking care to avoid more than one size smaller or larger prosthesis, a femoral component that was identical as much as possible to the anteroposterior diameter of the femoral condyle was chosen using a posterior reference method. Femoral osteotomy was carried out when femoral component size was determined. The PCL was retained in TKA. If severe flexion contracture and soft tissue contracture were present, posterior osteophyte removal and partial PCL release were done to achieve flexion-extension gap balance. Patella was not resurfaced in all cases. Electrocautery and sensitization were performed for the parapatellar soft tissue structures. Normal patellar tracking was confirmed using the no thumb technique.

3. Assessment and Analysis

The mean values of PTS measured by two observers using a picture archiving and communicating system (Maroview 5.4, Marotech, Seoul, Korea) were used for analysis. The anatomical axis and mechanical axis were measured on the weight-bearing radiographs preoperatively and at the last follow-up. PTS was defined as the angle between a line perpendicular to the proximal tibial anterior cortex and a line parallel to the tibial medial plateau.

Fig. 1. (A) Preoperative tibial posterior slope line was measured by perpendicular line of proximal tibia anterior cortex and tibial medial plateau line. (B) Postoperative tibial posterior slope line was measured by perpendicular line of proximal tibia anterior cortex and tibial medial plateau line.