Review Article

Lateral unicompartmental knee arthroplasty: a review of literature

Daniele Imarisio, Andrea Trecci

Ospedale Regina Montis Regalis, Mondovì (CN), ASLCN1, Italy

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Correspondence to: Daniele Imarisio. Ospedale Regina Montis Regalis, Mondovì (CN), ASLCN1, Italy. Email: d.imarisio@libero.it; Andrea Trecci. Ospedale Regina Montis Regalis, Mondovì (CN), ASLCN1, Italy. Email: andrea.trecci@aslcn1.it.

Abstract: Isolated lateral knee osteoarthritis accounts for the 5% to 10% of patients suffering from unicompartmental knee arthritis. Unicompartmental knee replacement is one of the surgical option for this population. In this paper we analyze the indications, surgical aspects and promising results of this kind of surgery according to Literature.

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Introduction

Unicompartmental femorotibial osteoarthritis is a quite common disease, seen in nearly the 40% of the population (1).

Even if the most frequent pattern is represented by the medial compartment involvement, often secondary to a varus alignment of the mechanical axis, the isolated lateral knee osteoarthritis accounts for the 5% to 10% of this population (2,3).

In general, both for medial and lateral compartment, in the first grade of osteoarthritis we can propose a conservative surgical treatment, such as arthroscopic debridement or osteotomies around the knee.

In the particular feature low grade degeneration of a lateral compartment, a femoral osteotomy is a well described solution, with proven results, particularly in young active patients, where the aim is to allow a pain free active lifestyle and to prevent the progression of the articular disease (4).

When the cartilage damage is too severe the conservative treatment cannot be considered as a reliable solution, and the joint replacement becomes the best option. In general the total knee arthroplasty (TKA) is considered the gold standard treatment (5), even if joint registry data suggest that at least 20% of patients undergoing TKA may have isolated unicompartmental disease (6), which can be suitably treated both by TKA and unicondylar knee replacement (UKR).

UKR has several potential advantages compared with TKA, such as preservation of bone loss, lower morbidity, more physiological knee function quicker recovery (2). While medial UKR has reasonable mid and long term outcomes, that show a survivorship at 10-year greater than 95%, limited long-term follow up are available for lateral UKR (7).

This is due to many different reasons. Both the anatomic and biomechanical characteristics are different in each of the femorotibial compartments (8), and similar surgical treatment may not provide reproducible results when applied to a different compartment. Furthermore, lateral UKR is, at now, 10 times less performed than medial UKR, thus representing less than 1% of all knee arthroplasty procedures (2,9).

That's why it's useful to evaluate titerature about this topic, in order to establish a starting point for our knowledge and clinical practice.

Indications

Lateral UKR is indicated, first of all, for high grade of

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articular degeneration of the lateral compartment. Some authors state that the Ahlback grade equal or more than 2 is sufficient to make the patient suitable for the replacement, since only limited results could be expected in these patients after conservative surgery (3,10).

As known, this kind of isolated disease is related to valgus alignment of the knee joint (11). In this pattern the medial collateral ligament is chronically elongated, while the lateral structures are retracted. A key point for the success of the lateral UKR is the evaluation of passive correctability of the valgus deformity: its absence should lead the surgeon to prefer a TKA procedure, in order to better deal with ligament balancing (11). For the same reasons a valgus deformity greater than 15° and a contracture in flexion greater than 15° represent contraindications to UKR for most authors (7,8,11).

Of course, as well known for the medial side, also for the lateral UKR the integrity and functionality of the medial pivot, represented by the ACL and PCL, is mandatory for achieve a good clinical result and for the survivorship of our implant. The lack of these structures represents a contraindication to this surgery (3,8,11).

A particular attention has to be focused on those patients who underwent previous surgery, such as osteotomies, to correct the valgus alignment of the knee. Particularly after upper tibial osteotomy we know that skin scars, capsular retractions, patellar tendon shortening, tibial slope changing with consequent alteration of cruciate ligaments tension are all elements that can play a critical role in the knee kinematic, so that the results of a UKR could be unpredictable. In these cases most Authors suggest to go through a TKA instead of a UKR (10,12).

A different indication is represented by the avascular necrosis of the lateral femoral condyle (11). This rare disease usually involve a very distal portion of the femoral bone, and the prostheses is implanted in a normal quality bone. This is a critical point in order to eliminate the knee pain and to obtain a long lasting implant. For these reasons it is very important a preoperative evaluation of the amount of the necrotic process and a good planning of surgical steps.

Another key point in the indication to UKR, either lateral or medial, is the patellofemoral (pf) joint. Most Authors agree about the necessity to have a pf joint pain-free more than free from degenerative changes, so that narrowing of the joint line or the presence of patellar osteophytes don't represent absolute contraindications (6-8,11).

Another aspect that can be taken into account is the patient's weight. While early reports of UKR looked at obesity as a relative contraindication, some more recent studies have not found any correlation between body mass index (BMI) and outcomes (3,13,14), even if high values of BMI are in general related to higher risk of general complications, such as infection and venous diseases.

For many Authors age is not a concern for the indication to this kind of surgery, that can provide good results in cases of bone-to-bone disease with a working ACL also in old patients (3,13,14).

An absolute contraindication is represented by any form of inflammatory arthritis, due to the potential risk of progression of the degenerative process in the other compartments (3,15).

Surgical aspects

The procedure can be performed under general or epidural anesthesia on a standard operating table. Some authors prefer to position the leg with to foot resting on the table, with two leg holders, other with the leg suspended in a thigh holder (3,10,11).

Lateral UKR is usually realized through a lateral parapatellar skin incision, directed longitudinally from the superior patellar pole to a point 2 cm distal to the joint line, laterally to the tibial tuberosity. From this incision, after a parapatellar capsular opening and a partial excision of the lateral portion of the fat pad, the surgeon get access to the joint space (2,3,13,14).

Some papers describe good results of UKR with a medial parapatellar arthrotomy, without soft tissue healing problems or difficulties in visualisation of the surgical field (16).

The evaluation of the articular space is now mandatory, in order to confirm the indication to UKR: the medial compartment and the patellofemoral joint have to be intact, the ACL tensioned at 60° of flexion. Most Authors suggest not to remove lateral osteophytes, because they will help in the positioning of the femoral component (3,17).

The tibial cut is now performed. It's important to consider a minimal resection (2–4 mm) since the defect is usually on the femoral side. Moreover a conservative tibial cut allow the support of a stronger tibial cortex for the tibial component. The extramedullary guide is positioned, in order to obtain a transverse osteotomy perpendicular to the mechanical tibial axis, with an anteroposterior slope of 0° (according to the natural slope).

A critical point is represented by the sagittal tibial cut.

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The direction should be identified by the line between the most medial part of the lateral plateau posterior to the ACL insertion in flexion and the most medial part of the tibial plateau anteriorly to the AC insertion in extension. Many Authors suggest to perform this cut retracting medially the patellar tendon (3), while other groups consider as a good option a trans patellar approach (18,19).

Femoral cuts are usually performed with an intramedullary technique. The distal femoral cut has to obtain the extension alignment calculated on the full weight bearing view , usually 4–6° of valgus alignment. The extension gap is now checked, in order to evaluate the appropriate amount of bone resection. UKR doesn't allow ligamentous balancing of the knee, so that accuracy in bone resections is very important.

A crucial aspect for UKR in general, but particularly for lateral ones, is the rotation of the cutting block for the remaining cuts, that leads to the final positioning of the femoral component. The lateral femoral condyle is naturally divergent compared to the medial condyle (20). Moreover, according to the "screw home mechanism" (3,20,21), between full extension and 20° of flexion an external rotation of the tibia occurs, tightening the cruciate ligaments and locking the knee. These two considerations, which play a key role in the standing upright stability of the knee, make fundamental for surgeons the research of the best compromise in positioning the femoral component between an anatomically center position in the lateral condyle and a long axis perpendicular to the tibial plateau. They have to keep in mind that a perfect position in flexion can lead to excessive internal rotation in extension, with impingement on the tibial spine eminence. To avoid this mistake, the femoral component should be positioned in flexion as lateral as possible on the femoral condyle, without removing lateral osteophytes.

Another important consideration is to avoid oversizing of the femoral component, also because a potential femoro-patellar notching.

When the femoral cuts have been completed, the tibial preparation is performed, and trial components are tested, to evaluate the correct thickness of the liner. The deformity must be undercorrected, to avoid medial overstuffing (2).

Then the definitive components are implanted.

Results

Lateral UKR is technically more demanding and nearly ten times less commonly performed then medial UKR, so not so many data are available about long term results. Nevertheless we can find many papers that give us a general idea of how this surgery works.

Implant survivorships, when as end point revision surgery is considered, are encouraging: Scott (9) 95% at 8 years, Ollivier (3) 96% at 10 years, Berend (22) 95-99% at 10 years, Walker (11) 90-98% at 4 years.

Compared to medial UKR the survivorship seems to show no differences (7).

Talking about clinical results, treatment of isolated lateral osteoarthritis with lateral UKR seems to provide better functional results compared to TKA (23). Most Authors agree about the satisfactory clinical outcomes of this surgery, both for primary degeneration and post traumatic disease (24-26).

The most significant factor leading to reoperation is progression of medial disease (15). On the other side, addition of lateral UKR is considered a good option in the treatment of progression of lateral disease after medial UKR (27).

Some paper have reported a high rate of failure with a mobile bearing implant (2), but this finding is not confirmed by other authors (26,28).

Postoperative valgus alignment of 3–7° valgus was correlated, in Van der List's study, with the best short term clinical outcomes compared to neutral axis (–2° to 3°) (7).

The most commonly used approach is represented by a lateral arthrotomy, even if some authors describe good exposure with medial approach (2,16). Some of them came back to the lateral arthrotomy after the introduction of minimally invasive instrumentations, which allow to avoid patellar luxation (2).

Surgeons using transpatellar approach to perform the sagittal tibial cut during domed lateral UKR didn't find any increase in patellar tendon shortening, without effects on clinical outcomes (18).

According to Walker *et al.* (29), when performed in relatively young patients, this kind of surgery provide good results on return to sports: 98% of these patients returned to recreational activities, two thirds of them reaching again a high activity level.

Despite better functional outcomes in term of recreation and sports of UKRs patients, Matthews *et al.* (30) found that satisfaction was similar amongst TKA and UKR patients. This could reflect higher preoperative expectations in patients undergoing UKR and underline the importance of correct communication between surgeons and patients.

Since lateral compartment of the knee is biomechanically

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and anatomically different from the medial side and most commercially available unicompartmental implants are not specifically designed for the lateral compartment, some authors (31) sustained the superiority of patient-specific implants compared to standard ones in terms of clinical and radiological short term outcomes.

Conclusions

Literature confirms how lateral UKR is a safe, reliable and satisfactory surgical procedure.

Several short-midterm follow-up studies have showed encouraging clinical results and implant survivorship.

Anatomical and biomechanical differences between medial and lateral knee compartments are directly related to some important surgical tricks, that surgeons have to keep in mind while performing these procedure.

Even if isolated lateral knee osteoarthritis is not a frequent disease, lateral UKR can be a good solution that knee surgeons can take in consideration for well selected cases.

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