

Robotic-arm assisted unicondylar knee arthroplasty (RA-UKA): A review of clinical outcomes and costs

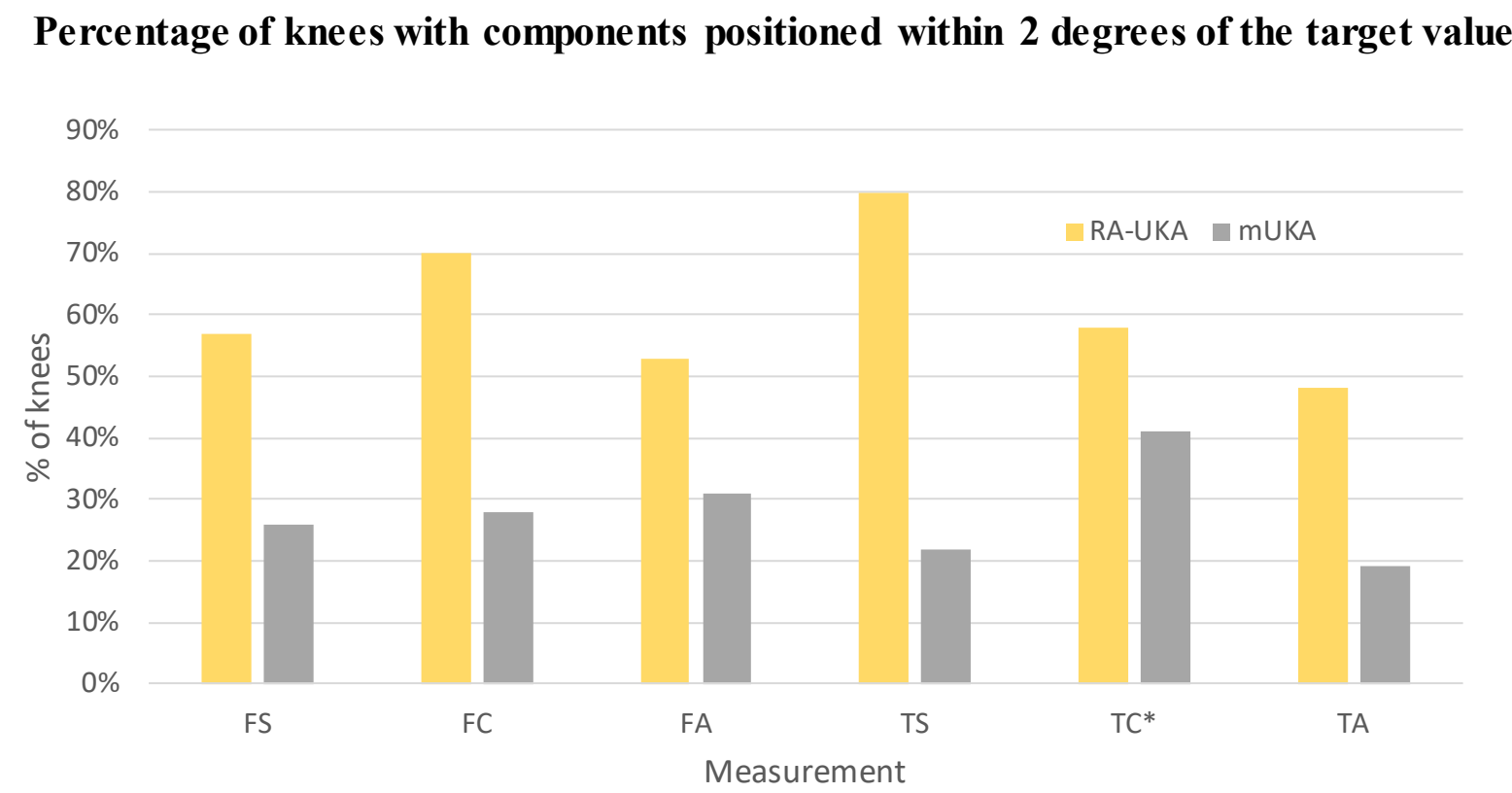
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Introduction:

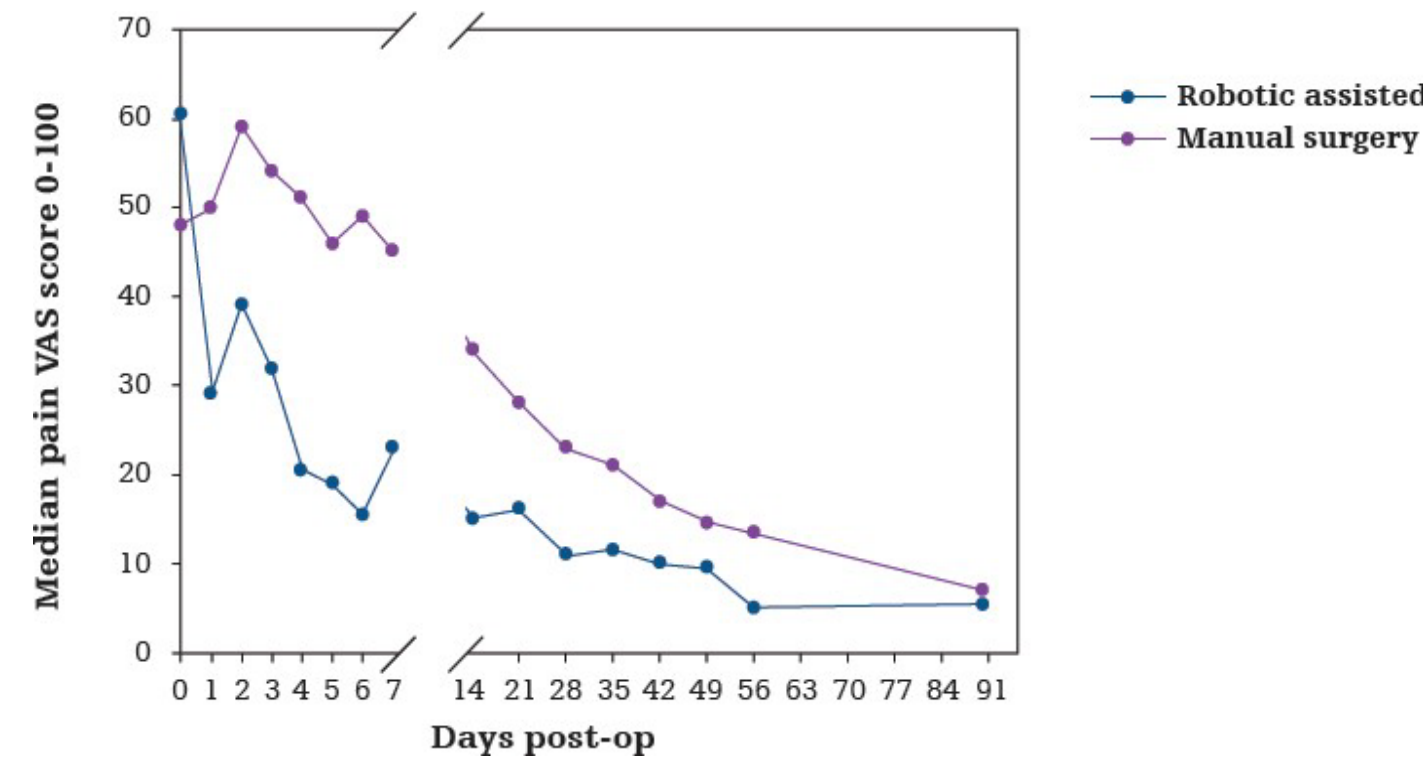
Studies show unicondylar knee arthroplasty (UKA) offers potential advantages over total knee arthroplasty (TKA) in terms of faster recovery, fewer post-operative complications and improved functional outcomes. However, the technically demanding nature of UKA and higher revision rates seen with conventional/manual UKA (mUKA) has limited its widespread adoption. Innovations such as robotic-assistance have the potential to reduce technical complexity and enhance outcomes. The purpose of this abstract is to review the impact of a haptic-guided RA-UKA to component placement, patient outcomes, implant survivorship and costs.

Results:

Component placement accuracy¹



Post-operative pain scores²



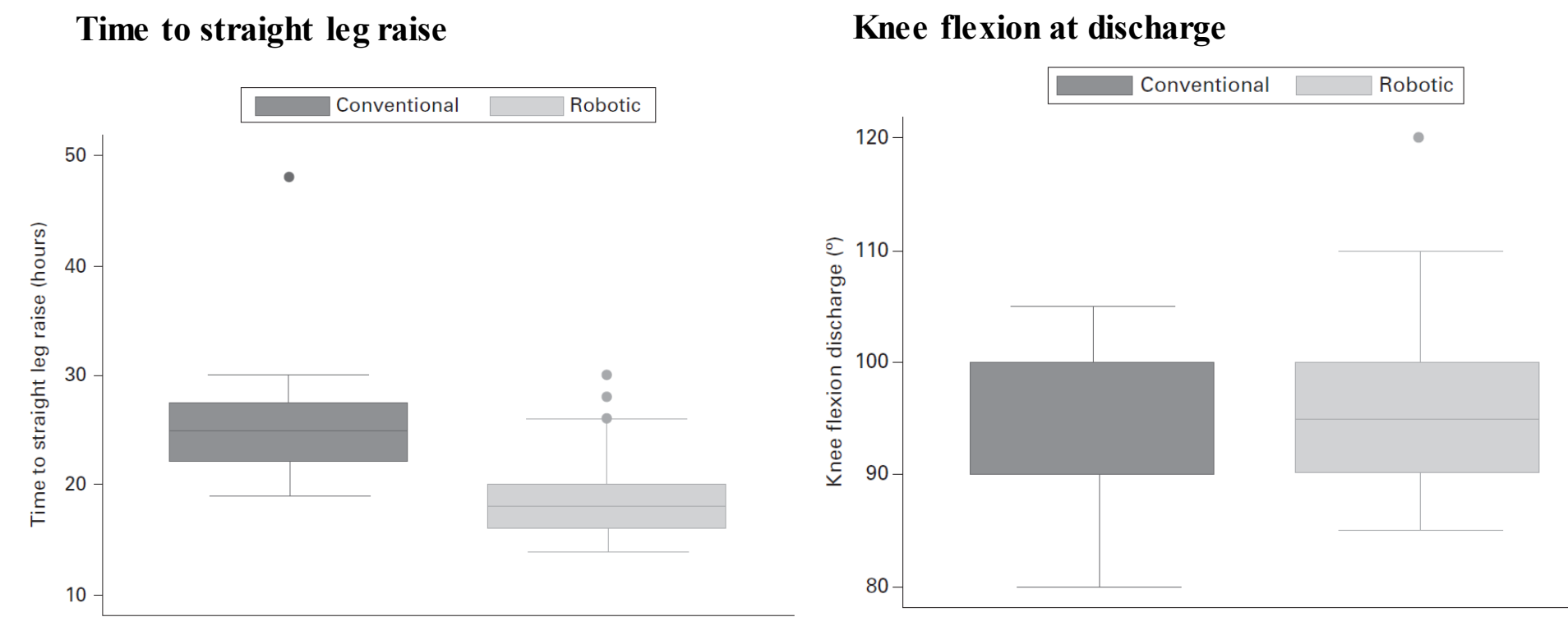
In a randomized controlled trial, Bell et al (2016) showed that RA-UKA enabled surgeons to place the tibial and femoral components more accurately and consistently to plan. FS – Femoral sagittal, FC – Femoral coronal, FA – Femoral axial, TS – tibial sagittal, TC – tibial coronal, TA – tibial axial, *non-significant parameter

In this study, 139 patients from a single-center were randomized to RA-UKA or mUKA. From the first post-operative day through to week 8 post-operatively, the median pain scores for the robotic arm-assisted group were 55.4% lower than those observed in the manual surgery group (p = 0.040).

Methods:

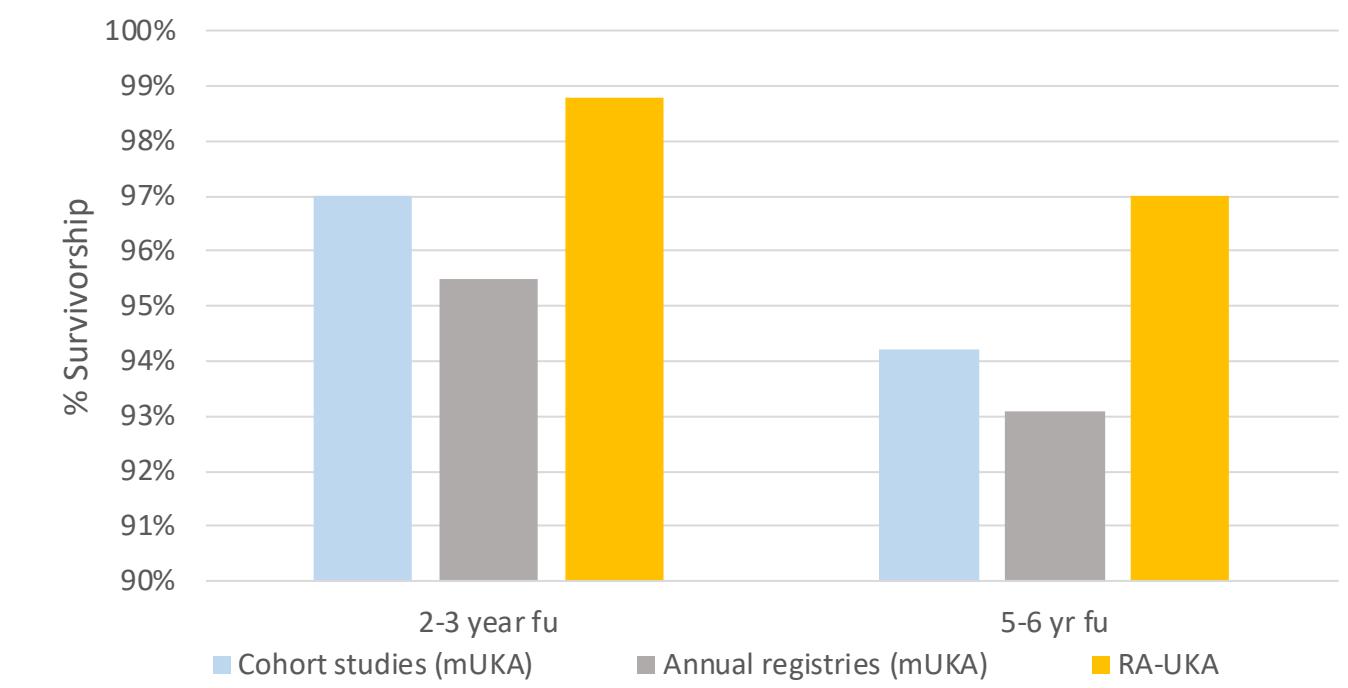
Recent publications including journal publications and presentations at scientific conferences that focused on accuracy of component placement, clinical outcomes, implant survivorship and costs of RA-UKA with haptic guidance were reviewed.

Post-operative functional outcomes³



Prospective, cohort study of 73 consecutive RA-UKA and 73 consecutive conventional/mUKA patients performed by a single-surgeon. RA-UKA was associated with shorter time to straight leg raise (p<0.001), decreased number of physiotherapy sessions (p<0.001) and increased maximum knee flexion at discharge (p<0.001) compared to conventional/mUKA patients.

Implant survivorship^{5,6}



Favorable implant survivorship seen at 2-3 year⁶ and 5-6-year follow-up⁵ reported with RA-UKA compared to survivorship reported for conventional or mUKA in cohort studies reported in literature and annual registry data.

Cost comparison between RA-UKA vs manual UKA⁷

A longitudinal, retrospective analysis of administrative claims from the OptumInsight Inc. database comprising claims representing approximately 25 million patients in a US commercial health plan was done to compare hospital admissions for revision surgeries in RA-UKA vs manual UKA. Eligible patients were propensity matched based on demographics, comorbidities and geographic location.

Outcomes category	RA-UKA	mUKA	Δ	P value
Total index procedures	246	492		
Index outcomes				
Average cost	\$25,786	\$26,307	-\$521	.3996
Average LOS	1.77	2.02	-0.25	.0047
24-mo. revision outcomes				
Rate of revision (n)	0.81% (2)	5.28 (26)	-4.47%	.0017
Average cost	\$26,512	\$30,430	-\$3918	.5468
Average LOS	2.00	2.33	-0.33	.9277
24-mo. Inpatient episode				
Average cost	\$26,001	\$27,977	-\$1975	.1144
Average LOS	1.78	2.15	-0.37	.0045

At 24 months after the primary UKA procedure, patients who underwent RA-UKA had fewer revision procedures (0.81% [2/246] vs 5.28% [26/492]; P <.002), shorter mean length of stay (2.00 vs 2.33 days; P > .05) and incurred lower mean costs for the index stay plus revisions (\$26,001 vs \$27,915; P >.05) than mUKA patients. Length of stay at index and index costs were also lower for RA-UKA patients (1.77vs 2.02 days; P =.0047) and (\$25,786 vs \$26,307; P > .05).

Conclusion:

Haptic guided RA-UKA has demonstrated improved accuracy of component placement, enhanced patient outcomes and improved implant survivorship which has been shown to result in cost-savings. As mid- to long-term survivorship data is starting to be published, RA-UKA has the potential to be a preferred treatment option for patients with isolated compartment osteoarthritis.



References: (1) Bell SW, Anthony I, Jones B, MacLean A, Rowe P, Blyth M. Improved Accuracy of Component Positioning with Robotic-Assisted Unicompartmental Knee Arthroplasty: Data from a Prospective, Randomized Controlled Study. J Bone Joint Surg Am. 2016 Apr 20;98(8):627-35. (2) Blyth MJG, Anthony I, Rowe P, Banger MS, MacLean A, Jones B. Robotic arm-assisted versus conventional unicompartmental knee arthroplasty: Exploratory secondary analysis of a randomised controlled trial. Bone Joint Res. 2017 Nov;6(11):631-639. (3) Kayani B, Konan S, Tahmassebi J, Rowan FE, Haddad FS. An assessment of early functional rehabilitation and hospital discharge in conventional versus robotic-assisted unicompartmental knee arthroplasty: a prospective cohort study. Bone Joint J. 2019 Jan; 101-B(1):24-33. (4) Clement ND, Bell A, Simpson P, Macpherson G, Patton JT, Hamilton DF. Robotic-assisted unicompartmental knee arthroplasty has a greater early functional outcome when compared to manual total knee arthroplasty for isolated medial compartment arthritis. Bone Joint Res. 2020 May 16;9(1):15-22. (5) Kleebad LJ, Borus TA, Coon TM, Douchis J, Nguyen JT, Pearl AD. Midterm Survivorship and Patient Satisfaction of Robotic-Arm-Assisted Medial Unicompartmental Knee Arthroplasty: A Multicenter Study. J Arthroplasty. 2018 Jun;33(6):1719-1726 (6) Pearle, A. et al. Survivorship and Patient Satisfaction of Robotic-Assisted Medial Unicompartmental Knee Arthroplasty at a Minimum Two-Year Follow-Up. Knee. 2017 March ; 24(2): 419-428. (7) Cool, C. et al. Revision Analysis of Robotic-Arm Assisted and Manual Unicompartmental Knee Arthroplasty. J Arthroplasty 34 (2019) 926-931.