A pilot study: short-term outcome of medial unicompartmental knee arthroplasty following previous anterior cruciate ligament reconstruction

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Background
There is considerable debate regarding the management of young patients with isolated unicompartmental osteoarthritis and previous anterior cruciate ligament (ACL) reconstruction. Medial unicompartmental knee arthroplasty (UKA) can be safely done after ACL reconstruction from a technical point of view. The procedure has been performed in younger patients with the aim of preserving bone in case of need for future revision. The short-term results are encouraging, although longer term data are necessary to evaluate the role of this procedure in these patients.
Aim
To assess the results of UKA following previous ACL reconstruction.
Patients and methods
UKA was done for eight patients with previous ACL reconstruction. Postoperative radiograph were done for all patients, follow-up period lasted for an average of 2 years, functional scoring using Oxford knee scoring system was done for all patients preoperatively, and at last, follow-up was done to assess the outcome.
Results
Last follow-up showed good results, with Oxford knee scoring system showing 50 of 60 points, no infection or loosening happened in all patients, and none of them required revision for any reason.
Conclusion
Medial UKA is a good proposed technique for patients with previous ACL reconstruction fulfilling the other criteria of unicompartmental arthroplasty.

Keywords:
anterior cruciate ligament deficiency, anterior cruciate ligament reconstruction, medial compartment osteoarthritis, Oxford unicompartmental knee arthroplasty

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Introduction

Few rules are known in medicine, but one of these assumes that unicompartmental knee arthroplasty (UKA) for medial osteoarthritis is contraindicated if anterior cruciate ligament (ACL) is functionally deficient [1].

This has been accepted since the first report highlighted a higher incidence of complications, in terms of tibial loosening and higher revision rates, when UKA was performed in ACL-deficient knees [2].

Symptomatic osteoarthritis of the medial compartment in young and active patients with preexisting deficiency of the ACL is an increasingly common problem. The incidence of arthritis of the medial compartment after ACL injury has been shown to range from 33 to 70%. Isolated ACL injury seems to increase the risk of developing osteoarthritis 10-folds compared with an age-matched uninjured population. Associated meniscectomy further doubles the risk [3,4].

Two different scenarios of medial osteoarthritis and ACL tear need to be identified to ensure correct surgical planning and minimize the risk of poor surgical outcome. Osteoarthritis development of the medial compartment of the knee may be owing to ACL failure, or the ACL failure can be due to the arthritic phenomenon within the knee [5].

Treatment options in either of these patient groups include arthroscopic debridement, ACL reconstruction, high tibial osteotomy (HTO) with or without ACL reconstruction, UKA with or without ACL reconstruction, and total knee arthroplasty [6].

UKA is commonly used for the treatment of isolated compartmental osteoarthritis of the knee. It has shown to be a good and less-invasive alternative to total knee

arthroplasty. If usual indications are applied, UKA guarantees many advantages over total knee arthroplasty, in terms of better range of motion, less tissue damage allowing rapid recovery, preservation of bone stock, minimal blood loss, lower complication rates (including significantly reduced risks of stroke, death, or venous thromboembolism), and preservation of normal kinematic function [7].

Improved results of ACL reconstructive procedures led to an evolving concept of performing ACL reconstruction followed by medial UKA for those medial osteoarthritic knees that were previously traditionally excluded for UKA and its potential benefits [8].

Although medial UKA can be safely done after ACL reconstruction from a technical point of view, published research on performing UKA following ACL reconstruction is rare.

To the best of our knowledge, this is the first reported series of cases reporting the early results of UKA in patients with isolated medial compartment osteoarthritis and previous ACL reconstruction.

Patients and methods

We prospectively evaluated eight consecutive patients with previous ACL reconstruction and concomitant symptomatic osteoarthritis of the medial compartment who were treated with UKA between November 2015 and November 2017. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Age group ranged from 39 to 50 years, with a mean of 45 years. The average duration of follow-up for these eight patients was 2 years (range, 1–3 years), and no patient was lost to follow-up.

Informed consent was obtained from all patients. Inclusion criteria were as follows: patients were included according to the indications of the UKA except the intact ACL, the primary complaint of all the patients included pain located in the medial joint compartment, and all the patients should be relatively younger and have higher activity level (Fig. 1).

The exclusion criteria included inflammatory arthritis, hemochromatosis, chondrocalcinosis, hemophilia, and a positive patellar grind test, lateral compartment arthritis, positive Lachman's test result, and positive anterior drawer test result.

Figure 1

Preoperative plain x ray showing medial compartment arthritis with the screws of the reconstructed ACL graft in place. ACL, anterior cruciate ligament.

MRI is done preoperatively to assess graft condition in all cases, and all the cases included in this study have shown proper graft position and integrity.

We used Oxford knee score preoperatively and at 1, 6, 12, and 24 months postoperatively.

The preoperative anteroposterior radiographs in 15° flexion, lateral, femoral-patellar in 30° flexion view, and long-leg standing radiographs were routinely performed. Stress radiographs in valgus were additionally available to verify the well-preserved lateral compartment, and varus deformity of the knee before surgery.

Surgical procedure

Patient lied in a supine position having a tourniquet on his thigh as high as possible. A leg holder secured to the table that allowed the knee to remain suspended and permitted 90° of flexion for the bone cuts and unicompartmental preparation.

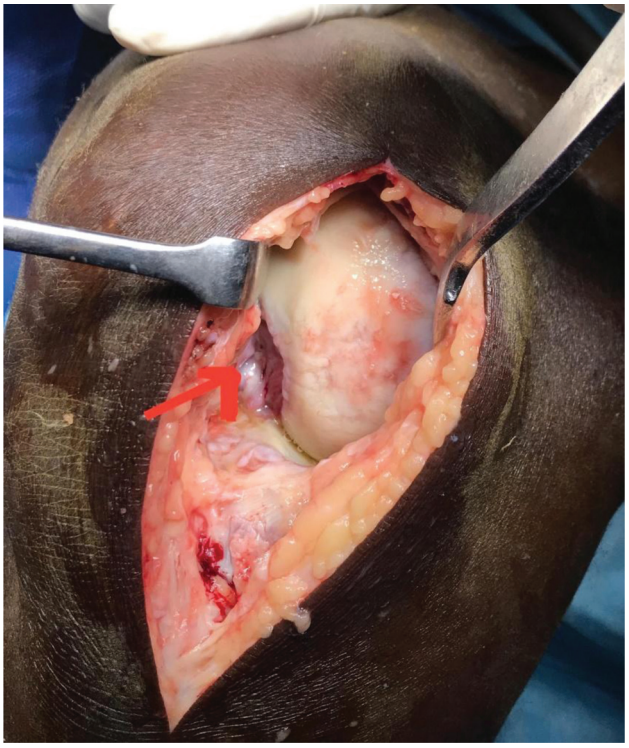
A straight anterior skin incision with medial parapatellar capsular incision was used. Intravenous antibiotic prophylaxis and antibiotic-loaded cement (Palacos with gentamicin) were used. Extramedullary instruments were used to guide tibial resection (Fig. 2).

A medial capsulotomy was performed to get sufficient access to the medial femorotibial compartment. An important issue is how to identify intact ACL. Preoperative assessment performed by clinical test or MRI study can underestimate or overestimate the presence of ACL lesion. The presence of bone deformities, osteophytes, or soft tissue contracture may change the perception of anteroposterior laxity. So, we prefer to do intraoperative assessment under direct visualization. We use a hook and pass it around the ACL graft and give a hard pull. If the ligament gets pulled off, then the ACL was deficient, but if it does not, then it is functionally intact.

The procedures were all performed with preparation of the femoral and tibial surfaces in the usual manner for unicompartmental arthroplasty (Fig. 3).

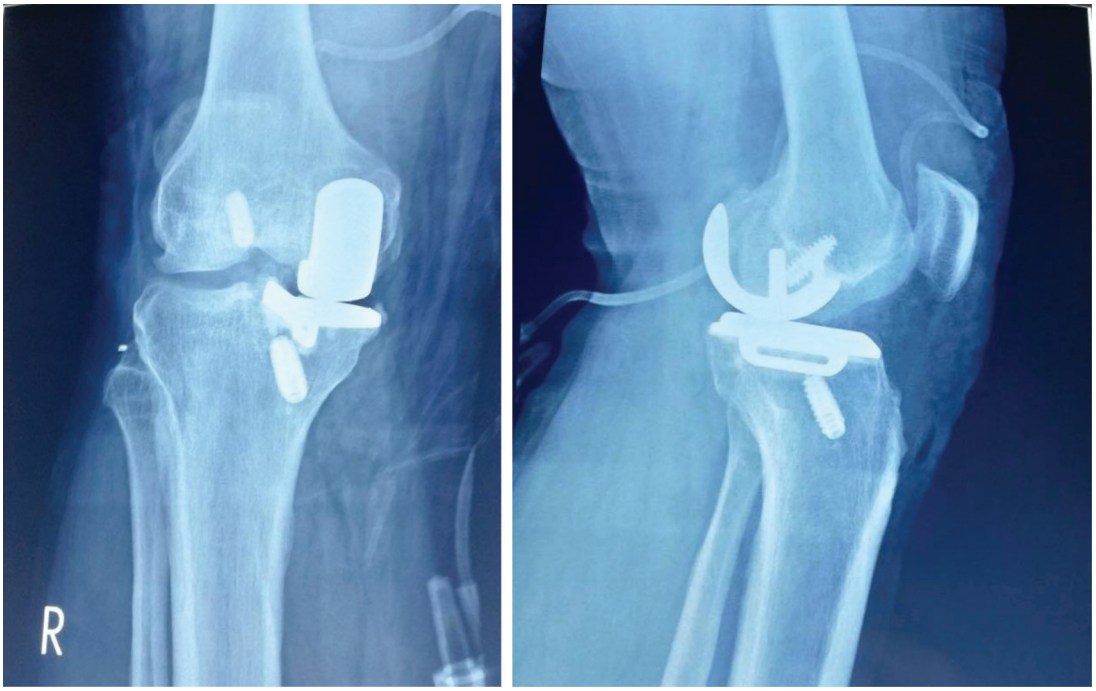
Osteophytes were removed from the patella, the medial condyle, and intercondylar notch, and the bone was prepared for the tibial component of the UKA according to the technical manual. The vertical tibial cut was followed by the horizontal cut. The saw vertical cut must be medial to the origin of the ACL avoiding damage to its fibers. One important aspect is to avoid impingement of the tibial component of the UKA on the graft tunnel of the ACL.

Figure 2



Intraoperative photo showing the old reconstructed Acl graft. ACL, anterior cruciate ligament.

Figure 3



Post operative plain x ray of unicompartment knee arthroplasty with the screws of ACL graft in place. ACL, anterior cruciate ligament.

Posterior facet of the femoral condyle is then excised, and the bone is prepared for the femoral component of the UKA according to the technical manual. Care must be taken to cut parallel to the guide and to avoid damage to the medial collateral ligament and ACL graft.

At that point, the trial components were inserted to check the flexion and extension gap. The tibial base plate and the femoral component were cemented by stages, and after that the bearing with the suitable size was installed, followed by application of drain and closure in layers.

Postoperative management

Drainage was removed after 24 h. The patients were mobilized the first day after surgery by use of crutches as we did not use postoperative bracing. Full weightbearing is allowed on the operated leg from the first postoperative day. Hospital stay began 1 day before surgery and lasted a mean of 4 days.

Results

Follow-up was done at 1, 6, 12 months, and 2 years postoperatively. The postoperative range of motion, the varus or valgus degree of the operated knee, and the posterior slope of the tibial component were recorded.

Clinical evaluation with Oxford knee score was done. The preoperative average Oxford knee score was 29.3, and it reached 39.5 after 1 month, 48.2 after 6 months, 50.1 at 1-year follow-up, and 50.4 at the last follow-up ($P<0.05$). There is a statistically significant difference between preoperative and postoperative scores (Fig. 4).

There were no signs of instability during the follow-up of patients, with negative anterior drawer and pivot shift tests, when compared with the normal side. No revision was done to any of these patients.

The average preoperative deformity was 9° of varus (range, 2° of varus to 16° of varus). The average postoperative alignment was 2° of varus (range, 2° of valgus to 9° of varus), for an average correction of 7°.

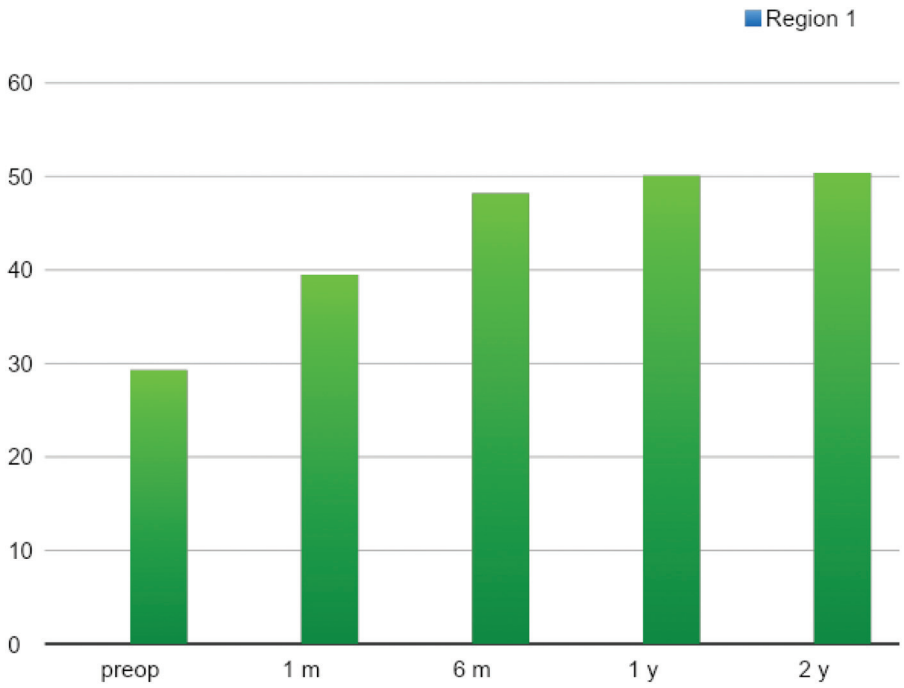
At the time of final radiographic evaluation, no patient had evidence of any component subsidence or pathological radiolucencies to suggest presence of loosening. No patient was fractured during operation, and there was no patient with collapse of tibial plateau, infection or thrombosis.

All data were presented as mean and SD of the mean. Statistical analyses were performed using SPSS for Windows (version 18.0) (USA, IBM).

Discussion

The recommendations that suggest that ACL deficiency is a contraindication in unicompartmental

Figure 4



Oxford knee score during the follow up period.

knee revision is derived from the initial study done by Murray *et al.* [9].

Anteroposterior knee joint laxity because of ACL insufficiency produces various degenerative changes in the joint, including intraarticular damage, meniscal tears, and varus morphology, leading to gradual thinning of the cartilage and resulting in posteromedial osteoarthritis [10].

One of the most important causes of failure in UKA is the absence of ACL, and the majority of failures after UKA without ACL reconstruction occur because of tibial loosening, which tends to occur early [11].

Owing to younger age and higher activity levels seen in these patients, bone-conserving options are preferred with total knee arthroplasty not being recommended as the primary treatment option.

For the patients who report instability as their primary complaint, ACL reconstruction alone can be used as a reasonable treatment option to improve symptoms before subsequent HTO or UKA, which is a definitive treatment option [12].

However, more studies reported that the rate of complications and revisions following HTO was higher than that seen in patients receiving UKA.

Many research studies have been done to discuss the option of performing UKA together with ACL reconstruction in the same setting, showing satisfactory short-term follow-up results.

Krishnan and Randle [12] reported the results of their studies, in which 9 patients were treated by the combined operation of UKA and ACL reconstruction, with follow-up of 2 years. No revision was needed in these patients, and the mean knee scoring system was as high as 196 points.

Similar good clinical outcomes were reported by Pandit *et al.* [13]. In their study, 15 patients received the combined operation, and the mean knee scoring system was 195 points after a follow-up time of 2.5 years.

Weston-Simons *et al.* [14] also reported their outcome of combined Oxford UKA and combined or sequential ACL reconstruction in 2012. A total of 52 patients were enrolled in the study, with a mean follow-up of 5 years. The Oxford knee score was improved from 28 to 41.

Another study about the in vivo kinematics of the combined Oxford UKA and ACL reconstruction showed that the sagittal plane kinematics were nearly normal after combined UKA and ACL reconstruction [13].

In a study done by Dervin *et al.* [8], their first patient had staged ACL reconstruction followed by Oxford unicompartmental arthroplasty based on the theory that the two procedures combined would be excessive. The evaluation of this patient led to the change to concomitant procedures in their treatment protocol. The patient reported a more difficult recovery after ACL reconstruction, likely related to the symptomatic osteoarthritis that remained after the first stage. This, combined with the burden of two surgical recoveries, encouraged them to consider the combined procedure of concomitant ACL reconstruction with UKA in the same setting [8]. One should always keep in mind that this procedure is technically very demanding as we know that the long-term success rate in UKA correlates well with the number of operations performed per year [15], and performing UKA following ACL reconstruction is even more technically demanding.

In our study, we demonstrated that UKA is technically feasible and provides good short-term results following ACL reconstruction.

Our data are too preliminary to establish the long-term survivorship of this procedure, but it shows encouraging clinical results.

Our impression is that patients usually needs to maintain as close to normal activity level as possible, while preserving the lateral and patellofemoral compartments.

Close follow-up is required to determine whether UKA following previous ACL reconstruction will help avoid the complication of premature loosening of the tibial component and whether the early positive clinical results can be sustained.

Conclusion

Medial UKA is a good proposed technique for patients with previous ACL reconstruction fulfilling the other criteria of unicompartmental arthroplasty. The technique carries many intraoperative and postoperative advantages.

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Nil.

Conflicts of interest
There are no conflicts of interest.

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