Lateral Release Can Increase Range of Flexion during Computer Assisted Total Knee Arthroplasty with Patellar Maltracking

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Objective: *The patellar tracking is an important factor that affect range of motion after total knee arthroplasty (TKA). Intraoperative patellar maltracking during TKA can be improved by performing lateral release. We hypothesized that TKA with patellar maltracking after undergoing lateral release can increase intraoperative range of flexion.*
Material and Method: *A prospective study was conducted on 110 knees that underwent computer assisted TKA. The patellar tracking was assessed with no thumb test technique. Fifty-two knees were classified into negative no thumb test group, and 58 knees were classified into positive no thumb test group. The positive no thumb test group further received lateral release with outside to inside technique. The range of flexion was recorded before and after final implantation in both groups, and recorded after lateral release in positive no thumb test group.*
Results: *After final implantation, the negative no thumb test group had significant greater flexion angle than the positive no thumb test group (128.20° and 123.90°). The range of flexion after performing the lateral release in positive no thumb test group increased the flexion up to 127.60°. Thus, there was no significant difference from the negative no thumb test group (128.20°). After the lateral release was performed, the flexion angle had significantly increased by 3.70°.*
Conclusion: *The results indicated that intraoperative lateral release in patellar maltracking can improve range of flexion in computer assisted TKA.*

Keywords: *Lateral release, Patellar maltracking, Computer assisted total knee arthroplasty*

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In Asian culture, squatting and sitting cross-legged is very common in religious activities. Therefore, total knee arthroplasty (TKA) requires increased knee flexion. There are many intraoperative factors that affect the range of flexion after TKA including flexion and extension gap imbalance, joint line elevation, retention of posterior osteophyte of femoral condyle, femoral component malposition, and patellar tilt and shift. Those have been considered to be important factors that affect postoperative range of flexion[1-7]. Intraoperative patellar tilt or maltracking during TKA can be managed by performing a lateral release procedure[8]. The biomechanical effect of lateral release has been examined and it could decrease pressure on the lateral patellar facet in flexion[9]. The incidence of some degree of lateral release has been reported to be as high as 40%[10]. Various studies have reported that lateral release does not compromise the clinical outcomes or increase the complication rate of TKA[11-14]. However, effects of lateral release in improving the range of flexion during TKA have not been studied. We hypothesized that the intraoperative lateral release will not only improve patellar tracking but will increase flexion angle during TKA navigation as well.

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Material and Method

This prospective study was performed between January 2009 and January 2010. The study protocol was approved by our institutional ethics committee. All 110 osteoarthritis knees underwent primary TKA with mobile posterior stabilize prosthesis (emotion PS, Aesculap, Tuttlingen, Germany). All cases underwent TKA under the navigation system (Orthopilot version 4.3 tibia cut first) with gap balancing technique. The exclusion criterion was TKA

with resurfacing patella. When the operation was begun, the tourniquet was inflated with knee maximally flexed and mini-midvastus arthrotomy was used in all cases. The operation was performed step by step under navigation. The deformity and range of flexion by gravity were recorded after each registration step and at final implantation. After cementing of the final prostheses, patellar tracking was evaluated with "no thumb test"[15,16] from knee flexion 30° to 80° and the tourniquet was not released. If the absolute no degree of patellar opening or tilting and perfectly tracking of patella within the trochlear groove of the femoral prosthesis was found, it was classified in the "negative no thumb test" group. If any degree of patellar opening or tilting during range of motion trialing was found, the lateral release was performed and classified in the "positive no thumb test" group (Fig. 1). The range of motion was recorded again after lateral release (Fig. 2). The lateral release was performed in a staged fashion with outside to inside technique. The lateral retinaculum was sequentially released in three stages with reassessment of patellar tracking between each stage until no opening or tilting of the patella could be detected. The outside to inside technique was begun with open the lateral skin flap over the patella deep to deep fascia to expose the lateral retinaculum. The first stage of lateral release started from the level of the superior pole of the patella, beginning 5 mm lateral to the lateral border of the patella to the inferior pole of the patella (Fig. 3). The second stage was extended from the level of the lower pole of the patella to the Gerdy's tubercle (Fig. 4). The line of incision was parallel to the patellar tendon. The third stage, the incision was made upward from the superior pole of the patella to the superficial layer of vastus lateralis obliquus tendon (Fig. 5, 6). The superior lateral genicular artery was not identified during release.

The statistical analysis used to compare preoperative deformity between two groups was independent sample t-test. The statistical analyses for comparison flexion angle, final implantation, and postoperative flexion angle between two groups and including a comparison between flexion angle of final implantation and after lateral release in lateral release

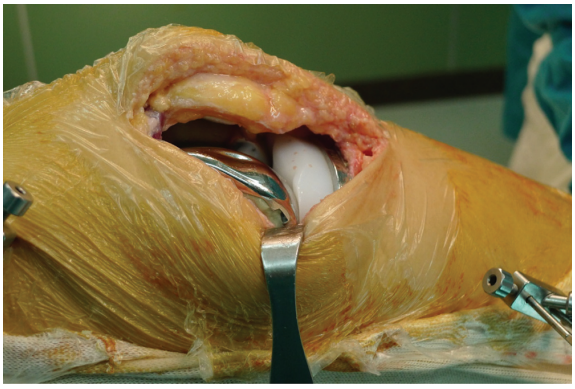

Fig. 1 Photograph showed positive no thumb test with medial opening of patella.

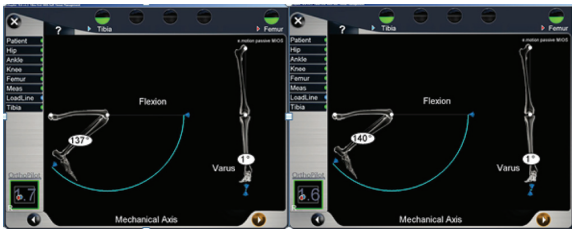

Fig. 2 Photograph showed the range of the flexion by gravity without released tourniquet before and after the lateral release was recorded from navigation.

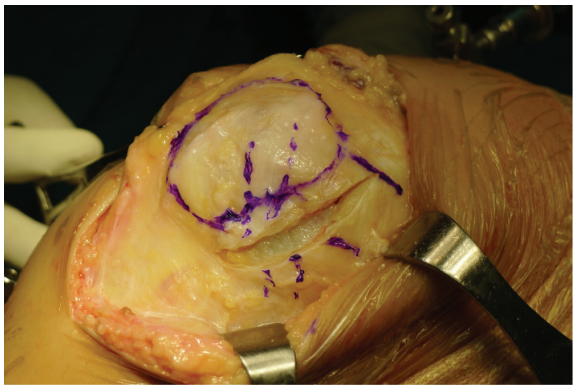

Fig. 3 Photograph showed the first stage of lateral release. The lateral patellofemoral ligament and patello-meniscal ligament were cut.

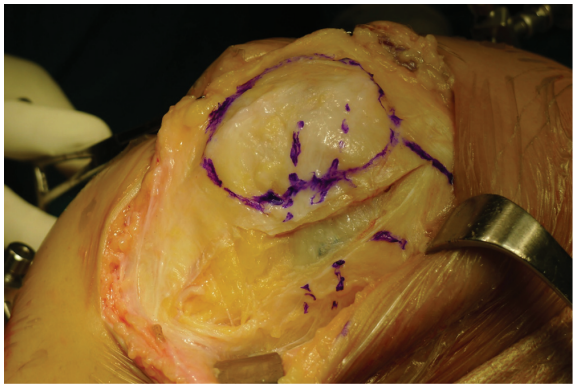

Fig. 4 Photograph showed the second stage of lateral release. The incision extended from the lower pole patella toward Gerdy's tubercle.

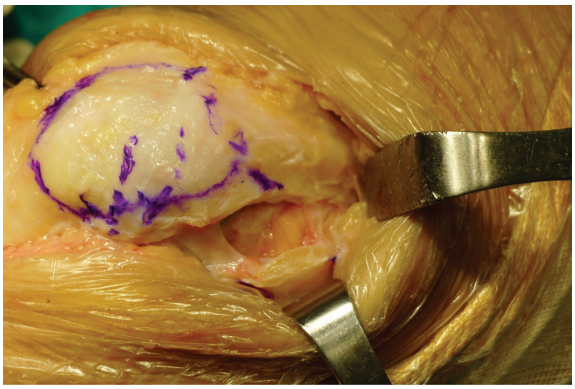

Fig. 5 Photograph showed the third stage of lateral release. The incision extended from upper pole patella toward superficial layer of vastus lateralis obliquus tendon.

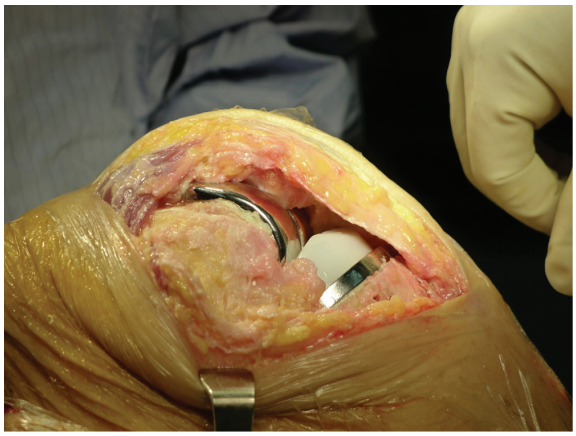

Fig. 6 Photograph showed the absent patellar opening after the lateral release was performed.

group were paired two-tailed Student's t-test. Statistical significance was set at p-value <0.05. Sample size calculated for one-tailed t-test study with 0.05 probability level, 0.5 anticipated effect and 80% statistical power level was 51 knees in each group. SPSS for windows (Version 9.0, SPSS, Chicago, Illinois, USA) was used for the statistical analysis.

Results

The 110 TKAs were classified into two groups according to no thumb test after final implantation. The negative no thumb test group consisted of 52 knees. The average age of patients in this group was 69.2 years. The deformity consisted of 46 varus knees had average 9.28° varus, and six valgus knees had average 3.16° valgus. The positive no thumb test group had 58 knees. The average age of patients was 69.0 years. The positive no thumb test group consisted of 52 varus knees, with an average degree of deformity of 9.38° varus, and six valgus knees had average 3.00° valgus. There was no significant difference between two groups in term of preoperative deformity (Table 1). The preoperative flexion angle and the angle after the final implantation were analyzed in both groups (Table 2). The results revealed no statistical significant difference in preoperative flexion angle between the two groups. However, it was noted that after final implantation, the negative no thumb test group had significant greater flexion angle than the positive no thumb test group.

After the lateral release was performed, the flexion angle had significantly increased by 3.70° compared with the final implantation (p = 0.00). Finally, postoperative flexion angle was comparable in each group, with no significant difference in flexion angle after operation (Table 2).

Table 1. Preoperative deformity between the negative no thumb test and the positive no thumb test group

Deformity	Negative no thumb test group	Positive no thumb test group	p-value*
Varus deformity	9.28°	9.38°	0.93
Valgus deformity	3.16°	3.00°	0.87

* Independent sample t-test

Table 2. Preoperative, final implantation, and postoperative flexion angle of the negative no thumb test and the positive no thumb test group

	Negative no thumb test group	Positive no thumb test group	p-value*
Preoperative flexion angle	124.00°	122.00°	0.91
Final implantation flexion angle	128.20°	123.90°	0.00
Postoperative flexion angle	128.20°	127.60°	0.437

* Paired two-tailed Student's t-test

Discussion

According to the present study's results, the negative no thumb test group had significant greater flexion angle after the final implantation than the positive no thumb test group. This indicated that patellar tracking is one of the factors affecting range of motion after TKA. Kawamura and Bourne had a similar conclusion[7]. The lateral release is a procedure to correct patellar maltracking. The lateral release can be performed using either of two techniques: "inside-out" and "outside-in". The inside-out technique was performed in the knee joint and release through synovial lining and joint capsule, which exposed the joint to subcutaneous plane under the skin. This technique has associated risks of hematoma under the skin and spread of infection into the joint[17]. Strachan et al reported six stages of outside-in lateral release proximal to distal manner[11]. Maniar et al described three steps of outside-in technique with: step-1 release was from the midpatella to the upper tibial border, step-2 release was from the midpatella to the proximal pole of the patella, and step-3 release was proximal to the superior pole of the patella; and reported as preserving the superior lateral genicular artery in 76% of patients and no complications were seen at follow-up with functional and radiographic examinations[18]. The technique we used was to release from the upper pole of the patella to the lower pole of the patella, in the first step release the lateral patellofemoral and patellomeniscal ligament[19]. In the second step, from the lower pole of the patella to the Gerdy's tubercle we release the patellotibial ligament. The ligament was attached to the lateral tibial condyle between the tibial tuberosity and Gerdy's tubercle[19]. In the third step, the incision was made upward from the superior pole of the patella to the superficial layer of vastus lateralis obliquus tendon. The role of lateral release for improving range of motion is rarely mentioned, especially in TKA navigation. Kawamura and Bourne found the tilt angle of patella had a negative correlation with postoperative range of flexion[7].

According to our results, after performing the lateral release for the correction of the patellar tilt, the flexion angle was increased 3.7° (from 123.9° to 127.6°) and postoperative flexion angle in positive no thumb test group had no significant difference from the negative no thumb test group. The results indicated that patellar tracking effects on range of motion during TKA and lateral release can improve range of flexion in TKA with patellar maltracking. Laskin[20] and Lombardi et al[21] had recommended releasing the tourniquet before performing lateral release and found that it could reduce the incidence of lateral release between 6% and 22%. However, the perfect intraoperative patellar tracking is the goal of TKA and lateral release does not associate with negative outcomes. The short- and long-term improvement of the range of motion should be followed in the future. The postoperative follow-up is an important factor that requires the cooperation of the patients, if we determine to have the long-term postoperative range of motion. Therefore, the efforts of the patients in conscientiously participating in the postoperative physical therapy program are required.

Conclusion

Based on the data of the present study, we can conclude that lateral release can increase intraoperative range of flexion in TKA with patellar maltracking.

What is already known on this topic?

The intra-capsular factors influencing range of flexion after TKA were implant design, ligament balance, flexion-extension gap balance, height of joint line, and patellar tracking.

What this study adds?

Patellar tracking is a significant factor of intraoperative range of flexion. Lateral release in patellar maltracking has also been improving intraoperative range of flexion during TKA.

Potential conflicts of interest

None.

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การตัดเลาะเนื้อเยื่อด้านข้างลูกสะบ้าช่วยเพิ่มองศาการงอเข่าขณะการทำผ่าตัดเปลี่ยนข้อเข่าเทียมด้วยคอมพิวเตอร์นำวิถี ในผู้ป่วยที่มีตำแหน่งลูกสะบ้าผิดปกติ

พรภวิษญ์ ศรีภิรมย์, ชัยพร ศิระมานะกุล, บุญวัฒน์ จะโนภาษ

วัตถุประสงค์: *ตำแหน่งของลูกสะบ้าเป็นปัจจัยหนึ่งที่สำคัญต่อองศาการงอเข่าหลังการผ่าตัดเปลี่ยนข้อเทียม ตำแหน่งลูกสะบ้าที่ผิดปกติขณะผ่าตัดสามารถแก้ไขด้วยการตัดเลาะเนื้อเยื่อข้างลูกสะบ้า สมมติฐานของการศึกษานี้คือการตัดเลาะเนื้อเยื่อข้างลูกสะบ้าในผู้ป่วยที่มีตำแหน่งผิดปกติของลูกสะบ้าขณะผ่าตัดเปลี่ยนข้อเทียมสามารถเพิ่มองศาการงอเข่าได้ด้วย*

วัสดุและวิธีการ: *เป็นการศึกษาไปข้างหน้าในผู้ป่วยที่ผ่าตัดเปลี่ยนข้อเทียมด้วยคอมพิวเตอร์นำวิถีจำนวน 110 เข่า ตำแหน่งของลูกสะบ้าประเมินด้วยวิธีประเมินตำแหน่งของลูกสะบ้า พบว่า 52 เข่า จัดในกลุ่มตำแหน่งลูกสะบ้าปกติ และ 58 เข่า จัดในกลุ่มที่มีการเอียงของลูกสะบ้า โดยกลุ่มที่มีการเอียงของลูกสะบ้าจะได้ทำการตัดเลาะเนื้อเยื่อด้านข้างลูกสะบ้าโดยวิธีตัดด้านนอกเข้าสู่ด้านในเข่า องศาการงอเข่าจะได้รับการบันทึกก่อนและหลังใส่ข้อเทียมในทั้งสองกลุ่มรวมทั้งได้บันทึกองศาการงอเข่าหลังการตัดเลาะเนื้อเยื่อด้านข้างลูกสะบ้าด้วย*

ผลการศึกษา: *หลังจากใส่ข้อเข่าเทียม กลุ่มที่ตำแหน่งลูกสะบ้าปกติมีองศาการงอเข่ามากกว่ากลุ่มที่มีการเอียงของลูกสะบ้าอย่างมีนัยสำคัญ (128.20° และ 123.90°) หลังทำการตัดเลาะเนื้อเยื่อข้างลูกสะบ้าในกลุ่มที่มีการเอียงของลูกสะบ้า พบว่าองศาการงอเข่าเพิ่มขึ้นจนสามารถงอเข่าได้ถึง 127.60° และพบว่าสุดท้ายองศาการงอเข่าของทั้งสองกลุ่มไม่แตกต่างกัน การตัดเลาะเนื้อเยื่อข้างลูกสะบ้าสามารถเพิ่มองศาการงอเข่าได้ 3.70° อย่างมีนัยสำคัญ*

สรุป: *การตัดเลาะเนื้อเยื่อข้างลูกสะบ้าในผู้ป่วยที่มีตำแหน่งของลูกสะบ้าผิดปกติขณะผ่าตัดสามารถเพิ่มองศาการงอเข่าในการผ่าตัดข้อเข่าเทียมด้วยเครื่องคอมพิวเตอร์นำวิถี*