SMOC Approach for Total Knee Arthroplasty in Valgus Knees

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Research article

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Abstract

Purpose The subvastus approach sometimes can not provide adequate exposure and lateral approach has disadvantages of closure of the soft tissues and patellar tracking. The hypothesis of this study was that SMOC approach could be used in valgus knees and would offer good function.

Methods We retrospectively reviewed 25 patients (25 knees) with valgus deoformity undergoing primary total knee arthroplasty (TKA) with SMOC approach. Necessary soft tissue releases, Visual Analog Scale (VAS), straight leg raising (SLR), International Knee Society score (KSS), radiological alignment were assessed with average follow-up of 16 months.

Results KSS improved significantly from 38.5 to 90.3. The mean range of motion increased from 89.5°to 121.8°.The mean tibiofemoral valgus was corrected from preoperative 17.1° to 6.3°. No instability, recurrent valgus deformity, or radiographic loosening was found during follow-up.

Conclusions SMOC approach provides adequate exposure and excellent early recovery for TKA in valgus knees, without increase in incidence of complications.

Introduction

The standard medial capsular approach most widely used in varus knee has been reported unsatisfactory results with in incomplete axis restoration, changes in the joint line, constraint implants, underlying instability and low clinical outcome [1, 2, 3, 4]. The lateral parapatellar capsular approach, described by keblish [5], and modified lateral capsular approach [6, 7, 8, 9] have advantage of preservation of the extensor mechanism’s blood supply and easier to release contracted structures, but not routinely adopted for closure of the soft tissues, eversion of the patella, osteotomy of the tibial tuberosity, or vastus lateralis. Recent years, the far medial subvastus approach (subvastus approach without tibial medial collateral ligament release) [10] also used in in the type I and II valgus knee.

Subvastus with Minimal Oblique Cut (SMOC) approach, combined the subvastus with limited parapatella approach, protect vastus medialis obliquus (VMO) and patellar tendon from damage or excessive release during exposure, expand the indication of MIS technique, minimize dependency on special or custom instruments for MIS surgery. At present, SMOC approach was used in TKA for varus deformity and seldom adopted in TKA for valgus knees.

Therefore, the aim of this study is to evaluate the clinical and radiological outcomes of SOMC approach in valgus knee in (1) functional recovery, (2) the tibiofemoral alignment, (3) postoperative related complications.

Materials And Methods

25 knees in 25 patients adopted SMOC approach with valgus deformity (Fig. 1), were included in this retrospective study between January 2015 and December 2017. There were 18 females and 7 males with a mean (SD) age of 65 (6.3) years and a mean (SD) BMI of 29 (4.7) kg/m^2. Seventeen patients had osteoarthritis and eight rheumatoid arthritis. Previous arthrotomy of knee, infection, neurological disease, patellar tendon or quadriceps problems were excluded in this study. Medial collateral ligament was assessed preoperatively and intraoperatively. Sixteen knees present with mean 15°flexion deformity ranged 5° to 40°. A cemented, posterior stabilized prothesis (Zimmer, Warsaw, IN, USA) was used for all knees. The patella was treated with osteophyte removal and patellar rim denervation. All surgeries were conducted by a senior surgeon.

Midline incision in 7-12cm length was made from the superior pole of the patellar to 2 cm below joint line, medial to the tibial tubercle. Medial soft tissue sleeve was released to expose the Vastus Medialis Oblicans (VMO). After cut open the myolemma, the VMO was blunt released off the intermuscular septum, and then a Hoffmann retractor was inserted below the VMO to lateral sulcus. The VMO was then blunt released proximally within 5 cm, and elevated by the Hoffmann retractor. A midline incision was made on the suprapatellar capsule, and cut down to the skin incision level, parallel with the patellar tendon. Throughout operation, the patellar was retracted instead of eversion. For particular situations, such as large muscular patients, severe deformity, far distal VMO insertion, short patellar tendon, which leads to exposure difficulty, limited oblique cut was then introduced. Begin from the medial superior corner of the patellar, leave 5 mm tendon tissue of quadriceps insertion, the oblique cut was made 45 degree laterosuperior in length of 0-2cm (Fig. 2). The medial ligament release was not peformed.

“Mobile window” technique was used for next procedures. The distal femoral cut was made using the intramedullary alignment guide, with the knee in 30 degree flexion, in order to avoid excessive tension on patellar tendon. Using an extrarmedullary cutting guide, the tibial cut was made, and then the extension gap was detected. The femoral size was measured by a posterior-referenced guide, and 4-in-1 cutting block was introduced. Intercondylar notch is cut for posterior stabilized component. Osteophytes and residual meniscus were removed, and posterior release was then performed if necessary. As for the contracted lateral side of the knee, all osteophytes were removed and the iliotibial band was released inside-out by piecrusting with a needle. Lateral patellar retinaculum, lateral collateral ligament, posterolateral capsule, the popliteus tendon, lateral gastrocnemius tendon, and biceps femoris tendon were also released in order to achieve a better tissue balancing when necessary. After trial reduction, range of motion, soft tissue balancing and patellar tracking were detected. The patella was prepared by denervation, osteophyte removal and surface debridement, instead of replacement. Tibial plateau was prepared by keel instrument, and then the tourniquet was inflated. Using standard cementing techniques, the components were implanted sequentially, starting with the tibial tray, then the femoral prosthesis and polyethylene insert. After harden of cement, the tourniquet deflated and hemostasis was performed. Wound closing was started from suprapatella capsule repairing whenever there wasn’t any sign of inflammatory changing. Medial retinaculum and deep fascia were repaired and a drain was input into the joint cavity. Finally, the wound was closed by layer. After wound closure, 1 g tranexamic acid was injected into the joint cavity.

Antibiotics was only used once before surgery and twice after TKA. Celecoxib was used for analgesia, and supplementary analgesia like pethidine hydrochloride was added if necessary. Rivaroxaban was used once daily for 12 days for DVT prevention. The drainage was removed 24 h postoperatively. Ankle flexion and extension exercise and straight leg raising (SLR) were encouraged from day 0. CPM was utilized on day 1 postoperatively.

International Knee Society score (KSS) [11], included 50 points for pain, 25 points for movement and 25 points for stability, was used to assess the clinical function of the knee preoperatively and postoperatively. Moreover, range of motion, SLR and VAS were others evaluation index for the clinical function. The tibiofemoral valgus angle was adopted to evaluate the improvement of the limb alignment. Postoperative general or local complications were recorded in follow-up.

The mean postoperative follow-up period was of 16 months with a range between 10 and 25 months.

The data were expressed as mean ± standard deviation (SD). Variables of the preoperation and postoperation were compared using the Student's t test. Statistical significance was set at p value less than 0.05. Analysis was performed using SPSS version 19.0 (SPSS Inc, Chicago, IL).

Results

Surgical observations

Minimal oblique cut was adopted during the surgical exposure in 5 female and 7 male patients, while 13 female patients do not need minimal oblique cut. The mean intraoperative blood loss was 152.3 and the mean postoperative drainage was 88.7 ml. No one need blood transfusion intraoperatively and postoperatively. Sixteen knees were performed lateral retinacular release.

Functional outcome

Straight leg raising (SLR) can be achieved on day 1 postoperatively in all knees. The mean range of motion increased from 89°to 121°.The KSS mean score increased from 38.5 points preoperatively to 90.3 points postoperatively.

Radiographic findings

Femorotibial angle was corrected from an average of 17° (range 10°-31°) preoperatively to 6° (range 3°-9°) postoperatively.

Complications

No surgical relevant postoperative complications were found in this study. No prosthesis loosening and infection were observed during postoperative follow-up.

Discussion

Valgus knee was defined as a valgus alignment of the anatomical axes of the femur and tibia in the frontal plane greater than ten degrees [12]. Pathological changes in valgus knee include bone and soft tissue around the knee. A lateral femoral condyle deficiency, lateral tibial plateau deficiency and external rotation deformity of the tibia are associated with the bone change of valgus knee. As for the soft tissue, contracted lateral tissue and lax medial tissue are the typical features of the valgus knee, which is difficult to reach a balance in surgery.

According to the severity of the valgus deformity, the classification introduced by Ranawat [12] is as follows: type I is minimal coronal plane valgus with medial soft-tissue stretching; type II is a fixed coronal deformity greater than 10° with attenuated medial soft tissues, and type III, a severe bony deformity with incompetent medial soft tissues and a previous osteotomy.

As the standard approach for TKA, The medial parapatellar approach is also utilized in the valgus knee. This traditional approach provides better operative exposure and convenient operative procedure [13]. The release of the medial structures should be minimised in order to avoid the medial laxity of the knee. However, it is difficult to expose and release the posterolateral joint capsule and soft tissue. Therefore, medial parapatellar approach is suitable for the mild and moderate valgus knee.

Lateral parapatellar approach described by Keblish [14] has advantages of the easy release of lateral and posterolateral structures and lateral patellar retinaculum, which is necessary in valgus knee. However, patellar tendon tear, insufficient operative exposure and difficulty with soft-tissue closure are the disadvantages of this approach. Sometimes a tibial tubercle osteotomy is required which increases surgical difficulty and trauma. Moreover, most surgeons are not familiar with this approach which can lead to technical difficulties.

Medial subvastus approach was also used in the TKA for valgus knee. A retrospective study conducted by Koninckx et al [10] included 78 patients (84 knees) undergoing primary TKA for type I or II fixed valgus knees. It was shown that The Knee Score, the function score, flexion improved significantly. Alignment was corrected to 181°(1.5°) HKA angle with a postoperative joint line shift of + 2.8 (3.2) mm. No clinical instability or osteolytic lines was observed. Shah et al [15] retrospectively reviewed 112 knees with valgus deformity. It was found that The AKS and function score showed significant improvement from preoperative mean score of 39 and 36 to 91 and 79 ($P < 0.001$), respectively.

Combined the subvastus with limited parapatella approach, we proposed SMOC approach (subvastus with minimal oblique cut approach) which protects vastus medialis obliquus (VMO) and patellar tendon from damage or excessive release during exposure. At present, SMOC approach was used in TKA for varus deformity and seldom adopted in TKA for valgus knees.

Different from midvastus approach, the SMOC technique is cut the VMO tendon insertion from top medial corner of patellar for 0–2 cm gradually in the direction of 45 degree to the upper lateral, instead of upper medial. By this way, the generated moment on VMO facilitate lateral retraction of patellar, and decrease the tension on extensor mechanism and patellar tendon. Limited release on tendinous tissue rather than muscle, less pain and blood loss after surgery will be.

In our this study, postoperative KSS improved significantly from 38.8° to 90.3°. The mean range of motion increased from 89.5°to 121.8°. It can be been from this research that SMOC approach can achieve excellent clinical results in valgus knee.

Many of valgus knee need the release of the lateral structure of the knee, including lateral patellar retinaculum, lateral collateral ligament and posterolateral capsule. Three-step technique [12] was adopted to evaluate the lateral soft tissue of the knee in our study. Firstly, the extension gap was evaluated by the knee in extension with lamina spreaders after osteophytes have been removed. If it was very tight, posterolateral capsule and iliotibial band were released in sequence with a pie-crusting method. Secondly, the knee in valgus or vasus status with stress was to evaluate the stability in extension of the knee. Thirdly, flexion gap of the knee was evaluated. In our research, the iliotibial bands in 16 knees were released inside-out by piecrusting with a needle and popliteus tendons in all cases were preserved.

Becasue of the lateral femoral condyle deficiency and the release lateral structure of the knee, postoperative subluxation of patella offen occur. In this study, No one had postoperative subluxation of the patella. Subvastus is the most medial approach for TKA, and the moment needed for patellar displacement is the largest, therefore minimize the tendency of patellar dislocation.

Conclusions

SMOC approach is an excellent approach for valgus knee, which provides satisfactory clinical results without increase in the incidence of related complications.

Declarations

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None

Authors’ contributions

TL and HNZ designed the research ideas. YZW and HYL analyzed the data, and wrote out the original manuscript. PCG and YZW took part in the design of the study. The co-authors read and authorized the final manuscript for publication. The author(s) read and approved the final manuscript.

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Availability of data and materials

All data were contained in the text and charts of published articles.

Ethics approval and consent to participate

This study is a retrospective study, so no informed consent is required.

Consent for publication

The co-authors agreed on the final manuscript.

Competing interests

The co-authors claim there was no competition between them.

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Tables

Table 1
Clinical data of individual patients included in the study

Variables		
Age (y)		65.5 ± 6.3
gender		
	male	7
	female	18
BMI		29.6 ± 4.7
Operative time (min)		82.3 ± 15.2
Lateral retinacular release rate (%)		64
Intraoperative blood loss (ml)		152.3 ± 51.6
Blood transfusion rate (%)		0
Postoperative drainage (ml)		88.7 ± 35.9
Straight leg raising (d)		1.0 ± 0.5
Follow-up		16 (10–25) months

Table 2
Comparison of follow-up results between the two groups

Variables	Pre-operative	3 months postop	*P* value
Valgus angle	17.1 ± 0.8	6.3 ± 0.7	< 0.05
VAS score	7.5 ± 0.9	3.7 ± 0.8	< 0.05
ROM	89.5 ± 18.1	121.8 ± 20.1	< 0.05
KSS	38.5 ± 4.5	90.3 ± 5.1	< 0.05

Figures

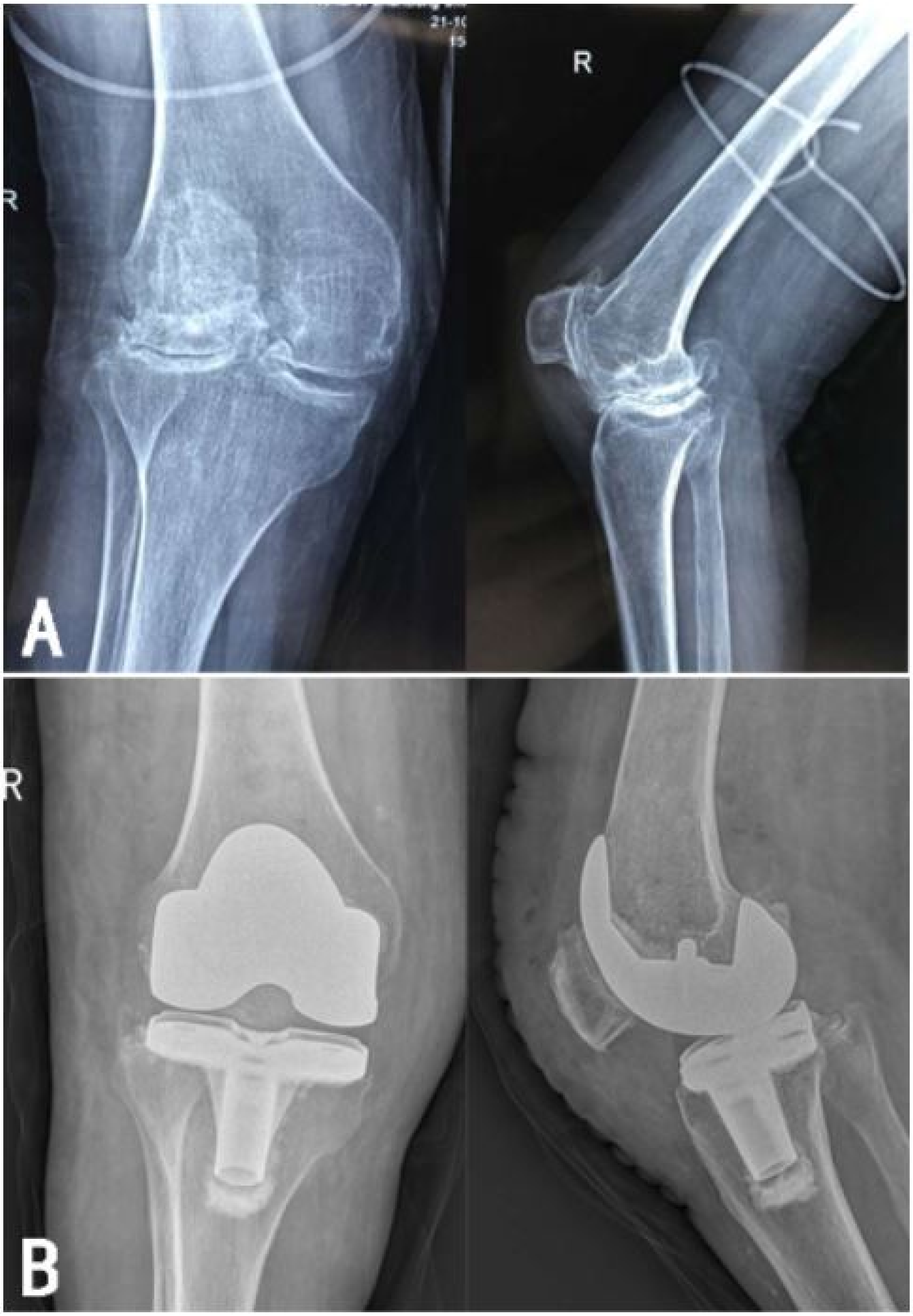

Figure 1

25 knees in 25 patients adopted SMOC approach with valgus deformity (Figure 1), were included in this retrospective study between January 2015 and December 2017.

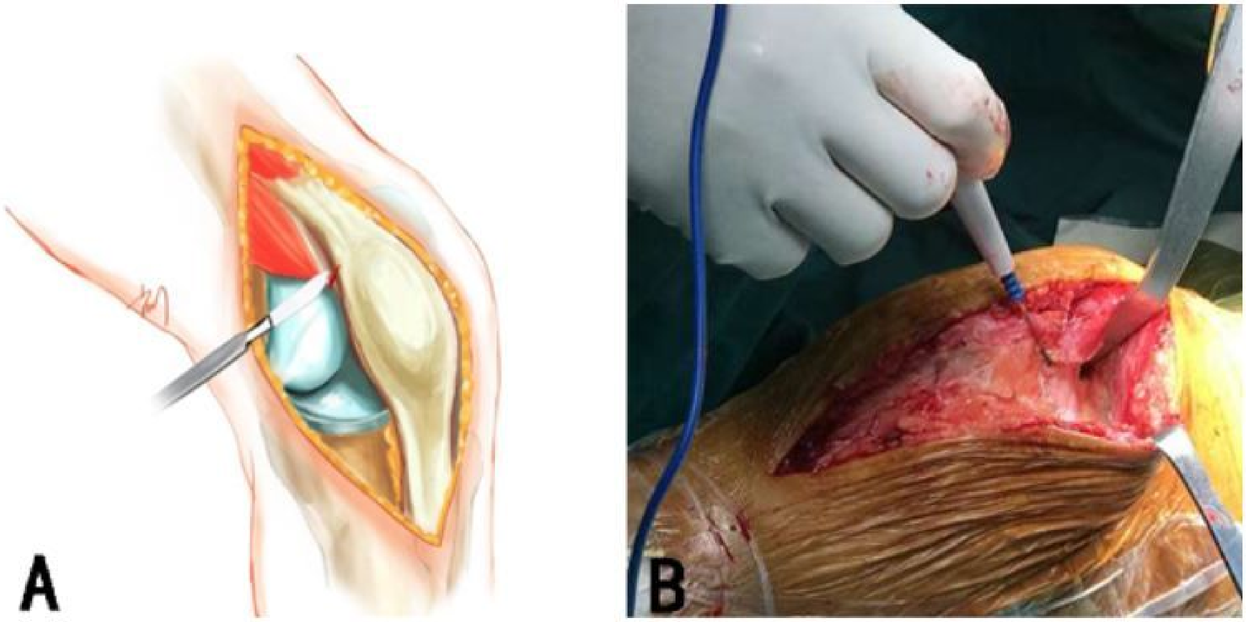

Figure 2

Begin from the medial superior corner of the patellar, leave 5mm tendon tissue of quadriceps insertion, the oblique cut was made 45 degree laterosuperior in length of 0-2cm (Figure 2). The medial ligament release was not peformed.