Mid-term Result of Total Knee Arthroplasty in the Young Osteoarthritis Patients

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Background: *The primary goals of total knee arthroplasty (TKA) are to relieve pain and improve function in inflammatory and degenerative knee arthritis. Long-term clinical success has been shown in elderly patients.*
Objective: *The purpose of this study was to evaluate the clinical and radiographic results of TKA in patients with advanced stage osteoarthritis of the knee joints where the patients were younger than fifty-five years of age at the time of operation.*
Materials and methods: *The authors retrospectively reviewed the results of 70 patients with osteoarthritis who were 55 years or younger (mean age, 52.2 years) and who had received a fixed-bearing cemented TKA prosthesis and patellar resurfacing. The patients were assessed with regard to clinical, radiographic and knee motion assessment. Kaplan-Meier analysis of implant survival was performed.*
Results: *The mean preoperative and postoperative knee motion was 97.0° and 119.8°, respectively (P < 0.01). At the latest follow-up, Knee Society knee clinical scores improved from 45.6 to 83.3 points (P < 0.01) and Knee Society knee functional scores improved from 45.9 to 72.6 points (P < 0.01). There were three revision TKA that included aseptic loosening for two knees and septic loosening for one knee. The mean follow-up was 8.7 years (range, 5.0-16.0). The Kaplan-Meier survivorship analysis of implants showed that the rate of survival was 97.9% (95% CI, 90 to 99) at 10 years postoperatively and 96.9% (95% CI, 80 to 98) at 15 years postoperatively when revision was defined as the end point.*
Discussion: *The study showed improvement of functional and clinical knee scores at mid-term follow-up in patients with advanced stage osteoarthritis of the knee where the patients were younger than fifty-five years of age. However, there is concern in the findings of previous literature regarding the success of TKA in young patients. It will be important to determine the functional outcome and ability to return to an active lifestyle in younger patients. Long-term follow-ups in the second decade should be performed because younger patients will likely live long enough to require revision surgery.*

Keywords: *total knee arthroplasty, cemented, young patients, osteoarthritis, results*

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Introduction

The primary goals of total knee arthroplasty (TKA) are to relieve pain and improve function in advanced stage osteoarthritis of the knee. Long-term clinical success has been shown in elderly patients with implant survivorship of as much as 94-98% between 15 and 20 years after surgery when loosening or revision is used as the end point[1-3]. The factors affecting the good results of TKA included improvements in surgical technique, polyethylene durability and prosthesis design[4]. These factors have allowed indications of TKA to expand for all ages and it can be performed with increasing frequency in younger and more active patients. The data from the Swedish knee arthroplasty registry show an increased proportion of TKA in patients who are younger than 55 years old in 2000 and actual numbers of patients between 45-65 years of age having a TKA were three times more than unicompartmental knee arthroplasty. This can be explained with increased confidence that TKA is beneficial for younger patients[5].

Because of concerns regarding survivorship and functional outcome of TKA in younger patients, who have a higher level of activity, higher demand of pain-relief and a state of health that more often allows for revision surgery[5-7], TKA in younger patients have always been challenging and controversial[8].

Most mid-term and long-term studies on TKA in younger patients have included patients who have preoperative diagnosis of rheumatoid arthritis and who were in the inactive life style or heterogeneous group of patients with respect to diagnosis, activity levels, and surgical technique[6,7,9-12]. There are relatively few studies that focused specifically on younger patients with advanced stage primary osteoarthritis.

The purpose of this study was to evaluate the clinical and radiographic results, and survivorship of TKA in advanced stage

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osteoarthritis patients who were younger than fifty-five years of age at the time of operation.

Materials and Methods

Participants

Between 1997-2008, 1,998 patients underwent TKA in Ramathibodi Hospital. One hundred and twenty seven patients were younger than fifty-five years of age. Of these patients, thirty-nine were excluded due to being diagnosed with secondary osteoarthritis (27 rheumatoid arthritis, 5 post-traumatic arthritis, 5 hemophiliac, 1 post septic arthritis, and 1 systemic lupus erythematous with osteonecrosis of the medial femoral condyle). Four other patients were excluded because TKA were performed with a mobile bearing design and a further two patients were excluded because a cementless fixation technique was used when performing the TKA. Therefore, 82 patients had been diagnosed with primary tricompartmental osteoarthritis of the knee (Ahlbäck grade III to V) and recieved TKA with fixed-bearings, a posterior stabilized design, cemented fixation and patella resurfacing. But twelve patients (twelve knees) were lost at follow-up. In summary, 70 patients (97 knees) were included in this study.

All surgeries were performed by one senior author with the posterior stabilized prosthesis design and cemented fixation consisting of Nexgen LPS, Nexgen LPS Flex,and Insall-burstein II: Zimmer. All knees had a standard medial-parapatellar approach. Patellar resurfacing was performed in all cases with a cemented all-polyethylene component. No defects in the tibial plateau needed supplemental support.

Clinical evaluation

The demographic data, Knee Society scores, clinical active range of motions and radiographs were obtained before the operations and at the latest follow-up. The Knee Society score, used for the assessment of clinical and functional outcomes separately for each knee, consist of distinct 100-points scales per knee. At the time of follow-up, all clinical data were recorded and complied with independent observer.

Radiological evaluation

Weight-bearing anteroposterior radiographs and lateral radiographs were used to determine the overall alignment of the limb (tibio-femoral angle). Postoperative radiographs were evaluated for alignment using tibial and femoral component position. The anteroposterior and lateral radiographs were analyzed for the presence and progression of radiolucency lines at the bone-cement and the prosthesis-cement interfaces by comparing with those on previous radiographs.

Statistical analysis

Statistical analysis was performed using the 2-sample test or Wilcoxon signed-rank sum test for comparison of continuous variables. Changes in the continuous variables were assessed using the paired t-test or signed rank test. Kaplan-Meier analysis of implant survival was performed. Failure was defined as revision of the femoral, tibial or patellar component for any reason. This included surgery for septic or aseptic loosening, instability, and fracture of the tibia, femur, and/or patella.

Results

A total of 70 patients (97 knees) were included in the study. The mean age of the patients at the time of surgery was 52.2 ± 3.9 years (range, 42-55). Sixty-one patients (87 knees) were women (87.1%), and nine (10 knees) were men (12.9%). The average weight at the time of surgery was 66.5 kg (range, 44.8-91.0). The mean height was 154.9 cm (range, 148-162). The mean body mass index was 27.7 kg/m^2 (range, 19.4-37.9). There were 56 right knees (57.7%) and 41 left knees (42.3%). Twenty-seven of the patients had staged bilateral knee arthroplasties (38.6%). All staged bilateral TKA were performed before patients were 55 years old. The average follow-up period was 8.7 years (range, 5-16 years). The mean thickness of the tibial polyethylene insert was 12 ± 2 mm.

Results of both preoperative and postoperative function were graded according to the Knee Society score (Table 1). The mean preoperative knee clinical score was 45.6 ± 7.7 points (range, 10.0-67.0), and the mean preoperative functional score was 45.9 ± 14.3 points (range, 0-82.0). At the latest follow-up, the mean knee clinical score was 83.3 ± 10.7 points (range, 18.0-95.0), and the mean functional score was 72.6 ± 10.8 points (range, 0-90.0). Wilcoxon signed-rank sum test was used to compare knee scores between preoperation and postoperation because the data were not normally distributed. There were statistically significant differences of both functional and clinical scores between preoperation and postoperation TKA in these groups of patients (P-value < 0.01).

Preoperative range of motion was increased from 97.0 ± 17.0 degrees (range, 60.0-135.0) to 119.8 ± 11.9 degrees (range, 75.0-135.0) postoperatively. Wilcoxon signed-rank sum test was used to compare knee range of motion between preoperation and postoperation because the data were not normally distributed either. There was a statistically significant difference between preoperation range of motion and postoperation range of motion in these groups of patients (P < 0.01).

Table 1 Clinical Results

	Pre-operative	Final follow-up	*P*-value
Mean Knee Society clinical score *(points)*	45.6 ± 7.7 (10-67)	83.3 ± 10.7 (18-95)	< 0.01
Mean Knee Society functional score *(points)*	45.9 ± 14.3 (0-82)	72.6 ± 10.8 (0-90)	< 0.01
Mean range of motions *(degrees)*	97.0 ± 17.0 (60-135)	119.8 ± 11.9 (75-135)	< 0.01

The average preoperative alignment was 1.6° varus (range, 16° varus to 20° valgus), and the average postoperative alignment was 2.8° valgus (range, 6° varus to 11° valgus). Four knees (4.1%) had radiolucent lines (> 2 mm in width) around the tibial component, and three of four tibial components showed evidence of loosening. Three knees (3.1%) had radiolucent lines (> 2 mm in width) around the femoral component (Table 2).

There were three revision TKA in the study. The first case occurred 4 years postoperation and was diagnosed with septic loosening acute hematogenous type (Segawa et al.)[13]. This patient was managed with intravenous antibiotics and a two-stage revision. One patient was revised TKA due to aseptic loosening in both knees, 7 and 10 years postoperatively.

Table 2 Radiographic Results

Tibial radiolucent lines *(knees) (%)*	
< 1mm	8 (8.2)
> 2mm	4 (4.1)
Femoral radiolucent lines *(knee) (%)*	
< 1mm	2 (2.1)
> 2 mm	3 (3.1)
Pre-operative tibio-femoral alignment *(degrees varus)*	1.6 (16 varus to 20 valgus)
Final follow-up tibio-femoral alignment *(degrees valgus)*	2.8 (6 varus to 11 valgus)

Survival analysis was performed with Kaplan-Meier survivorship curves (Fig. 1). The Kaplan-Meier survivorship analysis of implants showed that the rate of survival was 97.9% (95% CI, 90 to 99) at 10 years postoperatively and 96.9% (95% CI, 80 to 98) at 15 years postoperatively when revision was defined as the end point.

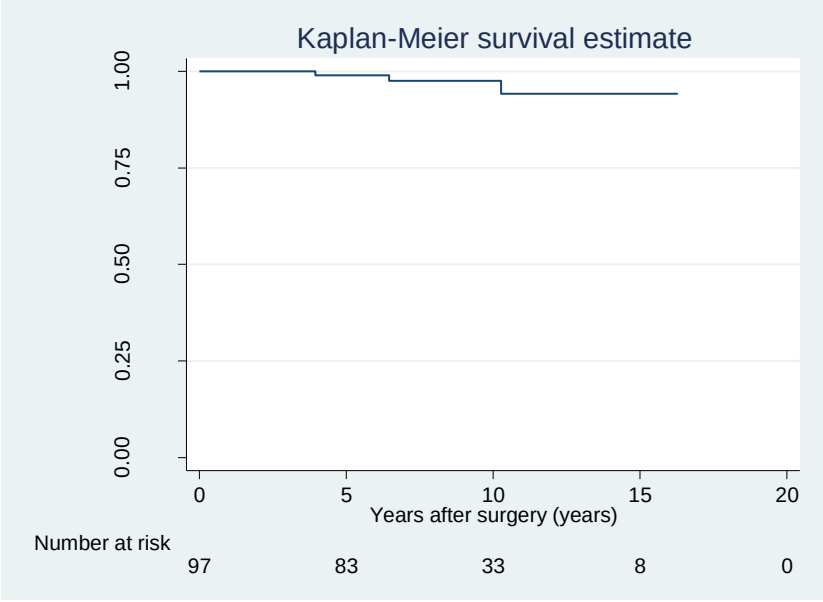

Fig. 1 The Kaplan-Meier survivorship analysis of implants.

Discussion

TKA is one of the surgical managements of multi-compartment advanced stage knee osteoarthritis in elderly patients. Improvements in surgical techniques, fixation methods, implant design and bearing surfaces have allowed TKA to be a successful procedure for elderly patients and expanded indications to younger patients[5,14]. The primary goals of performing TKA in younger patients are the same as in elderly patients, i.e., to relieve pain, increase function and improve quality of life[1].

In younger osteoarthritic patients, nonoperative treatments should be considered before surgical decision. When nonoperative treatments fail, the choices of operation include arthroscopy, knee arthrodesis, proximal tibial or distal femoral osteotomy, and unicompartmental knee arthroplasty, but in the setting of advanced disease, these often do not provide adequate pain relief, and may be at higher risk of complications when converted to total knee arthroplasty. However, there are significant functional limitations after knee arthrodesis.

For advanced stage knee disease in younger patients, it is important to recognize that not all patients have the same functional demands following arthroplasty as elderly or low demand patients. There are early concerns that knee arthroplasty would prove to be less durable and have a lower patient satisfaction in patients with higher levels of activity or higher demand patients than the TKA in the elderly patients, including concerns regarding wear, instability, loosening and the potential need for multiple revision surgeries in the whole life of younger patients[5,6,15-17].

The decision to proceed with TKA in younger patients is a difficult one. Diduch et al.[15] reported a 94% survival rate at eighteen years on patients < 55 years of age with post-traumatic arthritis or osteoarthritis, with use of revision as an end point. When the exchange of the spacer was also included in the failures, the survival rate was 87% at eighteen years. Dixon et al.[18] reported a 92.6% survival rate at fifteen years in younger patients with an average age of sixty-seven years, using revision as an end point. Duffy et al.[7] reviewed TKA in patients aged under 55 years, most of whom were diagnosed with inflammatory arthritis, noted 96% implant survival at 10 years but an increase in polyethylene wear-related failures at 15 years (85% survival). Ewald et al.[4] reviewed TKA in patients aged under 45 years, 58% of the patients had rheumatoid arthritis, and 29% had juvenile rheumatoid arthritis. There were no revisions of these knees for a loose prosthesis at an average follow-up period of 7.2 years.

The purpose of this study was to assess the performance and durability of the TKA when performed in patients younger than 55 years of age. The strength of the study encompasses a large number of patients who are specific to advanced stage primary osteoarthritis. TKA were performed on these patients by a single surgeon and the surgical techniques limited to cemented fixation, posterior stabilized implant design, and patellar resurfacing.

This study showed improvements of functional and clinical knee scores at mid-term follow-up and supported the findings of the previous reports in the literature. Concerning the success of TKA in the young, it would be important to determine functional outcome and ability to return to an active lifestyle in younger patients.

There are some limitations in this study. First, this retrospective study lacked the documentation of the activity level of the patients and radiographic protocol to complete an assessment of polyethylene wear. Second, there was a relatively large number of patients who were lost to follow-up (12 from 82 patients, 14.6%) which may result in an underestimate of the revision rate. Third, the Kaplan-Meier survival analysis is normally used to measure the fraction of the subjects living for a certain amount of time but the follow-up time of each patient in this study ranged from 5 to 16 years, mean follow-up time was 8.7 years. The survival rate of the patients in this study should be 96.9% at mean follow-up 8.7 years.

Further study on assessment of the activity level or sport activity of the patients will be needed for comparison between preoperation and postoperation using the assessment tools e.g., SF-36, WOMAC, KOOS, and Tegner activity level scale. It would be better to follow-up for a longer period because younger patients are more likely to live long enough to require revision surgery[9].

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ผลการรักษาระยะกลางในผู้ป่วยอายุน้อยที่ได้รับการผ่าตัดเปลี่ยนผิวข้อเข่าเทียม

วิโรจน์ กวินวงศ์โกวิท, พบ, ศิวดล วงค์ศักดิ์, พบ, ปรัชญา ผดุงพรรค, พบ

เป้าหมายของการผ่าตัดเปลี่ยนผิวข้อเข่าเทียมในผู้ป่วยสูงอายุที่มีโรคข้อเข่าเสื่อมคือลดอาการปวด เพิ่มการใช้งานข้อเข่า และทำให้คุณภาพชีวิตดีขึ้น ปัจจัยที่มีผลต่อการรักษาที่ดีคือ การเลือกผู้ป่วยที่เหมาะสม เทคนิคการผ่าตัดที่ดี และการพัฒนาข้อเข่าเทียมที่สามารถใช้งานได้ทนทานตลอดอายุขัยของผู้ป่วย เนื่องจากผลการรักษาที่ดีมากในผู้ป่วยสูงอายุ จึงมีการผ่าตัดเปลี่ยนผิวข้อเข่าเทียมมากขึ้นในผู้ป่วยอายุน้อย วัตถุประสงค์ของการศึกษานี้เพื่อศึกษาผลการผ่าตัดเปลี่ยนผิวข้อเข่าเทียม ในผู้ป่วยอายุน้อยกว่า 55 ปี ที่มีโรคข้อเข่าเสื่อมระยะสุดท้ายจำนวน 70 ราย ติดตามการรักษาเป็นระยะเวลาเฉลี่ย 8.7 ปี โดยทำการศึกษาทางคลินิกและภาพถ่ายรังสี ผลการรักษาพบว่าหลังผ่าตัดเปลี่ยนผิวข้อเข่าเทียมในผู้ป่วยที่มีอายุน้อยกว่า 55 ปี ผู้ป่วยมีพิสัยการเคลื่อนไหวของข้อเข่าดีขึ้น จาก 97.0 องศา เป็น 119.8 องศา Knee Society Clinical Score เพิ่มขึ้นจาก 45.6 เป็น 83.3 และ Knee Society Functional Score เพิ่มขึ้นจาก 45.9 เป็น 72.6 จากผู้ป่วยทั้งหมด 70 ราย มีผู้ป่วยจำนวน 3 ราย ที่ต้องผ่าตัดซ่อมข้อเข่าเทียม ซึ่งเกิดจากข้อเทียมหลวม 2 ราย และภาวะติดเชื้อ 1 ราย การศึกษาทางสถิติโดยใช้ Kaplan-Meier survivorship analysis พบว่า ถ้าติดตามการรักษาเป็นเวลา 10 ปี จะมีข้อเข่าเทียมจำนวนร้อยละ 97.9 ที่ยังสามารถใช้งานได้ดี และถ้าติดตามการรักษาเป็นเวลา 15 ปี จะมีข้อเข่าเทียมจำนวนร้อยละ 96.9 ที่ยังคงสามารถใช้งานได้ กล่าวโดยสรุปคือ ผลการรักษาโรคข้อเข่าเสื่อมในผู้ป่วยที่มีอายุน้อยกว่า 55 ปี โดยการผ่าตัดเปลี่ยนผิวข้อเข่าเทียมให้ผลการรักษาที่ดี ผู้ป่วยหายปวด สามารถใช้งานของข้อเข่าได้ดี และมีคุณภาพชีวิตที่ดีขึ้น อย่างไรก็ตาม ผู้ป่วยอายุน้อย ใช้งานข้อเข่าเทียมที่หนักและมีการใช้งานที่ยาวนานขึ้นจึงต้องมีเทคนิคการผ่าตัดที่ดี และมีการพัฒนาคุณภาพของข้อเข่าเทียมให้ทนทานต่อการใช้งานในระยะยาว