

Clinical Results of Genesis-I Total Knee Arthroplasty for Patients with Knee Osteoarthritis: A Five-year Longitudinal Study

Haojiang LIU¹, Go OMORI¹, Hiroyuki SEGAWA¹, Munenori MATSUEDA¹, Yoshio KOGA², Kuanyu HUANG¹ and Hideaki E. TAKAHASHI¹

¹Division of Orthopedic Surgery, Department of Regenerative and Transplant Medicine, Niigata University Graduate School of Medical and Dental Sciences, ²Orthopedic Surgery, Niigata Kobari Hospital, Niigata, Japan

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Summary. Ten patients (17 knees) with knee osteoarthritis (OA) treated with the Genesis-I Total Knee Arthroplasty (TKA) System were clinically and radiographically evaluated after more than five years. The average Japanese Orthopaedic Association Knee Rating Score (JOA score) was 37 points (range, 25 to 40) before surgery, increasing to 84 points (range, 75 to 90) at the most recent observation. In the JOA score parameters (pain at walking, pain at stairs, range of motion, swelling), pain at walking was most improved. Range of motion (ROM) increased 8.4 ± 19.3 degrees postoperatively, but the flexion angle decreased from 105.4 ± 20 degrees to 99.4 ± 15.0 degrees. No complications were seen in this study. Radiographic evaluation showed no evidence of loosening. The femoral component angle at the follow-up observation was 96.9 ± 2.7 degrees in the anteroposterior (AP) view and 5.1 ± 2.8 degrees in the lateral view. Tibial component angle was 88.8 ± 2.4 degrees in the AP view and 85.8 ± 3.5 degrees in the lateral view. Three of six knees with less than 3 degrees of posterior slope of tibial component had decreased knee flexion after TKA. In the patellofemoral joint, the non-resurfaced patella tilted laterally, but showed no subluxation, dislocation, or articular deformity. From this study, we believe that Genesis-I TKA is a successful surgical treatment for a patient with OA knee, and that the patella can remain unresurfaced.

Key words—knee osteoarthritis, Genesis-I total knee system, clinical results.

INTRODUCTION

Total knee arthroplasty (TKA) is one of the most successful surgical interventions for a patient who has a severe deformity of the knee joint due to osteoarthritis (OA), rheumatoid arthritis, or other diseases.

Currently, more than 100 different kinds of TKA systems are used throughout the world, and there are many reports of clinical results^{1,2,4,5}. The Genesis-I TKA system (Smith & Nephew Richards Inc, Memphis, TN) (Fig. 1) is a semiconstrained anatomical surface replacement type, and is one of the standard TKA systems in use today. This TKA system has several features such as an anatomical component design, bi-convex patellar component, and modular system for revision surgery. The surgical instrumentation for Genesis-I TKA is simple and easy to use, allowing the surgeon to obtain accurate bone cutting and reproducible knee alignment. The Genesis-I TKA system was introduced to Japan in 1992, and we started to use this system in the same year, which was the first opportunity for using the Genesis-I TKA system in this country.

The purpose of this study was to evaluate the clinical and radiographic results of Genesis-I TKA for patients with knee OA at follow-up observations after more than 5 years.

Correspondence: Go Omori M.D., Division of Orthopedic Surgery, Department of Regenerative and Transplant Medicine, Niigata University Graduate School of Medical and Dental Sciences, 1-757 Asahimachi-dori, Niigata 951-8510, Japan.

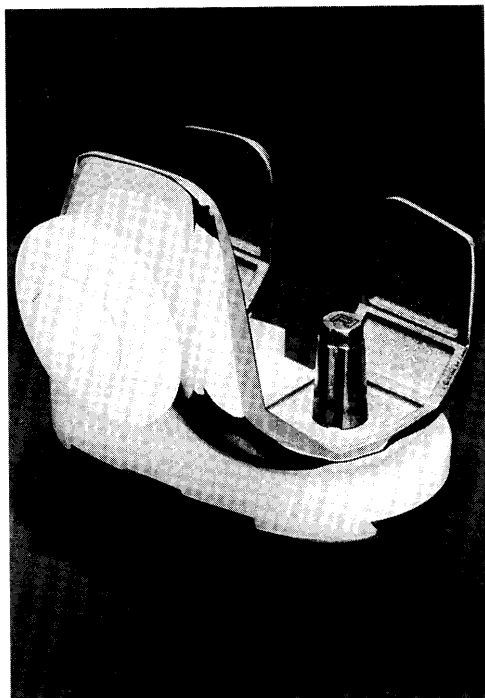


Fig. 1. Genesis-I Total Knee System.

The Genesis-I Total Knee System features surface anatomic, cobalt-chrome femoral components, asymmetric, semiconstrained, moderately conforming, titanium tibial tray, and a bi-convex polyethylene patellar component.

MATERIALS AND METHODS

Seventeen primary TKA in ten patients (1 male and 9 females) using the Genesis-I TKA system from 1992 through 1994 were reviewed. Preoperative diagnosis was osteoarthritis in all cases. The age at surgery ranged from 61 to 81 years with an average of 72.4 years, and the mean follow-up period ranged from 60 to 84 months with an average of 68.5 months. In the current study, the preoperative condition of the patient was obtained from medical records, and the most recent information from a direct examination.

Two senior authors (G.O. and Y.K.) performed the surgery in all cases. In the current study group, the posterior cruciate ligament was preserved, and both tibial and femoral components were fixed with cement. At the patellofemoral joint, the patella was not resurfaced. The distal femur was cut with 6 degrees valgus alignment to the femoral mechanical axis in the anteroposterior (A-P) dimension. The proximal tibia was cut perpendicular in the A-P plane, and 3 degrees posterior slope in the lateral plane to the tibial axis. After surgery, the patient

started range of motion (ROM) exercises using a continuous passive motion (CPM) device from 2 to 3 postoperative days. Gait exercises were started at 7 postoperative days, and the patient was immediately allowed to bear his/her full weight.

In this study, the Japanese Orthopaedic Association Knee Rating Score (JOA score) was used for clinical evaluation. The JOA score consists of four categories: pain and walking ability, pain and stair-climbing ability, total range of motion (ROM), and joint swelling. One hundred points were defined as a full score. For the roentgenographic study, we evaluated the femorotibial angle (FTA), component setting angle, radiolucent line, and patellar tilting angle. The Knee Society evaluation system³⁾ was used to measure the component setting angle and the radiolucent line (Fig. 2).

For the statistical analysis, the paired t-test was used, and significant p-value was set at 0.05.

RESULTS

Clinical evaluation

The JOA score averaged 37 points (range, 25 to 40 points) preoperatively and 84 points (range, 75 to 90 points) at follow-up observations. There was a significant difference between the preoperative JOA score and that of the follow-up (Fig. 3). Category-wise analysis showed the following. Relief from pain was excellent. The pain and walking score improved significantly from 9.4 to 19.7 points. The pain and stair climbing also improved significantly from 1.5 to 23.5 points. There was no significant difference in either total ROM nor the joint swelling score (Fig. 4). As for ROM of the knee joint, the average extension was -14.7 ± 9.0 degrees preoperatively, which improved to -0.3 ± 1.2 degrees at the most recent follow-up observation. On the other hand, mean flexion angle was 105.4 ± 20 degrees preoperatively, which decreased to 99.4 ± 15.0 degrees at the follow-up check. Six knees showed less flexion angle at a recent check-up than in the preoperative condition. In this study group, there were no complications such as acute or late infection, aseptic loosening of the component, or patellofemoral problems.

Radiographic evaluation

The component setting angle (α , β , γ , δ) showed acceptable results, except for the tibial posterior slope (δ) (Table 1). The tibial posterior slope was more than 87 degrees in six knees, of which three

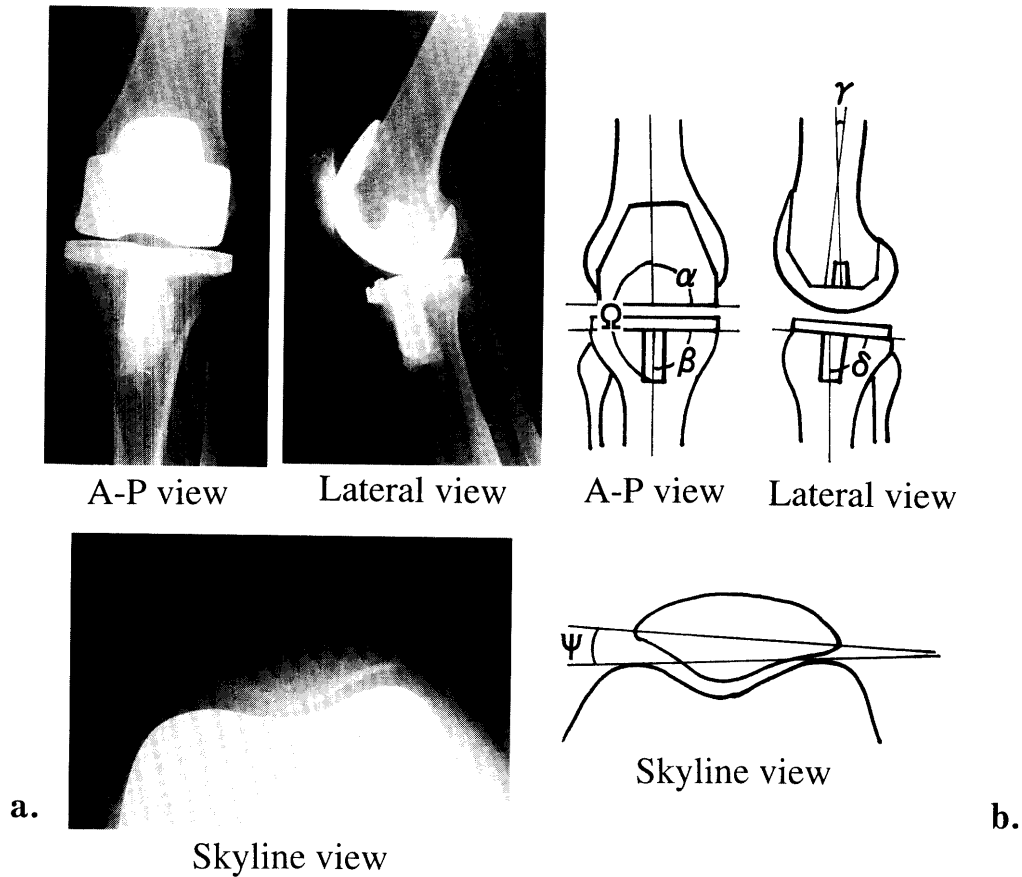


Fig. 2a. Post-operative X-ray after Genesis-I TKA. **b.** Radiographic measurement.

α , femoral angle; β , tibial angle; γ , femoral flexion angle
 δ , tibial posterior slope; Ψ , patellar tilt; Ω , femorotibial angle.

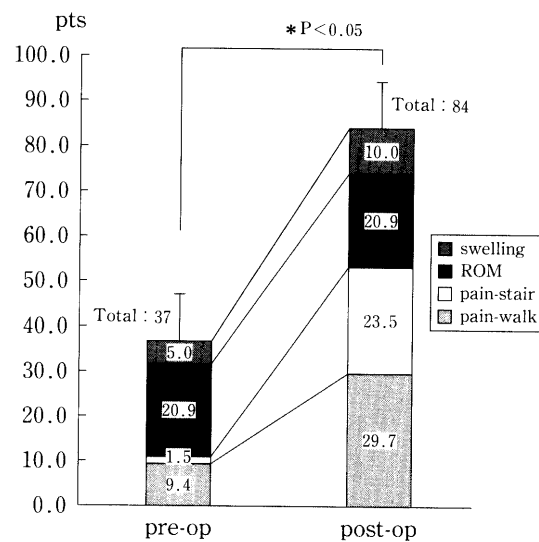


Fig. 3. Clinical evaluation with Japanese Orthopaedic Association Knee Rating Scores pre- and postoperatively.

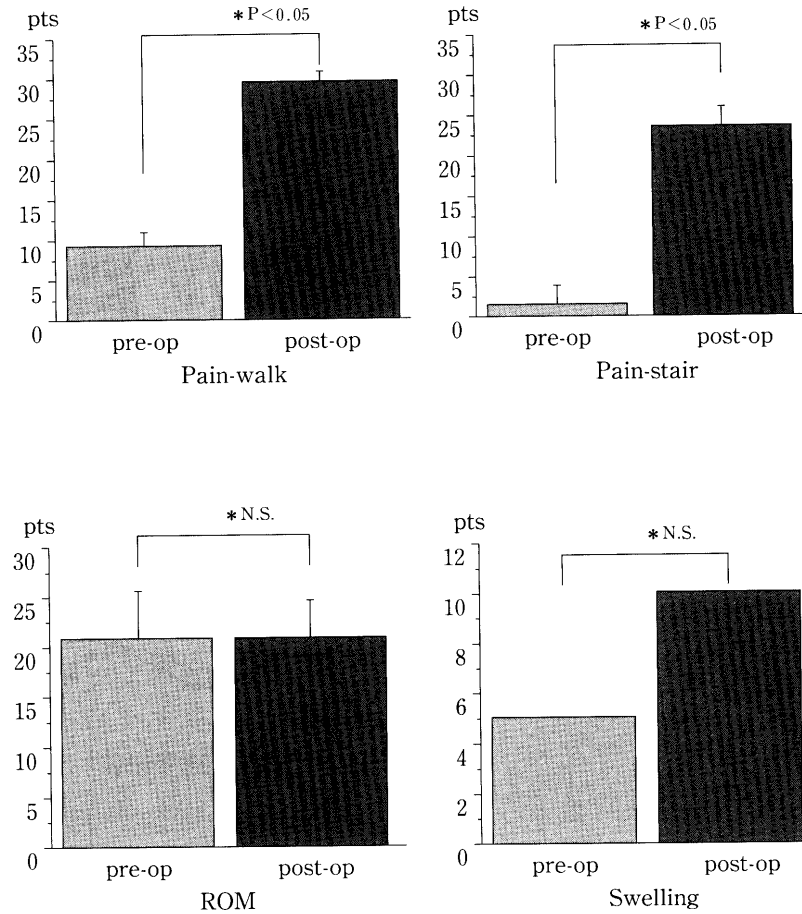


Fig. 4. Comparison of each category of JOA score.

Table 1. Results of radiographic measurements

Measuring angle	Results (degrees)
Femoral angle (α)	96.9 ± 2.7
Tibial angle (β)	88.8 ± 2.4
Femoral flexion angle (γ)	5.1 ± 2.8
Tibial posterior slope (δ)	85.8 ± 3.5
Patellar tilt (Ψ)	10.7 ± 7.0
Femorotibial angle (Ω)	174.2 ± 3.8

resulted in a smaller flexion angle than that before TKA. The average tibial posterior slope was 84.2 ± 2.2 degrees in the non-changed or increased postoperative flexion group and 89.5 ± 3.2 degrees in the decreased postoperative flexion group. There was no significant difference between the two groups (Fig. 5).

FTA showed 179.0 ± 5.9 degrees preoperatively, and 174.2 ± 3.8 degrees at follow-up observations. Postoperative FTA was close to the physiological valgus angle. The radiolucent line was seen in three knees, but none were more than 2mm in width, nor was any loosening was seen in this series. In the patellofemor-

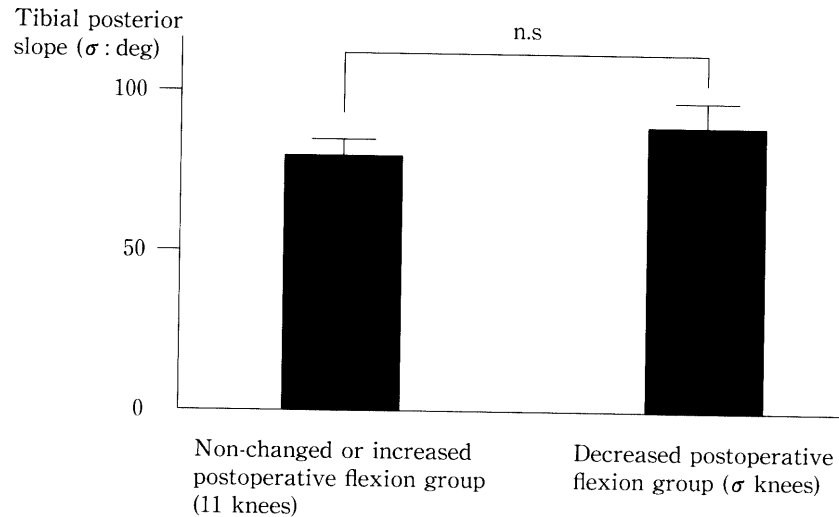


Fig. 5. Comparison of tibial posterior slope angle between non-changed or increased flexion group and decreased flexion group.

al joint, the non-resurfaced patella tilted laterally and the mean tilting angle was 10.7 ± 7 degrees at a recent follow-up evaluation. Neither dislocation, subluxation, nor degenerative change in the articular surface of the non-resurfaced patella was seen in this study group.

DISCUSSION

There are several studies on long-term clinical results of TKA. In these reports, the survival rates at follow-up observations after more than 10 years ranged from 90 to 98%^{1,2,4,5,6}.

The main purpose of TKA is to obtain relief from pain and improve ambulatory ability. From this point of view, the results of this study demonstrated that Genesis-I TKA for a patient with OA knee has satisfactory clinical results over a mean follow-up period of 68.5 months. Mokris et al.⁷ evaluated 126 primary Genesis-I TKA patients with a mean follow-up period of 4.5 years and reported similar favorable clinical results. He also reported that complications occurred in 14 knees (13%), and that these complications included patellar subluxation, patellar fracture, deep vein thrombosis, and wound infection. We observed no major complications in our study, which is mainly due to the small number of cases (17 knees).

In the current study, postoperative knee extension increased due to the correction of the flexion contracture, but the postoperative flexion angle de-

creased after TKA, indicating that actual ROM did not change in total. Several authors reported similar results for changes in ROM after TKA^{7,8}. Many factors influence postoperative flexion after TKA. These include preoperative diagnosis, preoperative knee flexion, prosthesis design, surgical technique, and postoperative rehabilitation^{9,10}. It is difficult to decide which factor is more critical, but the results of this study revealed that a smaller posterior tilting angle of the tibial component might result in decreased postoperative flexion. In Japan, most patients wish to obtain greater flexion after TKA—up to 120 degrees—in order to facilitate sitting without using a chair. The results of this study were sufficient for this purpose, and it may be suggested that a design improvement to the prosthesis as well as more accurate surgical technique are required for better flexion.

The indication for patella resurfacing in TKA remains controversial because patellofemoral complications are frequently encountered after TKA. These complications included fracture, dislocation or subluxation due to abnormal tracking, loosening of the patellar component, and severe synovitis due to polyethylene debris. The prevalence of these problems has been reported to be as high as 9%^{9,11}. However, some authors advocate patellar resurfacing in all cases. Other authors have stated that routine use of a patellar prosthesis is not advisable and may in fact be unnecessary^{12,13}. In this study, all patellae were left unresurfaced and there have so far

been no patellofemoral problems such as pain, dislocation or subluxation, or deformity of the articular surface. Based on the results of this clinical study and our previous biomechanical study using the Genesis-I TKA system¹⁴⁾, we consider that it is not necessary in this particular TKA system to resurface the patella for patients with OA.

In conclusion, the Genesis-I TKA system showed satisfactory clinical results for OA knee cases. However, the number of patients in this study group was relatively small and the follow-up period was not sufficiently long. Although a long-term follow-up study with a large series is needed, we believe that the results of this study are encouraging and indicative of the long-lasting survival rate for this particular TKA system.

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