

Contralateral Total Knee Arthroplasty after Unilateral Surgery in Bilateral Varus Gonarthrosis

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The authors retrospectively evaluated the rate of contralateral total knee arthroplasty (TKA) in 93 patients who had bilateral varus gonarthrosis and underwent unilateral TKA. Patients were divided into 3 groups according to degree of anatomical varus of the contralateral knee and/or contralateral knee pain at the time of first TKA. Group A, 25 patients, had no pain and within 10-degree deformity. Group B, 48 patients, had pain and within 10-degree deformity. Group C, 20 patients, had pain and more than 10-degree deformity. At a minimum of 2-years follow up after the first TKA, the mean function scores among the groups were significantly different ($p, < 0.0001$). Seventy-five percent of group C, 34% of group B and 0% of group A underwent sequential contralateral TKA, respectively at average 6.7-month interval. Rate of contralateral TKA was high if patients had contralateral knee pain and more than 10 degrees of anatomical varus.

Key words : Unilateral, Total knee arthroplasty, Varus knee, Gonarthrosis, Contralateral knee

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Generally, bilateral total knee arthroplasty (TKA) is recommended for patients that have moderate to severe bilateral varus arthritic knees to accomplish predictable clinical results. The surgery may be scheduled as either a 1-stage or 2-stage procedure, depending on multiple preoperative and postoperative factors. One-stage bilateral TKA is considered a cost effective procedure; however, certain higher risks of pulmonary embolism^(1,2) and 30-day mortality rate^(3,4) were reported.

On the other hand, results of unilateral total knee arthroplasty in patients with bilateral varus gonarthrosis are variable. Symptom of contralateral knee may exacerbate and cause knee replacement later. To the authors' knowledge, no study has specifically focused on the postoperative clinical results of this group of patients. The purpose of this study was to evaluate the rate of contralateral TKA after the first surgery in a subgroup with different preoperative contralateral knee pain and deformity.

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Material and Method

Between January 1998 and May 2001, 175 consecutive patients (226 knees) underwent TKAs, which were performed by a single surgeon (AT). During this period, 116 patients had primary TKA due to bilateral varus gonarthrosis and 93 patients who had complete preoperative anteroposterior standing radiographs of both lower extremities and underwent unilateral TKA were included in the study. On the physical examination, all patients were evaluated for knee score and function score according to the Knee Society rating scale⁽⁵⁾ and also were asked for active pain on the opposite knee by senior orthopaedic residents that was confirmed by a member of the orthopaedic staff (AT). Radiographic evaluation of severity of arthritis was graded according to Ahlback⁽⁶⁾. The tibiofemoral angle of anteroposterior standing radiograph of the knee was measured by a single surgeon (SN) with a goniometer and patients were determined to have varus gonarthrosis if the radiographic tibiofemoral angle was more than 0 degree of anatomical varus. The authors divided the patients into 3 groups according to degree of anatomical varus of the contralateral knee and/or contralateral knee pain at the time of first TKA (Fig. 1). Group A, patients had

no pain and within 10-degree deformity. Group B, patients had pain and within 10-degree deformity. Group C, patients had pain and more than 10-degree deformity.

The study group included 78 women and 15 men with a mean age of 65.6 years (range, 40 to 82 years) at the time of arthroplasty. There were 43 left knees and 50 right knees. All knee replacements were performed using the same type of prosthesis (posterior stabilized knee system) and cementing technique. Same postoperative rehabilitation protocol was used without using the continuous passive movement machine. On the day of surgery and the first postoperative day, patients were encouraged to have active quadriceps exercise on the bed, as well as ankle and foot exercise. On the second postoperative day, patients were allowed to bear weight and walk with a walking aid. To promote range of motion, patients were instructed to sit on the side of the bed with their feet dangling and perform active quadriceps exercise as tolerated. All patients were discharged from the hospital after they had gained at least 90 degrees of knee flexion. Home rehabilitation program was continued with active range of motion exercise and active quadriceps exercise for both knees.

Patients were examined after surgery at 2-3 weeks, 6 weeks, 3 months, 6 months then every 6-month period both clinically and radiographically. Hospital records, including preoperative studies, operative reports, and clinical notes, were retrieved for data collection. Patients were assessed clinically with the Knee Society rating scale⁽⁵⁾. A score of 85 points or more was considered excellent; 70 to 84 points, good; 60 to 69 points, fair; and less than 60 points, poor. After 3-months' follow-up, all patients were reevaluated for pain on the opposite knee. Opposite knee replacement was performed later upon the patients' request.

The minimum follow up time was 2 years in all patients, except in one patient. This patient underwent TKA on the contralateral side at 2 months following the first TKA and died from an acute medical condition (airway obstruction) at 3 months after the second surgery. The mean follow-up time was 36.8 months (range, 24 to 62 months) post-operatively. At the latest follow up, 11 patients were lost to follow up. Thus, 82 patients (18 patients in group A, 44 patients in group B and 20 patients in group C) were left for evaluation of the latest contralateral knee pain and TKA.

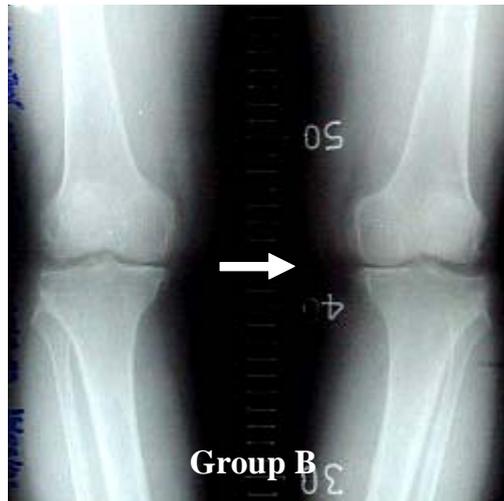
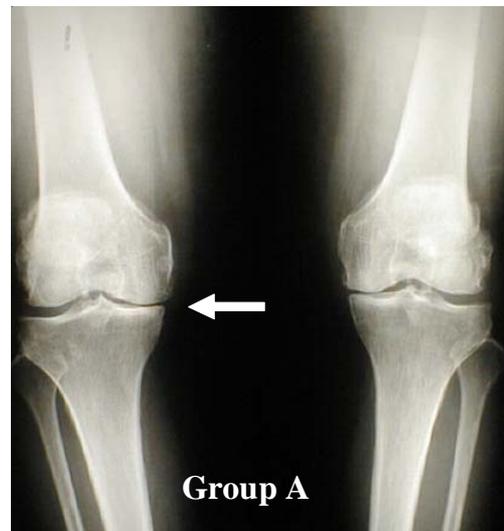


Fig. 1. Preoperative radiographs of patients; patients were divided into 3 groups; A, B and C, according to the contralateral knee pain and deformity. The white arrow demonstrates the affected knee that will be operated on.

Statistical analysis

The correlation of varus deformity of both knees was compared with Pearson's correlation coefficient test. The one-way analysis of variance (ANOVA) test was used to detect significant differences of knee score and function score improvement among the groups. Bonferroni t-test was used to evaluate the improvement of each individual group of patients after they underwent contralateral knee replacement. Fisher exact test was used to analyze the association between patients who had preoperative contralateral knee pain, varus deformity and patients who underwent contralateral knee replacement. The *p* values < 0.05 were considered significant.

Results

Preoperative data

There was a correlation between deformities of both knees in each patient (*Pearson coefficient, 0.8*). The average varus angles on the operated side and the contralateral side of 93 patients were 9.4 degrees (range, 1 to 35 degrees) of anatomical varus and 8.2 degrees (range, 1 to 35 degrees) of anatomical varus, respectively. The average varus deformity of the contralateral knee in group A, B and C were 5.0 degrees (range, 0 to 10 degrees), 6.0 degrees (range, 0

to 10 degrees) and 15.7 degrees (range, 11 to 35 degrees) of anatomical varus, respectively. Preoperative Knee Society score, pain score and function score were not statistically different among groups (*p, 0.398, 0.424 and 0.2, respectively*). The average preoperative range of motion (ROM) in group A was 120.3 degrees (range, 20 to 150), in group B was 117.5 (range, 65 to 150) and in group C was 115.8 (range, 80 to 155).

Clinical results

After a mean follow-up duration of 36.8 months (range, 24 to 62 months), the mean Knee Society score of group A, B and C improved from 49.5, 47 and 42 points to 95, 94 and 92.5 points respectively (Fig. 2). The mean pain score of the operated side of group A, B and C improved from 28.5, 27 and 26 points to 47.2, 45 and 43.3 points respectively (Fig. 3). The mean function score of group A, B and C improved from 32.9, 32 and 30 points to 90.3, 74.2 and 60 points respectively (Fig. 4). The average postoperative ROM were 130.3 degrees (range, 55 to 155), 125.6 (range, 90 to 150), 126.5 (range, 110 to 155) in group A, B and C respectively. There was no significant difference among groups with regard to postoperative Knee Society score (*p, 0.467*), pain score (*p, 0.116*) and

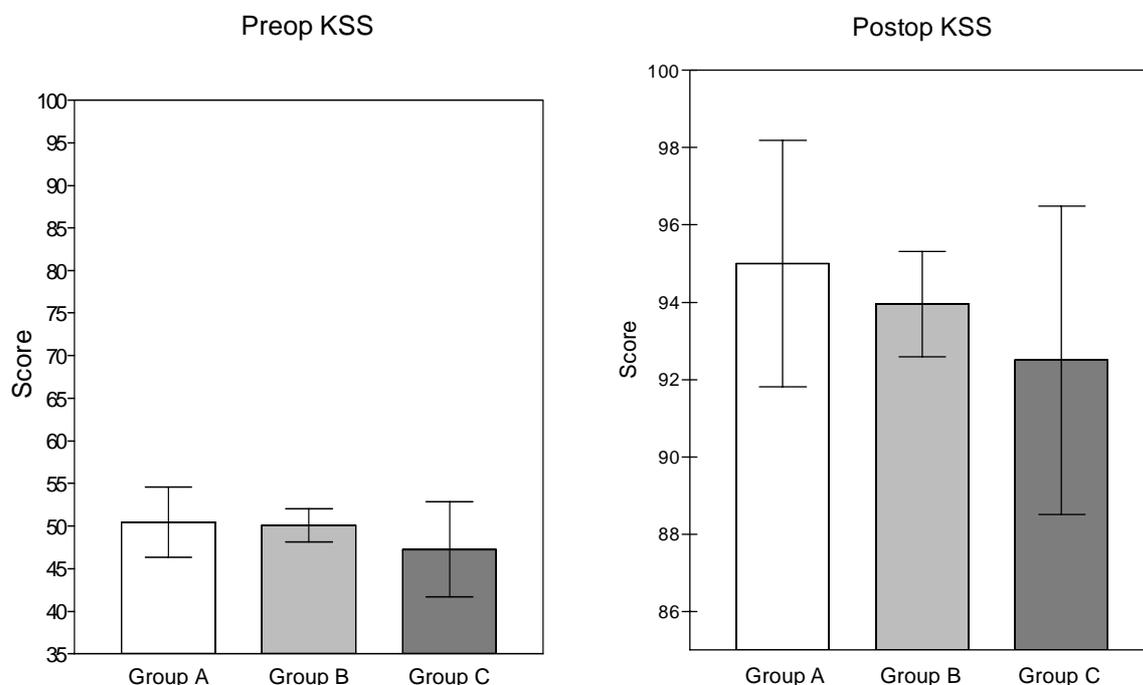


Fig. 2 Graphs of preoperative and postoperative Knee Society scores (KSS) in patient groups A, B and C with 95% confidence interval (95%CI)

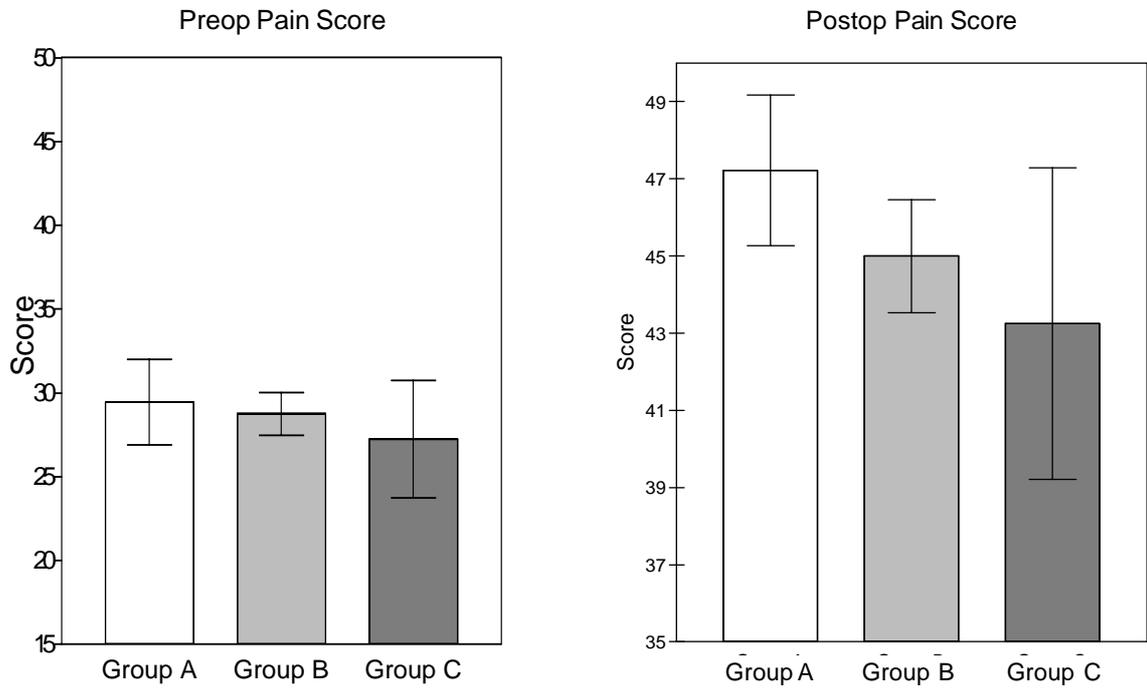


Fig. 3 Graphs of preoperative and postoperative pain scores in patient groups A, B and C with 95% confidence interval (95% CI)

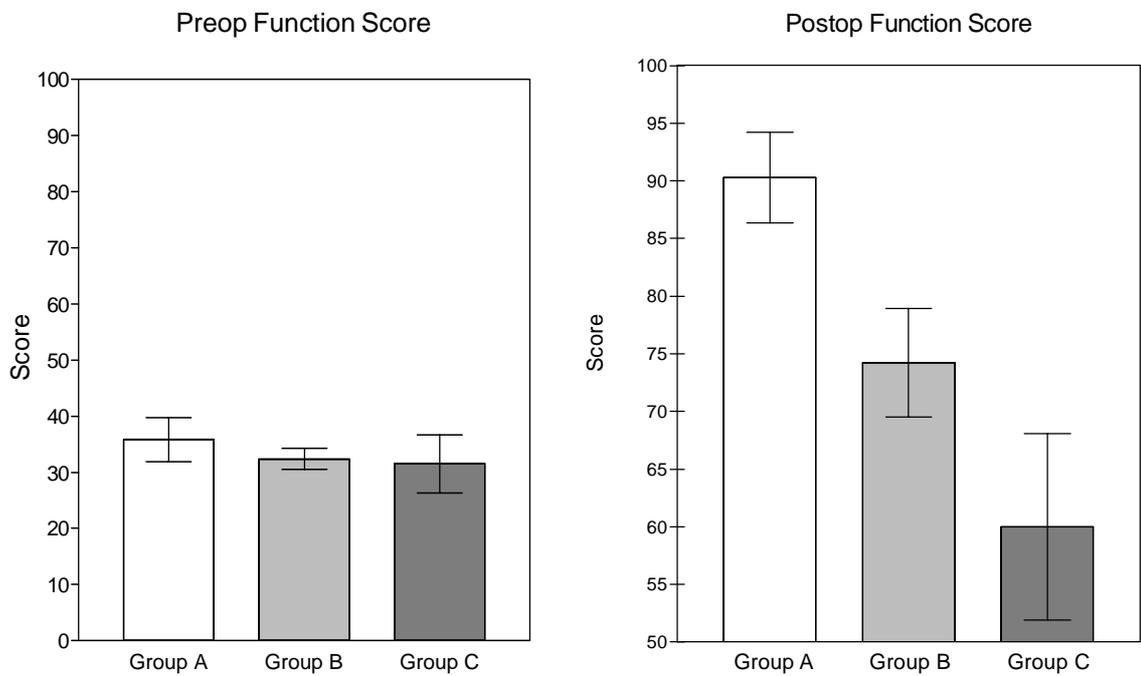


Fig. 4 Graphs of preoperative and postoperative function scores in patient groups A, B and C with 95% confidence of interval (95% CI)

ROM ($p, 0.264$); however, there was significant difference of postoperative function score among groups ($p, <0.0001$).

According to the Knee Society score⁽⁵⁾, 96.3% of the patients had an excellent clinical result, 2.4% had good result, and 1.2% had fair result. There was no early failure or revision of both first and second TKAs. Complications regarding the first TKA included 1 intraoperative femoral condyle fracture, 1 transient ischemic attack of the cerebral blood flow with full recovery and 3 stiff knees (less than 100 degrees of knee flexion at 6 weeks postoperatively) which improved with manipulation under anesthesia. Complications regarding the contralateral TKA included one case of peroneal nerve palsy that recovered after 12-week follow up and one case of poor functional result due to late stage of the disease and the advanced age. This patient had very limited activity at home postoperatively and died from an acute respiratory problem (airway obstruction) 3 months after the second surgery.

Contralateral TKA

At the latest follow-up, none of the patients (0%, 0 of 18) in group A underwent TKA on the contralateral knee (Fig. 5). In group B, 20 of 44 patients (45%) still had pain on the contralateral knee and 15 patients (33%) underwent contralateral TKA later. Seventeen of 20 patients (85%) in group C had continuous pain on the contralateral knee and 15 patients (75%) underwent contralateral TKA later. Among the 5 patients in group B with contralateral knee pain who did not undergo TKA, 2 patients were relatively contraindicated for major surgery due to advanced medical diseases, 3 patients were satisfied to limit their activities (Table 1). Both patients in group C with contralateral knee pain and did not undergo TKA accepted the condition and modified their activities by using a cane to avoid surgery (Table 1). The overall contralateral knee replacement was performed later in 30 patients. The average time elapsed since the first knee arthroplasty was 6.7 months (range, 1.5 to 17 months).

With regard to preoperative pain on contralateral knee, there were 64 from 82 patients and 47% of them underwent sequential contralateral with significant difference (*Fishers's test* $p, <0.0001$) from those who did not have a painful contralateral knee. With regard to preoperative varus deformity of the contralateral knees of more than 10 degrees, there were 20 from 82 patients and 75% of them underwent

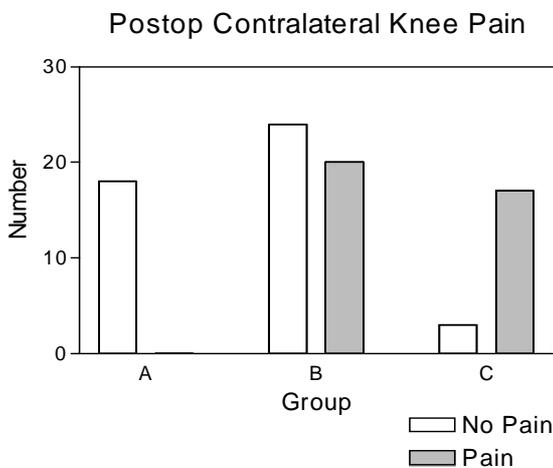


Fig. 5 The above graphs demonstrate contralateral knee pain after TKA on the affected side in patient groups A, B and C. The below graphs demonstrate the number of contralateral TKA after patients underwent the first TKAs on the affected side.



sequential contralateral with significant difference (*Fishers's test* $p, <0.0001$) from those who had less than 10-degree deformity.

After the contralateral TKA, the average Knee Society score, pain score and function score in this subgroup improved from 92.9, 43.8 and 57.2 points to 96.4, 49.2 and 84.8 points respectively with no significant difference (Fig. 6). However, the mean function score increased from 57.2 to 84.8 point with statistical significance (*t-test* $p, < 0.0001$).

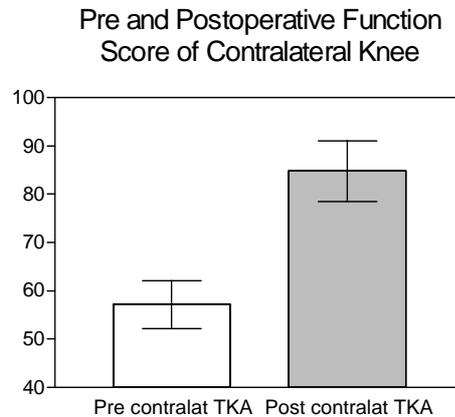


Fig. 6 Graphs of preoperative and postoperative Pain Scores (left) and Function Scores (right) in group C patients before and after contralateral TKA with 95% confidence interval (95%CI)

Discussion

Regarding the outcome of patients after primary total knee arthroplasty, Lingard⁽⁷⁾ has shown that there was poor correlation between the postoperative Knee Society score and postoperative function score which suggested that a good score on one part of the assessment may not necessarily reflect a good score on the other. In the present study, all patients were classified in category B according to the Knee Society clinical rating system⁽⁵⁾. The severity of the disease tended to increase from group A toward group B. Postoperatively, group A seemed to have better results than group B and C respectively in terms of knee score and function score; however, the improvement of the knee score and pain score was higher than that of the function score. This difference was attributed to the fact that most patients

had substantial pain relief on the affected knee, but the improvement in the function score was limited by the presence of disease on the contralateral side.

Sahlstrom et al⁽⁸⁾ followed the natural course of arthrosis of the untreated or conservatively treated knee for 20 years. He found that 28% of patients having joint space narrowing more than 50% (Ahlback's grade II) at the time of diagnosis had no radiographic evidence of disease progression; however, 100% of patients who previously had at least attrition of bones (Ahlback's grade III) and consistent pain had disease progression at the follow-up and no patient was pain free when later major bone attrition or subluxation was developed. According to Ritter's and Mont's studies^(9,10), the incidence of bilateral osteoarthritic involvement was 64% and 89% of patients who underwent unilateral

Pre and Postoperative Pain Score of Contralateral Knee

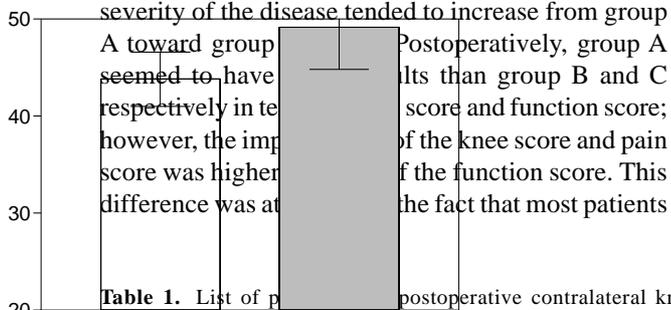


Table 1. List of patients with postoperative contralateral knee pain who did not undergo TKA on the contralateral knee

Patient	Age	Deformity of contralateral knee	Follow-up	Postoperative evaluation				need for cane	Remarks	
				KSS	Pain score	Function score	ROM			
Name	Year	Degree	Group	Months	Point	Point	Point	Degree		
AN	45	0	B	24	85	35	75	145	N	Limited activity
BS	71	1	B	53	85	40	60	145	Y	Advanced medical disease
SA	66	7	B	26	100	50	70	120	N	Limited activity
CP	76	9	B	25	95	45	70	120	Y	Accepted condition
DL	69	10	B	24	95	45	75	115	Y	Advanced medical disease
CK	75	16	C	47	90	40	70	125	Y	Limited activity
SS	72	20	C	27	95	45	65	110	Y	Accepted condition

ROM: range of motion, Y: yes, No: no

TKA. Ritter⁽⁹⁾ reported that 19% of unilateral TKA patients had disease progression and eventually had TKA on the contralateral knee within 10 years. This low incidence of contralateral TKA could be based on only radiographic diagnosis. On the other hand, Mont⁽¹⁰⁾ reported that 68% of patients scheduled for unilateral TKA had symptomatic contralateral knees (45%; mild to moderate and 23%; severe). At a minimum follow up of 5 years, the contralateral TKA was 8% in asymptomatic knees, 20% in the mild pain group, 54% in the moderate pain group and 93% in severe symptom patients with an overall rate of 43%.

The present study included patients with Ahlback's radiographic criteria from grade II and varus deformity. With respect to the latest number of patients who came for follow up, the authors found that 78% of patients (64 patients; group B and C) whose contralateral knees were symptomatic, pre-operatively. This included, 54% classified as mild to moderate severity (44 patients; group B), and 24% classified as severe disease (20 patients; group C). Compared to Mont's study, the present series had more symptomatic patients because the study group had disease in combination with varus deformity. At the minimum 2-year follow up, the percentage of TKA on the opposite side was at least 0% in asymptomatic contralateral knee (group A), 34% in patients with mild to moderate severity (group B) and 75% in patients with severe disease (group C), respectively. The overall contralateral TKA rate was 37%. The authors consider this to be the minimum rate for contralateral TKA because some patients requested 1-stage bilateral TKA who were excluded from the study. In addition, progression of the disease by time may increase the rate of opposite knee surgery. Even though the percentage of disease severity of the patients in the present series was in agreement with that of Mont's, with less follow up time in this series, the subsequent arthroplasty rate was less than the former series. At follow up, some patients should undergo sequential contralateral TKA according to symptoms and radiographic evaluation; however, the pattern of a complex-family life style and high concern the patient's character contributed to the decision to have opposite knee arthroplasty. The authors found that all patients in group B and C who had continuously symptomatic contralateral knee and did not undergo contralateral TKA lived happily with limited activity and fully assist of their descendents. On the basis of the authors' findings, preoperative contralateral knee pain and more than 10-degree varus

deformity of the contralateral knee were significant factors that influenced the functional outcome of unilateral TKA.

Although the appropriate interval for staged bilateral knee replacement is reported with variation, Ritter's study regarding complications demonstrated that a 3- or 6-month interval had the least overall complication rates⁽¹¹⁾. In the present series, the average interval was 6.7 months with 2 complications. Although the interval for staged surgery in the present series was in agreement with the above, the number of knees was too small to discuss regarding the complications.

Conclusion

Unilateral TKA in bilateral varus gonarthrosis provided satisfactory results when the pain was located only on the affected knee and varus deformity was within 10 degrees. Patients with bilateral severe symptoms may not achieve high functional outcome after unilateral TKA. The incidence of sequential contralateral TKA was significantly high if the contralateral knee deformity is more than 10 degrees of anatomical varus and/or the contralateral knee is still painful after the first TKA.

References

1. Dorr LD, Merkel C, Mellman MF, Klein I. Fat emboli in bilateral total knee arthroplasty: predictive factors for neurologic manifestations. *Clin Orthop* 1989; 248: 112-9.
2. Kim YH. Incidence of fat embolism syndrome after cemented or cementless bilateral simultaneous and unilateral total knee arthroplasty. *J Arthroplasty* 2001; 16: 730-9.
3. Parvizi J, Sullivan TA, Trousdale RT, Lewallen DG. Thirty-day mortality after total knee arthroplasty. *J Bone Joint Surg (Am)* 2001; 83-A: 1157-61.
4. Morrey BF, Adams RA, Ilstrup DM, Bryan RS. Complications and mortality associated with bilateral or unilateral total knee arthroplasty. *J Bone Joint Surg (Am)* 1987; 69-A: 484-8.
5. Insall JN, Dorr DL, Scott RD, Scott WN. Rationale of the Knee Society clinical rating system. *Clin Orthop* 1989; 248: 13-4.
6. Ahlback S. Osteoarthritis of the knee: A radiographic investigation. *Acta Radiol (Suppl)* 1968; 277: 7-72.
7. Lingard EA, Katz JN, Wright RJ, Wright EA, Sledge CB. Validity and responsiveness of the Knee Society clinical rating system in comparison with the SF-36 and WOMAC. *J Bone Joint Surg (Am)* 2001; 83-A: 1856-64.

8. Sahlstrom A, Johnell O, Redlund-Johnell I. The natural course of arthrosis of the knee. Clin Orthop 1997; 340: 152-7.
9. Ritter MA, Carr KD, Keating EM, Faris PM. Long-term outcomes of contralateral knees after unilateral total knee arthroplasty for osteoarthritis. J Arthroplasty 1994; 9: 347-9.
10. Mont MA, Mitzner DL, Jones LC, Hungerford DS. History of the contralateral knee after primary knee arthroplasty for osteoarthritis. Clin Orthop 1995; 321: 145-50.
11. Ritter M, Mamlin LA, Melfi CA, Katz BP, Freund DA, Arthur DS. Outcome implications for the timing of bilateral total knee arthroplasties. Clin Orthop 1997; 345: 99-105.

การเปลี่ยนข้อเข่าเทียมอีกข้างหนึ่งหลังจากการเปลี่ยนข้อเข่าเทียมข้างแรกในผู้ป่วยที่มีข้อเข่าเสื่อมและขาโก่งทั้งสองข้าง

อารี ตनावลี, สาทิต เทียงวิทยาพร, สีหรัช งามอุโฆษ, บุญสรรงค์ สิทธิพงศ์

คณะผู้ทำการศึกษาวิจัยศึกษาในผู้ป่วย 93 รายที่มีข้อเข่าเสื่อมและขาโก่งทั้ง 2 ข้างซึ่งได้รับการผ่าตัดเปลี่ยนข้อเข่าเทียมเพียงข้างเดียว และในเวลาต่อมาผู้ป่วยได้รับการผ่าตัดเปลี่ยนข้อเข่าเทียมอีกข้างในอัตราเท่าไร โดยแบ่งผู้ป่วยเป็น 3 กลุ่มตามความเจ็บปวดและมุมโก่งของขาอีกข้างหนึ่งในขณะที่ทำผ่าตัดเข่าข้างแรก โดยวัดมุมโก่งของขาตาม anatomical axis กลุ่ม A จำนวน 25 ราย ไม่มีอาการปวดและมุมโก่งไม่เกิน 10 องศา กลุ่ม B จำนวน 48 ราย มีอาการปวดและมุมโก่งไม่เกิน 10 องศา กลุ่ม C จำนวน 20 ราย มีอาการปวดและมุมโก่งเกิน 10 องศา มีการติดตามผู้ป่วยหลังจากการผ่าตัดอย่างน้อย 2 ปี พบว่าค่าเฉลี่ย knee score ระหว่างกลุ่มไม่แตกต่างกัน แต่ค่าเฉลี่ย function score แตกต่างกันอย่างมีนัยสำคัญ อัตราการทำผ่าตัดเปลี่ยนข้อเข่าเทียมอีกข้างหนึ่งตามความต้องการของผู้ป่วยเป็น 75% ของกลุ่ม C , 34% ของกลุ่ม B และ 0 % ของกลุ่ม A โดยมีค่าเฉลี่ยระยะห่างหลังจากผ่าตัดข้างแรกประมาณ 6.7 เดือน อาการปวดเข่าและการมีมุมโก่งมากกว่า 10 องศาของเข่าอีกข้างหนึ่งสัมพันธ์กับอัตราการทำผ่าตัดเปลี่ยนข้อเข่าอีกข้างหนึ่งที่สูงขึ้น