Posterior Cruciate Retaining Total Knee Arthroplasty in Severe Deformed Knee
การผ่าตัดเปลี่ยนข้อเข่าเทียมชนิด เก็บเอ็นไขว้หลัง ในผู้ป่วยที่มีภาวะเข่าผิดรูปแบบรุนแรง

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ABSTRACT

Severe deformed knee is surgical challenging. Fully constrained knee prosthesis is the proper one. However various techniques and methods were advocated to address the problem. This study will show the results of PCL retaining knee prosthesis combining with various techniques.

Material and Method: A retrospective descriptive study of 6-12 years follows up of TKA in 28 severe deformed knees. The Knee Society Score and Roentgenographic Scoring System were used for monitoring the outcome.

Results: During July 1989 to October 2005, 28 knees were performed total knee replacement with PCL retaining prosthesis (Balansys Model). Age average was 65 years. Pre-operative Knee Society Score[1] were 6 on pain, 15 on range of motion, 4 on stability and 7 on function. There were 12 knees could achieved TKA with only soft tissue released and balanced, 14 knees needed to fill the defect with bone graft, the other 2 knees used only positioning screw alone. The mean follow up time was 9.5±3.5 years. The knee score at last follow up were 35 on pain, 23 on range of motion, 24 on stability and 70 on functions. The total knee arthroplasty radiographic Knee Society Score was 0.5. There was significant clinical improved statistically.

Conclusion: Severe deformed knee can be treated effectively with PCL retaining prosthesis. Good alignment, stable knee and proper postoperative program are essential for the good outcome.

Keywords: Severe deformed knee, PCL retaining TKA prosthesis

บทคัดย่อ

การผ่าตัดเปลี่ยนข้อเข่าในภาวะข้อเข่าเสื่อมผิดรูปแบบรุนแรงเป็นงานที่ท้าทาย ต้องใช้ทักษะอย่างสูง มีการแนะนำให้ใช้ข้อเข่าเทียมชนิดยึดตรึง (fully constrained) ว่าเป็นข้อเทียมที่เหมาะสมในผู้ป่วยเหล่านี้ แต่อย่างไรก็ตาม ยังมีปัญหาในหลายๆ ข้อของข้อเทียมชนิดยึดตรึง จึงทำให้มีการพยายามทำการผ่าตัดหลายๆ วิธี เพื่อที่จะหลีกเลี่ยงข้อเข่าชนิดนี้ รายงานนี้ ได้แสดงถึงผลของการใช้ข้อเข่าเทียมชนิดเก็บเอ็นไขวัหลังร่วมกับเทคนิคต่างๆ ในผู้ป่วยที่มีภาวะข้อเข่าเสื่อมผิดรูปแบบรุนแรง

วัสดุและวิธีการ : เป็นการศึกษาแบบพรรณนาแบบย้อนกลับในผู้ป่วยภาวะเข่าผิดรูปแบบรุนแรง 28 ราย ที่ได้รับการผ่าตัดเปลี่ยนข้อเข่า โดยมีการติดตามผลอย่างน้อย 6-12 ปี โดยใช้คะแนนของ Knee Society Score และคะแนนของภาพรังสีเอกซเรย์ เพื่อประเมินผลการรักษา

ผลการศึกษา : ผู้ป่วย 28 ราย อายุเฉลี่ย 65 ปี ได้รับการผ่าตัดโดยใช้ข้อเข่าเทียมชนิดเก็บเอ็นไขวัหลัง (Balansys Model) ร่วมกับเทคนิคต่างๆ ในการแก้ปัญหาเฉพาะราย คะแนน Knee Society Score ก่อนผ่าตัดของผู้ป่วย ความปวดได้ 6 คะแนน การเคลื่อนไหวของข้อได้ 15 คะแนน ความมั่นคงของข้อได้ 4 คะแนน และการใช้งานได้ 7 คะแนน สามารถทำการผ่าตัดโดยใช้เทคนิคเฉพาะการจัดสมดุลของเนื้อเยื่ออ่อนรอบเข่า 12 ราย ต้องใช้กระดูกเสริมร่วมด้วย 14 ราย อีกสองรายต้องใช้สกรูเสริม การติดตามผล เฉลี่ย 9.5 ± 3.5 ปี คะแนนของเข่าในการติดตามผลครั้งสุดท้าย ปวด ได้ 35 คะแนน การเคลื่อนไหวของข้อได้ 23 คะแนน ความมั่นคงของข้อได้ 24 คะแนน และการใช้งานได้ 70 คะแนน คะแนนของภาพเอกซเรย์ ได้ 0.5 ซึ่งผลลัพธ์หลังการผ่าตัดดีขึ้นอย่างมีนัยสำคัญ

สรุป : ผู้ป่วยที่มีภาวะข้อเข่าเสื่อมผิดรูปแบบรุนแรง สามารถรับการผ่าตัดเปลี่ยนข้อเข่าโดยใช้ ข้อเข่าเทียมชนิดเก็บเอ็นไขวัหลัง (Balansys Model) ร่วมกับเทคนิคต่างๆ เพื่อให้ได้แนวเข่าที่ดี เข่ามีความมั่นคง เพื่อผลการรักษาที่ดี

คำสำคัญ : ข้อเข่าเสื่อมผิดรูปแบบรุนแรง ข้อเข่าเทียมชนิดเก็บเอ็นไขว้หลัง

Introduction

Total knee arthroplasty in profound deformity cases such as severe varus or valgus, bone loss, knee ligament attenuate is extremely challenging. A highly constrained or hinged prosthesis is one method to address such a knee.[2] However, this kind of prosthesis is not suitable for all situations due to very high cost and financial problem in some countries. Several reports show different techniques to address usual knee prosthesis for a severe deformed osteoarthritis knee.[3-10] Laskin RS et al[11] reported the necessity of using a posterior stabilized TKA. But Faris PM et al[12] reported that a PCL retaining prosthesis can be use in a very varus knee. Furthermore, Ritter MA et al[13] suggested to balancing PCL to keeping the ligament from hindering the flexion arc when using a PCL retaining prosthesis.

This article will report the midterm results of TKA in severe deformed knee cases by using PCL retaining prosthesis combined with various techniques.

Material and Method

A retrospective descriptive study on the results of total knee arthroplasty (posterior cruciate retaining type) in severe deformed knee eg. fix varus or valgus more than 12 degrees, huge bony defect, which were operated during July 1989 to October 2005 by one surgeon. The medical records of patients were reviewed and data collection. The Knee Society Score[1] (pain, range of motion. stability and function) and The Knee Society TKA Roentgenographic Evaluation and Scoring System[14] were used as a criteria for evaluated both pre and postoperatively. The scores were recorded at pre operatively, 2 months and every year postoperatively. The ANOVA test was used for evaluation at p value <0.05.

Operative technique

Patient on supine position under tourniquet, a standards midline skin incision and medial parapatellar approach for varus knee or lateral parapatellar approach for valgus knee. Osteophytes around knee joint were all removed then initial gap between femoral condyle and tibial plateau was evaluated. The prosthetic joint line was planned. Proximal tibial was cut perpendicular to the tibial axis with 7 degrees posterior slope by using extramedullary guide. The thickness of bone cut was depended on the expected prosthetic joint line. If there was remaining defect on proximal tibia, it will be reshaped to be rectangle then filled with autogenous bone graft (stout iliac or pieces from tibial or femoral cut) and fixed with screw or buttress plate. If the depth of the defect was different between medial and lateral tibial plateau about 5 mm or less, small screw will be used to equalize both tibial condyles by positioning the screw head at same level of the other. Then soft tissues and ligaments were released and balanced by using the tensor device until mechanical axis was achieved including total detachment of MCL and pes anserinus tendon. Posterior and distal femoral condyles were prepared by using intramedullary alignment guide. The thickness of the distal cut was depended on the pre-existed gap and imaginary prosthetic joint line. If there was also bony defect at distal femur, it would be managed by the same manner as proximal tibia. Tourniquet was released for checking and stop the active bleeding, and then re-inflated. The knee prosthesis were implanted by the sequence of tibial tray, tibial insert and femoral prosthesis respectively.[15] Re-attachment of MCL and pes anserinus tendon with screw and washer in case of total detachment. Suction drainage was placed and wound was sutured. Pressure dressing was applied.

Results

There were 28 knees in 22 female patients present with severe deformed knee were performed total knee replacement with PCL retaining prosthesis (Balansys Model). Age range from 30-72 years, (average 65 years). There was only one 30 years old rheumatoid patient. The other age was start from 61 years. There were

12 left knees and 16 right knees. Body mass index were about 20-32 with average at 30. 25 knees were osteoarthritic, 3 were rheumatoid arthritis. 22 knees were varus more than 20°. The pathologies in this group were unyielding medial soft tissue contracture conjunct with medial tibial condyle defect (slope more than 15°). 4 knees in this group were totally loss of medial tibial condyle and one knee in this group had severe lateral collateral ligament (LCL) laxity needed to be reconstruction. 3 knees were severe deformed in both medial and lateral tibial condyle with anterior or posterior subluxation. 3 knees were severe valgus. The Knee Society Score[1] pre operatively were 6 on pain (range 0-10), 15 on range of motion (range 10-18), 4 on stability (range 0-5) and 7 on function (range 0-10). Posterior cruciate ligaments in 25 knees were totally damaged.

There were 12 knees could achieved TKA with only soft tissue released and balanced. 14 knees needed to fill the defect with bone graft (stout iliac or local bone from tibial or femoral cut). In bone grafting group, 4 were totally medial tibial condyle bone grafting which were fixed with screw or buttress plate, 2 were medial femoral condyle defect larger than 9 cm^3, 4 were bone graft fixed with screw as positioning screw. One case was performed LCL reconstruction with iliotibial band combined with large iliac stout graft for tibia and chip graft for large medial femoral defect. 2 were positioning screw alone. Most of the cases needed to have medial soft tissue release beyond the insert of pes anserinus. The operating time was average at 1:30 hours (range 1-2:45 hours), estimate blood loss was 50 cc (20-100 cc) intraoperatively. There were only 2 sizes of tibial insert thickness was used (8 and 10.5 mm). Every case could do active range of motion on 2nd day post operatively, except the LCL reconstruction case that needed to immobilize for 6 weeks. Patients could ambulate with walking aid 3-5 days post operation, on the 2nd week patients could walk without walking aid except for the group of massive bone graft that needed to protect weight 4 to 6 months until follow up x-ray film showed consolidate of bone graft. Average knee range of motion was 0-90° at 3rd week. (Fig. 1)

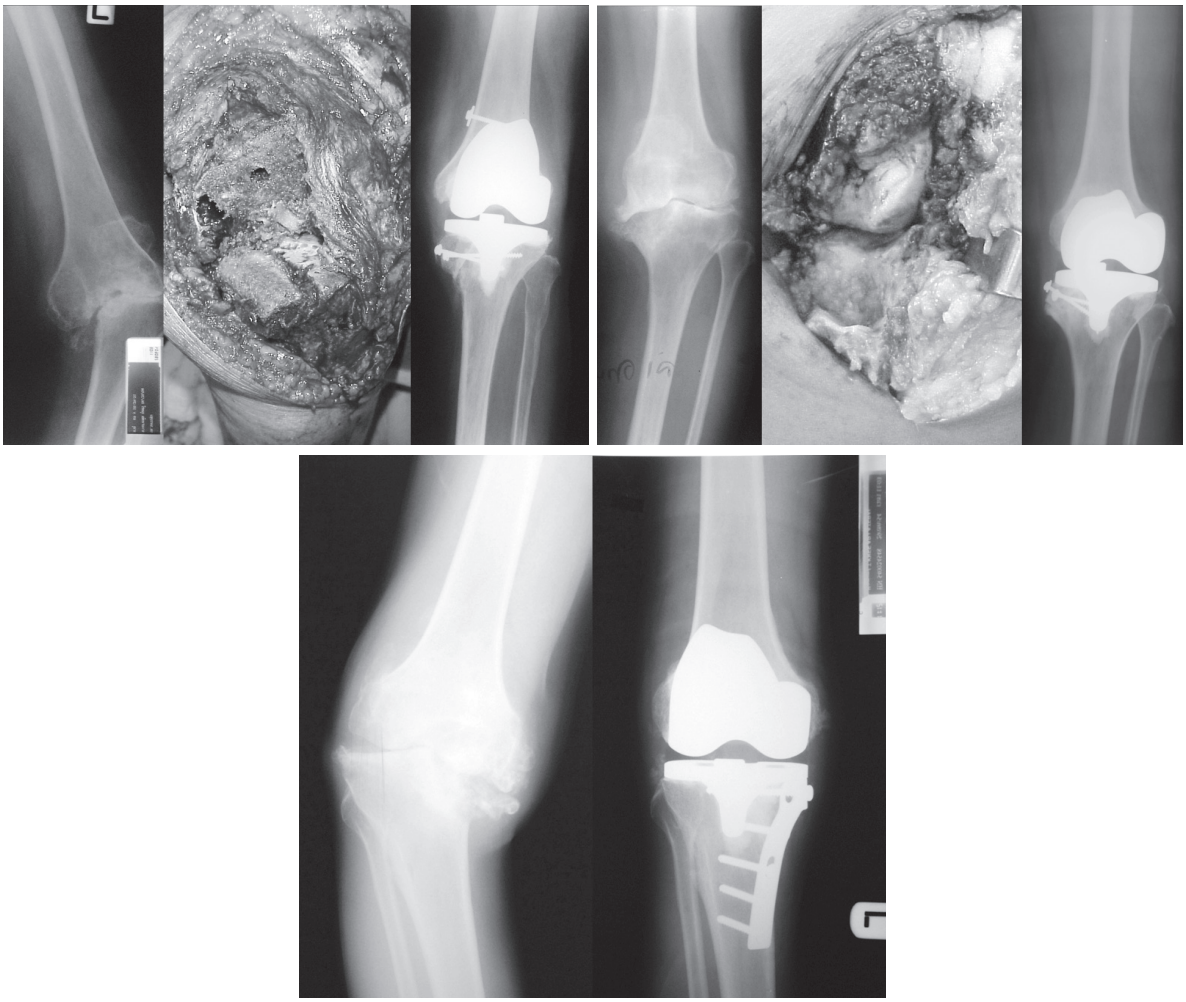

Fig.1 Some of knee x-ray pictures show severe deformity before surgery and its post operative films.

The mean follow up time was 9 ± 3 years. The knee score at 3 months post operative was 42 on pain (range 30-50), 23 on range of motion (range 20-25), 25 on stability and 75 on functions (range 50-90). At 24 months were 39 on pain (range 30-50), 23 on range of motion (range 20-25), 24 on stability (21-25) and 75 on functions (range 50-90). At last follow up were 35 on pain (range 30-48), 23 on range of motion (range 20-25), 24 on stability (21-25) and 70 on functions (range 45-84). (Table 1) The Total Knee Arthroplasty Radiographic Knee Society Score[14] was 0 at 24 months and 0-4 (average 0.5) at last follow up. There were significant clinical improvement statistically. Autogenous bone graft was good fused to recipient base in all cases. No any sign of non union, collapse or fragmentation of bone graft. There were no any complications in this study.

Table 1 Knee Society Score at preoperatively and at 2, 24 and last follow up postoperatively.

	Pain	Range of motion	Stability	Function
Preoperative	6	15	4	7
	(0-10)	(10-18)	(0-5)	(0-10)
Post operative 2 mo.	42	23	25	75
	(30-50)	(20-25)	(25-25)	(50-90)
Post operative 24 mo.	39	23	24	75
	(30-50)	(20-25)	(21-25)	(50-90)
Last follow up	35	23	24	70
	(30-48)	(18-25)	(21-25)	(45-48)

Discussion

There were several factors causing patients to seek surgery for OA knee very late those made patients developed severely deformed knees. These include ignorance, fear of surgery (experience of worsen outcome after TKA of the neighbour), access to alternative and traditional medicine and the high cost of treatment.

Deformity of severe OA knee will present in many figures such as severe varus in one side and severe valgus in contralateral side, or posterior tibial plateau defect at both condyles with posterior femoral subluxation or severe deformed both femoral and tibial condyle. There were several different methods described to correct severe deformed knee at arthroplasty.[3-10] however, each method was not suitable for all situations. Teeny SM et al[4] found in their series of 27 cases, the alignment of knee after TKA trend to be varus, average postoperative angle between the mechanical axes of femur and tibia to be 3° of varus (range: 9° valgus-11° varus). Yagishita K et al[16] found most of severe varus knee trend to be unstable after TKA. From that report, the technique used for balancing soft tissue was only soft tissue release and space blog usage. This could not evaluate tension of both collateral ligaments, when knee was under loading, stand on one leg, the knee will varus until ligament was tight. Engh GA[8] advocated knee after TKA should have 2-3 mm knee open when varus and valgus stresses were applied. This might cause unstable knee while walking or stand on one leg.

Laskin RS[17] advised to fill the defect with cement that could do only small circumscribed areas with and intact peripheral rim. In this series, the cement usage could be extended by using the positioning screw to encounter tibial tray collapse while impacted the prosthesis and cement holding. Laskin RS et al[11] also reported that the use of a posterior stabilized TKA provides superior results for those patients with a greater

than 15° varus deformity. From that study, authors reported significantly better postoperative alignment, flexion and residual flexion contracture using the Insall Burstein prosthesis (posterior stabilized) but they did not mention the alignment after stress test was applied to the knee or stand on one leg. More recently, Laskin RS[17] emphasized his earlier findings with a 10 year follow up study. He reported that severe varus deformity could not be corrected by medial ligamentous release alone. Faris PM et al[12] reported that a PCL retaining prosthesis could be used as long as proper soft tissue balancing was performed at the time of surgery. Ritter MA et al[13] confirmed the Faris's opinion and advised to balancing the PCL to keep the ligament from hindering the flexion arc. Author personally experience found that there were no different outcomes of PCL preserved or sacrified when using PCL retaining knee prosthesis in primary simple TKA in terms of Knee Society Score and complications in case of both knee collateral ligaments were well balanced. From this study also showed a satisfactory outcome of PCL retaining prosthesis TKA in severe knee deformity without PCL preserved in immediate post operative or late follow up. There was no anterior or posterior subluxation or instability and also no abnormal movement of knee on ambulation and motion. This could be explained by the very stable knee created by the technique of sequential prosthetic part implantation.[15]

Laskin RS[17] also reported about more than 50% of bone graft was not biologically alive. Even he used autogenous bone graft from iliac and local bone from knee. He also showed the variety of tibial insert thickness used (6/7.5 to 15/16). In this series, There was no bone biopsy to prove but the follow up film and clinically outcome showed no any sign of non union, fragmentation or subsidence of bone graft that might be explained by optimum time of weight protecting until bone graft was consolidated and screw or plate sharing the load from tibial tray to the tibial bone underneath rather than bone graft. There were only 2 tibial component thickness sizes used in this series which could be explained by the preplan prosthetic joint line and the thickness of the bony cutting before knee gap was created.

Conclusion

Severely deformed knee can be treated effectively with PCL retaining prosthesis even without PCL. Good alignment, stable knee and proper postoperative program are essential for the good outcome.

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