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Summary:
This is the first study to use optical motion capture technology to quantify the change in FFD during robotic-assisted UKA.

Data:
Introduction Unicompartamental knee arthroplasty (UKA) is an effective surgical treatment for patients with unicompartamental knee arthritis. Residual fixed flexion deformity (FFD) may lead to worse functional outcomes, but the change in FFD with UKA remains unknown. The objective of this study was to assess the change in FFD in patients undergoing medial UKA. Methods This prospective cohort study included 63 patients with medial compartment arthroplasty undergoing robotic-assisted UKA at a single tertiary centre between 2018 and 2022. This study included 30 males and 33 females with a mean age of 62 ± 5.7 years. Patients were divided into four study groups based on the degree of preoperative FFD: < 3 degrees, 3 - 6 degrees, 6-9 degrees, and >9 degrees. Intraoperative optical motion capture technology was used to assess pre- and postoperative FFD. The Oxford Knee Score (OKS) was assessed in all patients be-fore surgery and at one-year follow-up. Results This study found statistically significant increase in mean preoperative to mean postoperative FFD for each of the four treatment groups: < 3 degrees (pre op FFD = 1.53, post op FFD = 0.61 degrees, P = 0.004), 3 - 6 degrees (pre op FFD = 4.94 degrees, post op FFD = 3.71, P = 0.015), 6 - 9 degrees (pre op FFD = 7.96 degrees, post op FFD = 3.63, P < 0.001), >9 degrees (pre op FFD = 11.63 degrees, post op FFD = 7.18, P value < 0.001). All treatment groups showed statistically significant improvements from preoperative to postoperative OKS (p<0.001) at one year follow-up. There were no significant differences in OKS between the four treatment groups at one-year follow-up. Conclusion This is the first study to use optical motion capture technology to quantify the change in FFD during robotic-assisted UKA. The FFD was reduced by approximately half in all four treatment groups with no difference in functional outcomes based on the degree of preoperative FFD. These findings may help to modify existing clinical criteria for medial UKA.

Category: Knee - Arthroplasty

Image-free Robotic-Assisted Total Knee Arthroplasty Improves the Rotational Mismatch Between Femoral and Tibial Components, but Not Forgotten Joint Score 12 using three-dimensional computed tomography

Measurements: A Consecutive Case Control Study

Abstract ID# 21801
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Summary:
In robotic-assisted (RA) TKA, the accuracy of femoral component rotation placement was improved and there were fewer cases of the rotational mismatch, although, forgotten joint score-12 was lower in RA-TKA compared to conventional TKA.

Data:
Background: The primary aim of this study was to compare the postoperative short-term patient reported outcome measurements (PROMs) and component accuracy in conventional jig-based total knee arthroplasty (Conv-TKA) versus a robotic-assisted TKA (RA-TKA) using three-dimensional computed tomography (3DCT) measurements. Methods: This retrospective, consecutive case control trial included 83 patients with varus osteoarthritis of the knee undergoing Conv-TKA versus RA-TKA using bi-criciate stabilized TKA (BCS) (Journey®BCS; Smith & Nephew. Inc. Memphis, TN, USA). PROMs (2011 Knee Society Score (KSS), Forgotten Joint Score 12 (FJS-12), patella score) were compared in patients who had been postoperative for at least 1 year and less than 2 years. Hip-knee-ankle (HKA) angle, component alignment (1989 knee society (KS); a, b, 7, d angle), rotational angles of the femoral and tibial component and rotational mismatch between the two groups were compared using 3DCT measurements. Results: There were no statistically significant differences in the preoperative factors between the groups: age at surgery, BMI, preoperative range of motion (ROM), HKA angle, and 1989 Knee society knee and function score. Postoperative PROMs (pain, patient satisfaction, patient expectation, advanced activities in 2011 KSS) and patella score were not significantly different between the groups, but FJS-12 was significantly improved in Conv-TKA than in RA-TKA (p<0.01). Although there were no significant differences in postoperative HKA angle, a, b, 7, d angles, and tibial rotation angle, the absolute value of femoral rotational angle and rotational mismatch were significantly smaller in RA-TKA group than in Conv-TKA group (p<0.01). Conclusions RA-TKA did not improve FJS-12 compared to Conv-TKA, but improved accuracy of femoral component rotational position and rotational mismatch.

Category: Knee - Arthroplasty

Initial Experience With a Novel Extended-Release, Dual-Acting Local Topical Anesthetic in TKA

Abstract ID# 22356
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Summary:
In this initial study, a topical anesthetic option appears to have lower cost, faster application, and similar or superior pain management effects compared to a long-lasting bupivacaine injection.

Data:
Introduction: The benefits of peri-articular injections for initial pain management after primary TKA are reflected by its nearly universal use. However, the many different cocktails currently available illustrates that there is no single solution to local pain management. In addition, peri-articular injections are limited by cost, consistent efficacy, and required specific technique in delivery. A novel needle-free topical dual-acting local anesthetic consisting of bupivacaine and meloxicam may provide an alternative option to the traditional limitations of peri-articular injections. Methods: Two-hundred consecutive primary TKA patients were evaluated prospectively with application of this dual-acting local topical anesthetic, and compared to the previous 200 patients where a long-lasting periarticular injection was used. Patients were evaluated for pain scores, opioid use, therapy goals, and need for rescue medication for 72 hours after surgery. Results: There were no intraoperative events with anesthetic application in either group. Application of the needle-free anesthetic was faster, compared to the periarticular injection group (1 vs 4 min, p<0.03). Pain scores between groups were similar upon entrance to the PACU after surgery. Patients receiving the topical anesthetic had less pain at discharge (p<0.05), 17% reduction in opioid use during the hospital admission (p<0.05), and fewer refill requests after discharge. Fewer patients had severe pain, and patients tolerated more PT after surgery compared to the control group. Incidence of adverse events were similar for the two groups. Discussion: This extended-release dual-acting local anesthetic showed improved analgesia for the first 72 hours after primary TKA compared to a peri-articular injection protocol. This reduction in pain led to a lower requirement of opioids in this same period. In this initial study, this topical anesthetic option appears to have lower cost, faster application time, and similar or superior pain management effects compared to a long-lasting bupivacaine injection.

Category: Knee - Arthroplasty

Outcomes of Calipered Mechanically Aligned Versus Calipered Restricted Kinematically Aligned Bilateral Total Knee Arthroplasty - A Randomized Controlled Trial

Abstract ID# 22468
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Summary:
No difference in patient reported outcome measures at 6 months follow-up between restricted kinematically aligned and mechanically aligned bilateral simultaneous Total knee arthroplasty.

Data:
Introduction: A recent focus on total knee arthroplasty (TKA) is primarily
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Directed toward restoring natural knee kinematics, thereby improving the gait parameters and targeting better patient-reported outcomes. However, it has also been considered that correcting the full varus by kinematic alignment may lead to more stress on the medial/tibial insert in severe varus-aligned knees, increasing the chances of early failure. The restricted kinematic alignment (RKA) technique is thus a midway between true kinematic and conventional mechanical alignment. Restoring some amount of varus alignment by the RKA technique will allow the patient a native feel of the joint without the expense of excess stress on the implants and thus may improve the overall outcomes after knee arthroplasty. This study aims primarily to compare patient-reported outcome measures (PROMs) for conventional Mechanically Aligned (MA-TKA) with restricted Kinematically Aligned (RKA-TKA). Methodology: A prospective double-blinded split body, non-inferiority trial was conducted following CONSORT protocol among 38 patients (76 knees) undergoing simultaneous bilateral TKA. Each blinded patient had one knee operated by crKA-TKA and the contralateral by MA-TKA. The trial was registered in the clinical trial registry of India. The institutional ethics board approved the study, and all patients consented to participate before enrolling. Group 1 had 38 knees operated by crKA-TKA, and Group 2 had 38 knees operated by cMA-TKA. A blinded observer collected all patient-reported outcome measures. We used MediCAD Hector GmbH (Germany) software for pre-operative planning for all our patients before randomisation. A single orthopaedic trainee resident doctor performed all pre-operative planning on the software, with each knee being planned for both MA and RKA protocols. Tibial cuts and the coronal alignment technique in this patient cohort. Balance achieved prior to bony cuts is maintained at the completion of the procedure despite the posterior osteophytes remaining in situ at the time of initial balancing. Both MA and FA-TKAs can be accurately performed by this technique.

Category: Knee - Arthroplasty

Robotic-Assisted TKA Allows for Accurate Prediction of Balance Prior to Bony Resection

Abstract ID# 22518

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Summary: Pre-resection balancing with robotic arm assisted technology is an accurate and reproducible technique, with balance achieved prior to bony cuts being maintained at the completion of the procedure despite the posterior osteophytes remaining in situ at the time of initial balancing.

Data: Introduction: Total knee arthroplasty (TKA) traditionally relied on the surgeon’s judgement to determine soft tissue balance. Recent papers have shown inaccuracies in these subjective techniques when compared to objective measurements of soft tissue tension using technology. Robotic-assisted TKA (RATKA) allows for prediction of soft tissue balance prior to bony resection in addition to the ability to accurately execute a surgical plan. This study aims to determine the accuracy this pre-resection balancing technique. Methods: A consecutive prospective cohort of 2028 TKAs utilising Triathlon Knee system with the Mako robotic-assistance (Stryker, Kalamazoo, MI) was assessed. Following removal of medial and lateral osteophytes and optimisation of component position, virtual gap measurements were recorded at 10° and 90° of flexion. Soft tissue release were performed if imbalance of greater than 2mm observed. Balance was assessed post implantation. The final values were then compared to the pre-resection values to determine the accuracy of this pre-resection balancing technique. Results: Of the 2028 TKAs performed 50.1% were female, with a mean age of 67 and BMI of 31. In terms of alignment philosophy 83.1% utilised functional alignment (FA), and 16.9% adjusted mechanical alignment (AMA). The pre-resection technique achieved virtual balance in extension within 1mm by alteration of virtual component position in 83% of cases (86% of FA and 69% of AMA) and 95% had <2mm difference in extension balance. 99% of TKAs had final extension balance within 2mm. Of those that were able to be virtually balanced within 1mm, 98% of TKAs maintained balance within 1mm at the completion of the procedure without soft tissue release. Being unable to virtually balance a TKA prior to bone resorption resulted in a significantly greater requirement for soft tissue release (p<0.001). The absolute values of the final gaps achieved were a mean of 1.3mm greater than virtual gaps predicted for both medial and lateral gaps in both flexion and extension. There were no clinically significant differences in ability to maintain pre-resection balance post execution based on alignment philosophy with FA having a mean absolute difference in extension balance of 0.3mm and MA resulting in 0.5mm. Discussion: Pre-resection balancing with robotic arm assisted technology is an accurate and reproducible technique in this patient cohort. Balance achieved prior to bony cuts is maintained at the completion of the procedure despite the posterior osteophytes remaining in situ at the time of initial balancing. Both AMA and FA-TKAs can be accurately performed by this technique.

Category: Knee - Arthroplasty

Smartphone-Based Step-Count Measures Correlate with KOOS-12 Function and UCLA Activity Proms During Early TKA Recovery

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Summary: High step count led to improved PROMs scores compared to low step-count across all time points.

Data: Introduction: Passive smartphone-based apps are becoming more common for measuring patient progress after total knee arthroplasty (TKA). Optimum activity levels during early TKA recovery haven’t been well documented. Correlations between step-count and patient reported outcome measures (PROMs) during early recovery were explored. This study also investigated how demographics impact step-count during early post-operative recovery. Methods: Smartphone capture step-count data from 456 TKA patients was retrospectively reviewed. Mean age was 68±8years. 61% were female. Mean BMI was 31±6kg/m2. Mean daily step count was calculated over three time-windows: 60 days prior to surgery (preop), 5-6 weeks postop (6wk), and 11-12 weeks postop (12wk). Linear correlations between step-count and KOOS12-function and UCLA activity scores were performed. Patients were separated into three step-count levels: low (<1500steps/day), medium (1500-4000steps/day), and high (>4000steps/day). Age >66years, BMI >30kg/m2, and sex were used for demographic comparisons. Student’s t-tests determined significant differences in mean step-counts between demographic groups, and in mean PROMs between step-count groups. Results: UCLA correlated with step-count at all time-windows (p<0.001). KOOS12-Function correlated with step-count at 6wk and 12wk (p<0.05). High step-count individuals had improved PROMs scores compared to low step-count individuals preoperatively (UCLA: delta=—1 [p<0.001]), at 6wk (UCLA: delta=—0.8 [p<0.01], KOOS12-Function: delta=—6 [p<0.05]), and at 12wk (UCLA: delta=—0.8 [p<0.01], KOOS12-Function: delta=—6.5 [p<0.05]). Younger patients had greater step-count preoperatively (3.6±2.8k vs. 2.6±2.4k, p<0.001), and at 12wk (3.8±2.6k vs. 2.7±2.3k, p<0.01). Males had greater step-count preoperatively (3.7±2.7k vs. 2.5±2.5k, p<0.001), at 6wk (3.5±2.6k vs. 2.1±2.3k, p<0.001), and at 12wk (3.7±2.1 vs. 2.7±2.6k, p<0.01). No differences in step-count were observed between low and high BMI patients preoperatively, at 6wk, or at 12wk.