Unicompartmental Knee Arthroplasty versus High Tibial Osteotomy in Treatment of Isolated Medial Compartment Osteoarthritis of the Knee

Systematic Review and Meta-Analysis

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List of Contents

List of Tables

Table No.	Title	Page No.

List of Figures

List of Figures (Cont...)

List of Abbreviations

Abb.	Full term
ACL	*Anterior cruciate ligament*
AMOA	*Antero-medial osteoarthritis of knee joint*
BMI	*Body Mass Index*
HS	*Highly significant*
HSS	*Hospital for Special Surgery*
HTO	*High tibial osteotomy*
LCWHTO	*Lateral Closing Wedge Osteotomy*
MCL	*Medial collateral ligament*
NS	*Non-significant*
OA	*Osteoarthritis*
OWHTO	*Opening Wedge Osteotomy*
PRISMA	*Preferred Reporting Items for Systematic Reviews and Meta-analyses*
RCTs	*Randomized control trials*
ROM	*Range of motion*
S	*Significant*
SONK	*Spontaneous osteonecrosis of the knee*
TKA	*Total knee arthroplasty*
UKA	*Unicompartmental knee arthroplasty*

INTRODUCTION

Degenerative changes of the knee mostly involve the entire joint, including medial, lateral and patellofemoral compartments [1-2]. However, up to 30% of patients can develop osteoarthritis (OA) in only one compartment, mainly the medial compartment [3-4].

The primary treatment of OA is conservative and include patient education, weight reduction, physical therapy and pain killer medication [5]. Other non-operative measures for unicompartmental OA are knee braces which may alter the alignment of the lower extremity [5-6]. If conservative treatment fails, surgical treatment maybe indicated.

Several surgical procedures have been mentioned to treat it, as total knee arthroplasty (TKA), unicompartmental knee arthroplasty (UKA) and high tibial osteotomy (HTO) [7]. According to the age and the level of activity of the patient and the grade of disease severity [8]. However, the best option for these patients is still debatable [9-10].

TKA is the primary treatment for end-stage OA. However, for moderate-grade stages or isolated medial OA, TKA is not the best choice for treatment, especially for the younger and highly active patients. UKA and HTO are established treatment techniques for isolated medial

compartment OA, although the suitable surgical treatment for medial compartment OA remains somewhat controversial.

HTO is known as treatment for medial compartment OA, especially for those who are young and highly active. It was primary used in 1958 [11] to correct a varus deformity through lateral mechanical axis relocation [12-13]. Patients undergoing HTO as treatment option have the value of natural joint preservation.

HTO alters the joint anatomy and biomechanics. The most common changes are ligamental instability, patellar tendon length variation, scar formation and possible rotational deformities. All these changes may make a revision to TKA procedure more difficult[14].

UKA was initial used in the 1970s [15] as an alternative to TKA or HTO for unicompartment OA. UKA is a method of joint resurfacing in which the diseased compartment is replaced with implant prosthesis, while the other compartment is preserved.

Many studies have demonstrated excellent clinical outcomes after UKA, including the lowering of post-operative pain, low blood loss, partial correction of angle deformity (varus deformity) of the knee, the return of range of motion (ROM) and the improvement of clinical and functional scores. As it maintains bone stock better than TKA, UKA also

provides patient with preferable kinesiology and faster recovery. Although some studies indicated that the revision rate of UKA is relatively high compared with that of TKA, the current long-term follow-ups of UKA show good clinical results [16, 17].

Unicompartmental knee Arthroplasty:

UKA is considered a less invasive option for patients with isolated compartment OA. Also, because the anterior and posterior cruciate ligaments are preserved, patients are more likely to get a normal feeling knee and return to previous lifestyle and activities **(Fig. 1)**. Reports have mentioned a higher percentage of patients with flexion greater than 120^{o} and a huge number with their outcome was excellent in comparison to TKA [18].

Advantages & Disadvantages of UKA:

Comparing to TKA, UKA has numerous advantages including a smaller incision, preservation of more natural tissue, decreased blood loss, better proprioception, less morbidity, reduced pain, greater range of motion (ROM), shorter hospital stays, and a more rapid rehabilitation course[19].

UKA has less acceptance of component positioning in comparison to TKA, as improper component positioning may cause UKA failure [20].

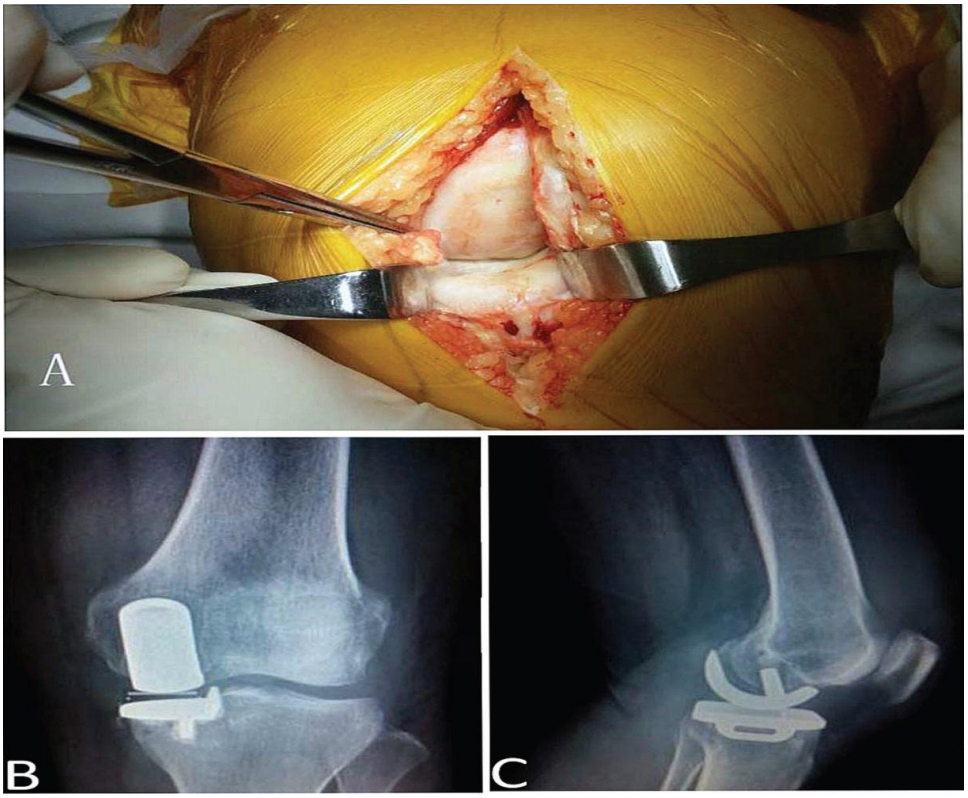

Figure (1): (A) Intra-operative photograph showing severe cartilage defects in the medial femoral condyle. (B and C) Post-operative Anteroposterior and lateral views after successful medial Unicompartmental arthroplasty [(18)].

Indications of UKA:

The operative criteria for UKA may be critical for surgical success and patient benefit, as improper patient selection is thought to be a risk factor for early UKA failure [(21)].

Classic indications for UKA reported by ***Kozinn and Scotland and others*** included: a patient with a sedentary life style (no impact sports or heavy manual work), age of greater than or equal to 60 years, minimal pain at rest, less than 15°

varus deformity, range of motion of at least 90° without a flexion contracture, correctable medial deformity, 50% unicompartmental joint space collapse, weightless than 82 kg, thin body habitus (as obesity may be a relative contraindication), diagnosis of OA, post-traumatic arthritis or osteonecrosis, and isolated unicompartmental knee pain**.** Inaddition, successful UKA requires an intact anterior cruciate ligament (ACL) and a stable knee that resists femorotibial subluxation [(22)]**.**

More recently, the indications have been expanded which lead to increase utilization of UKA. ***Pennington et al***. reported on 45 patients less than 60 years old undergoing medial UKA, noting a 92% eleven-year survival rate and 93% reporting excellent Hospital for Special Surgery (HSS) scores [(23)]**.** ***Berend et al.*** reported no difference in outcomes of patients greater than 82 kg; < 60 years of age or with patellofemoral radiographic changes in 318 UKAs performed with the Oxford implants [(23)]**.**

Oxford indication of UKA:

The indications for UKA include two main indications which based on the patho-anatomy of the disease:

- The primary is antero-medial osteoarthritis of knee joint (AMOA) with certain pre-requisites:

1. Full thickness cartilage loss on both sides of the medial compartment with bone on bone contact.

2. The lateral compartment should be well preserved, with an intact meniscus and full thickness of articular cartilage.
3. Functionally intact ligaments especially (MCL).
4. Functionally intact cruciate ligaments of the knee especially ACL.
5. Flexion deformity should be less than 15 degrees. If it is greater than 15 degrees the ACL is usually ruptured.
6. Varus deformity of more than 15 degrees can seldom be passively corrected to neutral; therefore, this figure represents the outer limit.

These pre-requisites are assessed radiographically pre-operative as well as it should be double checked intra-operatively so the decision for OUKA would be taken easily.

- The second category is spontaneous osteonecrosis of the knee (SONK) which is a rare **(Fig. 2)**.

Figure (2): (A) Preoperative anteroposterior and lateral radiograph of a 68-year-old woman with isolated osteonecrosis of the medial femoral condyle. (B) Postoperative radiographs after successful medial unicompartmental arthroplasty [18].