Unicompartmental Knee Arthroplasty - Principles and Practice

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Today’s Goals
- Medial and Lateral Unicompartmental Knee Replacement
- Not cover Patellofemoral
- Indications
- Technique
- Results

History
- Hemiarthroplasty of the knee using a space occupying prosthesis for painful varus or valgus deformity
- JBJS McIntosh, DL 1958;40-A: 1431

Ahlback 1968
- St Georg 1969
- Marmor 1972
- Ahlback Unicompartmental disease does not “spread to total involvement”
- General impression
  “UKA harder than TKA”

Longitudinal studies suggested unicompartmental osteoarthritis DOES NOT inevitably “spread” to the remainder of the knee
Tricompartmental

- Gradually surgical opinion that knee OA involved the ENTIRE knee
- Designers concentrated on tricompartmental knee designs, thus survival of UKA < TKA

General Opinion

- UKA is harder than TKA and therefore less successful for the average surgeon

Pubmed search “Unicompartmental Knee Replacement”

Search Results:
- 18,403 articles
- Review Articles: 1891
- Meta-Analysis: 332

Early Design

- Polycentric metal femur on flat plastic tibia
  - Marmor 1972

Etiology of knee deformity

- Congenital
- Constitutional
- Physeal arrest
- Metabolic
- Osteopathy
- Postrauma
- Joint destruction
- Cartilage loss
Physical signs of Anteromedial Arthritis

- Pain localized
- Pain present standing
- Pain severe walking
- Pain absent sitting
- Extended knee in varus

Indications for Uni

- Monocompartment osteoarthritis
- Active
- Minimal contracture
- Pain localization

Anatomic Features

- Cruciates normal
- Anterior tibial cartilage eroded, never posterior
- Anterior femoral cartilage eroded, not posterior
- Lateral cartilage full thickness
- MCL normal length
- Posterior capsule short

Medial compartment osteoarthritis is assessed in three key areas

1. Deformity magnitude
2. Ligament stability
3. Cartilage condition
   > osteoarthritis

Unicompartmental vs Total Knee Arthroplasty

- Osteoarthritis of the knee – Common cause of painful loss of mobility
- Often limited to one compartment

Clinical Audit

- 33 years
- 1,257 HTO
- 3,512 TKA
- 753 UKA
**Incidence Medial to Lateral**

10:1

**Evidence to consider a partial knee?**

When patient selected well, done well, …
- Few serious complications¹
- Earlier rehab²
- High Satisfaction³
- High Survivorship⁴

**Advantages of UKA**

- Less invasive
- Quicker recovery
- Less expensive
- Better proprioception
- Better kinematics
- Better gait

**Broad Considerations for Uni? Cultural Practical Effort**

**Why partial knee?**

Patients report a more “normal feel”
- Better range of motion
- Better kinematics
- Less recovery pain than TKA
- Accelerated recovery
- Faster return to work
- Less blood loss
- Expanding indications

**Goal: A satisfied patient**

- 95% pain relief
- Greater activity
- Minimal morbidity
- Survival > 15 years
Then, Why don't more surgeons do UKA?

- Early design failures
- Patient selection is subjective
- Residency training bias
- PFJ concerns
- Longevity concerns
- Technical difficult
- It takes practice!!!
**Patient Assessment**

- Pain localization
- Range of motion
- Gait observed - dynamic, thrust, indicating ligamentous laxity

**Dynamic Considerations**

- X-ray Assessment

**Decision Time**

HTO/DFO vs UKA vs TKA

- 2 visits
- Nuanced discussion
**Decision Time**

**HTO vs UKA**

- 2 visits
- Nuanced discussion

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**DFO vs UNI**

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**HTO over UKA**

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**Osteotomy Expectations**

- Impose No restrictions
- 90% Pain relief
- Improved function
- Delay / Avoid TKA
  - 10 years

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**Deciding on Uni vs Osteotomy**

- AT least two office visits
- LISTEN to expectations
- Get MRI
- Review prior scope images

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**My patient observations**

- Generally full ROM and little laxity or deformity
- No anterior pain with squat test
- Minimal patellar crepitus
- Good cartilage thickness on merchant’s view (may accept small osteophytes)
- Narrowing on standing AP or ski’s view
- Minimal lateral subluxation on-standing AP
Cases

SPONK

60 yo with lateral pain
48 yo male

Manages arboretum
RTW 5 weeks

52 yo elite runner
- Medial joint line pain
- Multiple scopes
- Difficulty walking
- Desires to continue running

Now hurts too much to run
Right medial joint line pain
States: "I will run...no matter what"

Now 6 years of running
50 miles / week
Reports no pain

Running 50 m / week
12 years after bilateral HTO

RTW 5 weeks
55 year old
9 years s/p UKA
- Told "running is harmless on your uni"
- Runs 5 miles per day
- Pain for past 6 months

Osteolysis, Aspirate and labs normal. Can I still run?

Revision with impaction graft
Agreed to quit running

Obesity and UKA?
- Literature mixed

6 weeks
ACL and Uni?

22 yo medical student familial osteonecrosis
- s/p scopes, OCD pinning, osteochondral allograft, distal femoral osteotomy

Youth and UKA

Options
- Hemiallograft
- TKA
The difficulty with partial knees

- Selection
- Inaccurate placement
- Difficult to consistently restore:
  - Tibial slope
  - Coronal alignment
  - Femoral rotation
  - Limb alignment
  - Implant congruency

Problems

- 6 mm poly
- Wear and distortion
- Thicker poly
- Persisting distortion
- Metal back ---- thinner poly

Partial knee failures and complications

Location and lysis associated with malalignment and under-correction. Scott et al JOA7

Causes of Failure

Australian registry n=4362

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Dahl n=12/753

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My experience in UKA knees

- Poor Patient Selection is the biggest Factor in the need for revision
- Osteoporosis
- Disease progression
- Mobile bearing dislocation
- Pain

Technical failures with manual partial knees

- Subjective “feel” for balance
- Pin stress risers
- No mid-flexion knowledge
- Difficult to reference "slope"

Mobile bearing dislocation

- Requires TKA
- Results from MCL injury
- Swedish registry 2.3 %
- 4 / 213
- I avoid mobile bearing

Inconsistent outcomes in manual approach

Is robotics the solution?

CT Planning
Positioning
Implants

Robotic UKA

- 1135 knees at minimum 2-year follow up
- 909 knees 2-year follow up
- 46 knees 5-year follow up

Too early to say
Robotic UKA, Rhodes et al

Robotic knees

2-Year follow up
- 9/909 reported revisions
  - 3 for pain
  - 3 for infection
  - 3 for implant loosening
- 0.9% revision rate at 2 years
- 92% patient satisfaction

UKA is more cost-effective than TKA in patients over 65

Methodology
- Markov model constructed using UKA and TKA data from Swedish Knee Arthroplasty Register, published literature, HHS government database, and HSS registry
- Assumption: UKA and TKA experience same post-operative increase in quality of life

Key Results
- In patients over 65, UKA was dominant over TKA primarily due to higher rehab costs of TKA, even with higher UKA revision rates
- UKA will become dominant in younger patients if UKA shows an improved QOL and reduced revision rate

UKA References
3. Conditt, M; Coon, T; Roche, M; Dounchis, J; Borus, T; Buechel, F; Branch, S; Pearle, A. Short to Mid Term Survivorhip of Robotically Assisted UKA: A Multicenter Study. ISTA 27th Annual Congress; September 24-27, 2014. Kyoto, Japan
7. Hernigou et al. Alignment Influences Wear in the Knee after Medial Unicompartmental Arthroplasty. CLINCIAL ORTHOPAEDICS AND RELATED RESEARCH. Number 423, pp.161‐165
10. Accuracy of Dynamic Tactile‐Guided Unicompartmental Knee Arthroplasty. Dunbar, NJ; Roche, MW; Park, BH; Branch, SH; Conditt, MA; Banks, SA. Journal of Arthroplasty. May 2012. 27(5): 803‐808.e1.