


A Randomized, Controlled Trial of Total Knee Replacement

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Total knee replacement is considered to be an effective treatment for end-stage knee osteoarthritis.¹ The number of total knee replacements performed each year in the United States has increased dramatically, from 31.2 per 100,000 person-years during the period 1971–1976 to 220.9 during the period 2005–2008.² In 2012, more than 670,000 total knee replacements were performed in the United States alone, with corresponding aggregate charges of \$36.1 billion.³ The number of total knee replacements is expected to increase as the average age of the population increases,⁴ which highlights the associated future economic burden.

Outcome of Unicondylar Knee Arthroplasty vs Total Knee Arthroplasty for Early Medial Compartment Arthritis: A Randomized Study


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Abstract

Background

With increasing number of patients with early osteoarthritis of knee opting for total knee arthroplasty (TKA), there has been increase in patients dissatisfied with surgical outcomes. It is being presumed that offering unicondylar knee arthroplasty (UKA) to them would improve outcomes.

Methods

Primary objective of our study was to look for any difference in patient-reported outcome and function at 2-year follow-up in patients undergoing UKA as compared to TKA. Our study was a randomized study with parallel assignment conducted at a high-volume specialized arthroplasty center. Eighty patients with bilateral isolated medial compartment knee arthritis were randomized into simultaneous 2-team bilateral TKA (n = 40) and UKA

(n = 40) group. We finally analyzed 36 patients in each group. Main outcome measure was improvement in Knee Outcome Survey-Activities of Daily Living Scale (KOS-ADLS) and High Activity Arthroplasty Score (HAAS) obtained at 2-year follow-up.

Results

Improvement in KOS-ADLS and HAAS at 2 years was similar ($P = .2143$ and $.2010$) in both groups. Performance as assessed with Delaware index was also similar. Length of hospital stay was less in UKA group (6.6 days as against 5.4 days). Complications and readmission rates were more in TKA group (nil in UKA group; 08 in TKA group).

Conclusion

At 2-year follow-up, UKA provides similar improvement in patient-reported outcomes, function, and performance as compared to TKA when performed in patients with early arthritis. However, UKA patients have shorter hospital stay and fewer complications.

Optimal usage of unicompartmental knee arthroplasty

a study of 41 986 cases from the National Joint Registry for England and Wales

A. D. Liddle, H. Pandit, A. Judge, D. W. Murray

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Abstract

Unicompartmental knee arthroplasty (UKA) has advantages over total knee arthroplasty but national joint registries report a significantly higher revision rate for UKA. As a result, most surgeons are highly selective, offering UKA only to a small proportion (up to 5%) of patients requiring arthroplasty of the knee, and consequently performing few each year. However, surgeons with large UKA practices have the lowest rates of revision. The overall size of the practice is often beyond the surgeon's control, therefore case volume may only be increased by broadening the indications for surgery, and offering UKA to a greater proportion of patients requiring arthroplasty of the knee.

The aim of this study was to determine the optimal UKA usage (defined as the percentage of knee arthroplasty practice comprised by UKA) to minimise the rate of revision in a sample of 41 986 records from the for National Joint Registry for England and Wales (NJR).

UKA usage has a complex, non-linear relationship with the rate of revision. Acceptable results are achieved with the use of 20% or more. Optimal results are achieved with usage between 40% and 60%. Surgeons with the lowest usage (up to 5%) have the highest rates of revision. With optimal usage, using the most commonly used implant, five-year survival is 96% (95% confidence interval (CI) 94.9 to 96.0), compared with 90% (95% CI 88.4 to 91.6) with low usage (5%) previously considered ideal.

The rate of revision of UKA is highest with low usage, implying the use of narrow, and perhaps inappropriate, indications. The widespread use of broad indications, using appropriate implants, would give patients the advantages of UKA, without the high rate of revision.

[J Orthop Surg Res.](#) 2017 Mar 28;12(1):50. doi: 10.1186/s13018-017-0552-9.

Unicompartmental knee arthroplasty, is it superior to high tibial osteotomy in treating unicompartmental osteoarthritis? A meta-analysis and systemic review.

[Santoso MB](#)¹, [Wu L](#)².

[Author information](#)

Abstract

BACKGROUND:

Debate remains whether high tibial osteotomy (HTO) or unicompartmental knee arthroplasty (UKA) is more beneficial for the treatment of unicompartmental knee osteoarthritis. The purpose of this study was to compare the functional results, knee scores, activity levels, and complications between the two procedures.

METHODS:

We performed a systematic review of published literature from August 1982 through January 2017. Fifteen papers reporting three prospective randomized trials were subjected to a meta-analysis.

RESULTS:

No significant difference between the two groups was noted with respect to free walking (velocity), knee score, deterioration of the contralateral or patellofemoral knee, or revision rate and total knee arthroplasty. However, UKA produced better outcomes compared to HTO in terms of the functional results, pain assessment, and complications, although patients who underwent HTO tended to have slightly better range of motion.

CONCLUSIONS:

Valgus HTO provides better physical activity for younger patients whereas UKA is more suitable for older patients due to shorter rehabilitation time and faster functional recovery. Although UKA patients tended to have improved overall long-term outcomes, which may be due to accurate indications and patient selection, both treatment options yielded pleasing results. Therefore, we are unable to conclude that either method is superior.

KEYWORDS:

High tibial osteotomy (HTO); Meta-analysis; Osteoarthritis; Unicompartmental knee arthroplasty (UKA)

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[10.1186/s13018-017-0552-9](#)

[J Bone Joint Surg Br.](#) 2009 Jan;91(1):52-7. doi: 10.1302/0301-620X.91B1.20899.

Unicompartmental or total knee replacement: the 15-year results of a prospective randomised controlled trial.

[Newman J¹](#), [Pydisetty RV](#), [Ackroyd C](#).
[Author information](#)

Erratum in

- [J Bone Joint Surg Br.](#) 2009 May;91(5):701.

Abstract

Between 1989 and 1992 we had 102 knees suitable for unicompartmental knee replacement (UKR). They were randomised to receive either a St Georg Sled UKR or a Kinematic modular total knee replacement (TKR). The early results demonstrated that the UKR group had less complications and more rapid rehabilitation than the TKR group. At five years there were an equal number of failures in the two groups but the UKR group had more excellent results and a greater range of movement. The cases were reviewed by a research nurse at 8, 10 and 12 years

after operation. We report the outcome at 15 years follow-up. A total of 43 patients (45 knees) died with their prosthetic knees intact. Throughout the review period the Bristol knee scores of the UKR group have been better and at 15 years 15 (71.4%) of the surviving UKRs and 10 (52.6%) of the surviving TKRs had achieved an excellent score. The 15 years survivorship rate based on revision or failure for any reason was 24 (89.8%) for UKR and 19 (78.7%) for TKR. During the 15 years of the review four UKRs and six TKRs failed. The better early results with UKR are maintained at 15 years with no greater failure rate. The median Bristol knee score of the UKR group was 91.1 at five years and 92 at 15 years, suggesting little functional deterioration in either the prosthesis or the remainder of the joint. These results justify the increased use of UKR.

[Knee](#). 2013 Sep;20 Suppl 1:S16-20. doi: 10.1016/S0968-0160(13)70004-8.

Uncertainties surrounding the choice of surgical treatment for 'bone on bone' medial compartment osteoarthritis of the knee.

[Price A¹](#), [Beard D](#), [Thienpont E](#).

[Author information](#)

Abstract

A number of different surgical interventions can be used for treating antero-medial osteoarthritis (AMOA) of the knee and this choice can present challenges for patient's decision-making. Patients with AMOA can undergo Total Knee Replacement (TKR), Unicompartmental Knee Replacement (UKR) or High Tibial Osteotomy (HTO) for the same pathology. However many uncertainties still exist as to deciding which operation is best for individual patients and the Orthopaedic community has failed to systematically compare treatment options. The relative lack of scientifically based evidence has impacted on the ability to provide clear guidelines on treatment choice, patient suitability and direct patient preference for treatment. This paper, using available evidence, discusses the issue and offers some suggestions for future development.

Med Eng Phys. 2009 Sep;31(7):752-7. doi: 10.1016/j.medengphy.2009.02.004. Epub 2009 Mar 10.

Elevated proximal tibial strains following unicompartmental knee replacement--a possible cause of pain.

Simpson DJ1, Price AJ, Gulati A, Murray DW, Gill HS.

[Author information](#)

[Abstract](#)

Elevated proximal tibial strains following unicompartmental knee replacement--a possible cause of pain.

[Simpson DJ](#)¹, [Price AJ](#), [Gulati A](#), [Murray DW](#), [Gill HS](#).

Author information

Abstract

Unexplained pain is an important complication of both total knee replacement and unicompartmental knee replacement. After unicompartmental knee replacement the most common site for the pain is antero-medial over the proximal tibia. The reason for this is not clear; however it may be due to high bone strain. A validated finite element model of a proximal tibia implanted with a fully congruent unicompartmental knee replacement was used to investigate the effect that certain implantation parameters had on the surface strains of the tibia. The tibial tray was positioned neutrally, and also mal-aligned separately in the sagittal and coronal planes. Different amounts of tibial tray overhang and underhang, and different resection levels were modelled. All models were compared to an intact tibia and the strain on the exterior cortex compared for a peak load condition measured in-vivo during a step-up activity. Following implantation the bone strain in the proximal tibia increased by 40%. There were no comparable increases in strain with different amounts of mal-alignment in the sagittal plane. There was a comparable increase in strain with a tibial tray overhang of 3 mm or greater, and excessive varus mal-alignment. This study has demonstrated that there is a large increase in strain, antero-medially on the proximal tibia, following implantation with a unicompartmental knee replacement. This may be the cause of antero-medial pain. As the bone remodels over time this strain will decrease, which probably explains why the pain usually settles within 12 months after surgery. However, certain errors in implantation result in strain values that might lead to degenerative remodelling and/or increased micro-damage of the bone; this may explain why the pain progressively worsens in some cases.

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Metal-backed versus all-polyethylene unicompartmental knee arthroplasty: Proximal tibial strain in an experimentally validated finite element model.

[Scott CE](#)¹, [Eaton MJ](#)², [Nutton RW](#)³, [Wade FA](#)³, [Evans SL](#)², [Pankaj P](#)⁴.

Author information

Abstract

OBJECTIVES:

Up to 40% of unicompartmental knee arthroplasty (UKA) revisions are performed for unexplained pain which may be caused by elevated proximal tibial bone strain. This study investigates the effect of tibial component metal backing and polyethylene thickness on bone strain in a cemented fixed-bearing medial UKA using a finite element model (FEM) validated experimentally by digital image correlation (DIC) and acoustic emission (AE).

MATERIALS AND METHODS:

A total of ten composite tibias implanted with all-polyethylene (AP) and metal-backed (MB) tibial components were loaded to 2500 N. Cortical strain was measured using DIC and cancellous microdamage using AE. FEMs were created and validated and polyethylene thickness varied from 6 mm to 10 mm. The volume of cancellous bone exposed to $< -3000 \mu\epsilon$ (pathological loading) and $< -7000 \mu\epsilon$ (yield point) minimum principal (compressive) microstrain and $> 3000 \mu\epsilon$ and $> 7000 \mu\epsilon$ maximum principal (tensile) microstrain was computed.

RESULTS:

Experimental AE data and the FEM volume of cancellous bone with compressive strain $< -3000 \mu\epsilon$ correlated strongly: $R = 0.947$, $R^2 = 0.847$, percentage error 12.5% ($p < 0.001$). DIC and FEM data correlated: $R = 0.838$, $R^2 = 0.702$, percentage error 4.5% ($p < 0.001$). FEM strain patterns included MB lateral edge concentrations; AP concentrations at keel, peg and at the region of load application. Cancellous strains were higher in AP implants at all loads: 2.2- (10 mm) to 3.2-times (6 mm) the volume of cancellous bone compressively strained $< -7000 \mu\epsilon$.

CONCLUSION:

AP tibial components display greater volumes of pathologically overstrained cancellous bone than MB implants of the same geometry. Increasing AP thickness does not overcome these pathological forces and comes at the cost of greater bone resection. Cite this article: C. E. H. Scott, M. J. Eaton, R. W. Nutton, F. A. Wade, S. L. Evans, P. Pankaj. Metal-backed versus all-polyethylene unicompartmental knee arthroplasty: Proximal tibial strain in an experimentally validated finite element model. *Bone Joint Res* 2017;6:22-30. DOI:10.1302/2046-3758.61.BJR-2016-0142.R1.

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[Bone Joint J.](#) 2013 Oct;95-B(10):1339-47. doi: 10.1302/0301-620X.95B10.31644.

Proximal tibial strain in medial unicompartamental knee replacements: A biomechanical study of implant design.

[Scott CE¹](#), [Eaton MJ](#), [Nutton RW](#), [Wade FA](#), [Pankaj P](#), [Evans SL](#).

Author information

Abstract

As many as 25% to 40% of unicompartamental knee replacement (UKR) revisions are performed for pain, a possible cause of which is proximal tibial strain. The aim of this study was to examine the effect of UKR implant design and material on cortical and cancellous proximal tibial strain in a synthetic bone model. Composite Sawbone tibiae were implanted with cemented UKR components of different designs, either all-polyethylene or metal-backed. The tibiae were subsequently loaded in 500 N increments to 2500 N, unloading between increments. Cortical surface strain was measured using a digital image correlation technique. Cancellous damage was measured using acoustic emission, an engineering technique that detects sonic waves ('hits') produced when damage occurs in material. Anteromedial cortical surface strain showed significant differences between implants at 1500 N and 2500 N in the proximal 10 mm only ($p < 0.001$), with relative strain shielding in metal-backed implants. Acoustic emission showed significant differences in cancellous bone damage between implants at all loads ($p = 0.001$). All-polyethylene implants displayed 16.6 times the total number of cumulative acoustic emission hits as controls. All-polyethylene implants also displayed more hits than controls at all loads ($p < 0.001$), more than metal-backed implants at loads ≥ 1500 N ($p < 0.001$), and greater acoustic emission activity on unloading than controls ($p = 0.01$), reflecting a lack of implant stiffness. All-polyethylene implants were associated with a significant increase in damage at the microscopic level compared with metal-backed implants, even at low loads. All-polyethylene implants should be used with caution in patients who are likely to impose large loads across their knee joint.