A Key Technique for Lateral Unicompartmental Knee Arthroplasty and Its Clinical Efficacy

Tao Wen
Shanghai Yangpu District Central Hospital
Ming Hua Xue
Shanghai Yangpu District Central Hospital
Tong Ma
Shanghai Yangpu District Central Hospital
Tao Yang
Shanghai Yangpu District Central Hospital
Long Xue
Shanghai Yangpu District Central Hospital
Hui Yi Tu (tuyihui2019@hotmail.com)
Shanghai Yangpu District Central Hospital https://orcid.org/0000-0001-9189-3622

Research article

Keywords: lateral knee arthritis, unicompartmental lateral arthroplasty, arthritic genu valgum deformity, unicondylar arthroplasty, knee arthroplasty

Posted Date: December 18th, 2020

DOI: https://doi.org/10.21203/rs.3.rs-129861/v1

Abstract

Background: Currently, the surgical technique and design of surgical instruments for lateral unicompartmental knee arthroplasty (UKA) in treating lateral knee compartment-specific anatomical structures cannot be replicated. Moreover, few articles have reported on the surgical techniques and clinical effects.These have caused most joint surgeons to dare not to carry out this operationinChina.Here, we report on how we perform this procedure in a replicable manner using redesigned tools, and evaluate subsequent American Knee Society scores, range of motion (ROM), and revision rates.

Methods: In this retrospective review (January 2014 through January 2016) we identified 158 patients (35 males and 123 females) who had 160 lateral unicompartmental arthroplasties with a minimum of 36 months follow-up (mean 54, range 36–60 months). The initial symptoms of painful osteoarthritis or osteonecrosis were localized to the lateral compartment. The standard of X-slices is mainly limited to the lateral compartment (Ahlbäck grade II OA or worse) while the articular cartilage of the medial compartment shows no obvious clinical or imaging signs of wear. Any valgus deformity must be correctable to reduce varus stress, and any form of inflammatory arthritis is an absolute contra-indication for lateral UKA.

Results: At follow-up, American Knee Society scores (0–100 points) averaged 47.3 ± 1.5 for pain, 97.0 ± 1.7 for clinical outcome, and 97.1 ± 4.1 for function, and ROM averaged 125.5 ± 5.3°. None of the patients had reoperations or revisions.

Conclusion: These standard surgical techniques and tools are useful to beginners because they can effectively avoid impingement of the femur against the tibial spine eminences and provide good results.

Introduction

Unicompartmental femoro-tibial osteoarthritis (OA) usually affects the medial compartment of the knee, but the lateral compartment is primarily involved in 10% of the cases [1]. Femoral osteotomy is more relevant for young patients with lateral compartment OA and significant valgus deformity [2]. However, the restoration of knee joint function after surgery for OA with Ahlbäck grade II and worse has limited efficacy [3,4]. Because of differences in the kinetic mechanisms of the lateral knee compartment, the effect of varus osteotomy is not as satisfactory as that of valgus osteotomy [5]. In addition, because of previous surgical incision and partial bone removal, total knee arthroplasty remains very difficult, and improvements in knee joint function after total knee arthroplasty are not satisfactory [6]. Unicondylar replacement for medial or lateral compartments began in the 1970s. For a patient with single-compartment OA, unicondylar arthroplasty offers faster recovery and better functional recovery than total knee arthroplasty [7,8]. In addition, it retains a large amount of bone, making it easier to complete knee revision later [9,10]. In the past, most studies considered that the failure rate of lateral unicompartmental knee arthroplasty (UKA) in the treatment of lateral compartment OA was high, reaching up to 17% [11–

15]. As a result, some surgeons believed that total knee arthroplasty would be the only effective treatment for lateral compartment OA [16]. However, with recent progress in technology, improvements in implant prostheses and tools, and strict screening of patients, the 10-year survival rates of prosthesis among patients undergoing lateral unicondylar replacement have exceeded 90% [17–20]. Because of fewer surgical indications and the functional anatomical structure of the lateral compartment, lateral unicompartmental replacement is technically more challenging than medial unicompartmental replacement [21,22]. Here, we review the current surgical indications for lateral unicompartmental replacement, patient selection, surgical techniques and postoperative clinical outcomes.

Materials And Methods

Study Design and Indications

In this retrospective review (January 2014 through January 2016), we identified patients who had undergone lateral unicompartmental arthroplasties. Our indications for lateral UKA are painful isolated osteoarthritis and osteonecrosis. The lateral compartment of the knees showed significant loss of joint space on radiographs (Ahlbäck grade II or worse), and the medial compartment of articular cartilage was intact on clinical imaging. Any valgus deformity has to be correctable to reduce stress and no significant femoropatellar problems or serious maltracking of patella. All forms of inflammatory arthritis are absolute contra-indications to lateral UKA.

Physical Examination

During the clinical examination of a lateral UKA knee joint, the surgeon must evaluate the mobility of the joint. We require a flexion of 100° and extension should be completely normal. If the patient has any pain in the front of the knee, then an assessment of the patellofemoral joint (PFJ) is essential. The stability of the sagittal and coronal joints should be evaluated carefully. Assessment of the anterior cruciate ligament (ACL) requires prior notification to the patient. Assessment of knee joint pain and swelling axial displacement tests might be limited. Any valgus deformation should be correctable upon varus stress [23].

Imaging

X-ray imaging should include the antero-posterior view, a lateral view, Rosenberg-View or stress radiographs in flexion (varus and valgus-stress in flexion by hands of the examiner). Ollivier et al. argued that the valgus deformity must be correctable by varus stress [23]. Internal and external stress-bearing X-rays should be taken with the patient in a supine position, and the surgeon should bend the knee when internal and external tumbling stresses are applied by the intraoperative C-arm machine. This view is essential to assess the loss of thickness of the medial knee cartilage and whether the valgus deformity can be correctable to a neutral position. For valgus deformities that cannot be correctable, soft-tissue release is necessary and should be treated with total knee replacement. Lateral radiographs should be used to assess whether the displacement of the tibial plateau of the knee is >10 mm, or whether wear of the tibia is present in the front, middle or rear of the knee to assess the integrity of the ACL. The humeral axial X-ray section is mainly used for confirming the lack of stenosis in the patellofemoral joint space. Occasionally, if the status of the ACL cannot be determined, then magnetic resonance imaging (MRI) or arthroscopy is necessary.

Surgical Technique

The procedure is performed with the patient under spinal or general anaesthesia on a standard operating bed with two leg rests and a blood strap. A stent is placed on the proximal thigh of the affected limb, causing the hip on the affected side to bend to 60°, and the knee joint will sag naturally. One leg rest is placed behind the thigh and the hip is flexed to 45°. The target knee is disinfected conventionally, and flexion is maintained at least 100°. Since the patella is much more disturbing the lateral preparation compared to medially, the surgeon first should reduce the lateral edge of the patella. The upper edge of the incision is flat on the upper patella, and the distal incision is 2cm below the joint line and the lateral edge of the tibial tuberosity. The joint capsule is cut open and the lateral infra-orbital fat pad is partially removed to facilitate observation of the femoral condyle, the ACL and related lateral tibial platform (Fig. 1). It is important to emphasize that the ligament balancing principle cannot be applied to lateral UKA. The lateral coronary ligament cannot be balanced or loosened, and the knee flexion is maintained at 60° to observe the tension of the ACL, the medial compartment and the patellofemoral joint (Fig. 2). Next, the intercondylar spurs should be removed to prevent any impact on the ACL. Before completion of vertical osteotomy of the femur, there’s a small sulcus on the anterior part of the lateral condyle. However, it is sometimes not obvious. So the front contact points of the femoral condyle and the tibial plateau should be marked (Fig. 3). It should be the anterior border for the femoral component.

Tibial Preparation

According to the anatomy of the lateral compartment, the width of the tibial cut need to be tested by the tibial prosthetic test tool. It has three sizes of 45, 50, 55mm. Sagittal cut line is drawn with the electrocautery between the medial border of the lateral femoral condyle and the lateral intercondylar spine (Fig. 3). The tibial cutting guide is placed flush with the distal of the prosthetic condyle(11mm) edge using a marked point on the front lower side of the tibial plateau. The 11-mm cutting height corresponds to the plateau (9mm), plus a 2-mm laxity safety margin. The saw blade is internally rotated 15 degrees relative to the vertical line of the front edge of the tibial cutting guide to carrying out a sagittal cut through the previously marked points. Horizontal cut is then performed (Fig. 4). The tibial resection should be as small as possible. At the same time, it is necessary to protect the cortex of the anterior and posterior tibia as far as possible, as this can not only important for avoiding a posterior subsidence of the implant but also for preventing a tibial fracture. The reclining angle is generally set according to the tibial cutting guide at usually 0–3 °. For cut on the sagittal plane, a vertical saw applied perpendicular to the leading edge of the tibial cut module is used. This standard procedure is simple and practical. Some surgical teams recommend splitting of the patellofemoral ligament. However, we use retraction of the patellar ligament and osteotomy after exposing the osteotomy. During the operation, the impact of the femoral condyle and intercondylar spine caused by the drop of the joint line after cut of the tibial is observed (Fig. 5).

Femoral Preparation

After tibial cut, the appropriate dimensions of the test models are selected according to the test results. The appropriate test models are then placed into the lateral space to restore the normal force line of the knee joint. Then parallel incisions on the test model of the tibia are cut using a swing saw to remove the sclerotic bone of the subchondral bone. This not only avoids the valgus and varus of femoral osteotomy, but also prevents excessive deviation or deviation of the prosthesis (Fig. 6). The midline of the femoral condyle prosthesis is the femoral condyle that corresponds to the midline marking line on the tibial plateau test model (Fig. 7). First, the femoral condyle is marked using an electric knife. The tibial test model is removed and then the knee joint is flexed extremely. The femoral drilling test model and special limit device are used for drilling tests. When drilling, the midline of the femoral model must coincide with the marker line on the femoral condyle, and the drill is placed at about 30° to the posterior cortex of the femur (Fig. 8). Particular attention should be paid to avoid too large a femoral prosthesis. We recommend that the depth of cut should be 1–2mm below the cartilage to avoid a step between the femoral prosthesis and the patella. The position of the femur drilling guide should be not in internalrotation or outerrotation, both for avoiding impingement to the tibial spine eminence in extension and also for minimizing contact to the patella. Once the femoral condyle cut is completed, the cutting module is removed. The removal of osteophytes in the posterior femoral condyle and soft tissues occupying the posterior space is necessary to improve knee flexion and prevent the impact of the polyethylene prosthesis in high flexion positions.

Prosthesis Selection and Placement

Next, the type of tibial gasket should be chosen according to the maximum coverage area of the tibial plateau. Theoretically, there should be no need for anterior, posterior or lateral prosthesis drapes. In practice, there should be at least no lateral or anterior edge drapes. The femoral prosthesis should match the lateral femoral condyle as closely as possible. If two adjacent models are acceptable, then the smaller one is recommended. First, the femoral prosthesis is placed, followed by the tibial prosthesis. At the same time, the tibial plateau is moved forward as far as possible to prepare for the smooth placement of the tibial prosthesis. The flexion–extension gap is tested by placing the test die and lining. Because of the different anatomical structures of the medial and lateral compartments, the joint space of the lateral compartment should be about 2mm larger than that of the extensor when flexing the knee at 90° (Fig. 9).

At this stage, whether the femoral side impacts on the tibial intercondylar spine during knee extension should be checked carefully. We have not found any impacts between the femoral prosthesis and the tibial intercondylar spine during knee extension and flexion tests. We recommended that the midline of the femoral prosthesis should be aligned with the midline of the tibial prosthesis. When the knee is bent at 90°, the median surfaces of the femoral and tibial prosthesis are aligned relatively, achieving good surgical results (Fig. 10). The valgus deformity of lateral UKA cannot be overcorrected to prevent the pressure of the medial compartment from increasing, which guarantees good long-term surgical results. When placing the prosthesis, we take the following steps. First, the knee joint is flexed extremely and rotated to increase the exposure of the lateral compartment. The femoral cement prosthesis is placed, the cement around the prosthesis is removed and then the tibial cement prosthesis is placed. Once the tibial prosthesis has been inserted, the knee joint appears nearly straight, and the bone cement behind the tibial plateau prosthesis is removed with a matching arc curette. Then the knee is bent at 45° and a 2-mm insert is inserted into the gap. After removing the excess cement and drying the bone cement, the insert is removed.

The Screw Home Mechanism

During the final stage of knee extension—from a knee flexion of 20° to knee extension—the tibia is rotated outwards, tightening the two cruciate ligaments and locking the knee joint. Because the tibia has greatest stability relative to the femur, some studies recommend that the choice of femoral prosthesis position is very important, as otherwise knee extension can lead to excessive internal rotation, impacting on the tibial intercondylar spine. Therefore, when bending the knee, the femoral prosthesis should be rotated as far as possible and laterally [23]. Preoperative imaging data and intraoperative observations have shown that the impact between the medial edge of the lateral femoral condyle and the tibial intercondylar spine occurs only in patients with narrow lateral compartments. After the height of the lateral articular surface has been restored during the operation, the impact disappears. Therefore, we believe that this impact may be mainly related to whether the joint line is restored. The width of the normal intercondylar concave is sufficient to avoid the impact between the femoral condyle and the tibial intercondylar spine during locking.

Results

We identified 158 patients who had 160 lateral unicompartmental arthroplasties (Table 1). There were 35 male and 123 female patients, aged 70.5 ± 8.4 years, weighing 67.1 ± 10.8 kg, with a body mass index (BMI) of 25.6 ± 3.7 kg/m^2. There was a minimum of 36 months follow-up (mean 54; range 36–60 months). The aetiologies of the cases were primary OA (95%), post-traumatic OA (3%) and OSN (2%). The American Knee Society clinical scores (0–100 points) (Table 2) for the 160 knees improved from 53.1 ± 4.1 (range 45–62) to 97.0 ± 1.7 (range 92–99). Pain scores (the prime subjective reason for surgery) moved from a mean of 9.1 ± 1.8 (range 3–14) to 47.3 ± 1.5 (range 45–49). Function improved from 49.7 ± 9.7 (range 35–70) to 97.1 ± 4.1 (range 90–100). ROM values also increased satisfactorily from 105.0 ±

4.4° (equivalent to ~100–115°) to 125.5 ± 5.3° (~110–135°). Pain scores at extreme ROM values were also reduced. We did not completely correct the valgus deformity in all cases to prevent overcorrection. To date, there have been no cases requiring reoperation. Two patients required readmission within 60 days because of severe knee swelling. No deep vein thromboses were found by vascular ultrasonography.

Discussion

Obesity is not considered a contra-indication for lateral UKA. Berend et al. reported that excess weight can worsen prosthesis wear [11]. However, other studies indicate that there is no specific relationship between BMI and surgical outcomes. Rather, the wear of a unicondylar prosthesis is not related to body weight but to the amount of exercise [23]. Patellofemoral arthritis and periarticular osteophytes are also not regarded as contra-indications for UKA, but severe damages laterally in the PFJ with associated symptoms should be a relative contraindication. With correction of the valgus, the lateral release due to the lateral approach and the partial resection of the lateral facette the tracking of the patella is automatically improved, but severe maltracking can not be corrected. Any type of inflammatory arthritis is an absolute contra-indication for lateral UKA. Therefore, it has been suggested that as long as the patient has bone-to-bone arthritis, the ACL will remain intact, so the patient's age, weight and early onset of patellofemoral arthritis are no longer issues that need to be considered [16,23].

The use of X-rays is mainly confined to the lateral compartment for OA of Ahlbäck grade II or worse when the medial compartment articular cartilage has no obvious clinical or imaging signs of wear and tear. A Roseberg view is taken at 45° of knee flexion, when the X-ray tube is placed behind the knee joint parallel to the articular line. According to Kozin and Scott, the valgus deformity before UKA should be <15°. Ollivier et al. [23] reported that the valgus deformity can be completely correctable by varus stress. For those deformities that cannot be correctable, lateral UKA operations cannot be considered because of the presence of subluxation on the coronal plane. Because lateral UKA is mainly used for surface replacement, it might not correct for severe bone loss or OCN [16,23].

Several studies have confirmed good long- and medium-term effects for medial UKA. The 10-year prosthesis survival rate in one study was 95% [24]; however, there are limited data on the long-term follow-up of lateral UKA [25]. It has been suggested that the clinical efficacy of lateral UKA is inferior to that of medial UKA. The dislocation rate of a lateral mobile gasket for UKA was reported to be 10%, and the 5-year prosthesis failure rate 21% [13]. Indeed, femoral rollback during knee flexion is important for lateral knee compartment functioning. This also partly explains the reasons for the early failure of UKA using mobile gaskets. Scott et al. followed up 12 cases of lateral UKA for 3.5 years and found that six failed [26]. Similarly, 20 cases of lateral UKA were followed up by Cameron et al. and nine of these had failed. The failures were blamed on osteoporosis of the lateral tibial plateau [12]. Insall and Laskin indicated that as long as patient choice was appropriate, lateral UKA achieved good clinical outcomes. Argenson et al. also noted that lateral UKA was an ideal choice for the treatment of lateral compartment OA [26]. Studies have shown that lateral UKA has similar clinical effects to medial UKA [20,27]. Xing et al. showed that lateral UKA (n = 178, 31 lateral and 147 medial cases) was associated with fewer complications and prosthesis revision rates compared with medial UKA but had similar good Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scores [28]. Kim et al. followed up 82 young patients with Oxford lateral hemispheric UKA (mean age 54.7 years, range 44–59) for 8.9 years (range 5.3–12). The 10-year prosthetic survival rate was 95% [29]. Pennington et al. followed up 29 cases of lateral UKA for 12 years; none of them were renovated, achieving satisfactory results [30]. Argenson et al. reported that the 16-year survival rate of lateral UKA was 84%. Lustig et al. followed up 49 cases of lateral UKA for an average of 8.4 years; the 10-year survival rate was 98%. Recent reports suggest that patient selection of lateral UKA prosthesis is important for survival. None of the cases in our study have been reoperated, which accords with Pennington et al. [30] in which the short- and mid-term clinical effects of lateral UKA were satisfactory.

A retrospective study by Ernstbrunner et al reported that the main causes of lateral UKA failure included OA progression (30%) and aseptic loosening (22%), and these were followed by less common causes of failure including instability (7%), unexplained pain (5%), infection (5%), polyethylene gasket wear (5%) and gasket dislocation (5%). Gasket dislocation was the most common cause of early failure (29%) and also the most common cause of overall failure (27%) for patients with a mobile gasket prosthesis. Among the mid- and late-stage failure cases, OA progression led to the highest failure rates (59% and 78%, respectively). Gasket dislocation is also the most common cause of failure of fixed gasket prosthesis (44%)[31]. In order to avoid complications as much as possible, we recommend that the following guidelines should be heeded: (1) strict compliance with the above surgical indications to screen patients, avoiding the possible complications caused by improper indications; (2) use of a fixed gasket prosthesis, thus effectively avoiding the occurrence of gasket dislocation; (3) Overcorrection should be avoided; and (4) use of standardized surgical methods so that the operation can be replicated, thus ensuring the reliability and consistency of the operation’s effect.

Conclusion

We believe that: 1. The intraoperative method of tibial cut using the method of 15 degrees of internal rotation is difficult to be accurately implemented. Our method of using the saw blade is internally rotated 15 degrees relative to the vertical line of the front edge of the tibial cutting guide is intuitive and accurate. 2. Whether the femoral prosthesis will collide or not with the sacral spine is mainly related to the restore of the normal height of the lateral tibia. In order to accommodate a more uniform distribution on the tibial prosthesis, we chose a method of aligning the midline of the femoral prosthesis with the midline of the tibial prosthesis. 3.To prevent the internal and external rotation of the femeral osteotomy, we used the femoral cut parallel to the tibial plateau. Our surgical technique uses a more intuitive reference, avoiding ambiguous subjective experience. It is easy to learn for beginners who meet often the problems where the prosthesis loosening or impact between the femoral condyle and the iliac crest. And it can also guarantee a good operation result.

Abbreviations

OA: osteoarthritis

UKA: unicompartmental knee arthroplasty

PFJ: patellofemoral joint

ACL: anterior cruciate ligament

MRI: magnetic resonance imaging

Declarations

Acknowledgments

The authors acknowledge for the kind support of Doctor Jenz Mueller, Senior Consultant of Orthopedics Endo Klinik Berlin Branch , Berlin, German.

Funding

Not applicable

Author information

Author notes

Tao Wen are first author.

Affiliations

1. Joint Surgery, Yangpu Hospital Affiliated to Tongji University, Tongji University school of medicine，Shanghai，200090，China
2. Tao Wen, Huaming Xue, Tong Ma, Tao Yang, Long Xue, Yihui Tu

Contributions

WT carried out the data analysis and drafted the manuscript. XHM,MT performed the statistical analysis. YT, XL collected the data and photos. TYH designed the study and reviewed the article. All authors have been actively involved in the drafting and critical revision of the manuscript, and each provided final approval of the version to be published. The authors read and approved the final manuscript.

Corresponding author

Correspondence to Yihui Tu.

Ethics declarations

Ethics approval and consent to participate

This study was performed in accordance with the Declaration of Helsinki as revised in 2008 and was authorized by the Ethics Committee of Shanghai Yangpu District Central Hospital. All patients or their families signed the informed consent form before surgery and provided consent to publish and report individual clinical data.

Consent for publication

Not applicable

Competing interests

The authors declare that they have no competing interests.

References

1. Ahlbäck S. Osteoarthrosis of the knee. A radiographic investigation. Acta Radiol Diagn 1968; 277:7–72.
2. Pietschmann MF, Wohlleb L, Weber P, Schmidutz F, Ficklscherer A, Gülecyüz MF, et al. Sports activities after medial unicompartmental knee arthroplasty Oxford III—what can we expect? Int Orthop 2013; 37:31–37.
3. Puddu G, Cipolla M, Cerullo G, Franco V, Enrico G. Which osteotomy for a valgus knee? Int Orthop 2010; 34:239–247.
4. Wang JW, Hsu CC. Distal femoral varus osteotomy for osteoarthritis of the knee. J Bone Joint Surg Am 2005; 87:127–133.
5. Newman JH. Lateral unicompartmental knee replacement. In: Bonnin M, Amendola NA, Bellemans J, MacDonald SJ, Menetrey J, editors. The knee joint, Paris: Springer; 2012, p. 1126–1130.
6. Kosashvili Y, Gross AE, Zywiel MG, Safir O, Lakstein D, Backstein D. Total knee arthroplasty after failed distal femoral varus osteotomy using selectively stemmed posterior stabilized components. J Arthroplasty 2011; 26:738–743.
7. Argenson JN, Paratte S, Bertani A, Aubaniac JM, Lombardi Jr AV, Berend KR, et al. The new arthritic patient and arthroplasty treatment options. J Bone Joint Surg 2009; 91(Suppl 5):43–48.
8. Pagnano MW, Clarke HD, Jacofsky DJ, Amendola A, Repicci JA. Surgical treatment of the middle-aged patient with arthritic knees. Instr Course Lect2005; 54:251–259.
9. Järvenpää J, Kettunen J, Miettinen H, Kröger H. The clinical outcome of revision knee replacement after unicompartmental knee arthroplasty versus primary total knee arthroplasty: 8–17 years follow-up study of 49 patients. Int Orthop2010; 34:649–653.
10. Saragaglia D, Estour G, Nemer C, Colle PE. Revision of 33 unicompartmental knee prostheses using total knee arthroplasty: strategy and results. Int Orthop2009; 33:969–974.

11. Berend KR, Lombardi AV, Mallory TH, Adams JB, Groseth KL. Early failure of minimally invasive unicompartmental knee arthroplasty is associated with obesity. Clin OrthopRelat Res 2005; 440:60–66.
12. Cameron HU, Hunter GA, Welsh RP, Bailey WH. Unicompartmental knee replacement. Clin OrthopRelat Res 1981; 7:109–113.
13. Leprohon RJ. Dislocation of the bearing of the Oxford lateral unicompartmental arthroplasty. A radiological assessment. J Bone Joint Surg Br 2002; 84:653–657.
14. Scott RD, Cobb AG, McQueary FG, Thornhill TS. Unicompartmental knee arthroplasty: eight- to 12-year follow-up evaluation with survivorship analysis. Clin OrthopRelat Res 1991; 271:96–100.
15. Scott RD, Santore RF. Unicondylarunicompartmental replacement for osteoarthritis of the knee. J Bone Joint Surg Am 1981; 63:536–544.
16. Servien E, Merini A, Lustig S, Neyret P. Lateral uni-compartmental knee replacement: current concepts and future directions. Knee Surg Sports TraumatolArthrosc2013; 21:2501–2508.
17. Argenson JN, Chevrolbenkeddache Y, Aubaniac JM. Modern unicompartmental knee arthroplasty with cement: a three to ten-year follow-up study. J Bone Joint Surg Am 2002; 84:2235–2239.
18. Berger, RA. Results of unicompartmental knee arthroplasty at a minimum of ten years of follow-up. J Bone Joint Surg Am 2005; 87:999–1006.
19. Lombardi AV, Berend KR, Berend ME, Della Valle CJ, Engh GA, Fitz W, et al. Current controversies in partial knee arthroplasty. Instr Course Lect2012; 61:347–381.
20. van der List JP, McDonald LS, Pearle AD. Systematic review of medial versus lateral survivorship in unicompartmental knee arthroplasty. Knee 2015; 22:454–460.
21. Scott RD. Lateral unicompartmental replacement: a road less traveled. Orthopedics2005; 28:983–984.
22. Khamaisy S, Gladnick BP, Nam D, Reinhardt KR, Heyse TJ, Pearle AD. Lower limb alignment control: is it more challenging in lateral compared to medial unicondylar knee arthroplasty? Knee 2015; 22:347–350.
23. Ollivier M, Abdel MP, Parratte S, Argenson JN. Lateral unicondylar knee arthroplasty (UKA): contemporary indications, surgical technique, and results. Int Orthop2014;38:449–455.
24. O'Rourke MR, Gardner JJ, Callaghan JJ, Liu SS, Goetz DD, Vittetoe DA, et al. The John Insall Award: unicompartmental knee replacement: a minimum twenty-one-year followup, end-result study. Clin OrthopRelat Res 2005; 440:27–37.
25. Hernigou P, Deschamps G. Posterior slope of the tibial implant and the outcome of unicompartmental knee arthroplasty. J Bone Joint Surg Am 2004; 86:506–511.
26. Argenson JN, Parratte S, Bertani A, Flecher X, Aubaniac JM. Long-term results with a lateral unicondylar replacement. J Clin OrthopRelat Res 2008466(11):2686–2693.
27. Insall J, Aglietti P. A five to seven-year follow-up of unicondylar arthroplasty. J Bone Joint Surg Am 1980;62: 1329–1337.

28. Xing Z, Katz J, Jiranek W. Unicompartmental knee arthroplasty: factors influencing the outcome. J Knee Surg2012; 25:369–374.
29. Kim YJ, Kim BH, Yoo SH Kang SW, Kwack CH, Song MH. Mid-term results of Oxford medial unicompartmental knee arthroplasty in young Asian patients less than 60 years of age: a minimum 5-year follow-up. Knee SurgRelat Res 2017; 29:122–128.
30. Pennington DW, Swienckowski JJ, Lutes WB, Drake GN. Lateral unicompartmental knee arthroplasty: survivorship and technical considerations at an average follow-up of 12.4 years. J Arthroplasty 2006; 21:13–17.
31. Ernstbrunner L, Imam MA, Andronic O, Perz T, Wieser K, Fucentese SF. Lateral unicompartmental knee replacement: a systematic review of reasons for failure. Int Orthop 2007;42 (Suppl 1):1827–1833.

Tables

Table 1

Patient Information.

Patient details	Value
Number of patients/number of knee joints	158/160
Female patients	123 (78%)
Age (y)	70.5 ± 8.4
Height (cm)	161.8 ± 8.1
Body weight (kg)	67.0 ± 10.7
BMI (kg/m^2)	25.6 ± 3.7
Follow-up (months)	54

Notes: Numerical expressions are means ± standard deviations.

Table 2

American Knee Society Scores and Activity Results Before and After Operation.

Measurement results	Preoperative	Postoperative
Pain score	9.1 ± 1.8	47.3 ± 1.5
Clinical score	53.1 ± 4.1	97.0 ± 1.7
Function score	49.7 ± 9.7	97.1 ± 4.1
Knee mobility	105.0 ± 4.4	125.5 ± 5.3

Numerical expressions are means ± standard deviations.

Figures

Figure 1

The knee is flexed 100° and the incision is made close to the lateral edge of the tibia.

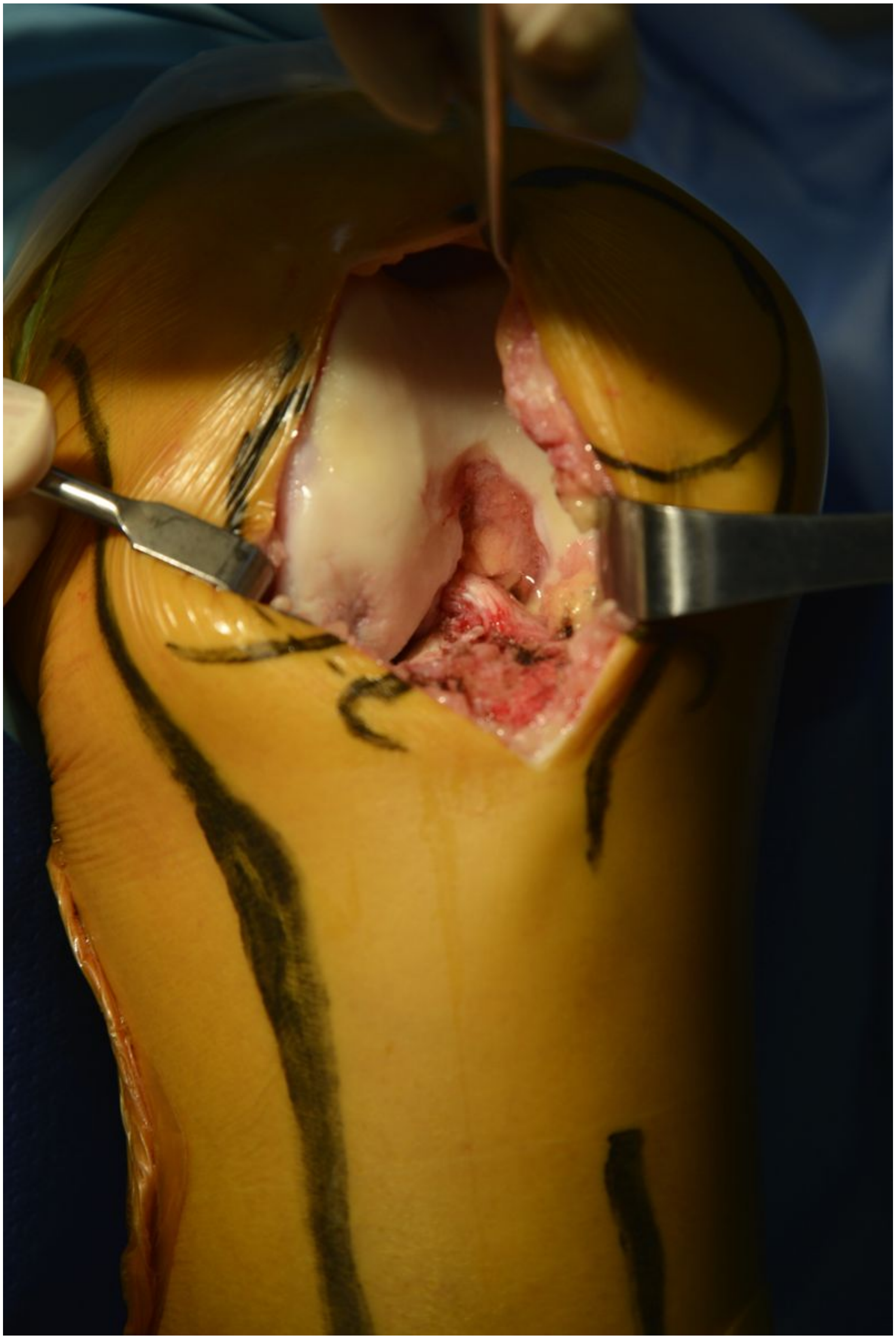

Figure 2

The knee is flexed 60° to observe the tension of the anterior cruciate ligament, the medial compartment and the patellofemoral joint.

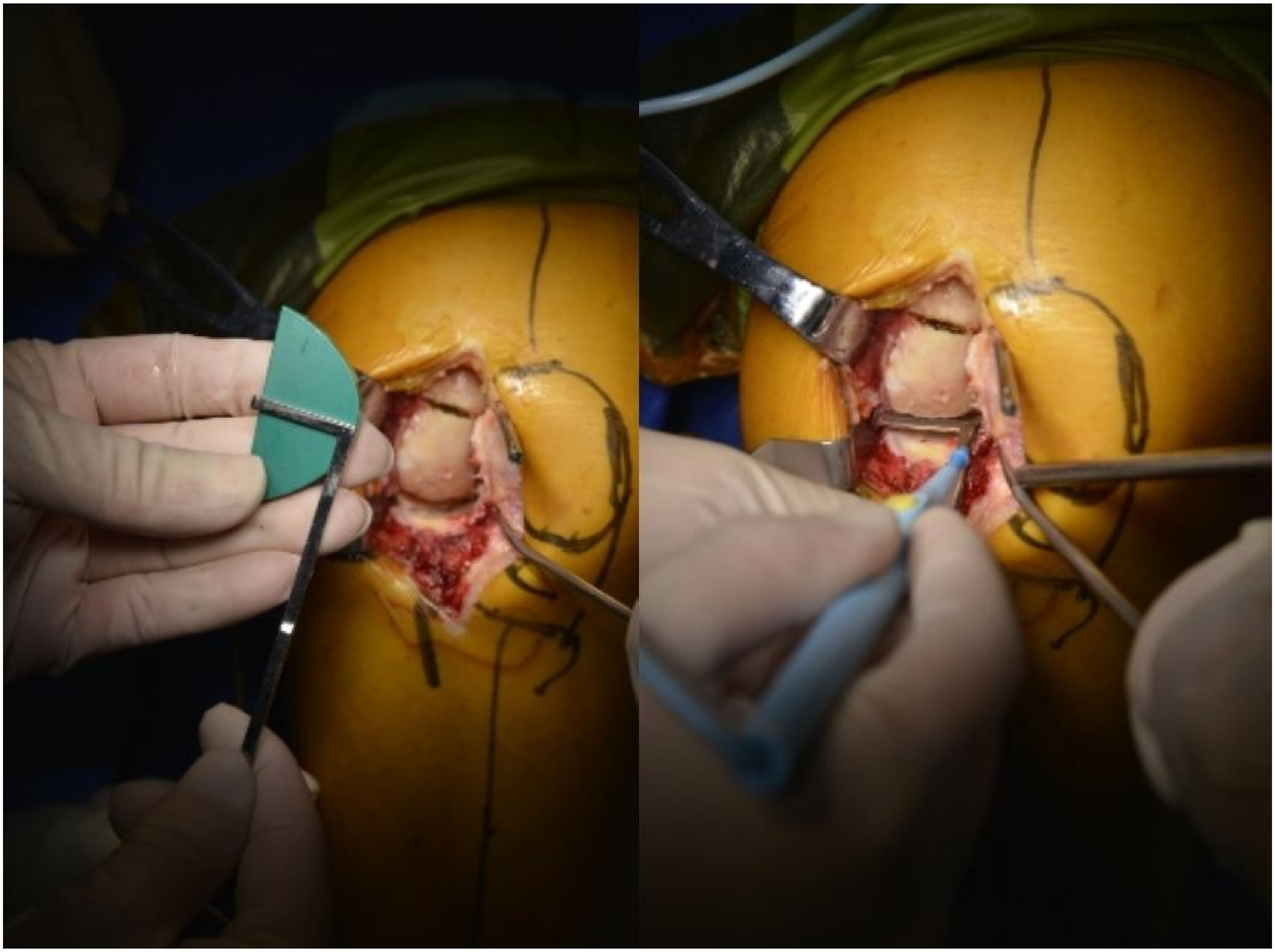

Figure 3

The width of the tibial cut are tested using a tibial prosthetic test tool, sagittal cut line is drawn with the electrocautery between the medial border of the lateral femoral condyle and the lateral intercondylar spine.

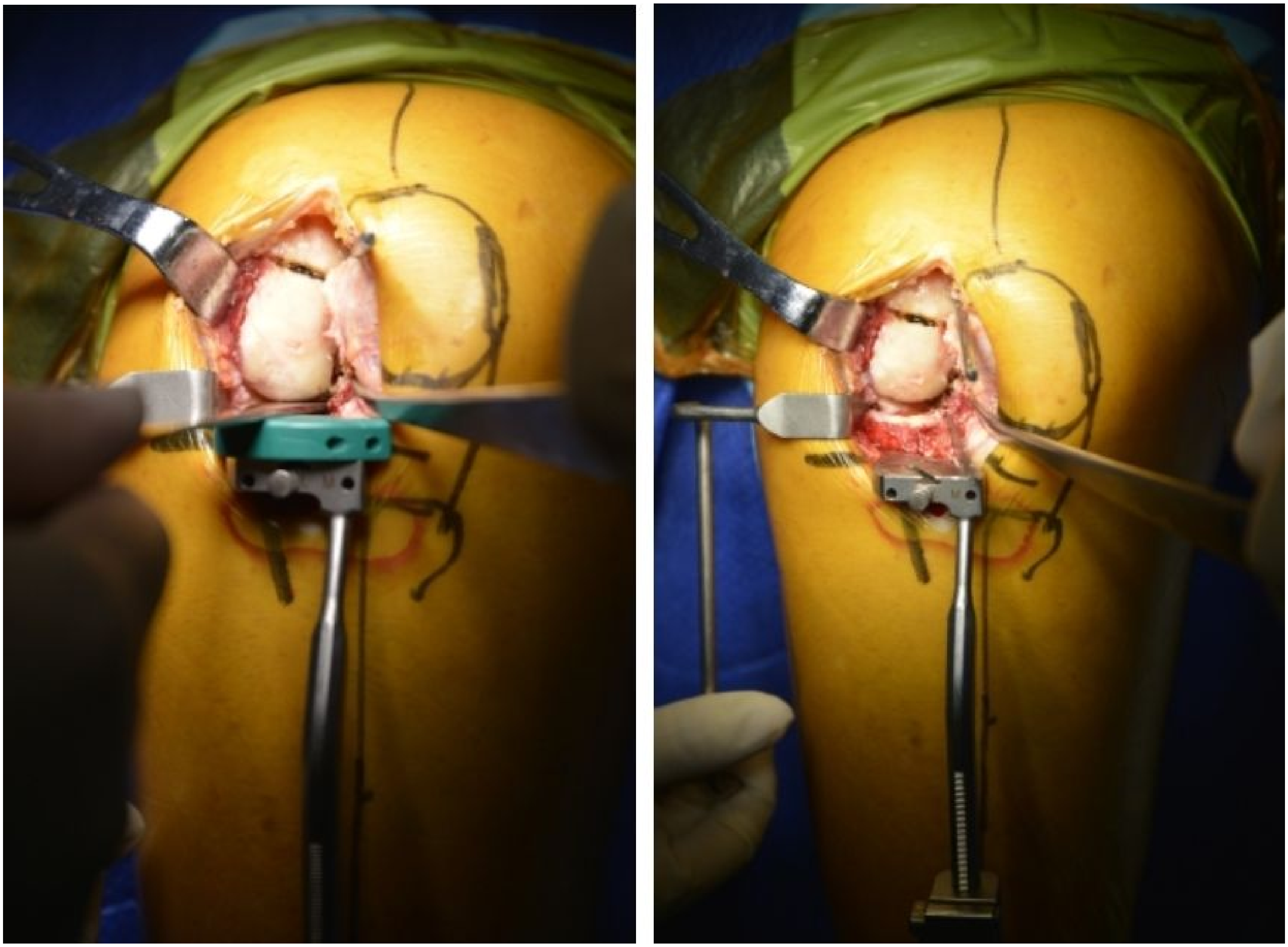

Figure 4

The tibial cutting guide is placed so that its upper edge is flush with the marked point on the front lower side of the tibial plateau. The saw blade is internally rotated 15 degrees relative to the vertical line of the front edge of the tibial cutting guide and is used to cut vertically through the previously marked points. Horizontal cut can be performed.

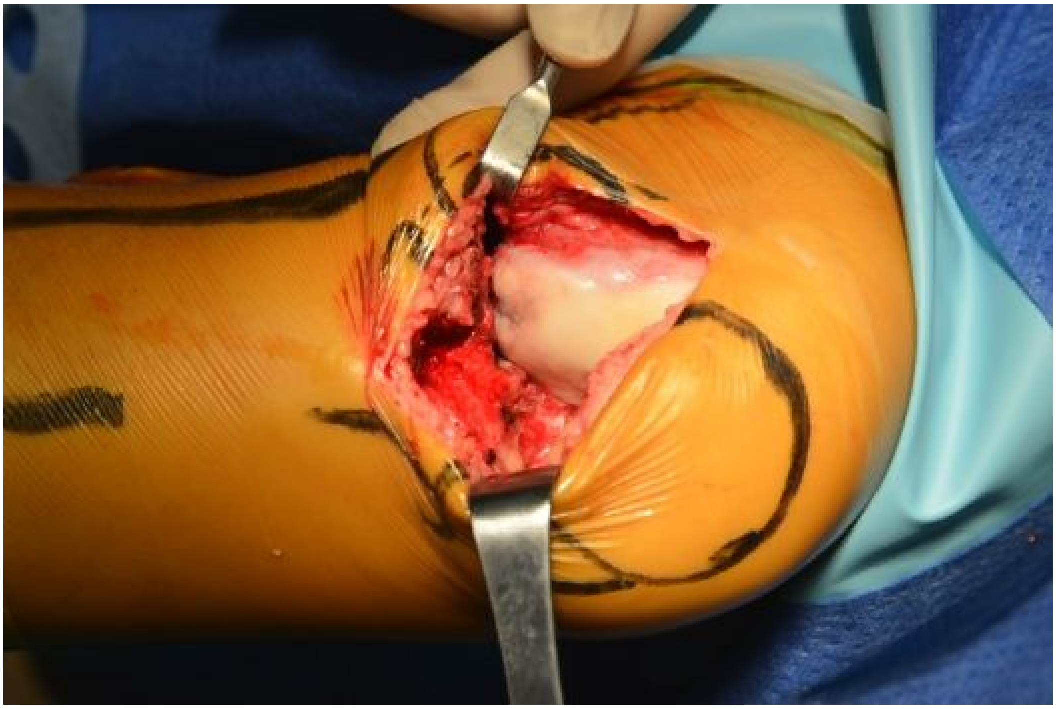

Figure 5

During the operation, observe the impact of the femoral condyle and the intercondylar spine caused by the drop of the joint line after cut of the tibia.

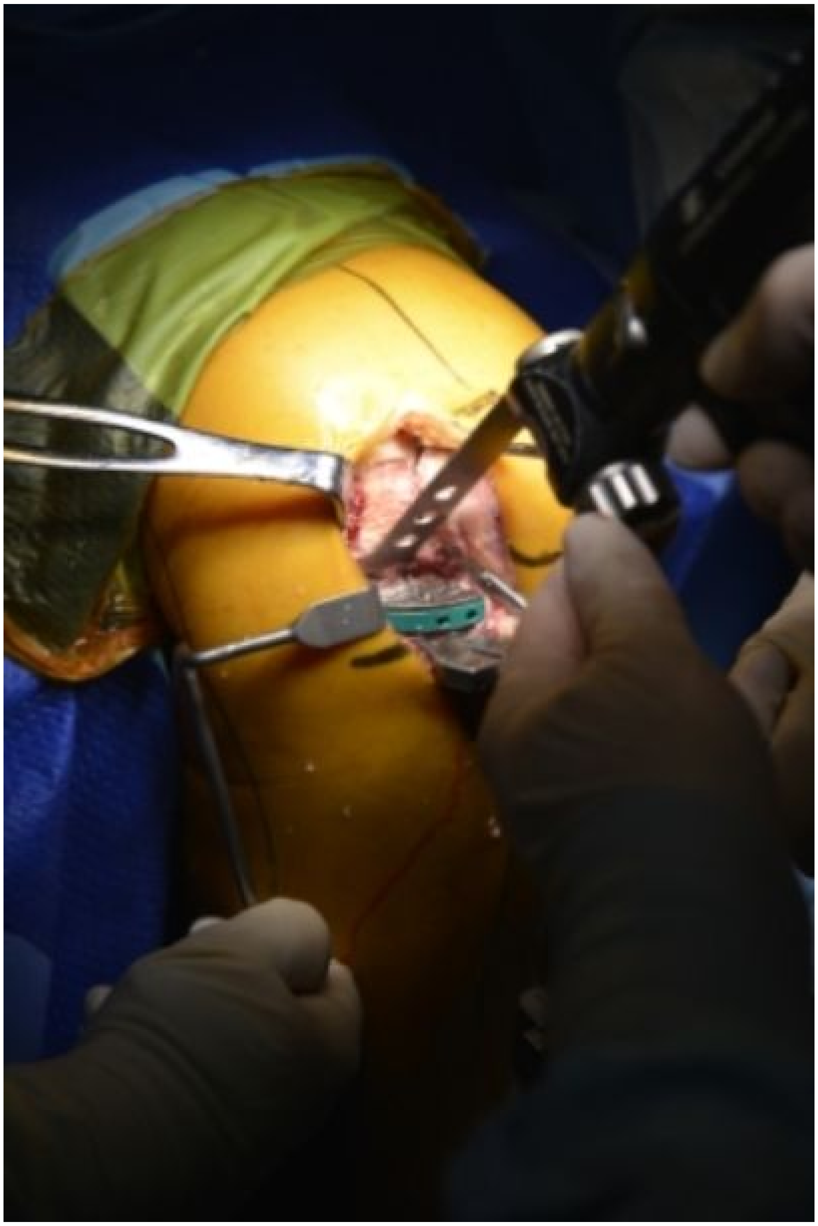

Figure 6

The parallel lines on the parallel tibial test model are used for cut to remove the hardened subchondral bone.

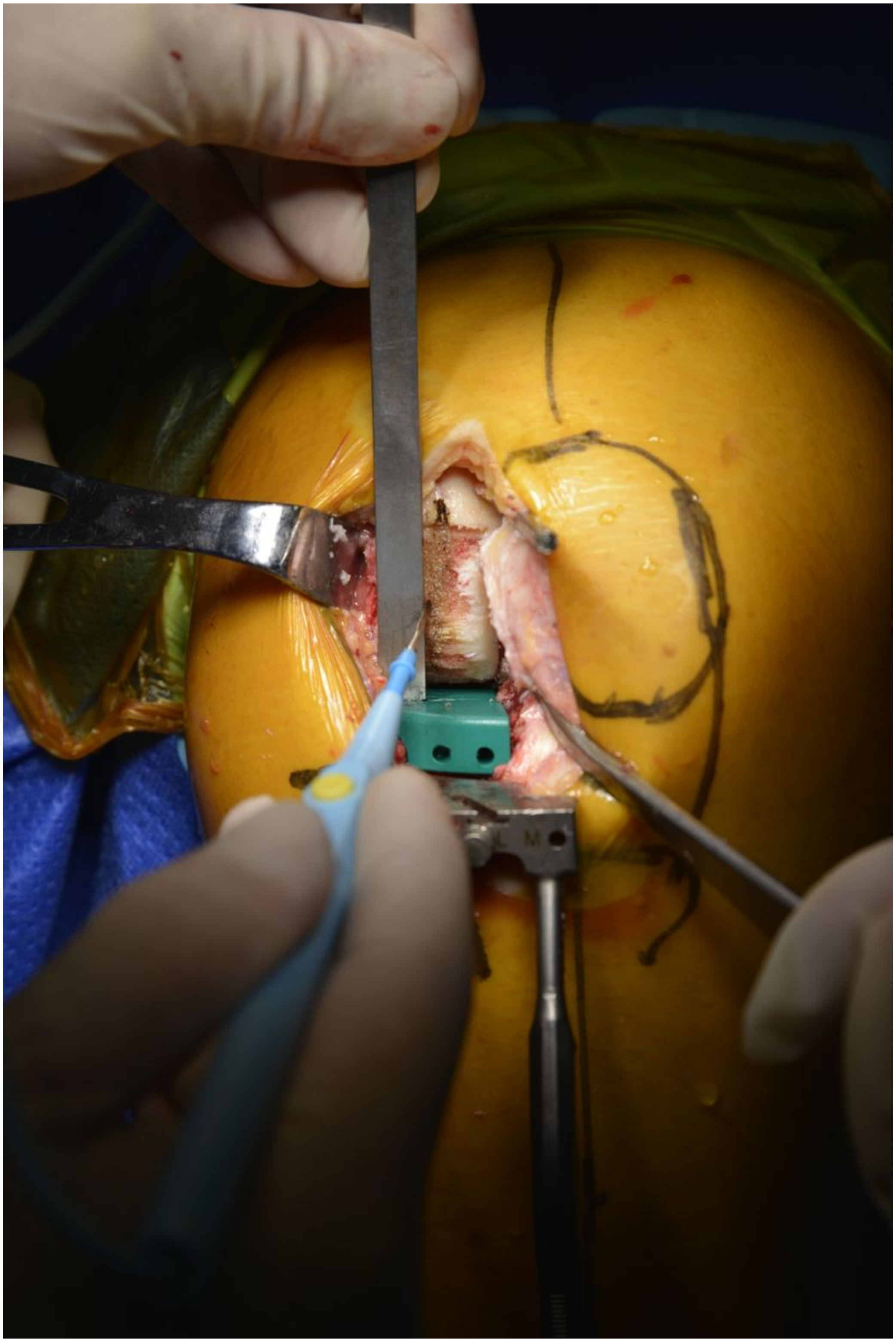

Figure 7

The midline of the femoral condyle is the part of the femoral condyle corresponding to the midline marking line on the tibial plateau trial, first marked on the femoral condyle with an electric knife.

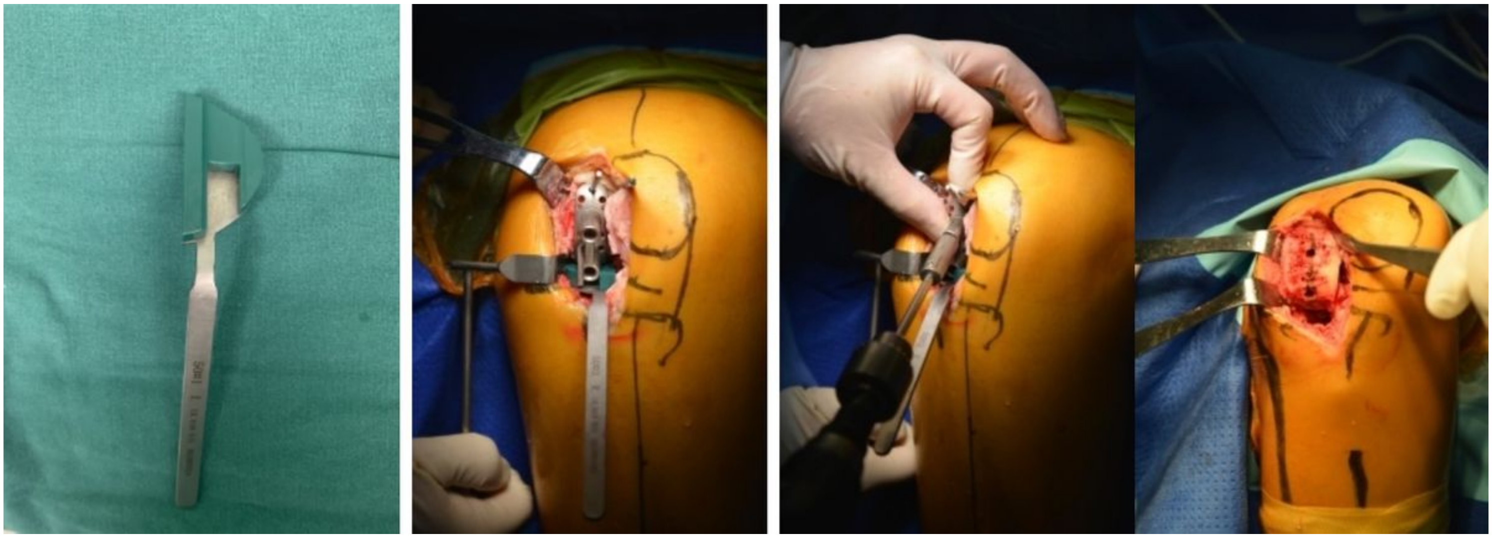

Figure 8

The femoral test model and special limit device are used for the drilling test. Drilling must be done by aligning the midline of the femoral model with the marking line on the femoral condyle, drilling at approximately 30° to the posterior cortex of the femur.

Figure 9

The lateral compartment flexes 90°. The joint clearance should be about 2mm larger than the knee extension.

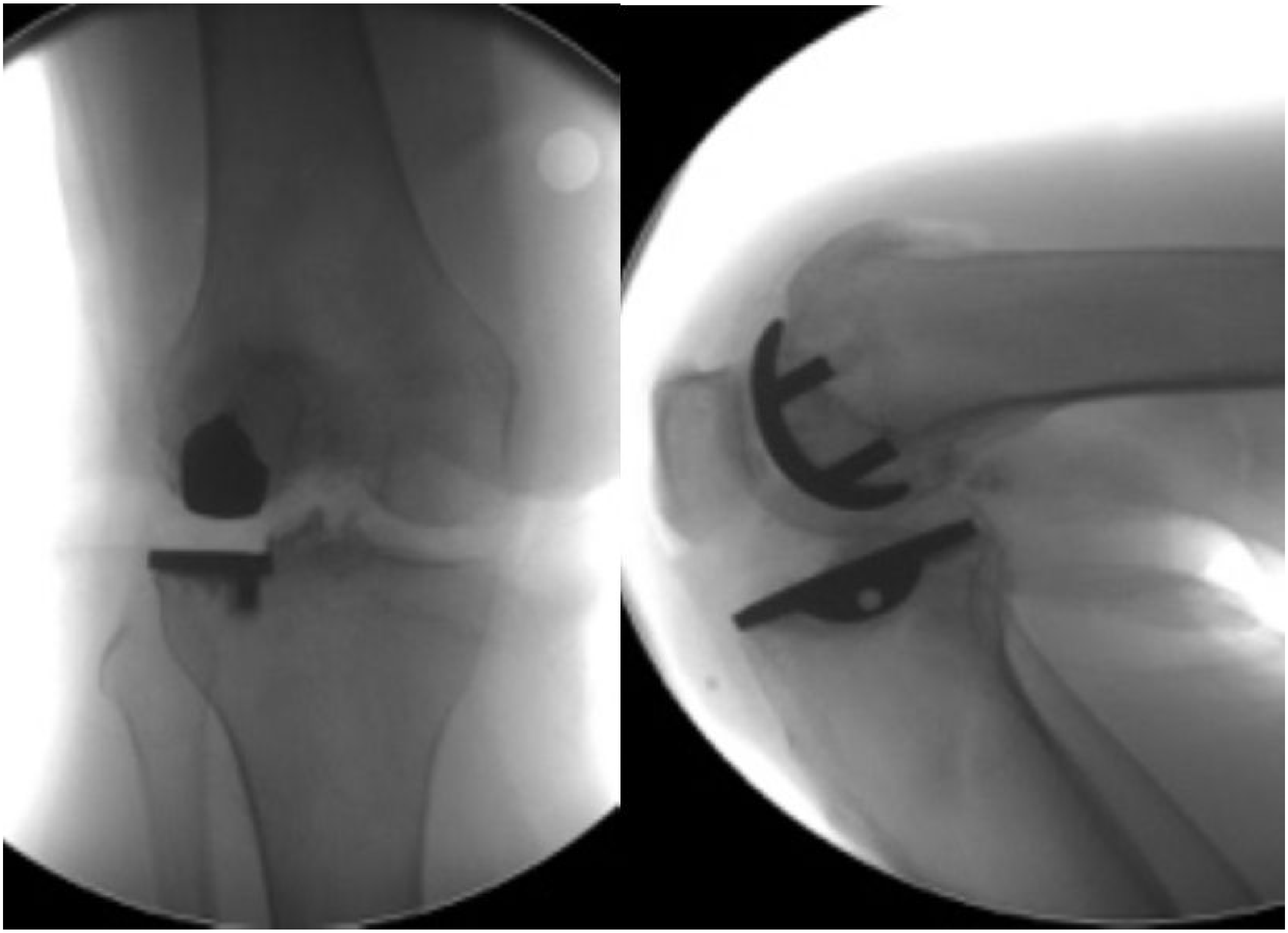

Figure 10

When the knee is bent 90°, the midline of the femoral prosthesis is aligned with the midline of the tibial prosthesis, and a good surgical effect is also achieved.